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1.0 INTRODUCTION

1.1 The Varanasi district, having an area of 1578 sq.km., lies in Uttar Pradesh with Varanasi city as the district headquarters. It is bounded by Jaunpur Distt. in north and north-west, by Mirzapur and Sant Ravidas Nagar Distt.s in south and south-west and by Chandauli and Ghazipur Distt.s in the east. This irregular shaped Distt. has more or less plain topography with mainly alluvial strata. The most prominent physical feature of the entire Distt. is River Ganga whose curving course dominates the landscape. The Distt. headquarters lie in the Varanasi city (popularly known as 'Kashi' or 'Banaras' by the locals).

1.2 Varanasi is one of the oldest cities in India and the holiest among seven sacred sites in Hinduism and Jainism. Situated on the banks of River Ganga with more than three thousand years of history and civilization, Varanasi has often been variously described as 'The religious capital of India', 'The holy city of India', 'The city of Temples', 'The city of Learning' and 'The cultural capital of India' (www.dsource.in). Sandwiched between the river Varuna in north and river Assi in the south, this city attained its modern name – Varanasi (Singh, 2018). Most Hindus in India believe that by dying here and getting cremated on the banks of the Holy River Ganges will help them break the chain of rebirth and attain salvation, thereby making it a major centre for pilgrimage (Saluja, 2019). The most characteristic feature of Varanasi is its many Ghats (embankments made in steps of stone slabs along the river bank) which are renowned worldwide and are a major reason for tourist influx. There are about 87 different Ghats in Varanasi among which Assi Ghat, Tulasidas Ghat, Dashashwamedh Ghat, Manikarnika Ghat, Harishchandra Ghat and Kabir Ghat are some of the prominent ones.

1.3 The Rajghat plateau in Varanasi, situated close to the confluence of Varuna and Ganga rivers, is the highest point in the city with the elevation of 83 m above mean sea level [mamsl]. The excavations in this region, coupled with ancient literature, provide ample evidence that Varanasi was once an inland port. This area, being closer to the confluence, was important in terms of deep-water availability throughout the year, facilitating ease of accessibility and transportation. It is also believed that the oldest core of Banaras was definitely in the northern part, which was mostly occupied by small villages, with an elongated projection along the Ganga to a little north of Raj Ghat, and expanded up to the Gomti-Ganga rivers confluence (village Kaithi). Most of the ancient ruins lie north of the present Maidagin-Kashi Railway Station Road and near the confluence of the Varuna river with the Ganga. [Ref. Map No. 1]

1.4 The entire Varanasi Distt. forms part of the Gangetic plain characterized with alluvial formations and plain topographic features. This region experiences subtropical humid climate with alternating rainy season, cold season and hot dry season. The Distt., in general, is more or less flat with the average elevation of land surface being about 85-105 mamsl. River Ganga is the most important characteristic feature of Varanasi Distt. along with other rivers such as Varuna, Assi and Gomti. Around Varanasi city, Ganga is the principal river, flowing incised into its narrow valley (1-2 km wide) from south to north-east direction. Ganga makes a prominent meander loop having a cut side towards Varanasi (Shukla & Raju, 2008). On the opposite side, a wide bar is developed followed by a vertical cliff along the valley margin on which Ramnagar town is located. Here, the Ganga has two tributaries – Assi Nadi on the southern flank and Varuna river on the north-eastern side of the city. Both the rivers are presently incised cutting into older alluvium called Bangar (Shukla, 2013). (ref. Map 1)

Image 1 : Dashashwamedh Ghat In Varanasi

2.0 GANGA RIVER IN VARANASI

2.1 River Ganga forms the Eastern and South-Eastern boundary of Varanasi and Chandauli Distt.s. The River meets the Distt. at Betwar village, in the extreme south of Varanasi. Here, the River is joined by a stream called Subba/Subbha Nala. Flowing northwards, the River provides water to Varanasi city and is joined by a stream called Assi Nadi (now Assi Nala) at Assi Ghat from left bank and Ghurha Nadi from right bank in Ramnagar (ref. Map 1)

2.2 The River Ganga makes its first curve between Subba Nala in Betwar and Ghurha Nadi in Ramnagar. Downstream of Ramnagar the River makes another curve and bends towards Varanasi City. In doing so, the River makes a semi-circular river course commonly referred as, "a moon over the head of Lord Shiva".

2.3 Varuna River, a major tributary of Ganga, joins the Ganga at Rajghat which is 7.5 km north of Assi Nadi. North of the villages Tantepur and Sehbar, the River forms a large riverine island which goes upto village Chhitauni and Gangapur. Between these villages the River forms two braided channels - the channel flowing through the west of riverine Island is named as Sota Nadi while the channel in the east is called as Ganga. Sota Nadi usually dries up in pre-monsoon season (ref. Map 1).

2.4 Near village Misirpura and Sarsaul the River turns sharply west upto Kaithi village and is joined by the tributary named Gomti. The Gomti-Ganga confluence, popularly called Sangam is one of the important pilgrim hotspots in the region. Ecologically, the Sangam area provides one of the important habitats to the national aquatic animal, the Gangetic Dolphin (*Platanista gangetica*).

Image 2 : Ganga River As Viewed From Malviya Bridge (Dufferin Bridge), Rajghat

Image 3 : Ganga River Bed As Seen From Katesar Village, Varanasi Distt.

3.0 METHODOLOGY FOR THE STUDY

3.1 The length of Ganga River in Varanasi Distt. is 59 km and in order to fulfil the objectives a 7 km of buffer zone on both the sides of River Ganga in Varanasi Distt. was marked out and divided into different grids (ref. Map 1). The total area within the study corridor was 497.92 sq.km. which is depicted in Map 01. Based on the secondary information analysed and the features noted on Google Earth imagery, plan for the field work was constituted to cover the different elements of natural heritage in these grids. Special focus was laid on denoting the sites important for riparian biodiversity, riverine fishing, boatmaking communities, turtle sanctuary, River and stream confluences, important waterbodies, oxbow lakes. Furthermore, contacts were developed with various resource persons in the Distt. for carrying out interactions pertaining to above mentioned aspects.

3.2 The field survey was carried out from July – October, 2019 wherein different localities were visited for data collection as depicted in Map 1. The location co-ordinates of all the localities were noted with the help of hand-held GPS and pictures of its characteristics were recorded with the help of a DSLR camera. Interactions were simultaneously carried out at most these locations for gathering information about the different cultural, social, religious and natural aspects pertaining to our objectives.

4.0 TRIBUTARIES OF RIVER GANGA

4.1a Tributaries of River Ganga in the study area fall under catchment 2B5A. Major tributaries like Varuna, Gomti, Assi and Subba Nala join from left bank to the River Ganga while Ghurha Nadi joins from right bank to the River. The details of these Rivers are –

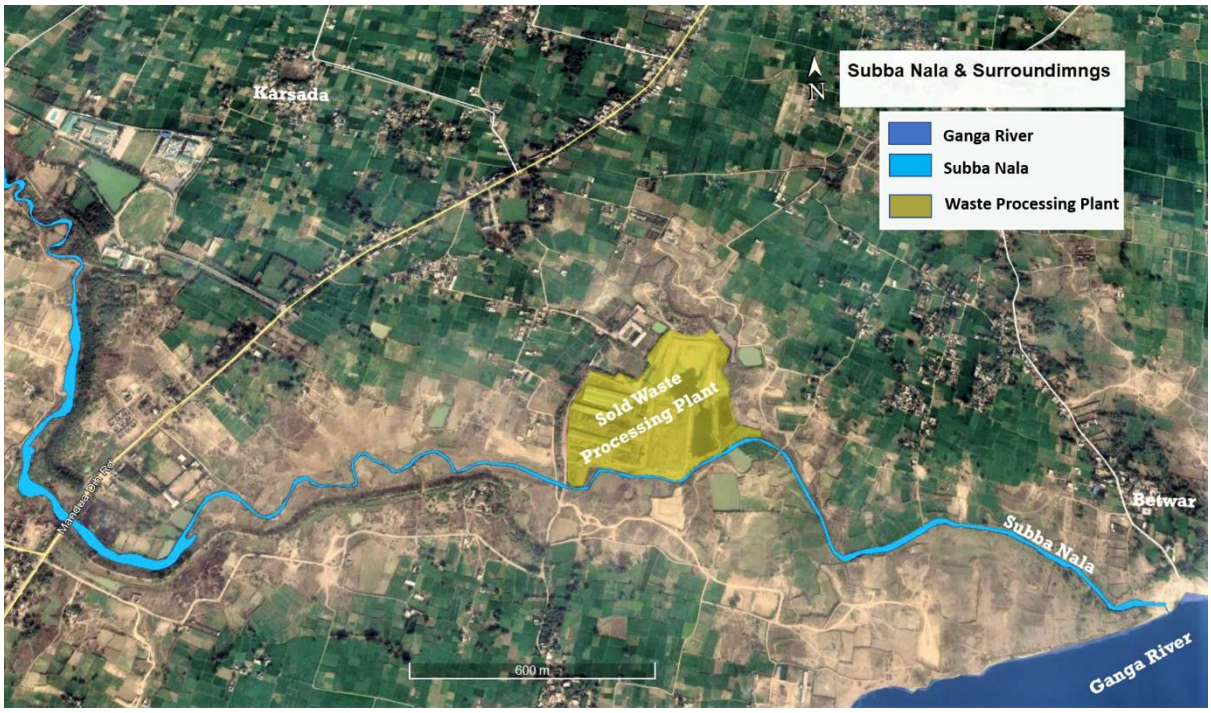
4.1 Subba Nala
4.2 Ghurha Nadi
4.3 Assi Nadi
4.4 Varuna River
4.5 Gomti River

4.1 Subba Nala

4.1.1 Subba Nala or Subbha Nala is a small tributary of River Ganga draining the south eastern part of Varanasi Distt. The stream originates near settlements called Khajuri village and Rakhaunan village and joins River Ganga near Betwar/Betawar village. Near village Bangalipur a canal called Adlapur Pumping Canal takes water from Subba Nala for irrigation. The demand from extensive agricultural activities between Bangalipur Village and Mahaban Village have limited the natural flow of the stream.

Image 4 : Subba Nala Sighted as From Mohan Sarai – Adalpura Road [Near Mahaban Village]

4.1.2 After Mahaban village the clustered brick kilns and Municipal Solid Waste (MSW) processing plant along the stream threatens the limnology, biota and morphology of the stream. The MSW plant located at the edge of the stream is embanking a channel of the stream seen in satellite image (ref. Map 2). Crossing the MSW plant at Karsada village, the stream outfalls into River Ganga at Betwar.



Map 1 : MSW Plant At The Edge Of Subba Nala

Image 5 : Subba Nala Confluence With River Ganga [Note Erosion Of Banks]

4.2 Ghurha Nadi

4.2.1 Ghurha Nadi is a small stream originating near Sengra Village of Chandauli Distt. After Sengra village, the stream is joined by a minor canal named Rahlupur minor. The stream travels a distance of 7.5 km in Ramnagar area of Varanasi Distt. and discharges into River Ganga, adjacent to newly constructed inland port in Ramnagar. Currently, the stream is carrying untreated sewage flow. The upstream stretch of the stream is altered by the railway line and industrial setup of the region (ref. Map 3).

Map 2 : Ghurha Nadi In Varanasi Distt.

Image 6 : Ghurha Nadi Near Inland Port

4.3 Assi Nadi

4.3.1 Assi River or Assi Nala is believed to have emerged from Kandwa Pokhara at Ghamahapur (Karmadeshwar Mahadev Temple, 25°16'5.81"N, 82°57'30.01"E) which is an important pilgrim site in Varanasi city. This River has a length of 7.7 km with an approximate watershed area of 13.5 sq.km (Srivastava et. al., 2017). The basin of the River is identified as a third order basin with dendritic drainage pattern. (Srivastava et. al., 2017).

4.3.2 Along the course, there are numerous industrial and domestic drains that empty into the River (ref. Image 10). The River, once surrounded by dense forest (based on local interactions), is now a threatened urban River of the Distt. The River flows through dense urban settlements and empties into River Ganga near Assi Ghat (25°16'58.86"N, 83° 0'35.32"E).

4.3.3 At the confluence the gradient is steep and the water meets the Ganga through an open concrete cunuit to prevent soil erosion. Continuous dumping of waste and heavy encroachments (ref. Image 9) have reduced this River into little more than a drain. The River has a discharge of around 75 MLD with a BOD load of around 100 mg/l. The River now debouches into Ganga 700m south of Assi Ghat, its final course having been altered to 200 m south of its original outfall and straightened.

Image 7 : Assi Nadi And Ganga River Confluence

Image 8 : Encroachments And Garbage Dumping In Assi Nadi


Image 9 : Assi Nadi From Pt. Malviya Road

Image 10 : Sewage Leaking From Sulabh Shauchalaya Eroding Own Foundations
[Note: Another Inflow At Bottom of Image]

4.4 Varuna River

4.4.1 Varuna [also called Barna] River is a tributary of River Ganga originating from Dain Tal [25°27′N, 82°18′E] near Mau Aima in Allahabad Distt. The River joins Ganga in Rajghat area of Varanasi at 25°19′46″N 83°02′40″E (ref. Image 11). In a total length of 225 km, the River is joined by two important tributaries. namely Basuhi and Morwa.

4.4.2 Varuna, in its terminal reach, is entirely an urban river, skirting the northern edge of Varanasi urban area. A river front development has been carried out by the usual beautification interventions of pathways, railings, lighting and benches but the beautification works were inundated in the recent monsoon season. The River's course is through agricultural countryside.

Image 11 : Varuna-Ganga Sangam At Rajghat, Varanasi

Image 12 : Rich vegetation Observed Along Varuna Stream Near Rajghat

4.5 Gomti Nadi

4.5.1 Gomti River originates at or near Madho-Tanda which is a densely forested area near Pilibhit town and drains a basin of 730 sq. km. area. It flows through important cities of Distt.s Pilibhit, Shahjahanpur, Sitapur, Lucknow, Barabanki, Sultanpur, Jaunpur and Ghazipur. The River forms the boundary of Ghazipur and Varanasi Distt. and finally, outfalls into River Ganga near Hatauri village of Ghazipur and Kaithi village of Varanasi at 25°30'26.40"N, 83°10'7.44"E. The River is characterized by sluggish flow throughout the year, except during the monsoon season.

Image 13 : Ganga Gomti Sangam [Oct, 2019]

Image 14 : Gomti River from NH 29 [Oct, 2019]

5.0 LAND USE AND LAND COVER [LULC]

5.1 Land Use Land Cover (LULC) Map of the study corridor has been prepared from Landsat imagery. Using unsupervised classification system 8 classes were generated as Vegetation, Agriculture, Fallow land, Open/Barren, River Bed/Sand Bar, Built-up Land, Water Area.

5.2 The study area constitutes 497.93 sq. km covering right bank of River Ganga, Ganga River bed, riverine islands and Ramnagar area of the right bank of Ganga. Based on the classification, following observations were drawn :

- Agricultural land covers 39.09% of the total area.
- Fallow land has a distribution of 20%. This includes agricultural fallow land and brick kiln area.
- Vegetation cover has a distribution of 9.29% of the total area. This includes vegetation in urban spaces like cantonment, BHU, DLW and Krishnamurthy foundation. The area includes the vegetation found on the bank of River Ganga and at Riverine islands.
- Open/Barren area has a distribution of 2.30% of total study area. It covers the abandoned construction sites, solid waste dumping sites like Ramna dumping site (ref. Map 05 & 06).
- River bed/Sand bar and water area together constitutes 10.5% of the study area. It covers lentic and lotic water systems within the study area.
- The built-up land is third largest class having area of 18.58%. This class has a major distribution in the middle stretch of the study corridor.

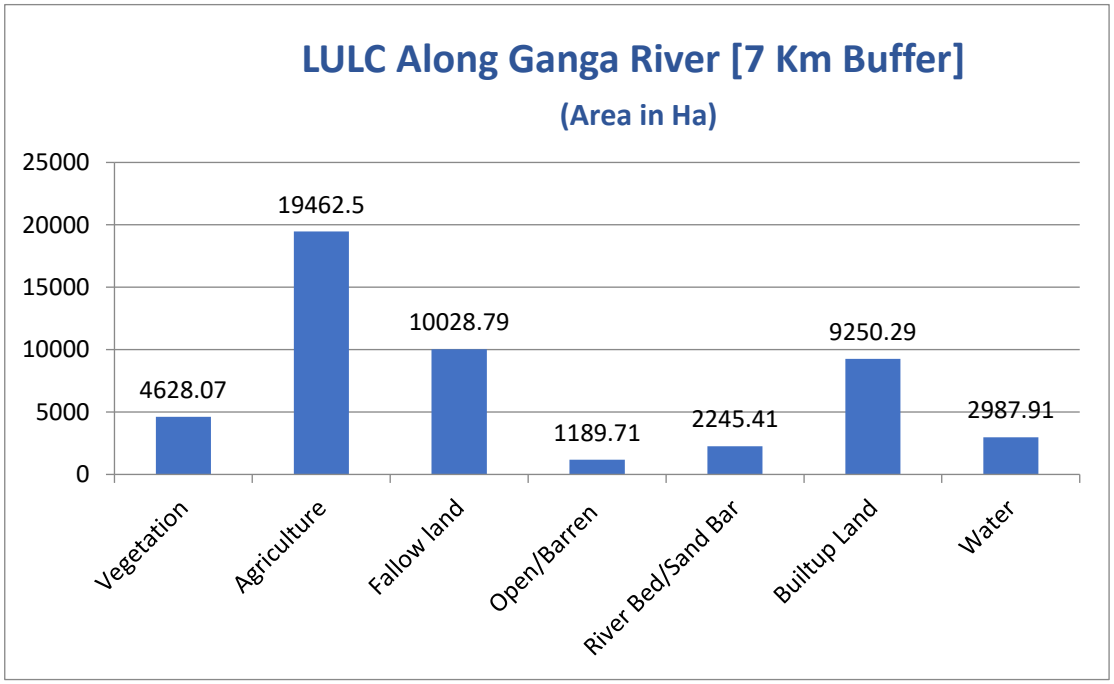


Figure 1 : Land Use And Land Cover [LULC] Along River Ganga

6.0 PALEO-CHANNELS IN THE STUDY CORRIDOR

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. In Distt.s like Varanasi there are other factors which act as a catalyst for the disappeared river channels. These factors are – extensive agricultural practices, rapid urbanization, brick kilns, industrial activities and infrastructure projects.

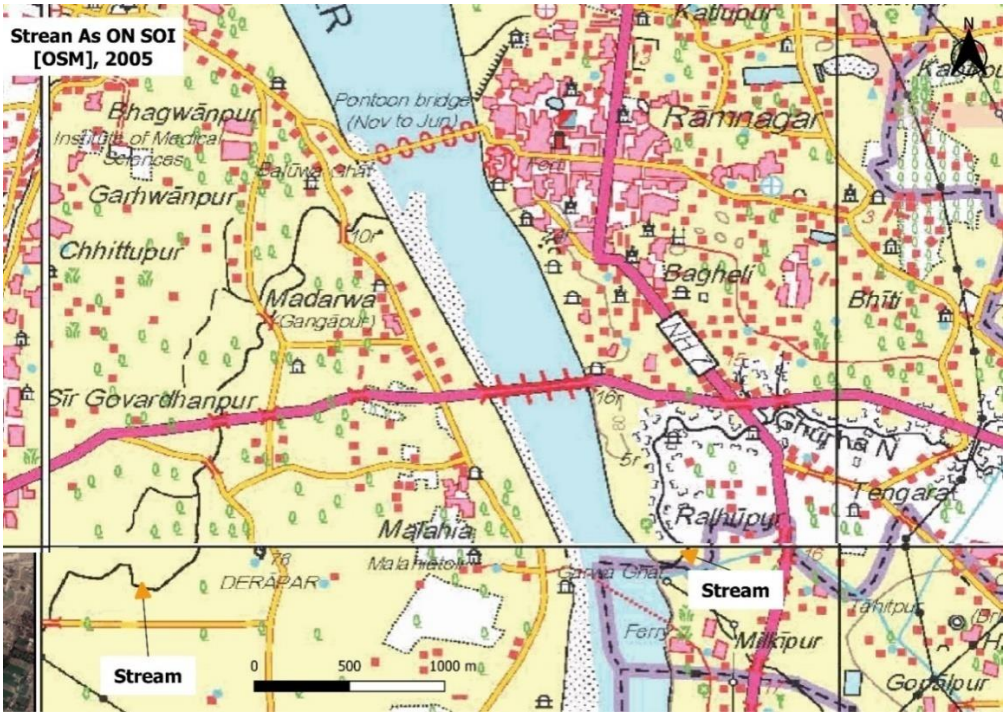
6.2 The comparative study of Survey of India (SOI) maps from 1925-1930 to SOI 2005 and Google Imagery upto April, 2019 shows that the river channel of Ganga in Varanasi has remained constant [without meandering] while a few small streams which flowed directly into Ganga have either disappeared or are on the verge of disappearing. Map 09 in the current section is also showing the paleo-water bodies in the study area.

6.3 In Varanasi city, it was informed that two streams, namely Mandakini and Godavari, once used to flow through Varanasi city. It was informed that the places named as Maidagin and Godauliya are the locations of those streams and that these streams find mention in Kashi Khand of Askanda Purana. The study of SoI map series and Google imagery (in time series) and ground survey showed four small streams whose courses have faded or disappeared altogether. The details are Tabulated Below:

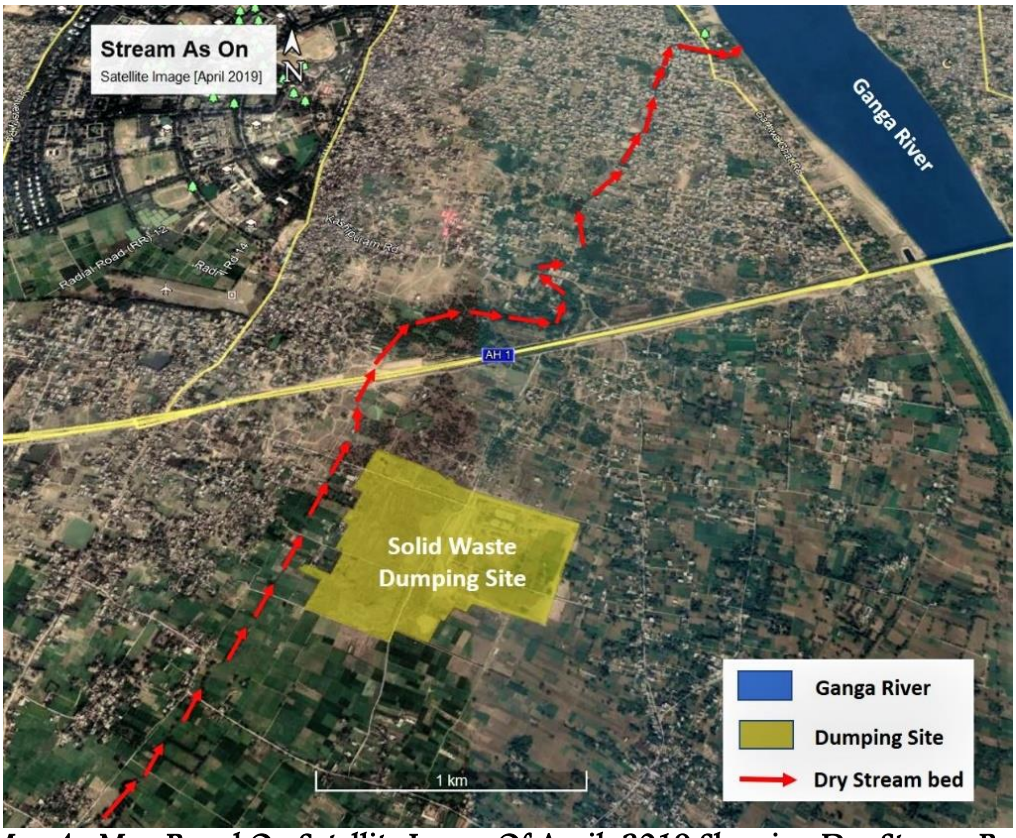
Table 1 : Current/Potential Threats On Small Streams

Name	Coordinates and Settlements near Stream	Current/Potential Threats
Nara	25°16'1.92"N, 83°1'2.44"E Settlements – Chittupur, Sear Goverdhan, Ramna	Encroachment, Agriculture Solid Waste Dumping in Ramna, Urbanization
Nara	25°20'4.26"N, 83°3'30.69"E Settlements – Sarai Mohana, Rajapur, Kotwa	Agricultural Activities Siltation Brick Kiln
Nara	25°20'49.19"N, 83°7'39.27"E Settlements – Chandpur, Hanumanpur, Dhanpur	Agricultural Activities Siltation Brick Kiln
Nara	25°22'51.40"N, 83° 9'11.36"E Settlements – Jalhupur Village, Amba Village	Agricultural Activities Siltation Brick Kiln Loss of Vegetation along stream

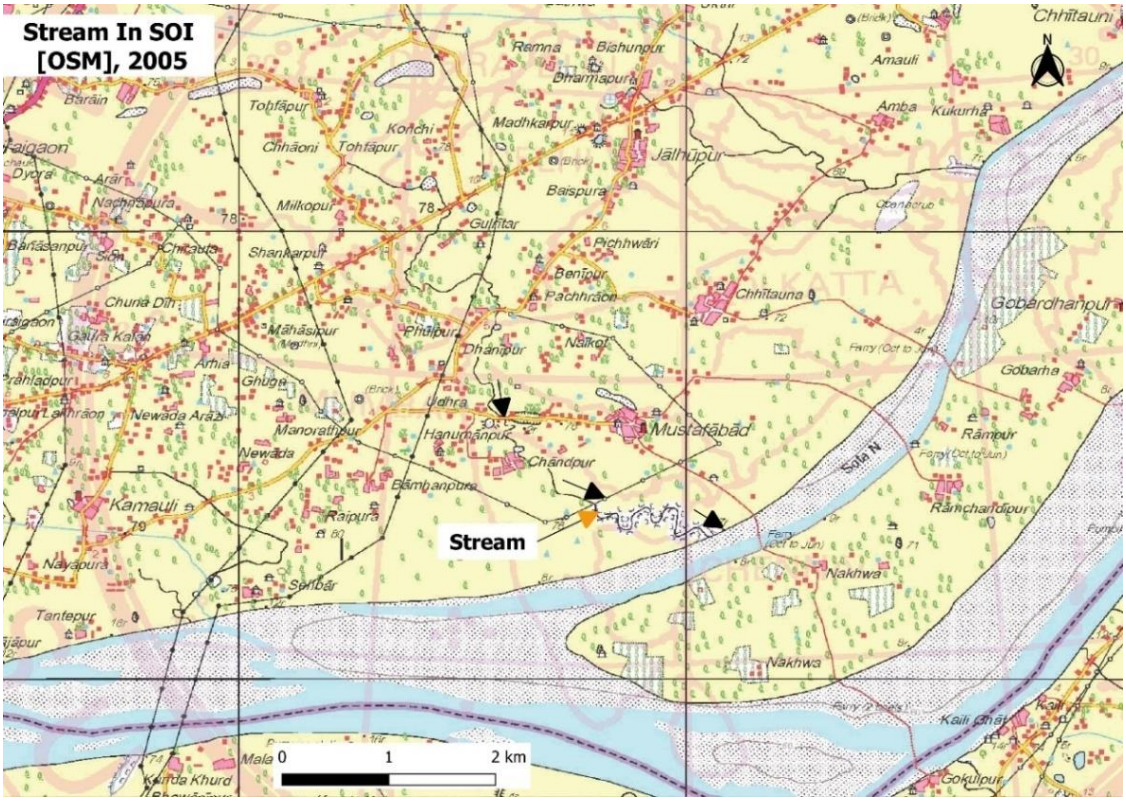
6.4 The newer alluvium occurs adjacent to the drainage course of the Ganga, the area being subjected to floods during rainy season each year, which deposit a mat of fresh silt, clay and loam.



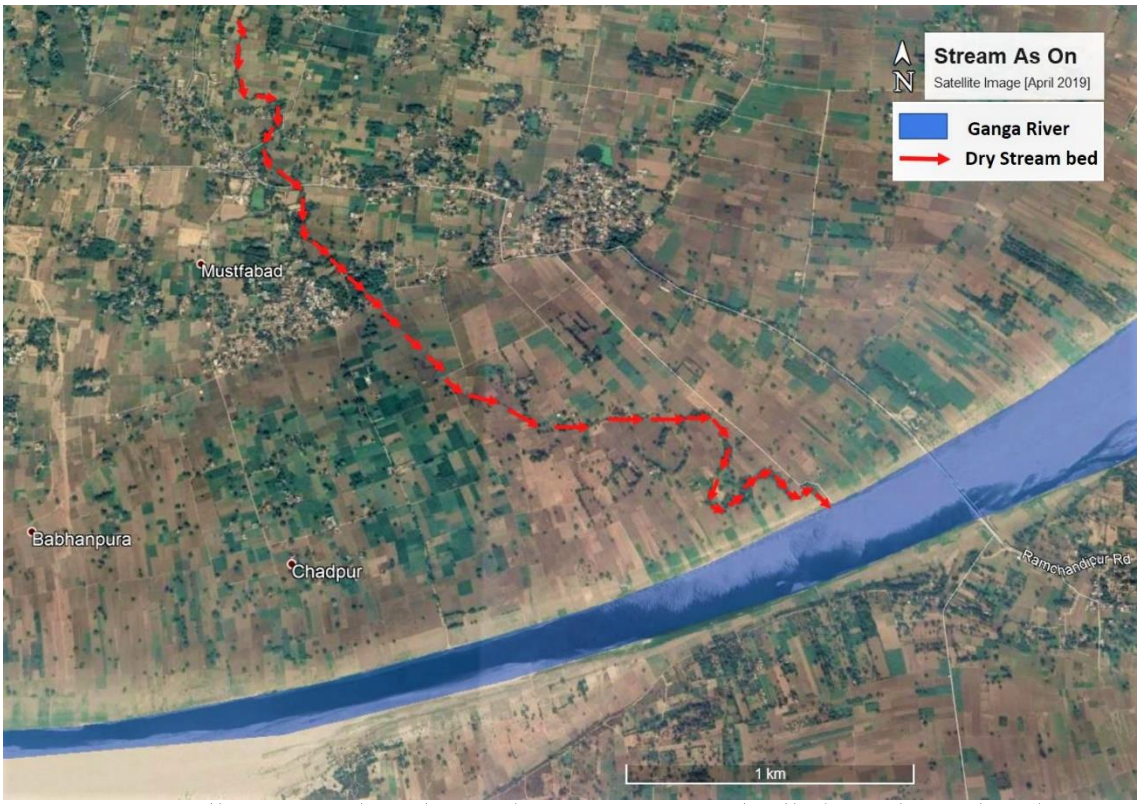
Map 3 : SOI (OSM), 2005 Showing Stream Bed In Ramna, Sir/Sear Goverdhan



Map 4 : Map Based On Satellite Image Of April, 2019 Showing Dry Stream Bed (Called Nara) In Ramna, Sir/Sear Goverdan



Map 5 : SOI (OSM), 2005 Toposheet Showing Stream Bed In Chandpur, Hanumanpur And Dhanpur Village



Map 6 : Satellite Image (April, 2019) Of Dry Stream (Called Nara) In Chandpur, Hanumanpur And Dhanpur Village

7.0 FLOODPLAIN OF RIVER GANGA IN VARANASI

7.1 The active flood plain of a river is defined as an area on either side of the River channel subject to flooding on a periodic basis. Maintaining the active flood plain of a River is critical for retaining lateral integrity and equilibrium in the ecosystem. The flood plain harbours rich biodiversity including riparian vegetation as well as many other groups of organisms which help in maintaining the fertility of this region. Wetting of the floodplain soil releases an immediate surge of nutrients - those left over from the last flood and those that result from the rapid decomposition of organic matter that has accumulated since then. Owing to their higher nutrient contents, these areas are often occupied by the local farmers for carrying out agriculture in the post-monsoon season.

7.2 Most of the floodplain agricultural fields in the Distt. had rice and bajra as the major crop produce. Many respondents claimed that earlier jowar used to be grown in these fields but is no longer preferred as these two crops enjoy commercial preference. Apart from these crops, vegetables such as lauki (gourd), tomato, karela (bitter gourd), parval, kaddu (pumpkin) and fruits such as tarbooja, kharbooja and pulses such as toor daal, urad daal were also found to be grown in the floodplain agricultural farms of different villages. The use of nitrogen-based fertilizer especially urea was reported in many floodplain agricultural fields in the district. The details of these villages along with the crops grown are provided in Table 02. Some of the floodplain agriculture farms are depicted in Images 15 & 16.

Table 2 : Floodplain Agricultural Produce of Different Villages in Varanasi Distt.

Sr. No.	Village Name	Floodplain Produce
1.	Amba village	Rice, Bajra, Sarso, Lauki, Parval, Kharbooja
2.	Katesar village	Rice, Wheat, Bajra, Arhar, Mooli
3.	Chhitauna village	Rice, Wheat, Karela, Lauki, Mutter, Tomato
4.	Betawar Village	Rice, Bajra, Lauki, toordaal, tarbooj

Image 15 : Rice Fields In Chhittauna Village

Image 16 : Bajra Fields In Katesar Village

7.3 Floodplain Grass

7.3.1 The Ganga floodplain in Varanasi Distt. is an important habitat for the luxuriant growth of *Saccharum bengalense* Retz. (formerly known as *Saccharum munja* Roxb.; Family – Poaceae). Commonly called as Munj or Sarkanda by the locals, this tall perennial grass species grows abundantly throughout the riparian areas in the Distt. (Image 17). It has successfully colonized alluvial sandy banks of Ganga in places not subject to water logging. Owing to its enormous growth potential combined with the binding capacity of its roots, it is very useful in checking soil erosion and stabilizing sandy soils (Vasudevan et al., 1984). The local communities use this grass in its dried state extensively for thatching the roofs of their dwellings.

Image 17 : Thick Growth Of Floodplain Grass – Saccharum bengalense In Amba Village

8.0 WETLANDS IN THE STUDY AREA

8.1 Wetlands are the most productive and unique ecosystems which play a crucial role in maintaining many natural cycles as well as support a wide range of biodiversity. They have also served as important resources for many eco-system services such as fishing, farming, water purification, bird habitats. During this study, **about 357 wetlands of different shapes and sizes were identified** with the help of Google imagery (April, 2019). The details of these wetlands are presented in Table 03 and their locations are depicted in Map 10. The total area occupied by these water bodies was found to be 300 ha of which the oxbow lake situated near Hatauri village constituted about 14.3% of the total wetland area making it the largest wetland in the study region.

Table 3 : List of Wetlands Recorded in the Study Area

S. No.	Site	Locations		Area (ha)
		Latitude	Longitude	
1	1	25°15'0.86"N	82°59'26.62"E	0.95
2	2	25°17'25.78"N	82°59'7.99"E	1.65
3	3	25°15'58.75"N	83° 2'10.11"E	2.73
4	Sona Talab	25°20'48.53"N	83° 0'59.06"E	2.60
5	Akshirsagar	25°16'49.96"N	83° 2'18.28"E	9.66
6	6	25°16'11.68"N	83° 2'27.96"E	4.1
7	Sagra Tal	25°16'28.62"N	83° 2'26.60"E	8.71
8	Moti Jheel	25°18'1.95"N	82°58'40.98"E	4.71
9	9	25°15'51.99"N	83° 2'21.50"E	1.48
10	10	25°15'28.79"N	82°57'14.29"E	2.65
11	11	25°16'5.98"N	82°57'25.61"E	1.48
12	12	25°16'6.13"N	82°57'31.01"E	1.15
13	13	25°15'52.69"N	82°57'48.71"E	0.79
14	14	25°18'37.12"N	82°55'50.83"E	4.1
15	Lahartara Talab	25°18'42.66"N	82°58'9.09"E	7.28
16	16	25°18'29.39"N	82°58'18.70"E	4.40
17	17	25°18'41.31"N	82°58'54.87"E	2.37

18	18	25°18'10.14"N	82°59'56.66"E	2.24
19	19	25°18'49.82"N	82°58'33.92"E	2.68
20	20	25°18'52.46"N	82°58'26.73"E	2.72
21	Chancha Tal	25°21'26.79"N	82°57'32.72"E	6.74
22	22	25°21'24.80"N	82°57'20.04"E	1.14
23	23	25°18'2.99"N	82°59'20.22"E	1.94
24	Pisach Mochan Tal	25°19'18.64"N	82°59'43.77"E	2.59
25	25	25°22'53.21"N	83° 1'55.39"E	14.8
26	26	25°21'9.81"N	82°59'23.36"E	2.85
27	Sarang Talab	25°21'1.49"N	83° 0'24.84"E	3
28	28	25°16'23.90"N	82°58'29.15"E	0.45
29	29	25°16'24.27"N	82°58'26.97"E	0.96
30	30	25°16'24.94"N	82°57'58.31"E	0.94
31	31	25°16'19.79"N	83° 1'56.31"E	1.68
32	32	25°17'17.46"N	82°59'29.46"E	1.35
33	33	25°17'31.93"N	82°59'13.33"E	0.82
34	34	25°17'29.75"N	82°59'19.05"E	0.64
35	35	25°16'22.36"N	83° 1'37.69"E	0.86
36	36	25°16'37.15"N	83° 2'33.43"E	1.65
37	37	25°16'6.15"N	82°57'31.16"E	1.15
38	38	25°16'10.71"N	82°57'35.22"E	0.70
39	39	25°15'52.69"N	82°57'48.71"E	0.79
40	40	25°16'24.84"N	82°57'58.29"E	0.94
41	41	25°19'3.22"N	82°57'15.82"E	1.23
42	42	25°18'19.64"N	82°57'56.19"E	3.69
43	43	25°18'24.35"N	82°57'48.37"E	1.47
44	44	25°15'26.58"N	82°57'6.19"E	2.69
45	45	25°16'53.11"N	82°58'5.55"E	2.60
46	46	25°16'55.00"N	82°57'55.80"E	2.93

47	47	25°16'13.29"N	82°58'7.14"E	1.76
48	48	25°15'15.84"N	82°58'46.24"E	0.30
49	49	25°15'7.40"N	82°59'57.58"E	0.43
50	50	25°15'6.92"N	83° 0'6.39"E	0.1
51	51	25°15'5.64"N	83° 0'11.29"E	0.41
52	52	25°15'8.37"N	83° 0'22.07"E	0.35
53	53	25°15'10.00"N	83° 0'30.24"E	0.81
54	54	25°15'20.27"N	83° 0'35.44"E	1.0
55	55	25°15'29.22"N	83° 0'33.16"E	0.59
56	56	25°15'37.93"N	83° 0'20.63"E	0.56
57	57	25°15'30.28"N	82°58'28.71"E	0.38
58	58	25°15'37.48"N	82°58'52.59"E	0.1
59	59	25°15'34.04"N	82°58'50.78"E	0.23
60	60	25°15'32.50"N	82°58'48.54"E	0.27
61	61	25°14'57.63"N	82°58'52.80"E	0.15
62	62	25°14'38.79"N	82°59'6.16"E	0.61
63	63	25°14'34.05"N	82°59'19.78"E	1.30
64	64	25°14'52.37"N	83° 0'1.50"E	0.41
65	65	25°14'24.92"N	82°58'12.02"E	0.13
66	66	25°14'19.50"N	82°57'53.43"E	0.23
67	67	25°14'19.45"N	82°57'55.07"E	0.76
68	68	25°14'17.41"N	82°57'47.09"E	0.35
69	69	25°14'13.92"N	82°57'51.51"E	0.1
70	70	25°14'6.92"N	82°57'17.96"E	0.30
71	71	25°14'0.95"N	82°57'33.65"E	0.73
72	72	25°13'38.74"N	82°58'32.14"E	2.88
73	73	25°13'53.91"N	82°57'20.48"E	0.37
74	74	25°13'51.87"N	82°57'26.49"E	0.21
75	75	25°13'23.12"N	82°58'9.76"E	1.28

76	76	82°58'9.76"E	82°58'23.40"E	0.48
77	77	25°13'13.71"N	82°58'17.42"E	0.18
78	78	25°13'6.85"N	82°58'58.97"E	0.83
79	79	25°13'10.49"N	82°59'8.68"E	0.23
80	80	25°13'35.83"N	82°57'50.35"E	0.76
81	81	25°13'14.62"N	82°57'0.27"E	1.89
82	82	25°13'11.40"N	82°56'41.30"E	1.22
83	83	25°13'13.82"N	82°56'42.44"E	0.1
84	84	25°12'53.39"N	82°57'26.75"E	0.15
85	85	25°12'50.02"N	82°57'29.12"E	0.1
86	86	25°13'48.34"N	82°54'57.84"E	1.18
87	87	25°13'42.58"N	82°54'59.50"E	1.82
88	88	25°13'15.78"N	82°54'17.45"E	1.49
89	89	25°12'31.81"N	82°53'58.95"E	1.18
90	90	25°11'49.51"N	82°50'14.48"E	2.61
91	91	25°12'7.65"N	82°49'32.97"E	0.66
92	92	25°12'3.76"N	82°49'31.50"E	1.27
93	93	25°12'8.76"N	82°49'5.25"E	0.56
94	94	25°11'55.38"N	82°48'22.98"E	0.78
95	95	25°11'53.18"N	82°48'31.97"E	0.39
96	96	25°12'2.67"N	82°48'38.06"E	0.44
97	97	25°11'57.62"N	25°11'57.62"N	0.86
98	98	25°12'1.92"N	82°48'12.57"E	0.19
99	99	25°11'58.35"N	82°48'18.31"E	0.17
100	100	25°29'49.23"N	83° 8'58.47"E	0.43
101	101	25°30'0.29"N	83° 8'36.63"E	0.26
102	102	25°28'58.28"N	83° 8'1.10"E	0.12
103	103	25°21'53.32"N	83° 0'14.88"E	0.1
104	Ladhu Talab	25°19'40.28"N	83° 1'0.69"E	0.47

105	105	25°20'4.08"N	83° 1'41.67"E	0.53
106	106	25°19'56.50"N	83° 1'48.28"E	0.37
107	107	25°19'53.28"N	83° 1'43.27"E	0.33
108	Bhakra Kunda	25°20'6.07"N	83° 0'39.92"E	0.69
109	109	25°30'5.62"N	83° 8'17.94"E	0.1
110	110	25°28'15.10"N	83° 7'19.57"E	1.20
111	111	25°28'17.65"N	83° 6'58.42"E	0.47
112	112	25°27'54.46"N	83° 6'35.30"E	0.35
113	113	25°16'25.44"N	82°56'57.99"E	0.46
114	114	25°28'11.11"N	83° 6'27.73"E	0.28
115	115	25°26'28.45"N	83° 6'32.17"E	0.76
116	116	25°26'35.59"N	83° 6'37.10"E	0.1
117	117	25°26'29.62"N	83° 6'26.29"E	0.20
118	118	25°26'18.76"N	83° 6'21.18"E	0.11
119	119	25°24'37.72"N	83° 7'22.96"E	0.44
120	120	25°24'34.05"N	83° 7'16.60"E	0.15
121	121	25°24'30.15"N	83° 7'13.37"E	0.14
122	122	25°24'13.74"N	83° 6'49.60"E	0.42
123	123	25°23'36.72"N	83° 6'44.76"E	0.27
124	124	25°24'0.19"N	83° 5'22.15"E	1.42
125	125	25°23'10.40"N	83° 5'19.76"E	0.53
126	126	25°23'9.64"N	83° 5'42.76"E	0.28
127	127	25°23'22.14"N	83° 6'8.18"E	0.26
128	128	25°24'48.87"N	83° 6'12.79"E	0.48
129	129	25°28'53.73"N	83° 5'51.10"E	0.15
130	130	25°29'3.74"N	83° 6'47.55"E	0.12
131	131	25°28'58.44"N	83° 7'4.06"E	0.14
132	132	25°28'53.81"N	83° 7'6.61"E	0.1
133	133	25°24'31.64"N	83° 5'33.63"E	0.24

134	134	25°24'26.52"N	83° 5'26.71"E	0.15
135	135	25°24'24.99"N	83° 5'21.95"E	0.1
136	136	25°22'47.81"N	83° 6'3.72"E	0.1
137	137	25°22'33.77"N	83° 6'45.33"E	0.31
138	138	25°23'4.52"N	83° 6'55.49"E	0.51
139	Kaccha Baba Pond	25°23'2.20"N	83° 6'59.44"E	0.85
140	140	25°23'14.81"N	83° 7'36.98"E	0.24
141	141	25°23'20.35"N	83° 8'36.99"E	0.42
142	142	25°23'39.96"N	83° 8'43.51"E	0.60
143	143	25°23'39.69"N	83° 8'46.55"E	0.69
144	144	25°23'44.63"N	83° 9'0.55"E	0.58
145	145	25°24'1.04"N	83° 9'29.88"E	0.32
146	146	25°24'26.13"N	83° 6'17.28"E	0.11
147	147	25°22'16.49"N	83° 7'24.06"E	0.73
148	148	25°22'32.67"N	83° 4'45.56"E	0.29
149	149	25°22'28.38"N	83° 4'32.18"E	0.86
150	150	25°22'31.68"N	83° 4'55.95"E	0.1
151	151	25°22'23.17"N	83° 4'19.46"E	0.47
152	152	25°22'28.77"N	83° 4'7.34"E	0.15
153	153	25°22'10.51"N	83° 4'34.18"E	0.32
154	154	25°21'17.77"N	83° 3'18.30"E	0.62
155	155	25°21'52.54"N	83° 2'53.17"E	0.27
156	156	25°21'55.07"N	83° 2'56.31"E	0.47
157	157	25°21'59.46"N	83° 3'30.01"E	0.58
158	158	25°22'3.83"N	83° 3'15.49"E	0.51
159	159	25°22'11.42"N	83° 3'19.03"E	0.75
160	160	25°22'5.86"N	83° 3'50.65"E	0.21
161	161	25°21'42.39"N	83° 2'29.12"E	0.35
162	162	25°21'37.31"N	83° 2'29.55"E	0.34

163	163	25°11'57.43"N	82°48'24.48"E	0.1
164	164	25°11'56.51"N	25°11'56.51"N	0.1
165	165	25°11'59.15"N	82°48'27.30"E	0.27
166	166	25°21'41.71"N	82°56'18.58"E	0.46
167	167	25°21'56.53"N	82°56'36.08"E	0.64
168	168	25°21'42.18"N	82°57'40.76"E	0.33
169	169	25°20'51.74"N	82°57'38.11"E	2.41
170	170	25°20'57.59"N	82°57'17.66"E	0.42
171	171	25°20'56.95"N	82°57'24.05"E	0.16
172	172	25°23'2.65"N	82°57'36.63"E	0.27
173	173	25°23'13.53"N	82°58'44.87"E	0.27
174	174	25°23'10.17"N	82°58'45.16"E	0.11
175	175	25°23'4.49"N	82°58'43.99"E	0.40
176	176	25°23'9.24"N	82°59'6.81"E	0.1
177	177	25°22'28.56"N	82°59'10.30"E	0.48
178	178	25°22'44.05"N	82°59'20.75"E	0.42
179	Fish Pond	25°21'34.83"N	82°58'20.79"E	0.35
180	180	25°22'23.57"N	82°57'58.63"E	0.75
181	181	25°21'39.87"N	82°58'20.22"E	0.18
182	182	25°21'43.05"N	82°58'27.56"E	0.1
183	183	25°21'40.85"N	82°58'27.95"E	0.1
184	184	25°21'39.10"N	82°58'27.02"E	0.40
185	185	25°21'29.01"N	82°58'28.55"E	0.26
186	186	25°21'27.55"N	82°58'41.27"E	0.23
187	187	25°22'33.88"N	83° 0'23.81"E	0.13
188	Sarang Nath Kund	25°22'36.52"N	83° 1'50.98"E	0.26
189	189	25°21'36.62"N	83° 2'46.75"E	0.19
190	190	25°21'45.49"N	83° 2'18.50"E	0.34
191	191	25°21'46.93"N	83° 2'27.26"E	0.15

192	192	25°22'9.69"N	83° 0'20.08"E	0.12
193	193	25°22'8.45"N	83° 0'18.35"E	0.1
194	194	25°22'49.92"N	83° 0'18.08"E	0.28
195	195	25°22'21.15"N	82°59'50.71"E	0.50
196	196	25°22'41.61"N	82°59'21.07"E	0.1
197	197	25°21'23.49"N	82°58'12.81"E	0.19
198	198	25°22'6.34"N	82°57'24.49"E	0.82
199	199	25°22'51.58"N	82°57'20.85"E	0.25
200	200	25°31'5.32"N	83° 6'27.29"E	0.11
201	201	25°15'53.51"N	82°57'35.87"E	0.32
202	202	25°15'48.09"N	82°57'36.46"E	0.25
203	203	25°16'2.88"N	82°58'12.55"E	0.75
204	204	25°12'23.17"N	82°48'47.10"E	0.24
205	205	25°13'26.65"N	82°56'49.77"E	0.1
206	206	25°13'26.65"N	82°56'49.78"E	0.1
207	Kurukshetra Pokhra	25°17'23.29"N	83° 0'8.37"E	0.40
208	208	25°17'20.91"N	82°59'58.77"E	0.63
209	Pushkar Talab	25°17'9.56"N	83° 0'16.06"E	0.79
210	Shankuldhara Pokhra	25°17'49.09"N	82°59'36.07"E	0.29
211	211	25°16'9.12"N	82°57'52.42"E	0.1
212	212	25°21'53.36"N	83° 0'29.60"E	0.11
213	213	25°20'21.85"N	82°57'48.62"E	0.1
214	214	25°19'19.80"N	82°57'50.33"E	0.27
215	215	25°18'59.23"N	82°57'43.84"E	0.34
216	216	25°21'33.60"N	83° 1'53.09"E	0.32
217	217	25°21'33.03"N	83° 1'55.58"E	0.1
218	218	25°20'32.09"N	83° 1'38.14"E	0.13
219	219	25°20'29.89"N	83° 0'58.78"E	0.0
220	220	25°19'36.18"N	83° 0'4.36"E	0.1

221	221	25°19'29.71"N	83° 0'3.89"E	0.1
222	222	25°17'20.07"N	82°58'9.45"E	0.1
223	223	25°20'5.62"N	83° 1'47.09"E	0.86
224	224	25°19'59.70"N	83° 1'33.70"E	0.23
225	225	25°20'6.88"N	83° 1'20.99"E	0.56
226	226	25°19'57.69"N	83° 1'27.28"E	0.27
227	227	25°20'16.50"N	83° 0'53.89"E	0.66
228	228	25°20'13.89"N	83° 0'42.32"E	0.54
229	229	25°20'31.33"N	83° 0'7.69"E	0.25
230	230	25°20'30.89"N	83° 0'5.09"E	0.16
231	231	25°20'22.51"N	83° 0'2.89"E	0.1
232	232	25°20'19.89"N	83° 0'2.24"E	0.1
233	233	25°20'31.56"N	83° 0'38.68"E	0.21
234	234	25°20'20.78"N	83° 0'42.03"E	0.1
235	235	25°21'3.30"N	82°58'40.31"E	0.1
236	236	25°21'0.75"N	82°59'4.99"E	0.55
237	237	25°20'37.14"N	82°59'39.70"E	0.14
238	238	25°20'38.94"N	82°59'41.20"E	0.13
239	239	25°20'34.35"N	82°59'45.09"E	0.72
240	Paharia Talab	25°21'19.20"N	83° 0'18.06"E	0.26
241	241	25°20'35.20"N	83° 0'3.50"E	0.19
242	Daulatpur Pokhra	25°21'38.06"N	82°59'48.98"E	0.25
243	243	25°21'17.08"N	82°59'25.58"E	0.93
244	244	25°20'12.14"N	82°59'21.38"E	1.19
245	245	25°20'15.81"N	82°59'15.97"E	0.1
246	246	25°20'44.30"N	83° 0'28.26"E	0.10
247	247	25°20'45.69"N	83° 1'31.03"E	0.16
248	248	25°20'35.40"N	83° 1'42.97"E	0.24
249	249	25°20'52.89"N	83° 1'58.47"E	0.1

250	250	25°20'36.78"N	83° 2'18.67"E	0.66
251	251	25°20'33.89"N	83° 2'17.84"E	0.58
252	252	25°20'24.25"N	83° 2'46.10"E	0.11
253	253	25°21'39.88"N	83° 1'45.34"E	0.66
254	254	25°21'39.35"N	83° 1'39.26"E	0.1
255	255	25°21'54.38"N	83° 1'29.52"E	0.1
256	256	25°21'51.47"N	83° 1'17.38"E	0.53
257	257	25°20'26.32"N	83° 3'11.53"E	0.30
258	258	25°20'34.68"N	83° 3'21.53"E	0.1
259	259	25°21'39.03"N	83° 1'52.77"E	0.17
260	260	25°21'43.77"N	83° 1'39.34"E	0.1
261	261	25°21'18.89"N	83° 2'13.86"E	0.58
262	262	25°21'20.18"N	83° 2'9.92"E	0.1
263	263	25°21'18.44"N	83° 2'18.76"E	0.13
264	264	25°21'14.59"N	83° 1'42.89"E	0.40
265	265	25°21'12.79"N	83° 1'42.93"E	0.39
266	266	25°21'41.53"N	83° 1'22.69"E	0.10
267	267	25°21'41.81"N	83° 1'19.49"E	0.1
268	Mavaiya Pokhra	25°21'36.32"N	83° 1'6.72"E	0.42
269	269	25°21'39.69"N	83° 1'9.57"E	0.23
270	270	25°21'33.29"N	83° 1'15.76"E	0.12
271	271	25°20'32.20"N	82°58'19.79"E	0.1
272	272	25°19'9.65"N	82°59'42.12"E	0.78
273	Pitrakunda Pokhra	25°19'1.16"N	82°59'54.84"E	0.45
274	274	25°18'43.67"N	83° 0'8.65"E	0.56
275	Chakra Taal	25°18'55.52"N	82°59'26.66"E	0.70
276	Sonia Pokhra	25°18'50.26"N	82°59'30.68"E	0.30
277	277	25°18'31.10"N	82°59'22.15"E	0.27
278	Ram Kund	25°18'33.99"N	82°59'48.48"E	0.26

279	Lakshmi Kund	25°18'35.99"N	83° 0'0.15"E	0.26
280	280	25°18'40.28"N	82°59'52.97"E	0.18
281	281	25°20'31.84"N	83° 0'16.53"E	0.1
282	282	25°20'16.03"N	83° 1'10.20"E	0.1
283	283	25°20'14.83"N	83° 1'23.03"E	0.1
284	284	25°20'11.32"N	83° 1'57.82"E	0.61
285	285	25°20'9.62"N	83° 1'57.42"E	0.23
286	286	25°20'17.52"N	83° 0'34.61"E	0.1
287	287	25°20'21.84"N	83° 0'27.54"E	0.1
288	288	25°20'15.20"N	83° 1'0.66"E	0.1
289	Ishwargangi Pokhra	25°19'31.03"N	83° 0'30.33"E	0.46
290	290	25°20'13.59"N	83° 1'38.19"E	0.40
291	291	25°19'14.02"N	83° 1'16.40"E	0.24
292	292	25°19'11.63"N	83° 0'50.93"E	0.32
293	293	25°18'37.62"N	82°58'17.07"E	0.16
294	294	25°18'38.11"N	82°58'21.11"E	0.45
295	295	25°18'45.39"N	82°58'8.15"E	0.21
296	296	25°18'52.38"N	82°58'17.92"E	0.75
297	297	25°19'4.81"N	82°58'5.97"E	0.65
298	298	25°18'57.63"N	82°57'48.27"E	0.11
299	299	25°18'44.24"N	82°57'45.67"E	0.38
300	300	25°18'43.81"N	82°57'53.54"E	0.1
301	301	25°18'45.77"N	82°57'29.32"E	0.70
302	302	25°18'38.30"N	82°57'20.89"E	0.27
303	Kreem Kund	25°17'47.12"N	83° 0'11.82"E	0.18
304	304	25°18'41.63"N	82°58'17.71"E	0.48
305	305	25°18'2.71"N	82°58'25.54"E	0.92
306	306	25°17'37.44"N	82°58'49.66"E	1
307	307	25°17'44.92"N	82°58'52.31"E	0.15

308	308	25°17'44.92"N	82°58'52.32"E	0.1
309	309	25°17'30.71"N	82°59'27.30"E	0.34
310	310	25°18'2.34"N	82°58'15.24"E	0.19
311	311	25°17'55.33"N	82°58'13.52"E	0.45
312	312	25°18'3.87"N	82°58'2.22"E	0.45
313	313	25°17'56.73"N	82°58'3.01"E	0.39
314	314	25°17'54.76"N	82°59'0.33"E	0.10
315	315	25°18'4.60"N	82°57'16.34"E	0.40
316	316	25°17'59.81"N	82°57'12.56"E	0.43
317	317	25°17'53.14"N	82°56'55.42"E	0.23
318	318	25°18'23.41"N	82°57'10.40"E	0.41
319	319	25°17'51.84"N	82°57'9.00"E	0.1
320	320	25°17'52.35"N	82°57'11.78"E	0.11
321	321	25°17'49.93"N	82°57'12.08"E	1.11
322	Surya Sarovar	25°16'59.99"N	82°57'27.86"E	0.99
323	323	25°16'47.48"N	82°58'0.08"E	0.18
324	324	25°16'41.59"N	82°57'48.82"E	0.29
325	325	25°16'40.35"N	82°57'40.00"E	0.17
326	326	25°16'7.06"N	82°58'13.26"E	0.16
327	327	25°16'34.83"N	82°56'58.05"E	0.1
328	328	25°16'52.78"N	82°56'58.39"E	0.12
329	329	25°16'54.87"N	82°57'6.80"E	0.34
330	330	25°16'54.30"N	82°57'2.48"E	0.12
331	331	25°17'12.79"N	82°56'59.11"E	0.14
332	332	25°17'15.12"N	82°57'9.28"E	0.23
333	333	25°17'44.32"N	82°56'53.77"E	0.30
334	334	25°17'42.74"N	82°56'51.41"E	1.68
335	335	25°17'41.18"N	82°56'45.94"E	0.31
336	336	25°17'52.42"N	82°56'36.14"E	0.17

337	337	25°18'2.94"N	82°56'29.84"E	0.67
338	338	25°18'19.15"N	82°56'5.59"E	0.34
339	339	25°18'5.55"N	82°55'59.73"E	0.60
340	340	25°18'13.78"N	82°55'45.38"E	0.34
341	341	25°18'16.55"N	82°55'42.12"E	0.13
342	342	25°18'15.42"N	82°55'40.10"E	0.17
343	343	25°18'10.18"N	82°55'37.29"E	0.30
344	344	25°18'5.89"N	82°55'38.52"E	0.1
345	345	25°18'18.47"N	82°55'27.49"E	0.14
346	346	25°18'41.29"N	82°55'35.57"E	0.10
347	347	25°18'47.76"N	82°55'42.59"E	0.26
348	348	25°18'47.49"N	82°55'50.34"E	0.28
349	349	25°14'30.00"N	83° 2'31.79"E	0.29
350	350	25°15'6.27"N	83° 2'32.11"E	0.82
351	351	25°15'26.72"N	83° 3'0.79"E	2.28
352	352	25°15'52.90"N	83° 2'24.57"E	0.17
353	353	25°15'46.77"N	83° 2'6.63"E	0.27
354	Pampasar Tank	25°15'57.55"N	83° 2'28.56"E	0.69
355	355	25°16'42.16"N	83° 2'34.24"E	0.53
356	356	25°15'53.11"N	83° 3'10.60"E	1.23
357	357	25°31'25.93"N	83° 9'48.21"E	43.1

8.2 Among these, some selected wetlands were surveyed for their ecological importance and associated socio-cultural beliefs. The wetlands such as Krim Kund, Kachcha Baba Pokhra, Pishach Mochan and others were found to be having some form of sanctity associated with them.

9.0 SACRED WETLANDS IN THE STUDY REGION

9.1 Sacred Water Bodies Associated With Baba Kinaram

9.1.1 Two sacred ponds were found to be associated with the legend of Aghor culture – Baba Kinaram. One pond was situated close to the Baba Kinaram temple in Ramgarh while another sacred pond – popularly known as "Krim Kund" was found in his ashram at Bhelupur in Varanasi city. According to local people and religious practitioners, Aghoracharya Baba Kinaram was believed to have born in the 16th century at Ramgarh village in Chandauli near Varanasi city. Believed to be an incarnation of Lord Shiva, he wandered throughout the country on his religious journey for the welfare of humanity. He is believed to have performed penance in the mountains of Girnar in Gujarat where he was guided and initiated by Lord Dattatreya. After this, he visited Mata Hinglaj Devi's Shaktipeeth (Goddess of Aghoris) in Balochistan and received her blessings through penance.

9.1.2 The temple in Ramgarh comprises of a small worshipping place constructed besides a Banyan tree which is where Baba Kinaram did penance. Besides the temple there are graves of different sadhus which practiced the Aghor culture and attained Samadhi in this place. In the backyard of this temple lies the water body (Images 18 & 19) referred by the locals as "Baan Ganga" who associate this with the Mahabharata. As this water body is considered sacred, no activities such as bathing, washing, fish catching are permitted making it suitable habitat for the native biodiversity.

Image 18 : Location Of Baan Ganga

Image 19 : "Baan Ganga" – The Sacred Water Body Besides Kinaram Temple – Ramgarh

9.1.3 The Krim Kund Sthal located in Varanasi city (Images 20-21) is another ancient place of religious importance. It is regarded as 'Mandarvana' in the *Puranas* and known to be Shiva Parvati's favourte garden in Kashi. The Krim Kund Kinaram Sthal is located close to the cremation ground of Harishchandra Ghat. It is said that during the *Vedic* period the owner of this area was the Dom Raja (the in-charge of the crematory). Surrounded with approximately 50 acres of forest, this area was isolated, elevated and protected from the River floods. Since the area was an ideal place for contemplative life, there were only ashrams and temples near the pond surrounded in lush green vegetation.

9.1.4 As the Doms residing here were aware of the sacredness of this place, they donated it to Baba Kinaram in order to express his divine and spiritual vision in this holy place. After prayers and penance for many years, Baba Kinaram took Samadhi at this place. This Sthal is like the headquarters of Aghor culture where people from far and wide including many different sadhus come for worship. The water of Krim Kund is believed to be sacred owing to the prayers of Baba Kinaram and hence, women and children are allowed to bathe here on some particular days as this water is believed to have curative powers. Besides the Kund, a well is also present at the entrance of this Sthal

which is said to be dug by the baba himself. The water of this well is believed to be suitable for treating abdominal pain and digestive disorders.

Image 20 : Location Of Krim-Kund Sthal

Image 21 : The Sacred Pond Of Krim-Kund In Varanasi City

9.2 Kandwa Pokhra

9.2.1 Located towards the southern end of Varanasi city, the Kardmeshwar Mahadev Mandir associated with Kandwa Pokhra (Images 22-23) is a very ancient temple dedicated to Lord Shiva. According to the folk tales and legends, Kardam Rishi is believed to have established this temple and performed penance here for about 5-6 thousand years and during that period this water body was formed from his tears. Taking note of his penance, Lord Vishnu granted him his wish after which he bathed in this pond and regained his youth. He married a woman named Devki and settled on the banks of River Ganga at a place called Kapil Dhara which is named after his son Kapil.

9.2.2 This temple is the first stop for the pilgrims undertaking the very popular **Panchkroshi Yatra** which involves a walk on a circuit of about 80-85 kms in and around Varanasi. The other four stops of this yatra are – Bhimchandi, Rameshwar, Shivpur and Kapildhara. This temple along with its sacred pond and the yatra find their mention in the religious scripture of *'Kashi Khand'* of the *Puranas*. According to the local people including historians, this temple was the only surviving temple during the attacks of Mughals during 17th century as it was surrounded by a thick forest and was overlooked by them. The Kandwa Pokhra harbors many fish and turtles particularly Gangetic Softshell Turtle which have attained large size owing to protection by local people and continuous feeding.

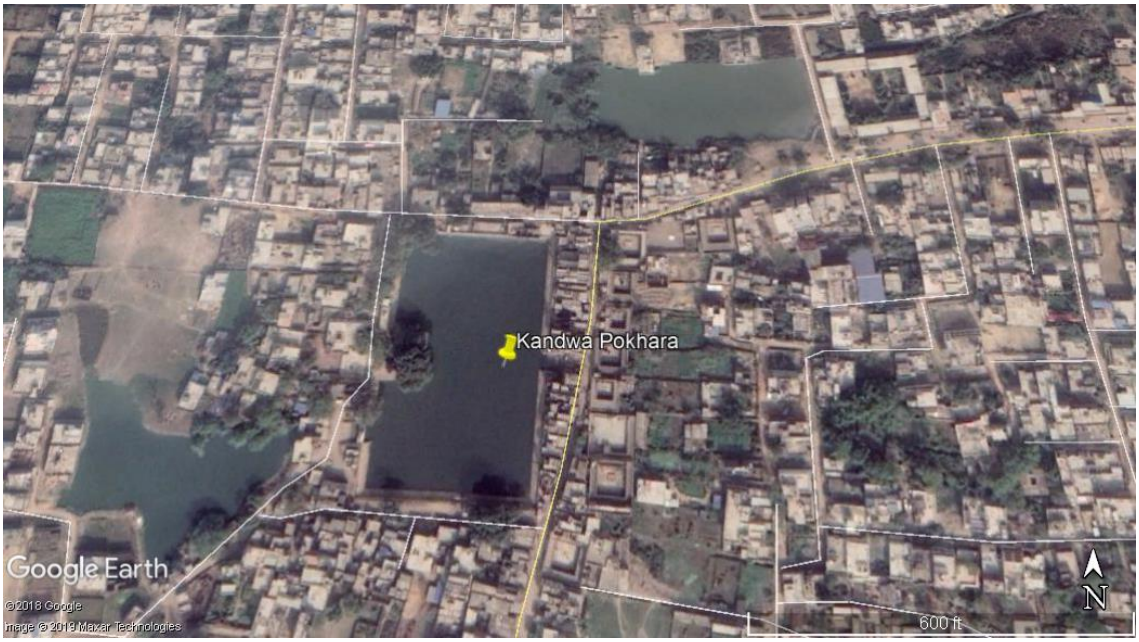


Image 22 : Location Of Kandwa Pokhara

Image 23 : Kandwa Pokhra Associated With Kardmeshwar Mahadev Mandir In Varanasi

9.3 Kachcha Baba ka Pokhra

9.3.1 This is another sacred water body situated adjacent to the Kachcha Baba temple in Jalhupur, Varanasi (Images 24-25). According to local folklore, Sant Kachcha Baba was a blind saint closely connected to Lord Ram. The term "Kachcha" got associated with his name by the fact that he only consumed raw food. It is believed that he took Samadhi in Jalhupur where his temple is located today and many people from neighboring areas come here for worship. The sacred pond associated with this temple is very popular in the region owing to the folktale that fish from this pond would remain raw [kaccha] even on cooking owing to the curse of Kachcha Baba. Hence, the people do not disturb the fish of this pond and instead feed them with biscuits considering them and the water body as holy. This pond shelters a sizeable population of catfish which often feed on the food items offered by pilgrims.

Image 24 : Location Of Kachcha Baba Ka Pokhara

Image 25 : Kachcha Baba Pokhra Along With The Temple

9.4 Pishach Mochan Talab

9.4.1 This sacred lake is situated in the Chetganj area of Varanasi (Images 26-27) and is an important auspicious place for those who believe in the immortality of souls and spirits. Pilgrims throng this place especially during the *'Pitra Paksh'* for performing the *Shraadh* and *Pinddaan* puja ceremonies in order to provide *moksha* to their deceased relatives. The pujaris associated with the *Pishach Mochan temple* located adjacent make arrangements for these ceremonies in their campus. This is believed to be the only place in India where the *'Tripindi Shraadh'* is performed for people who have had an untimely death as well as for relief from any effect of spirits. Hence, the name *'Pishach Mochan'* has been assigned to this pond where the spirits/souls achieve *moksha* through special pujas.

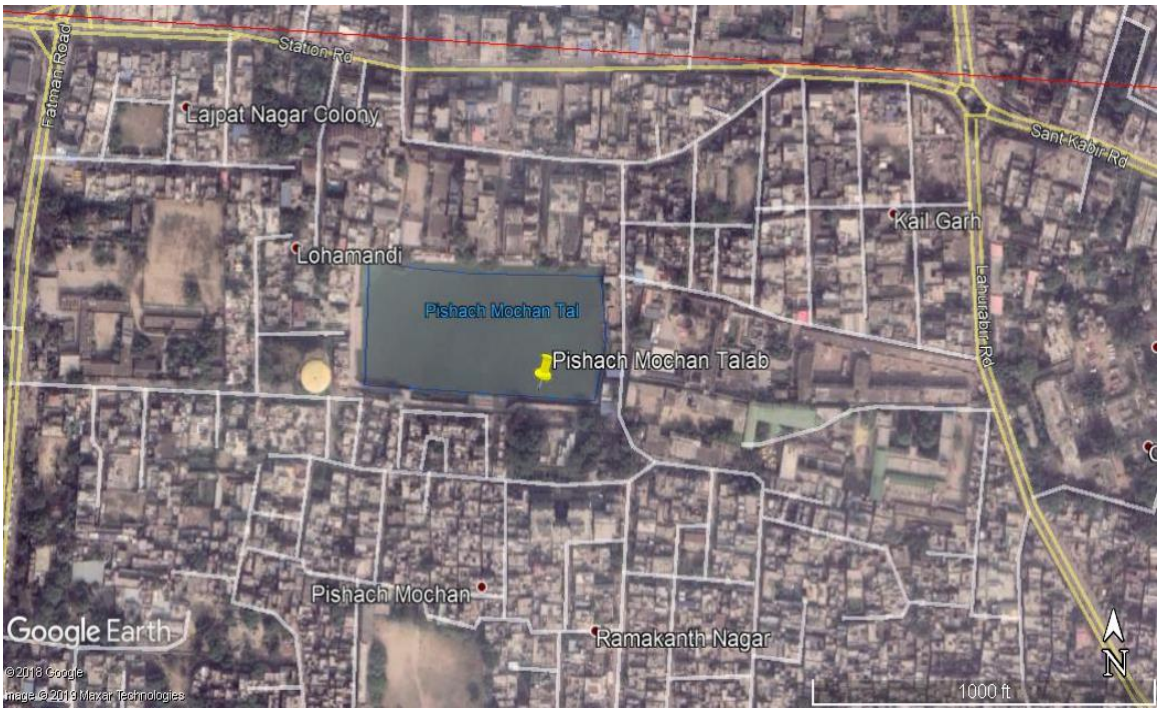


Image 26 : Location Of Pishach Mochan Talab

Image 27 : Pishach Mochan Talab In Varanasi City

9.5 Purana Pokhara in Ramnagar

9.5.1 A square shaped tank known as 'Purana Pokhara' (Old Pond) is present in front of the famous Durga Temple in Ramnagar area (Images 28-29). This temple and the associated pond was built by Maharaja Balwant Singh who ruled Benaras during the 17th century AD. The tank has stone steps for accessibility to the water on all the sides.

Image 28 : Location Of Purana Pokhara

Image 29 : Purana Pokhara Near The Durga Temple In Ramnagar

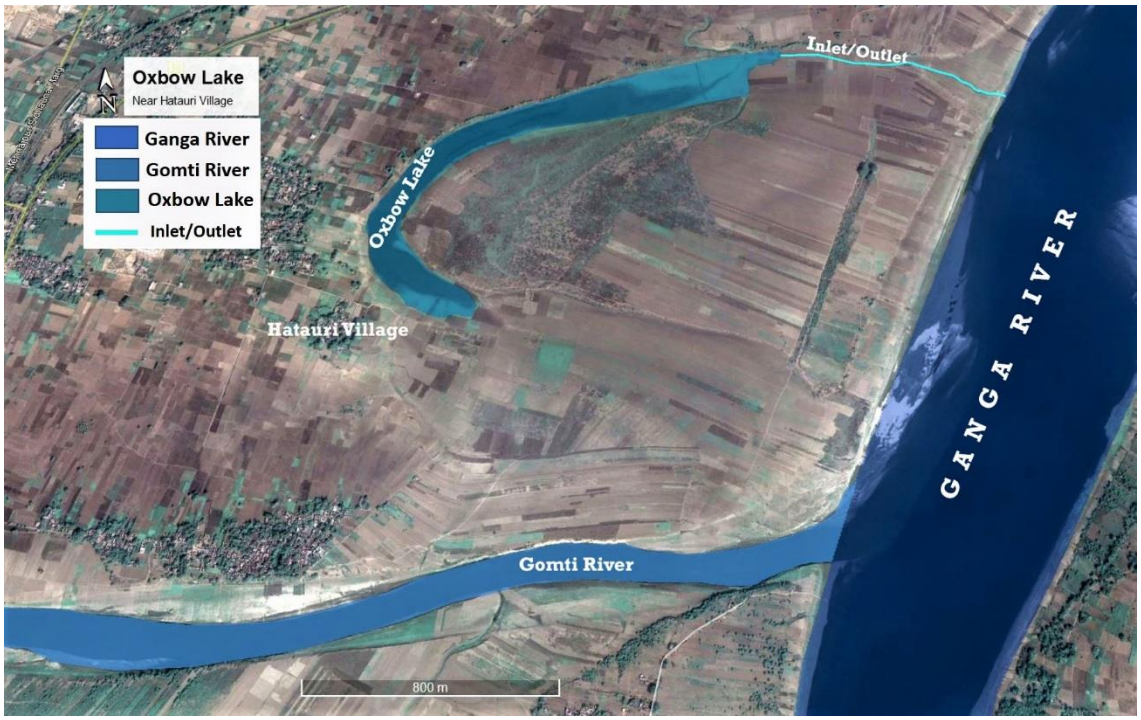
10.0 OTHER SIGNIFICANT WETLANDS IN THE STUDY REGION

10.1 Oxbow Lake Near Hatauri Village (ref. Map 11)

Table 4 : Basic Features of The Oxbow Lake

Location	Located at boundary of Varanasi and Gazipur Distt. of U.P. Nearest settlement: Hathauri, Marahai Hathaura and Kusahi village of Gazipur and Kaithi Village of Varanasi Distt.
Coordinates	25°31'25.93"N, 83° 9'48.21"E
Lake Type	Oxbow Lake [formed by Gomti River]
Water Spread Area	43.1 ha
Lake Perimeter	7.16 Km
Ownership	Community Land (based on local interactions)
Environ	Surrounded by scattered settlements in the West and South-west, agricultural fields in the north and River Ganga in the east.
Inlet and Outlet	Lake gets inflow during flood pulsing from Rivers Ganga and Gomti - Outflow goes to River Ganga in rainy season
Water uses	Bathing, fisheries, irrigation and navigation

10.1.1 The oxbow lake was surrounded by villages most of which depended mainly on agricultural lands farming rice, bajra, sarson, chillies and urad. Apart from the ground water, the villagers also used the water for their fields from this lake. Some villagers were also involved in fishing activities in this lake. Common fish caught by them were catfish and Chinese carp apart from some others seasonally. Most of these fish were used for local consumption. The flora around this lake included sparsely growing trees of *Acacia nilotica* (Babool), *Azadirachta indica* (Neem), *Syzigium cumini* (Jamun), *Dalbergia sisoo* (Shisham) and *Ficus* spp. The ground vegetation in this region mainly included *Tridax procumbens*, *Parthenium hysterophorus*, *Croton bonplandinum* and other grass species.



Map 7 : Location of Oxbow Lake

Image 30 : Oxbow Lake Near Hatauri Village

10.2 Pushkar Talab

10.2.1 Once a place of religious significance, the Pushkar talab is today in a dismal condition despite efforts by the authorities to revive this water body (Image 31-32). Local residents informed that this pond was thronged by elderly people, especially in the month of Karthik, for carrying out the lamp donation. However, the non-maintenance of this pond along with dumping of waste by miscreants and influx of sewage water has resulted in the water becoming extremely polluted and eutrophied resulting in a carpet of water hyacinth [*Eichornia crassipes*]. Also, gradually, the practice of lamp donation by the elders has reduced significantly. It may also be noted that Pushkar Talab lies on the course of AssiNadi and, thus, may have had a hydrological connectivity with it.

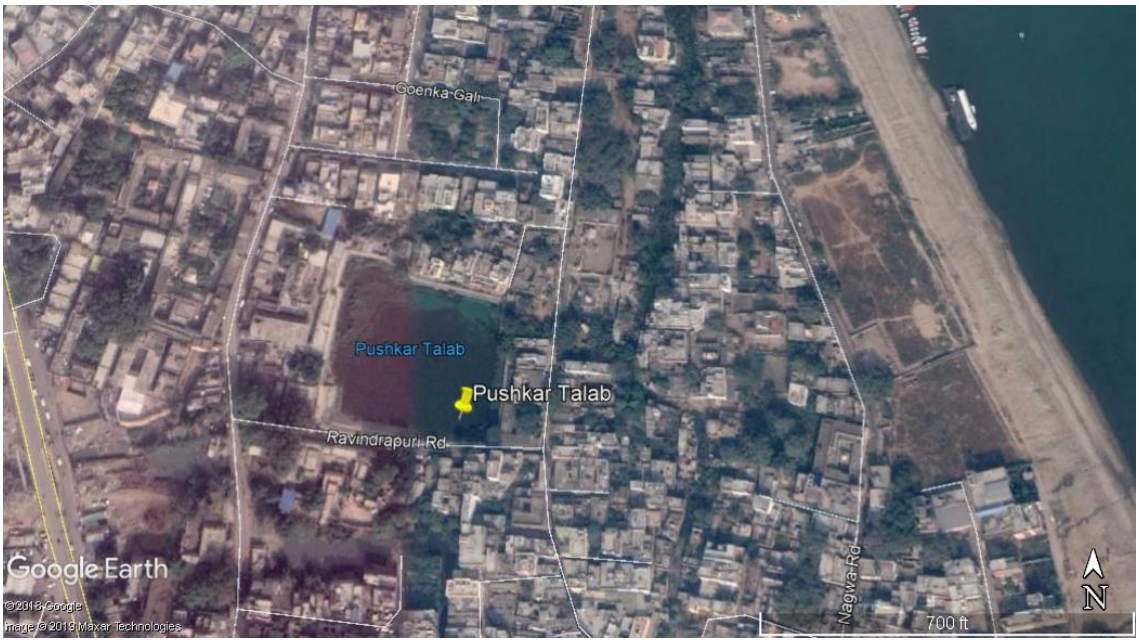


Image 31 : Location Of Pushkar Talab

Image 32 : Pushkar Talab With Dense Growth Of *Eichhornia* And Other Shrubs

10.3 Sagara Tal and Pampasar Tank :

10.3.1 These water bodies are located at a distance of about 2 kms from each other close to the right bank of Ganga River in Varanasi (Image 33). Both these water bodies form a part of Ramayan play conducted in the nearby villages wherein two different stages are enacted near these wetlands. In the Sagar Tal, the part of Ramayan where Ram and Sita leave Ayodhya and a fisherman helps them cross the River, is enacted whereas in Pampasar tank, the part of Ramayan where Sugriva meets Lord Ram, is enacted. Most of the villagers near these ponds catch fish for local consumption and maintain these water bodies in good condition by not allowing any waste to be disposed there.

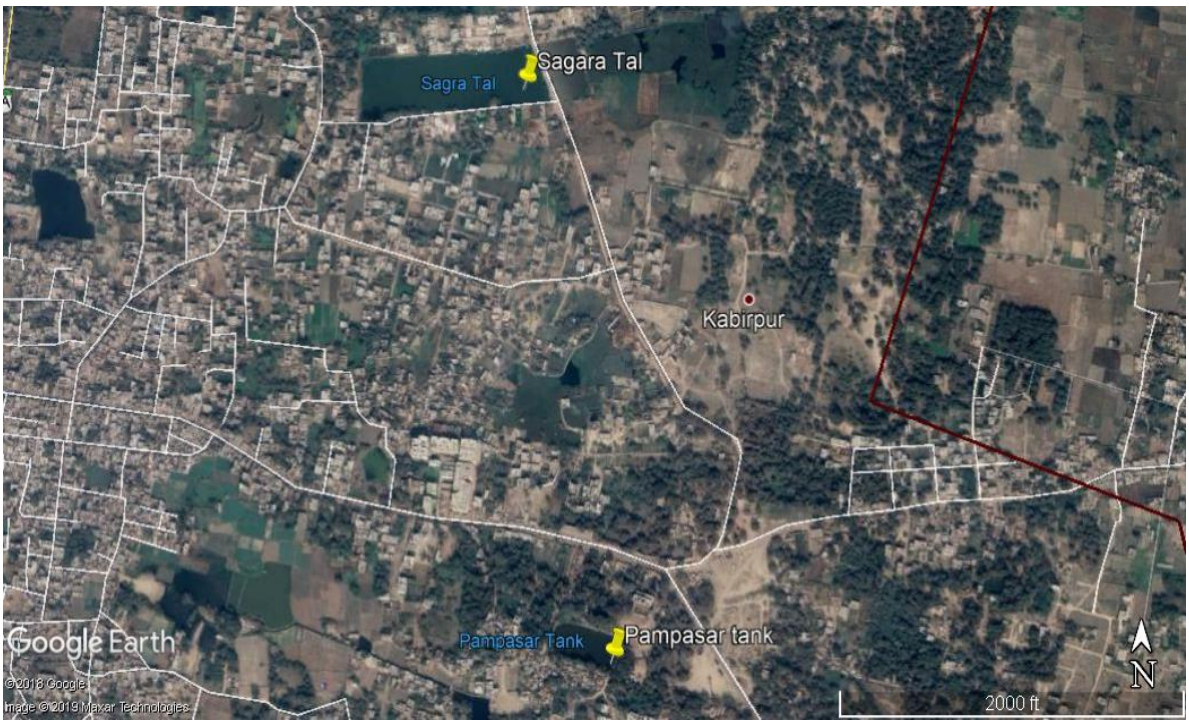


Image 33 : Location Of Sagara Tal And Pampasar Tank

Image 34 : Sagar Tal Located In Ramnagar

Image 35 : Pampasar Tank Near Sagar Tal In Varanasi

10.4 Moti Jheel

10.4.1 Located in the heart of Varanasi city near Manduadih, Moti Jheel was once an important wetland which has now been reduced to a dump yard (Image 37). There have been massive residential constructions surrounding the Jheel with continuous encroachments nibbling the periphery of wetland. In the absence of efficient waste collection system waste is dumped in the wetland which helps in reclaiming the wetland and encouraging encroachment. The water spread shrinks considerably by summer and the poor water quality leads to a profuse growth of aquatic weeds [*Eichhornia*].

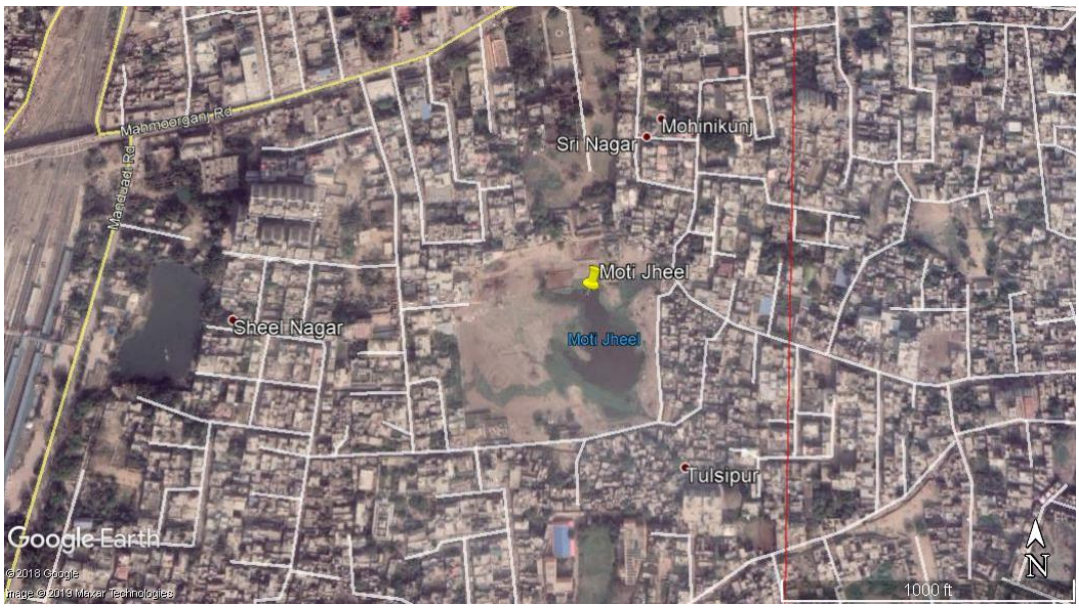


Image 36 : Location Of Moti Jheel

Image 37 : The Sad State Of Moti Jheel In Varanasi City

10.5 Lahartara Talab

10.5.1 The Lahartara Talab is located in the heart of Varanasi city (Image 38) and is associated with the Satguru Kabir Prakatya Dham which is built on the south side of this pond. According to the various articles online and the information available on their website (http://www.sadgurukabirprakatyadhamlahartaravaranasi.com/), it is believed that Saint Kabir was found floating on a Lotus leaf in this pond during 1398 A.D. when he was an infant. He was spotted by a Muslim weaver who took the child under his care and gave him the name 'Kabir' meaning 'the great one'. As per the website, a portion of this talab is protected by the Directorate of Archaeology, Uttar Pradesh while another part is under the possession of Sadguru Kabir Prakatya Dham. While the former part is in a neglected state with the surrounding households dumping sewage water and other waste into it, the latter is being managed better with the construction of a grand memorial and a *pucca* pond.

Image 38 : Location Of Lahartara Talab

Image 39 : The Neglected Part Of Lahartara Talab

Image 40 : The Part Of Lahartara Talab Managed By Sadguru Kabir Prakatya Dham

11.0 BIODIVERSITY PROFILE

11.1 References to the natural heritage of the Ganga can be traced back to Asoka the Great who, in his fifth pillar Edict, promulgated the game laws and fishery legislation in 3rd Century B.C. In the edict are listed an apparently obscure list of animals, including two faunal species from Ganga namely "String- Ray" and "Dhongoka Turtle". Many researches have reasonably assumed from the descriptions that his *ganga paputakas,* refers to the well-known Gangetic Dolphin.

11.2 Europeans, before the time of birth of Christ knew India as a land of myth and mystery. Pliny the elder, in 1st Century A.D., called the Gangetic Dolphin by its modem generic name *Platanista* and described 'in an uncanny manner the migration of fish to and from Ganga' for breeding. Another Greek, Aelian, in 2nd Century A.D., provided a fairly accurate description of the *Gharial*. Babar, the first Moghul, seventeen centuries after Asoka, described the Gangetic Dolphin and Crocodiles, from his own observations, marveling at such lifeforms which must have appeared alien to anyone from Central Asia. (ZSI, 1991).

11.3 The natural heritage of Ganga finds expression in an array of animal species described historically, the most well-known being Gangetic Dolphins. Besides the dolphin, all the three species of Crocodiles known from India, occurred variably at its different stretch namely *Gharial* or Gavial, Crocodile or *Magar* which is known to be worshipped since ancient days and Estuarine Crocodile or salt water crocodile.

11.4 Besides crocodiles, water monitor lizard, at least 11 different species of freshwater, mud and estuarine turtles and tortoises inhabit the Ganga system. J.E. Gray (1830-1835) in his "illustrations of Indian Zoology", described six species - the Dhongoka Turtle *Kachuga dhongka* (Gray, 1834), Bengal Roofed Turtle *Kachuga kachuga* (Gray, 1831), North Indian Roofed Turtle *Kachuga tecta* (Gray, 1831), North Indian Freshwater turtIe *Geoclemys hamiltoni* (Gray, 1831), Narrow Headed Soft Shell Turtle *Chitra indica* (Gray, 1831) and Peacock Marked Soft Shell Turtle *Trioryx hurum* Gray, 1831), *Trionyx gangetica* (Cuvier, 1831) described by noted French Zoologist Cuvier; besides these seven species, four other species, of which three were described by Gray, are also known to occur in Ganga system viz. Batagur River Terrapin *Baiagur basaka* (Gray, 1855), Peninsular soft shelled Turtle *Trioryxlethi* (Gray, 1872) and North Indian Flap-shelled Turtle *Lissemys punctata punctata* (Lacepede, 1788) - the last being the oldest of the described species listed above. Of the above 11 species, at least 5 are almost endemic to Ganga-Brahmaputra system; the other species of soft-shelled turtles also have restricted distribution.

11.5 The rich biodiversity in Ganga system is facing a critical situation for some years in the past. Besides untreated sewage, effluents from sugar mills, pesticides, oil refinery, pulp and paper factories, fly-ash from coal washeries, all contribute to the fast deteriorating environment of this largest Riverine system of the country.

11.6 The fisherfolk with whom we interacted and who are directly affected, understand the major threats of habitat modification and pollution. According to them construction of Farakka barrage and ingress of invasive species has led to decline in fisheries. Specifically, they mention the total disappearance of Hilsa and many Indian Carps.

12.0 RIPARIAN FLORA ALONG GANGA RIVER IN VARANASI

12.1 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).

12.2 Till recently, no scientific sampling had been undertaken or record had been maintained for the riparian plant diversity along Ganga River. There are however, some scattered but significant works of Duthie [1903], Pallis (1934), Auden (1941), Sahai (1953), Gupta (1960), Bhattacharyya and Goel (1982), Groffman *et al.* (1990), Krishanmurti (1991), Castelle*et al. (*1994), Gangwar and Joshi (2006), Shyam (2008), 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. The most recent detailed account of riparian flora of Ganga is available in the report of GRBMP (IIT Consortium, 2012) which documents the riparian vegetation in different stretches of Ganga River and also talk about its degradation and conservation measures. There has however, been no systematic study on the riparian flora of Varanasi Distt.

12.3 During our survey along Ganga River in Varanasi Distt., it was observed that no designated forest patch existed in the Distt. as per the forest department

records (Forest Working Plan). However, there were some areas such as Katesar village where the Forest Department had planted *Acacia nilotica* (commonly known as Babool) which has formed a vast patch spreading in an area of few kms on Ganga River bank. Similar plantation was also observed in the Kaithi village near the Ganga-Gomti confluence towards the northern part of Varanasi Distt. It is also interesting to note that, upon conversation with different stakeholders in the Distt., it could be concluded that, at one time, all the major attractions of Varanasi such as Kardmeshwar Mahadev Temple, Sankat Mochan Temple, Baba Kinaram Ashram in Ramgarh, and others were surrounded by dense forests on all sides. However, with the passage of time, forests have disappeared under the pressure of urbanization to such an extent that today virtually no forest exists in or around Varanasi city.

Image 41 : Babool *(Acacia Nilotica)* Plantations By The Forest Department In Katesar Village

12.4 The riparian floral diversity in the Distt. includes a total of 24 different plant species of which a major portion was herbaceous plants (14 species) followed by trees (8 species) and shrubs (2 species). The tree cover on the River banks was sparse with only few standing individuals. Besides *Acacia*

nilotica, the other major tree species commonly found in the riparian areas were Bili patra (*Aegle marmelos*), Neem (*Azadirachta indica*), Poplar (*Thespesia populnea*) and Peepal (*Ficus religiosa*). The ground vegetation in the riparian areas was mostly found to be dominated with *Calotropis procera* (Aiton) Dryand, *Croton bonplandianus* (Baill). and *Solanum xanthocarpum* Schrad & H. Wendl. Among these, both *Calotropis* and *Solanum* sps. are valued for their various medicinal properties in the Ayurveda medicinal system. On the other hand, two species – *Heliotropicum indicum* and *Polygonum* sp. were found to be sparsely distributed in the study region with the former being recorded from the Varuna-Ganga confluence and the latter being recorded from Amba village. Among the grasses, *Saccharum bengalense* Retz. (formerly known as *Saccharum munja* Roxb.; Family – Poaceae) was found to be growing luxuriantly throughout the Distt. The details of the riparian floral species recorded in this study are provided in Table 03 and some of the important species are represented in Images 42-45.

Table 5 : Riparian Plant Species Recorded In Varanasi

Sr. No.	Botanical name	Family	Common name	Habit
1.	*Acacia nilotica* (L.) Delile	Fabaceae	Babool	Tree
2.	*Aegle marmelos* (L.) Corrêa	Rutaceae	Bel Patra	Tree
3.	*Dalbergia sissoo*Roxb.	Fabaceae	Shisham	Tree
4.	*Prosopis juliflora* (Sw.) DC.	Fabaceae		Tree
5.	*Ficus religiosa* L.	Moraceae	Peepal	Tree
6.	*Ficus benghalensis* L.	Moraceae	Banyan tree	Tree
7.	*Azadirachta indica*A.Juss.	Meliaceae	Neem tree	Tree
8.	*Thespesia populnea* (L.) Sol. ex Corrêa	Malvaceae	Poplar	Tree
9.	*Calotropis procera*(Aiton) Dryand.	Apocynaceae	Aak	Shrub
10.	*Ziziphus* sp.	Rhamnaceae	Wild ber	Shrub
11.	*Argemone mexicana* L.	Papaveraceae		Herb
12.	*Biophytum sensitivum* (L.) DC.	Oxalidaceae		Herb

13.	*Cassia occidentalis* L.	Fabaceae	Bari kasondi	Herb
14.	*Croton bonplandianus* Baill.	Euphorbiaceae	Ban Tulsi	Herb
15.	*Heliotropium indicum* L.	Boraginaceae		Herb
16.	*Grangea maderaspatana* (L.) Poir.	Asteraceae		Herb
17.	*Parthenium hysterophorus* L.	Asteraceae	Congress grass	Herb
18.	*Phyla nodiflora* (L.) Greene	Verbenaceae		Herb
19.	*Solanum xanthocarpum* Schrad. & H. Wendl.	Solanaceae	Kateli	Herb
20.	*Tephrosia purpurea* (L.) Pers.	Fabaceae	Purple tephrosia	Herb
21.	*Xanthium strumarium* L.	Asteraceae		Herb
22.	*Cynodon dactylon* (L.) Pers.	Poaceae		Grass
23.	*Desmostachya bipinnata* (L.) Stapf.	Poaceae		
24.	*Saccharum bengalense* Retz.	Poaceae		Grass

Image 42 : Solanum xanthocarpum

Image 43 : *Phyla nodiflora*

Image 44 : *Croton bonplandianum*

Image 45 : *Heliotropicum indicum*

13.0 FAUNAL DIVERSITY ALONG GANGA RIVER IN VARANASI

13.1 Gangetic fauna has distinct characteristic features because of three distinct zones through which the River traverses i.e. hilly terrains, deltaic tract and the middle reaches characterized by alluvial plains of Uttar Pradesh. Some of the characteristic faunal resources of the Varanasi stretch are depicted in Map 12 and described in this section.

13.2 **Gangetic River Dolphin :** Several researchers have estimated the population of Ganga River dolphin (*Platanista gangetica*) in different segments of Ganga River and its tributaries in Ganga, Brahmaputra River system and Sundarbans delta but not much has been said about the Varanasi stretch. The species is exclusively riverine. Scientists have described relatively high densities of dolphins at the river confluences, just downstream of shallow stretches, generally in areas where the current is relatively weak, off the mouths of irrigation canals and near villages and ferry routes. In the river basins in India, the Ganga river dolphin is present mostly in plains where the Rivers flow gently. Local fishermen claim that dolphin sighting was plentiful 15-20 years ago in this stretch including Assi confluence. However, in our present survey we recorded the presence of river dolphin near the Ganga-Gomti confluence (6 counts).

Image 46 : Gangetic Dolphin *(Platanista gangetica)* Sighted at Ganga Gomti Confluence

13.3 **Crocodile :** Although all three species of crocodiles reported from India occur in River Ganga variably in different stretches, only the Mugger (*Crocodylus palustris)*, can be located in canal and bundhs along Ganga reach in Varanasi during floods. It is mostly reported observed by riparian communities.

13.4 **Freshwater Turtles :** Occurrence of freshwater turtles in Ganga and its tributaries has been recorded by many authors. Despite the unique turtle diversity, no qualitative or quantitative base line information exists on the species-wise occurrence or abundance in different habitats, in Uttar Pradesh. However, the checklist of turtle species known to occur in and around the Kashi Turtle Wildlife Sanctuary, Varanasi, a 7 km. reach between Ramnagar Fort and Malviya Bridge (WII, 2018) is provided in Table 6 below.

Table 6 : Checklist Of Turtle Species Known To Occur In An Around The Kashi Turtle Wildlife Sanctuary

S. No.	Common Name	Scientific Name
01	Red Crowned Roof Turtle	*Batagur kachuga*
02	Three Striped Roofed Turtle	*Batagur dhongoka*
03	Spotted Pond Turtle	*Geoclemys hamiltonii*
04	Indian Roofed Turtle	*Pangshura tecta*
05	Indian Tent Turtle	*Pangshura tentoria*
06	Brown Roofed Turtle	*Pangshura smithii*
07	Crowned River Turtle	*Hardella thurji*
08	Indian Black Turtle	*Melanochelys trijuga*
09	Ganges Softshell Turtle	*Nilssonia gangetica*
10	Indian Peacock Softshell Turtle	*Nilsonnia hurum*
11	Indian Flapshell Turtle	*Lissemys punctata*

13.5 Interactions with fishermen suggests that sightings of turtles especially hard shells have reduced drastically in last 5 years. Most of them identified Ganges Soft Shell Turtle (locally called 'Katawa") and said that sometimes the size is very large which destroys the trapping net. Besides the Ganges Soft Shell Turtle there are a few species of Kachuga *Pangshura tecta, P. tentoria, P. smithii* and *Batagur dhongoka*) in the River and Indian Flap Shell in the ponds but the numbers are very low compared to 5-10 years earlier. Some of the sacred ponds like Kardmaheswar had a significant number of *Nilsonnia gangetica.*

Image 47 : Indian Tent Turtle *(Pangshura tecta)* Sighted At Sarnath

Image 48 : Indian Flapshell Turtle *(Lissemys Punctata)* Sighted At Ramnagar

13.6 **Fish :** Information on fish is fragmentary although the middle stretch is described as most important in terms of commercial fisheries. At Varanasi

approximately 82 species are said to be recorded by various fisheries scientists. The list of commercially important species from Varanasi is as follows :

- **Major carp :** *Catla catla, Labeo rohita, Cirrhinus mrigala, Labeo calbasu*
- **Cat fish :** *Sperata aor, Sperata seenghala, Wallago attu, Rita rita, Eutropiich thysvacha, Clupiso magarua*
- **Exotic fish :** *Cyprinus carpio var communis, Oreochromis niloticus*

13.7 Interactions with fishermen revealed that Ganga once had an abundance of freshwater rays locally called Batawan (big size) and Sekchi (smaller ones). They claim to have regularly seen the rays near *ghats* 15-20 years ago. *Hilsa*, once abundant in this stretch, has totally disappeared after 1978. *Jhinga* has also declined drastically as have Indian carps (*Catlacatla*, *Labeorohita*, and *Cirrhinus mrigala*). **They strongly believe that change in dynamics of the fisheries is due to the presence of common carp**.

Image 49 : Cyprinus Carpio *(Common Carp)* Caught From Ganga River

13.8 **Golden Jackal :** The golden jackal (*Canis aureus*) is a wolf-like canid that is native to Southeast Europe, Southwest Asia, South Asia, and regions of Southeast Asia. It is listed as of Least Concern in the IUCN Red List with their population trend increasing in the last couple of years owing to their widespread distribution, availability of shelter and food in good quantity and

they being generalist foragers. The golden jackal was spotted frequently in villages close to the Ganga River and also on the riverine island.

Image 50 : Golden Jackal Spotted In Chhittauna Village

13.9 **Nilgai :** After the introduction of Wildlife Protection Act (1972) in India and through various management strategies, the population of many wildlife species has increased considerably. Some of these species have successfully adjusted to the human-impacted habitats and their population has become locally overabundant. One such important example is of Nilgai antelope – *Boselaphus tragocamelus*, which is widely distributed in different parts of the country. Although this species is considered as a sacred animal by Hindus, the agricultural crop damage caused by it has led to an increase in conflict between Nilgai and farmers. Most villagers we interacted with in Varanasi Distt. expressed their concern over the largescale presence of Nilgai which damages the crops by foraging as well as trampling. The presence of Nilgai in the agricultural fields was also reported in our survey. Despite the damage of crops and loss caused to the farmers most of the respondents in our survey claimed to just drive away Nilgai using sticks and refrain from killing them owing to their sacredness.

Image 51 : Nilgai Presence In The Agricultural Fields Near Chhittauna Village

13.10 **Avian Diversity :** Varanasi Distt. has a rich diversity of avian species which is relatively understudied so far. Field surveys were conducted in August and October, 2019. The diversity of avian species was recorded using binoculars and identified using field guides (Salim Ali, 2012; Grimmett et al., 2016). The conservation status of the species was listed by using IUCN Red Data List. A total of 70 species of birds were sighted during the field visits of which, 16 were wetland avian species and 6 raptor species. The remaining 48 were species of grassland and forest community. Based on the identified species, following observations were made:

- ❖ White throated kingfisher, Little Egret, Cattle Egret, and Indian Pond Heron were most frequently sighted wetland bird species
- ❖ While House Sparrow, Jungle Crow, Common Myna, Bank Myna, Common Pigeon, Asian Pied Starling, Black Drongo, Common Babbler, Eurasian Collared Dove and Spotted Dove were the most common species present
- ❖ Total five species of Dove were sighted
- ❖ Black Kite was the most common species among the raptors
- ❖ Palas's Fish Eagle, which is an endangered species, was sighted at Gomti-Ganga confluence point
- ❖ Indian Spotted Eagle, a vulnerable species, was also sighted. River Lapwing and Alexandrine Parakeet were the two species sighted which comes under Near Threatened Category

Image 52 : Rufous Treepie *(Dendrocitta vagabunda)* Sighted Near Akshir Sagar

Image 53 : River Lapwing *(Vanellus duvaucelii)* [Near Threatened], & Red-wattled Lapwing *(Vanellus indicus)* Sighted Near Tantepur Village

Image 54 : Pied Kingfisher *(Ceryl Erudis)* Sighted Near Katesar Village

Table 7 : List of Avian Species Sighted Within Study Corridor

Sr. No.	Common Name	Scientific Name	Conservation Status
1	White throated Kingfisher	*Halcyon smyrnensis*	Least Concern
2	Pied kingfisher	*Ceryle rudis*	Least Concern
3	Cattle Egret	*Bubulcus ibis*	Least Concern
4	Little Egret	*Egretta garzetta*	Least Concern
5	Intermediate Egret	*Ardea intermedia*	Least Concern
6	Great Egret	*Ardea alba*	Least Concern
7	Indian Pond Heron	*Ardeola grayii*	Least Concern
8	Purple Heron	*Ardea purpurea*	Least Concern
9	Common Sandpiper	*Actitis hypoleucos*	Least Concern
10	Little Cormorant	*Microcarbo niger*	Least Concern
11	Indian Cormorant	*Phalacrocorax fuscicollis*	Least Concern
12	Bronze-winged Jacana	*Metopidius indicus*	Least Concern
13	White breasted - Waterhen	*Amaurornis phoenicurus*	Least Concern
14	Purple Swamhen	*Porphyrio porphyrio*	Least Concern

15	Common Moorhen	*Gallinula chloropus*	Least Concern
16	Eurasian Coot	*Fulica atra*	Least Concern
17	**River Lapwing**	***Vanellus duvaucelii***	**Near Threatened**
18	Yellow-wattled Lapwing	*Vanellus malabaricus*	Least Concern
19	Red-wattled Lapwing	*Vanellus indicus*	Least Concern
20	Black Drongo	*Dicrurus macrocercus*	Least Concern
21	Oriental Skylark	*Alauda gulgula*	Least Concern
22	Common Myna	*Acridotheres tristis*	Least Concern
23	Bank Myna	*Acridotheres ginginianus*	Least Concern
24	Asian Pied Starling	*Gracupica contra*	Least Concern
25	Paddyfield Pipit	*Anthus rufulus*	Least Concern
26	Jungle Babbler	*Turdoides striata*	Least Concern
27	Common Babbler	*Argya caudata*	Least Concern
28	Large Grey Babbler	*Argya malcolmi*	Least Concern
29	Baya Weaver	*Ploceus philippinus*	Least Concern
30	Rufous Treepie	*Dendrocitta vagabunda*	Least Concern
31	White Wagtail	*Motacilla alba*	Least Concern
32	Indian Peafowl	*Pavo cristatus*	Least Concern
33	Indian Silver bill	*Euodice malabarica*	Least Concern
34	Asian Plain Martin	*Riparia chinensis*	Least Concern
35	Common Tailorbird	*Orthotomus sutorius*	Least Concern
36	**Alexandrine Parakeet**	***Psittacula eupatria***	**Near Threatened**
37	Rose-ringed Parakeet	*Psittacula krameri*	Least Concern
38	Indian Grey Hornbill	*Ocyceros birostris*	Least Concern
39	House Sparrow	*Passer domesticus*	Least Concern
40	Indian Jungle Crow	*Corvus culminatus*	Least Concern
41	House Crow	*Corvus splendens*	Least Concern
42	Oriental Magpie Robin	*Copsychus saularis*	Least Concern
43	Indian Robin	*Saxicoloides fulicatus*	Least Concern
44	Common Pigeon	*Columba livia*	Least Concern
45	Indian Roller	*Coracias benghalensis*	Least Concern
46	Green Bee-eater	*Merops orientalis*	Least Concern

47	Brown Shrike	*Lanius cristatus*	Least Concern
48	Brown-headed Barbet	*Psilopogon zeylanicus*	Least Concern
49	Coppersmith Barbet	*Psilopogon haemacephalus*	Least Concern
50	Ashy Prina	*Prinia Socialis*	Least Concern
51	Grey-breasted Prinia	*Prinia hodgsonii*	Least Concern
52	Plain Prinia	*Prinia inornata*	Least Concern
53	Asian Koel	*Eudynamys scolopaceus*	Least Concern
54	Greater Coucal	*Centropus sinensis*	Least Concern
55	Red-whiskered Bulbul	*Pycnonotus jocosus*	Least Concern
56	Red-vented Bulul	*Pycnonotus cafer*	Least Concern
57	Common Hoopoe	*Upupa epops*	Least Concern
58	Black Kite	*Milvus migrans*	Least Concern
59	**Indian spotted Eagle**	***Clanga hastata***	**Vulnerable**
60	Shikra	*Accipiter badius*	Least Concern
61	Common Kaestral	*Falco tinnunculus*	Least Concern
62	**Pallas's Fish Eagle**	***Haliaeetus leucoryphus***	**Endangered**
63	Red Necked Falcon	*Falco chicquera*	Least Concern
64	Scaly Breasted Munia	*Lonchura punctulata*	Least Concern
65	Indian Golden Oriole	*Oriolus kundoo*	Least Concern
66	Spotted Dove	*Stretopelia chinesis*	Least Concern
67	Oriental Turtle Dove	*Streptopelia orientalis*	Least Concern
68	Eurasian Collared Dove	*Streptopelia decaocto*	Least Concern
69	Red Collared Dove	*Streptopelia tranquebarica*	Least Concern
70	Laughing Dove	*Spilopelia senegalensis* (as on IUCN red data list 2018)	Least concern

14.0 GANGA RIVERINE ISLAND IN VARANASI DISTT.

14.1 River islands are typically exposed land parts surrounded by river water channels. These islands generally result from changes in the course of a River such as interactions with a tributary or the opposing fluvial actions of deposition and/or erosion such as forming a natural cut and meander. These islands exhibit various shapes and varying surface areas but are generally elongated along the course of the flow. The islands also divide the River into multiple channels and form the connection of interrelation and interaction between two channels (Sun et al., 2018).

14.2 One such massive river island was found to be existing in Ganga River towards the northern part of Distt. (ref. Map 13). This island has a post monsoon dimensions as follows :

- **Area : 13 sq.km.**
- **Perimeter : 22 km.**
- **Maximum Length : 9.6 km.**
- **Maximum Width : 1.8 km.**

14.3 The island is inhabited with main villages being Mokulpur, Gobrha and Ramchandipur which can be accessed by the Ramchandipur bridge situated near Chhittauna village. The island divides Ganga into two braids – the narrower channel [left bank/northern branch] is known locally as 'Sota' River, implying that it dries up during the lean season, and the wider channel, locally referred to as Ganga, which has a perennial flow.

Image 55 : Ramchandipur Bridge Connecting The Riverine Island With Varanasi Distt.

14.4 The island area is mainly cultivated, the farmers being mainly from Chandauli, who have lost their original lands owing to the shift in the River course. **However, there are 4 patches with natural vegetation with a cumulative area of 1.1 sq.km. which may be conserved as local nature reserves for minor fauna which are hard pressed for habitats elsewhere.**

14.5 The riparian flora on this island comprised of dispersed trees with most of them being *Acacia nilotica* (Babool) along with *Azadirachta indica* (Neem), *Ficus religiosa* (Peepal), *Dalbergia sisoo* (Shisham) and *Aegle marmelos* (Bel patra). Many trees on this island were found to be covered by *Cuscuta reflexa* (commonly known as Amar bel) which is an unusual parasitic vine growing prolifically on the host plants. This leafless and rootless climber establishes itself on a host body and develops roots like haustoria (sucking organs) which penetrate the host stem to draw water and nourishment from it. Over a period of time, this voracious and destructive vine overgrows and kills the host plant. Upon interaction with the locals, it was found that they were aware of this plant growing on the trees in the island, but were unaware regarding its harmful impacts.

Image 56 : Scattered Tree Growth In The Riparian Zone Of The Riverine Island

Image 57 : Dense Growth Of *Cuscuta Reflexa* (Amarbel) On The Trees And Other Vegetation Near Ramchandipur Village

14.6 The ground flora in the riparian zones of the island was dominated by *Parthenium hysterophorus* (Congress grass) and *Leucas aspera*. The riparian grass – *Saccharum munja* was also luxuriantly growing throughout the island and was being used for roof thatching by the villagers.

Image 58 : Temporary Shelter with Thatched Roof of Dried *Saccharum munja*
Note : Pucca Houses in the Background on the Island

14.7 A diverse avifauna was observed in the island area (Table 8). Interaction with villagers revealed that a significant population of migratory birds is seen during winters with a probability of nesting skimmers. The presence of freshwater turtles and Dolphins during the floods was also informed by the villagers.

Table 8 : Avifaunal Diversity Of Riverine Island

Sr. No.	Common Name	Scientific Name	Conservation Status
1	White throated Kingfisher	Halcyon smyrnensis	Least Concern
2	Pied kingfisher	Ceryle rudis	Least Concern
3	Cattle Egret	Bubulcus ibis	Least Concern
4	Little Egret	Egretta garzetta	Least Concern
5	Intermediate Egret	Ardea intermedia	Least Concern
6	Great Egret	Ardea alba	Least Concern
7	Indian Pond Heron	Ardeola grayii	Least Concern
8	Purple Heron	Ardea purpurea	Least Concern
9	Common Sandpiper	Actitis hypoleucos	Least Concern
10	Little Cormorant	Microcarbo niger	Least Concern
11	Indian Cormorant	Phalacrocorax fuscicollis	Least Concern
12	Indian Jungle Crow	Corvus Culminates	Least Concern
13	Eurasian Collared Dove	Streptopelia decaocto	Least Concern
14	Red Collared Dove	Streptopelia tranquebarica	Least Concern
15	Laughing Dove	Spilopelia senegalensis (as on IUCN red data list 2018)	Least concern
16	Greater Coucal	Centropus sinensis	Least Concern
17	Oriental Turtle Dove	Streptopelia orientalis	Least Concern
18	Yellow-wattled Lapwing	Vanellus malabaricus	Least Concern
19	Red-wattled Lapwing	Vanellus indicus	Least Concern
20	Black Drongo	Dicrurus macrocercus	Least Concern
21	Oriental Skylark	Alauda gulgula	Least Concern
22	Common Myna	Acridotheres tristis	Least Concern

23	Bank Myna	Acridotheres ginginianus	Least Concern
24	Asian Pied Starling	Gracupica contra	Least Concern
25	Paddyfield Pipit	Anthus rufulus	Least Concern
26	Jungle Babbler	Turdoides striata	Least Concern
27	Common Babbler	Argya caudate	Least Concern
28	Large Grey Babbler	Argya malcolmi	Least Concern
29	Baya Weaver	Ploceus philippinus	Least Concern
30	Rufous Treepie	Dendrocitta vagabunda	Least Concern
31	White Wagtail	Motacilla alba	Least Concern
32	Indian Silverbill	Euodice malabarica	Least Concern
33	Asian Plain Martin	Riparia chinensis	Least Concern
34	Common Tailorbird	Orthotomus sutorius	Least Concern
35	Common Pigeon	Columba livia	Least Concern
36	Indian Roller	Coracias benghalensis	Least Concern
37	Green Bee-eater	Merops orientalis	Least Concern
38	Brown Shrike	Lanius cristatus	Least Concern
39	Lesser Cuckoo	Cuculus lepidus	Least Concern

Image 59 :Lesser Cuckoo *(Cuculus lepidus)* Sighted At Riverine Island

Image 60 : Black Kite *(Milvus migrans)* And House Crow *(Corvus splendens)* Sighted At Riverine Island

14.8 Most of the villagers on this island practice agriculture while some are involved in fishing and cattle rearing for their livelihoods. The rich nutrients in the soil of this island along with water availability contributed by River Ganga make this region favourable for good agricultural produce. The interactions with the villagers revealed that rice and bajra were the main crops grown in the fields along with jowar in some scattered fields. However, during our survey in October, we found many of these agricultural fields cultivated with vegetables and fruits such as pumpkins, cucumbers, papayas, chilies. Most of this agricultural produce is consumed by the habitants of this island while some part of it is sold in the market of nearby villages.

14.9 One important issue faced by the villagers on this island was the disturbance of agricultural fields by the wild boars. 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). Even in the villages of this Riverine island, people claimed that the wild boars frequently trample the fields and cause massive loss especially to the newly germinating crop plants. Also, they claimed to drive the boars away from their fields but did not admit to killing any wild boar.

Image 61 : A Field Of Green Chillies On The Riverine Island

15.0 FISHING IN VARANASI

15.1 Commercial fishing is a major and important source of livelihood for many people living along Ganga River. In most of the villages surveyed, people were involved in fishing activity mainly using small boats and with a variety of fishing gear. Among the fishing gear in Varanasi, gill nets and dragnets were widely employed besides hooks and line, cast nets and traps.

Image 62 : Drag Net

Image 63 : Fishing with Gill nets in Ganga River near Amba village

Image 64 : Hook and Line fishing

Image 65 : Dip Net fishing

Image 66 : Cast Net Fishing

15.2 Most of the fish caught from River Ganga were sold in the local village markets while some fishermen, who used bigger boats and caught good amount of fishes, sell their catch in some designated fish markets in Varanasi city. We visited and surveyed one such fish market (Image 67) near Ramnagar Fort where majority of the Mallahs involved in fishing bring their catch for selling. This market was operational on most days of the year during evening hours. Within an hour or two, most of the catch was sold. Some of the major fish caught from Ganga River in Varanasi are depicted in Images 68-69 and their names are as follows:

- *Cyprinus carpio*
- *Cirrhinus mrigala*
- *Clarias batrachus*
- *Heteropneustes fossilis*
- *Labeo bata*
- *Labeo rohiita*
- *Mystus seenghala*
- *Mystus tengara*

Image 67 : Fish Market Operational In The Evening Hours Near Ramnagar Fort

Image 68 : *Cirrhinus Mrigala* Sold In The Fish Market

Image 69 : *Clarias batrachus* Sold In The Fish Market

16.0 BOATMAKING IN VARANASI

16.1 The tourism industry in Varanasi is one of the most important factors for the prosperity of the city and is directly linked with the ancient narrow lanes and the famous colorful "ghats" along the western bank of Ganges. And the visit to this ancient city is incomplete without experiencing a boat ride along the crescent shaped stretch of Ganga to witness the charm of Benaras especially during early mornings and in evenings. To facilitate this movement along the north-south stretch of Ganga between Rajghat and Ramnagar, several boatmen ply manual and motor boats of different sizes for the tourists. Tourism in Varanasi has provided a means of employment to these boatmen that allow them to work independently despite having any formal education or tourism related skill (Singh, 2013). Most of the boatmen traditionally belong to Mallah or Nishad Caste, although a number of boatmen are also coming from other different castes too (Doron, 2009). The boatmen community traces their origin from the story of the boatman Khevat in Ramayana, where Khevat ferries lord Rama, Sita and Lakshmana across the River Ganges (Patra, 2016).

16.2 During our survey, we interacted with some boat makers belonging to Mallah community near Ramnagar Fort and at Rajghat, near the Varuna-Ganga confluence point. They were found to be making two different kinds of boat – the bigger boat which is motor operated and the smaller boat which is manually rowed (Images 70 & 71). Unanimously all the boat makers revealed the use of Sekua or Sal wood (*Shorea robusta*) for construction of the main body of boats while other woods such as mango wood or bamboo wood for construction of its smaller parts. They also claimed that the cost of making the small boats can range between Rs. 2-3 Lakhs while the cost of making the bigger boats can range between Rs. 5-7 Lakhs. These boats are mainly used by their makers for plying between Rajghat and Ramnagar for tourists who pay anywhere between Rs. 100-200 per hour for enjoying the boating experience in Ganges. Similar observations were reported by Patra (2016) wherein the boatmen were found to be charging Rs. 150 per hour for Indian tourists and Rs. 500 per hour for foreign tourists. In other places such as Ganga-Gomti confluence, Assi Ghat, Dashashwamedh Ghat, the boatmen interacted with, claimed to get their boats prepared by 'Mistry' or carpenters from other communities coming from nearby villages.

Image 70 : Construction Of Big Sized Motor Boat By Mallah Community At Varuna-Ganga Confluence

Image 71 : Construction Of A Small Sized Boat By Mallah Community Near Ramnagar Fort

16.3 Once the boats are prepared and ready for plying in the river, the boatmen perform a small puja before the boat starts its journey on the water. One such ritual was recorded by the Mallah community at the Varuna-Ganga confluence. A newly prepared boat was applied turmeric and sindoor, offered flowers and money and the owners prayed for its successful venture by lighting incense sticks. After this ritual, the newly prepared boat was launched in the Ganges by the

owner with the help of other members from the community thereby marking its new journey for years to come. Similar rituals associated with the boatmen community in Varanasi Distt. were also recorded by Patra (2016) where the worshipping of newly made boats associated with Ganga River was mentioned.

Image 72 : The Owner Of A Newly Constructed Boat Performing Puja Before Launching His Boat In The River

17.0 GROUNDWATER

17.1 Ground water is mainly controlled by drainage, topography and lithology of the region. The geological setup of the study area [7 Km Buffer] is characterized by quaternary alluvium consisting of older and younger alluvium. Older alluvium consists of fairly consolidated clay with kankar, sand and fine to medium gravel while new alluvium consists of clay, sand and kankar.

17.2 Physiographically, the soil resource of the study area falls under soils of Gangetic plain, which is further divided into –

- ❖ **Soils of recent alluvial plain**
- Deep well drained soil, fine loamy soils with loamy surface and slight flooding.
- ❖ **Soils of active flood plain**
- Deep well drained, sandy with coarse loamy soil [Typic Ustifluvents].
- Deep well drained, coarse loamy cancerous soil with sandy surface.

17.3 The soils of recent alluvial plain cover the right bank of River Ganga i.e. extreme west of the study area. These soils area well drained soils. The Varanasi city and surrounding area falls under this soil sub-group. Soils of active flood plain cover the Ganga Riverbed, Ramnagar, Riverine islands including sand bars, confluence points of Subba Nala, Varuna and Gomti River with Ganga River and Rajghat area upto Kaithi village. This region is excessively drained area and provides good recharge to groundwater. According to Central Ground Water Board (CGWB), the net ground water availability of the Distt. is 47972.08 Ham and the stage of ground water development is 80.40%. The Varanasi Distt. including study area [7 Km Buffer] is experiencing a periodic decline in water level by 0.19 m to 1.03 m/year in last 10 years.

17.4 The periodic spatial variation map of Ground Water Level [GWL] of pre-monsoon and post-monsoon [2008, 2013, 2018] provided in Map 14 is showing a trend of decline of water level in the study area. These maps were prepared with the primary data collected from the website of Uttar Pradesh Ground Water Board (UPGWB) Based on the delineated map, it has been found that –

- ❖ Due to excessive extraction of ground water for agriculture, infrastructure projects and brick kiln industries, the ground water level has declined periodically.
- ❖ In ground water level map of pre-monsoon 2008, it has been found that the areas near Subba Nala and Gomti River upto Jalhupur village has better GWL in compared to Varanasi city area. However, this situation has changed in pre-monsoon GWL 2018 and ground water of entire study area has declined significantly.

- ❖ In Varanasi city area, the areas like Maldahiya and Kashi Vidyapeeth has maximum depth of ground water level. It may be due to over exploitation of ground water in the region.
- ❖ In the post-monsoon GWL maps, the values of levels were found to be in between 1 m to 11 m in 2008 while the range has been increased upto 1 m to 30 m in 2018.

17.5 During our field surveys, we have interacted in villages like Bhagwanpur, Chittupur, Sear Goverdhan, Ramna, Kaithi, Choubeypur and found that the well water level in Varanasi city area was lower than the villages outside the city in the study corridor. The observations are presented in the Table 9. The farmers of village Kaithi and Choubeypur told us that they generally dig handpumps for 40 m – 45 m While the range goes upto 82 m – 85 m for borewells used for irrigation purposes. The farmers also claimed that their the ground water has declined by upto 7 m – 10 m in last 20 to 30 years.

Table 9 : Water Levels Of Dug Wells (Based on local interactions)

Location	Coordinates	Ground water level (in metre)	
		Post-Monsoon	Pre-Monsoon
Ramnagar [Near Purana Pokhara]	25°16'45.53"N, 83°2'21.81"E	3-4	9-10
Near Pampa Sarovar, Ramnagar	25°15'55.45"N, 83°2'32.09"E	7	24-25
Bhagwanpur Village	25°16'26.50"N, 83° 0'4.21"E	10-11	15 -17
Chittupur Village	25°15'35.5"N, 83° 01'06.5"E	10-12	14-15
Chittupur Village	25°15'47.2"N, 83° 01'03.6"E	12-14	15-17
Sear Goverdhan	25°15'21.6"N, 82° 59'46.9"E	12-14	15-17
Ramna Village [near dumping site]	25°14'29.9"N, 82° 59'54.5"E	10-11	20-22
Ramna Village [near River Ganga]	25°13'33.5"N, 83°00'46.8"E	12-14	15-17
Mahamanpuri	25°16'06.4"N, 82°58'49.7"E	10	15
Kaithi	25°29'32.55"N, 83°9'31.65"E	6-7	11-14

Image 73 : An Old Well In Ramnagar, Near Purana Pokhara
[25°16'45.53"N, 83° 2'21.81"E]

Image 74 : Sacred Kardam Kupam at Kandwa Pokhara

18.0 BANK EROSION

18.1 Fast flowing water is a powerful landform agent. The action of water on the left and right banks of the River Ganga could be easily observed. The lateral erosion of the banks is observed frequently when the rainfall is heavy, streams and rivers swell, transporting large volumes of sediment downstream.

18.2 There are 34 lateral erosion sites marked within the study area. Out of this, major erosion sites are reported near Ramnagar and Amba village. The River Ganga in its first curve between Subba Nala to Ghurha Nadi erodes the right bank at several points. The erosion is severe near Bishesharpur (25°14'42.01"N, 83° 1'56.41"E) and Sherpur (25°14'31.41"N, 83° 1'56.61"E) (ref. Map 15). The River turns again and the banks become vulnerable to erosion upto Kaithi village.

18.3 The major eroded sites are found near village – Kunda Khurd (25°19'36.58"N, 83° 4'39.75"E) Rauna (25°19'11.96"N, 83°8'22.17"E), Kukuraha (25°23'4.36"N, 83° 9'12.67"E), Sarai (25°25'28.34"N, 83°10'46.86"E), Paranapur (25°27'31.14"N, 83° 7'37.01"E), Sonbarsa (25°29'16.96"N, 83°10'6.57"E and Kaithi (25°29'27.23"N, 83° 9'39.40"E)

Map 8 : Eroded Sites In Village Bishesharpur And Sherpur

Image 75 : Lateral Erosion Near Rasulganj [Right Bank]

Image 76 : Eroded Bank Near Tanda Kalan [Right Bank]

Image 77 : Eroded Bank Near Kaithi Village [Left Bank]

Image 78 : Eroded Bank Near Markand Mahadev Temple Ghat

19.0 BRICK KILNS WITHIN STUDY AREA

19.1 The growing population and rapid pace of urbanization and industrialization demands a better infrastructure setup to meet the demand and supply chain. Brick is one of the important building materials for construction activities. The brick making industry is considered as a small-scale industry. However, it impacts the ecology, economy and social setup of the region.

19.2 In Varanasi Distt. brick kilns (Image 79) are distributed near rivers and water bodies. In the study corridor the brick kilns are mainly clustered north and south of Varanasi city. Location of brick kilns, clay and sand excavation sites has initially been identified from the Google imagery (April, 2019) and thereafter verified during field surveys conducted in October, 2019. The spatial distribution of brick kilns in the study area is delineated in Map 17. After identification of sites, it was found that :

- 152 brick fields including brick kilns, clay digging sites and sand digging sites are present within the study area. Since, more than 90% of the area falls within the area liable to flood (ref. Map 17). Thus, all brick kiln sites are prone to flood.
- 20 sites are located within distance of 130 m to 600 m from River Ganga
- 7 sites are located within distance of 15 m while 13 sites are located upto a distance of 450 m from Subba Nala. During field work, we observed that a few sites are contributing sediments to Subba Nala as they are located within the active flood plain of the stream
- 3 sites are located within distance of 12 m to 130 m from the Gomti River

The production processes of bricks include - clay digging, clay preparation, clay mixing, forming, drying, firing and cooling.

19.3 Brick kilns in the study area are a major economic activity the region. However, this industry has posed current and potential future threats to the soil, air, biota and water system of the region. The clay digging process deteriorates the soil quality and productivity of the soil because the bricks are made from the top soil. During our field visits, the farmers claimed that the eroded land may filled up in few years, either by sediments transported during rainy season or during flood pulsing. However, it has been found that brick kiln sites in flood plain areas contribute to soil erosion during flood.

Image 79 : Brick Kiln in Amba Village (25°23'14.70"N, 83° 8'21.71"E)

19.4 Indiscriminate digging of clay and sand in active flood plain lead to several hydro-morphological changes in the river channel especially small streams like Subba Nala , Nala near Kukuraha village (25°22'52.24"N, 83° 9'14.76"E), Nala near Girdharpur (25°24'42.61"N, 83° 6'33.07"E) and Nala near Balrampur village (25°27'30.89"N, 83° 6'47.63"E). It has been found that these small channels are gradually shrinking due to several anthropogenic activities including brick making industries. Based on the field observations, local interaction and existing literature, impact of brick kiln industry are listed below :

❖ **Beneficial Impacts:**

1. Income generation and Employment opportunity
2. Creation of water bodies for storing water for brick making may improve groundwater

❖ **Adverse Impacts:**

1. Ecological damages - effect on plant growth
2. Air pollution [possible pollutants from brick kilns are - Carbon Dioxide (CO^2), Carbon monoxide (CO), Sulphur dioxide (SO^2), Nitrogen Oxides (NOx) and Suspended Particulate Matter (SPM)]
3. Deterioration of soil quality and productivity
4. Reduction of agricultural land
5. Health impacts

20.0 SACRED TREES IN VARANASI

20.1 **Sacred Neem tree in Amba Village** – An old Neem tree (*Azadirachta indica*), believed to be more than 100 years old, was found to be present in association with the Shiv temple of Amba village in the floodplain zone of River Ganga. According to the villagers, this tree was worshipped along with the stone sculptures kept beneath it, believed to be representation of Shitlamata. The women of the village visit this place for the Jivit Putrika puja which includes observing fast and worshipping the Goddess for the well-being of their family members especially children.

Image 80 : An Old And Sacred Neem Tree Near Ganga River In Amba Village

20.2 **Sacred Peepal tree in Jalhupur Village** – A sacred Peepal tree (*Ficus religiosa*) was found associated with the village temple dedicated to Goddess Kali in Jalhupur village. According to the locals, this temple was built by Kachcha Baba whose pokhra was situated few kms away from this village on the Jalhupur road.

Image 81 : Sacred Peepal Tree Associated With Kali Temple In Jalhupur Village

20.3 **Sacred Banyan tree in Ramnagar** – An old banyan tree (*Ficus benghalensis*) was present associated with an old Hanuman temple near the very famous Durga temple in Ramnagar.

Image 82 : Sacred Banyan Tree Associated With Hanuman Temple In Ramnagar

20.4 **Sacred Banyan tree in Rajghat** – A banyan tree with a huge canopy was found growing on a ghat below the Rajghat Bridge in Varanasi. The pujari living in a small house besides the tree claimed that this tree was planted by a sage known as Langda Baba on the bank of River Ganga after which he left for Haridwar to spend the remaining part of his life in penance there. After that, another sage named Brahmachari Baba started living near the tree, took care of it and carried out puja daily at this place. After he passed away, his Samadhi was created in the small house which is inhabited by the current pujari near the tree. During Gurupurnima, a mela is conducted at this ghat during which pilgrims and visitors from different places pay their homage to the Samadhi and do puja at this tree.

Image 83 : An Old And Sacred Banyan Tree On Ganga Bank Below Rajghat Bridge

20.5 **Sacred trees in Chhitauna village** – A group of sacred trees were found growing around the Kali-Durga temple which was the village temple of Chhitauna in Varanasi Distt.. These trees included – Peepal (*Ficus religiosa*), Banyan (*Ficus benghalensis*), Shisham (*Dalbergia sisoo*) and Pakad (*Ficus virens*) which were planted about 70-80 years ago when the temple was established. Since then, the trees have been protected and many different types of pujas and rituals are carried out at this site by the villagers.

Image 84 : A Group Of Sacred Trees In Kali-Durga Temple In Chhittauna Village

20.6 **Sacred trees in Domari village** – Two sacred trees were found to be associated with a local folklore in Domari village of Varanasi Distt. One of these trees was *Sapindus* sp. and the other one was *Diospyros* sp. According to the villagers, a saint named 'Nakkha Baba' came to this village and did penance under these trees after which he attained nirvana. Owing to his rigorous prayers, his soul is believed to be residing in the trees and hence, since more than 100 years, these trees are worshipped by all the villagers. Annual puja and a small festival are also carried out at this site where the villagers offer prayers to the sacred trees

Image 85 : Sacred Trees Associated With Nakkha Baba In Domari Village

21.0 TURTLE SANCTUARY IN VARANASI

21.1 The National Ganga Action Plan was created in 1987 and it was then that the authorities recognized not only the indiscriminate sewage and waste dumping but also the pollution caused by corpses in the River was adding up to the degradation of the River. Moreover, the half-burnt bodies created more of a nuisance around the cremation Ghats.

21.2 Back then the experts from WII with the authorities in MOEF offered a simple and harmless solution as Ganga was already home to many turtle species specifically the scavenger turtles (*Nilssonia gangeticus*) which were ideal for the existing problem. But it was soon realized that over a period of time the turtle species and population declined, owing to various factors like anthropogenic pressures, excessive hunting and pollution.

21.3 Secondly, it was found that Varanasi had no good turtle nesting sites in the vicinity. To overcome the void, Forest department decided to bring the eggs from Chambal River. As per the Forest Dept. statistics between 1987 and 1993 they brought an astounding 84,000 turtle eggs.

21.4 Since that time the same process is followed till date* and the eggs are brought from Chambal, hatched and reared till they turn a year old. Then, they are released into the Ganga at the turtle Sanctuary near Varanasi (ref. Map 13). From 2005 onwards, an approximate 1000-1500 turtles have been released every year into the Ganga.

(*Although in 1993, the funding to the hatcheries was stopped and the hatcheries themselves were discontinued until 2005 when the Forest Department, noticing the continuing decline in several species, resurrected it again to breed endangered turtles).

21.5 Thus, with an objective of reintroducing the turtles into the Ganges and a hope to help establish a self-sustaining population, Sarnath Breeding Center was established as a part of the turtle sanctuary The turtle rearing facility was developed in Sarnath with the objectives of rearing carnivorous turtles so as to release them in the Turtle Sanctuary. It was believed that these turtles could devour the dead bodies in the Ganga River thus assisting in cleaning the River system.

21.6 The Sarnath Centre also acts as a rescue and rehabilitation facility for confiscated turtles from illegal trade - the injured turtles are treated and then released in the Sanctuary enhancing the source population's genetic diversity. Over 41,000 turtles have been released till date in the Sanctuary by the Kashi Forest Department (estimated from Kashi Wildlife Division log books).

21.7 However, the main aim of creating the Sanctuary was to conserve and propagate the aquatic wildlife and their environment in Gangetic plains.

21.8 Recognizing the ecological, social, natural and cultural significance of a 7 km stretch of Ganga River between Rajghat (Malviya Bridge) to Ramnagar Fort, the area was declared as the *Kachhua Vanyajiv Abhyaranya* (Turtle Wildlife Sanctuary) vide government of Uttar Pradesh notification No. 4170/04-3-62/89 dated 21-12-1989 (Annexure X) under the provisions of Section 18 of the Indian Wild Life (Protection) Act, 1972.

Image 86 : Turtle Sanctuary Stretch Near Ramnagar

21.9 The main objectives for the creation of this sanctuary were to :

- Conserve and promote of representative ecosystem and biodiversity of Gangetic plains.
- Develop and nurture the biodiversity as (in the form of) live museums or gene banks
- Conservation of wildlife in their natural habitats
- Create favorable conditions to conserve natural ecosystem
- Provide an opportunity for the common masses to study the aquatic flora and fauna of the region

- Create conservation awareness among villagers, administration and political leaders
- Conservation of protected areas with the participation of the people residing in and around the area
- Promote environmentally conscious tourism and develop the protected areas as a natural ecological tourism destination
- Promote ecological and environmental research studies in and around the protected areas.

21.10 The secondary information and our field observations show that tremendous tourist pressure [pilgrims and boat traffic] is affecting the sanctuary adversely. Moreover, the riparian zone is largely disturbed by agriculture and construction activity.

21.11 The Sanctuary forms a large meander with huge sand bar on the eastern side [right bank]. Sand bars, in general, are crucial for the survival of the birds and reptiles in terms of their nesting and basking requirements but considerable amount of activity was observed on the site in terms of local boats [transport], stray dogs and ashrams.

21.12 The Kashi Forest Division has records of over 40,000 turtles released in the sanctuary till date but the effectiveness of the released turtles has not been assessed, no effort made to tag or to establish the base population. Based on our interactions it was evident that the turtle population has declined drastically, clearly indicating poaching in addition to other anthropogenic factors.

The Indo-Gangetic belt is one amongst the five turtle priority areas in India. Out of 28 species of freshwater turtles and tortoises in India, 15 are found in the Indo-Gangetic belt. Out of these, 10 species endemic to the Indo Gangetic plains, are facing tremendous threats due to poaching and habitat destruction, despite laws in place. The local communities around Ganga are known for poaching thousands of turtles every year, which occurs mainly for local consumption, traditional medicines and much of it for feeding the overseas trade/smuggling. How large the scale is and the enormity of the poaching can be understood by the seizures that have happened in the last few years. There have been confiscations of thousands of live turtles from Uttar Pradesh alone. Lower income groups mainly poach the Indian soft shell and flapshell turtles for meat. But now the Indian soft-shell turtle has increasingly been in the trade for its use in Chinese medicines and as delicacy for soups.

21.13 The sand bar formation in the Sanctuary area is stable over the years, which indicates that the area is an ideal site for biodiversity conservation, providing

suitable nesting and basking habitat for turtles, crocodiles and nesting Riverine birds.

21.14 After three decades of being declared as India's first and only protected area dedicated to the conservation of freshwater turtles, Varanasi Turtle Sanctuary is being denotified by the UP Govt. and being relocated to the Allahabad-Mirzapur stretch of the Ganga River. This relocation is for the purpose of facilitating the national waterways project which has to pass through the turtle sanctuary.

22.0 URBAN GREEN SPACES ALONG GANGA RIVER IN VARANANSI

22.1 India has been experiencing rapid urbanization in the last few decades which in turn has adversely impacted the natural resources such as water bodies and biodiversity rich areas. The growing demand for resources coupled with their limited availability have increased the overall environmental stress in the form of poor air quality, less water availability, land degradation, high levels of noise pollution. Along with this, the unplanned and unsustainable expansion of cities has caused major destruction of urban green areas. Urban green spaces are an integral part of any city landscape, providing the city and its residents with numerous tangible and intangible benefits and ecosystem services like pollutant sequestration and ambient temperature regulation (Nowak et al., 2006), social services and health (Grahn & Stigsdotter, 2003), and also economic services like tourism (Chaudhry & Tewari, 2010).

22.2 Varanasi is experiencing rapid urbanization especially owing to its status as an important tourist and pilgrimage destination. The influx of tourists has grown exponentially in the last couple of years and so have the facilities such as new roads, new flyovers, new hotels, new ghats. Thus, all-natural spaces are under tremendous pressure. Despite this, there are some sites which have taken up measures to improve and maintain the biodiversity of their respective areas and hence, stand out as important green spaces in our study region. During this survey, we visited three such important green spaces in Varanasi city which fall in the study corridor.

22.3 **Rajghat Education Centre :** This Centre was established in 1928 by Krishnamurti overlooking the confluence of the Rivers Varuna and Ganga. The Centre functions in the light of Krishnamurti's teachings and his vision of education. The Centre consists of The Rajghat Besant School, Vasanta College for Women, Krishnamurti Study Centre and Rural units that are engaged in community services (Ref: https://www.rajghatbesantschool.org/). These institutions chiefly focus on imparting holistic education to the students

which also include developing sensitivity towards nature and its different elements. With the constant efforts of the people involved since its inception till today, REC has been able to retain some form of original nature that was once a characteristic of this city.

22.4 With the protection of old trees and continuous plantation efforts, the institutions of REC together harbor more than 90,000 trees in the campus. Two important old trees in the campus belong to *Ficus benghalensis* (Banyan tree) and *Tamarindus indica* (Tamarind tree) which are believed to be more than 200 years old. Besides these, several other native and exotic tree species are found in the campus. The shrubs and herbs in the campus are mainly ornamental varieties planted for beautification purposes.

22.5 **Banaras Hindu University campus :** This premier public central university was founded in 1916 by Pandit Madan Mohan Malviya in co-operation with Dr. Annie Besant. The main campus of this university is semi-circular in design and spread over an area of 1300 acres of land with well-maintained roads, extensive greenery all along and a wall encompassing it from all sides. The campus harbors about 42 different tree species (Singh, 2011), many of which are now tall and stately.

22.6 **Varanasi Cantonment :** Varanasi cantonment is a census town in the Varanasi Distt. which mostly contains defense establishments. In the last few years this area has seen tremendous development with large number of luxury and mid-range hotels coming up in this zone along with malls and shopping stores. Most of the green cover in form of old growth trees in this region is present inside the defense settlements where they are protected and maintained.

22.7 Besides these three, some other important green spaces of Varanasi city are marked in Map 18. The details of major tree species recorded from these sites are presented in Table 10 and some representative images are depicted in Images 87-88.

Table 10 : Major Tree Species Recorded In The Urban Green Spaces Of Varanasi City

Sr. No.	Botanical name	Family	Common name
1.	*Acacia nilotica* (L.) Delile	Fabaceae	Babool
2.	*Aegle marmelos* (L.) Corrêa	Rutaceae	Bilipatra
3.	*Alstonia scholaris* R. Br.	Apocynaceae	Scholar tree
4.	*Annona squamosa* Linn.	Annonaceae	Sitafal

5.	*Azadirachta indica A. Juss.*	Meliaceae	Neem
6.	*Bauhinia purpurea* Linn.	Fabaceae	~~~~~~~~~
7.	*Bombax ceiba* L.	Bombacaceae	~~~~~~~~~
8.	*Borassus flabellifer* L.	Arecaceae	~~~~~~~~~
9.	*Caryota urens* L.	Arecaceae	Shivjata palm
10.	*Cassia fistula* L.	Fabaceae	
11.	Dalbergia sisoo Roxb.	Fabaceae	Shisham
12.	Delonix regia (Hook.) Raf.	Fabaceae	Gulmohar
13.	*Eucalyptus globulus* Labill.	Myrtaceae	Nilgiri
14.	*Ficus benghalensis* L.	Moraceae	Banyan
15.	*Ficus glomerate* Roxb.	Moraceae	~~~~~~~~~
16.	*Ficus religiosa* L.	Moraceae	Peepal
17.	*Mangifera indica*L.	Anacardiaceae	Mango
18.	*Melia azedarach Linn.*	Meliaceae	~~~~~~~~~
19.	*Mitragyna parvifolia* (Roxb.) Kunth	Rubiaceae	~~~~~~~~~
20.	*Moringa oleifera* Lamk.	Moringaceae	Drumstick
21.	*Murraya koenigii* (Linn.) Spring	Rutaceae	Curry leaves
22.	*Phyllanthus emblica* Linn.	Euphorbiaceae	Amla
23.	*Plumeria rubra* L.	Apocynaceae	~~~~~~~~~
24.	*Polyalthia longifolia* (Sonn.) Thwaites	Annonaceae	False Ashok
25.	*Psidium guajava*Linn.	Myrtaceae	Guava
26.	*Roystonea regia* (Kunth) O. F. Cook	Arecaceae	~~~~~~~~~
27.	*Syzygium cuminii*(Linn.) Skeels	Myrtaceae	Jamun
28.	*Tamarindus indicus* Linn.	Fabaceae	Imli
29.	*Tectona grandis* L.f.	Verbenaceae	Teak
30.	*Terminalia arjuna* (Roxb. ex DC.) Wight &Arn.	Combretaceae	Arjun
31.	*Thespesia populnea* (L.) Sol. ex Corrêa	Malvaceae	Poplar

32.	*Wodyetia bifurcata* A.K.Irvine	Arecaceae	~~~~~~~~~
33.	*Ziziphus mauritiana* Lamk.	Rhamnaceae	Ber

Image 87 : Old Tamarind Tree Believed To Be >100 Years Old In The REC Campus

Image 88 : Rich Floristic Diversity In Varanasi Cantonment

23.0 CLIMATE CHANGE IMPACTS

23.1 Among the different states in India, Uttar Pradesh is considered most vulnerable to climate change impacts. The state climate action plan warns of erratic climate patterns in future on the basis of climate projections. As per State Climate Change Report (UPSAPCC, 2014), the rainfall is predicted to increase by 15% to 20% and higher towards 2050s (25% to 35%). The temperature predictions are not favourable too. There is a predicted temperature rise of 1.8°C to 2.1°C during the same period. Moreover, Uttar Pradesh [East and West] also falls under frequently drought prone area (probability of occurrence of drought 10-20%) as per time series (1875-2009) delineation done by Indian Meteorological Dept. (Attri & Tyagi, 2010). This climatic variability in the state has might have cascading effects on region's biodiversity, water resources, food productivity and dependent livelihoods.

23.2 **Impact on fish resources :** Vass et al. (2009) studied in detail the impact of climate change on fisheries in Ganga River system. Their study pointed out factors such as flood magnitude and frequency owing to intense precipitation events, and low flows owing to increased evaporation, would have significant impact on the fish resources of Ganga River. They also analysed the monthly rainfall data at Allahabad site of the middle stretch of River Ganga from 1974-2003 which revealed that the rainfall had declined by 5% in the peak breeding season of fisheries while it had increased by 7% in the post breeding period when resorption of eggs of Indian Major Carps begins.

23.3 The fish production in the middle stretch of Ganga River was also severely impacted by the decrease in fish spawn availability and continued deterioration of Indian Major Carps seed coupled with increase of minor carps and catfish seed. **This effect was confirmed by the fishermen in our survey who unequivocally voiced their concern over the declining catch of Indian Carps while the catfish and exotic carps formed a major portion of their catch. They were also concerned about the changing weather patterns over last two decades which affected their livelihoods in terms of low catch and reduced fish size.**

23.4 **Impact on Ganges River Dolphin :** The Gangetic Dolphin (*Platanista gangetica*) is an indicator species for the River ecosystem and is at the apex of the food chain. Already classified as 'Endangered' by IUCN and with its population declining, this species is further threatened by climate change which impacts Ganga River and its tributaries. Other anthropogenic factors such as increasing pollution due to large-scale discharge of industrial and municipal waste, siltation, mechanised boats and overfishing have also affected the distribution and survival of dolphins in Ganga. Many

respondents in Varanasi city claimed to have sighted dolphins at the Ghats about 15-20 years ago. However, their sightings are now confined to only few places with the major one being at Ganga-Gomti confluence further north of Varanasi city. The changing currents of water, increased turbidity, increased surface water temperatures and availability of fish resources for food are some of the chief reasons for their habitat and population shift in Varanasi district.

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