# GANGA CULTURAL DOCUMENTATION

## MUNGER DISTRICT

### [Natural Heritage]

2022

National Mission for Clean Ganga

Indian National Trust for Art and Cultural Heritage

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Front Cover : Ganga River As Seen From Kashtharni Ghat, Munger Distt.

Background : Active Floodplain Of Ganga River As Seen From Peer Pahar

Back Cover : Fishing In Ganga River

Formatting And Design By : Abhishek Kumar Upadhyay & Abhishek Kumar

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## MUNGER DISTRICT

January, 2022

Sponsored By:

NAMAMI GANGE

National Mission for Clean Ganga

Authored By:

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# 1.0 Introduction

1.1 Munger District (25.2110311° North 86.5066274° East) is one of the thirty-eight administrative Distt.s of Bihar state. The district, having an average elevation of 53 metres above MSL, is divided into three subdivisions and nine developmental blocks[1]. Munger was spelt as "Monghyr" by early Britishers which nomenclature continued to be used till the 1971 Census. Before 1832, it formed a part of the Bhagalpur District. Munger, a very large district, has been apportioned into five other districts from its territory viz. Begusarai (1976), Khagaria (1988), Jamui (1991) and in 1994 Lakhisarai district and Sheikhpura.

1.2 With a total geographical area of over1419.7 sq.km. the Distt. is bounded on the north by Khagaria, on the west by Lakhisarai and Begusarai Distt.s, in the east by Bhagalpur, while in the south it is bounded by Banka and Jamui Distt.s [ Refer Map No. 01]. The important rivers flowing through the Distt. are Ganga, Kiul, Harohar and Mohane. The Ganga River flows a total distance of approximately 62.9 km. in Munger Distt.

1.3 The landscape of the Distt. comprises of hill tract, pediplain and alluvial plain. The Kharagpur Hill tract is formed of dominantly elevated and craggy landmasses. Pediplain is characterized by rolling topography and comprises of residual soil superimposed by mixture of sheet-wash deposits. The older Alluvial Plain constitutes the major part of Tarapur, Asarganj and part of Sangrampur blocks and it is composed of sediments derived from the erosion of the Chota Nagpur Plateau and Kharagpur Hills. The northern part of the distt. is constituted by the younger alluvial plain, confined to a few km from the river Ganga, locally known as the Diara or Diyara. (CGWB,2013; O'Malley & James, 1926)

1.4 The major part of the Munger Distt. consists of red sandy soil especially in the central areas of the Distt. It has poor fertility and is suitable for the highland crops. Older alluvial soils of slightly acidic nature are developed mainly in the marginal area along the northern border of hard rock terrain while the younger alluvial soils are restricted on northern and southern Ganga plain. It is deficient in phosphoric acid, nitrogen and humus. (CGWB,2013)

[1] District Census Handbook, Munger [2011]
*https://censusindia.gov.in/2011census/dchb/1024_PART_B_DCHB_MUNGER.pdf*

1.5 The climate of Munger Distt. represents a transition between the dry and extreme climate of northern India and the warm and humid climate of Bengal. In the summer, temperatures rise to 42°C, while in winter they dip down to 2°C. The Distt. receives an average annual rainfall of 1231 mm annually of which 80% of the rainfall is received during June to September through south-west monsoon. (CGWB,2013; O'Malley & James, 1926)

1.6 The District has a rich past with many suppositions about the origin of its name. "The Mahabharat mentions this place as Mudagiri, also known as Maudagalayagiri after Maudagalya, a famous Buddhist monk. However, a widely dominant tradition credits the name to the sage Mudalya Rishi, the grandfather of the epical Ahilya. In course of time Mudgalgiri, so named after Mudgala Rishi, was corrupted to Munger." Spread over an area of around 222 acres, the Munger fort has been occupied by many regimes viz., Khiljis, Tughlaqs, Lodis, Mughals, Nawabs of Bengal and later the British. (O'Malley & James, 1926)

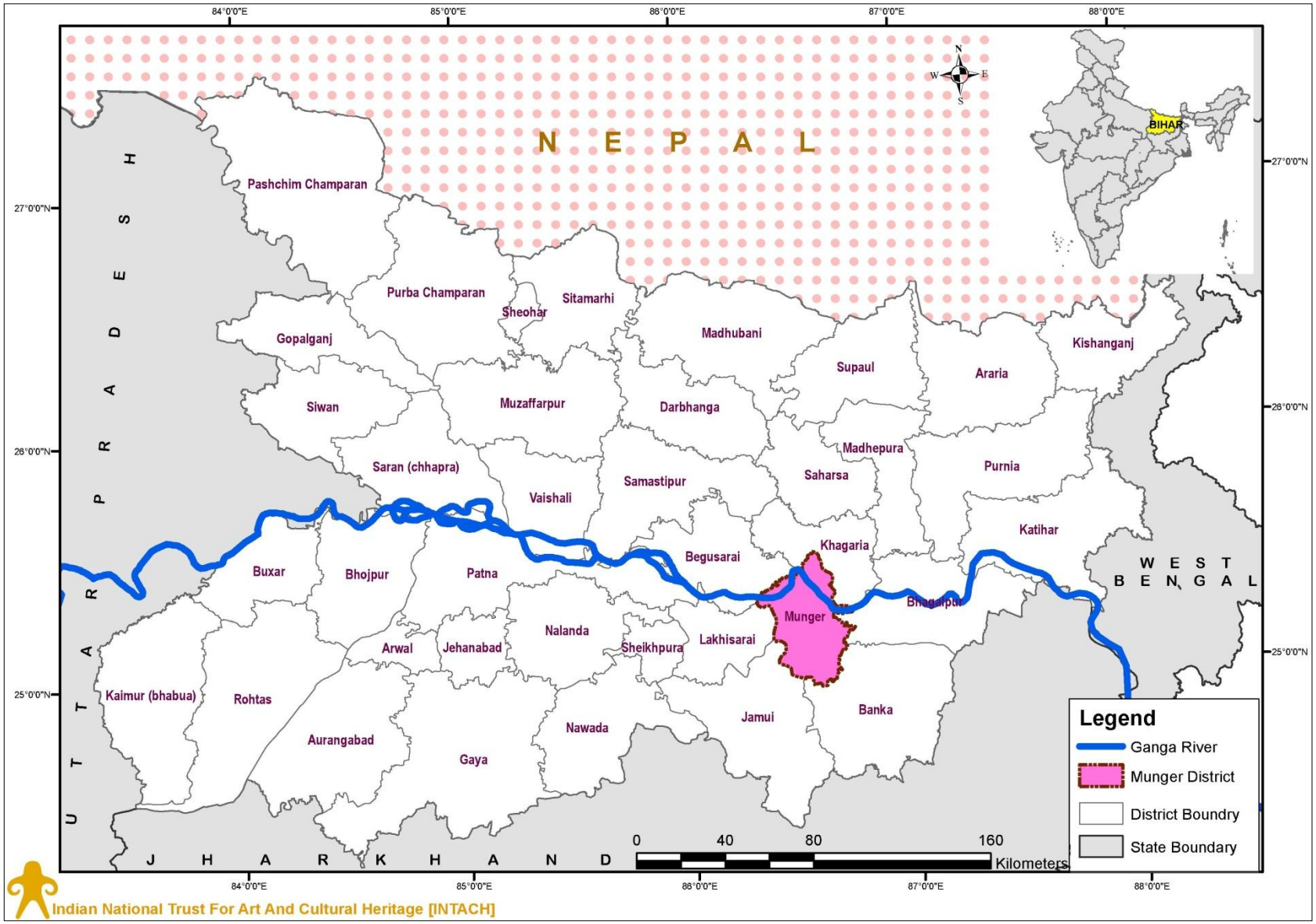
Munger is one of the historic towns of Bihar, known to be ruled by Karna. Its ruler Mir Kasim fought one of the last battles before East India Company captured eastern India. (CGWB, 2013)

Situated on the bank of Ganga River, Chandika Asthan is one of the Shakti Peeth in India. Being a Siddh Peeth, it is considered to be one of the most sacred and sanctified temples.

Kastaharani Ghat is a holy place situated in Munger Distt. which means "The bathing place which expels all pains". It is believed that on his return journey from Mithila to Ayodhya after marrying Sita, Lord Rama took a dip in this water to find relief from fatigue. (Distt. Gazetteer of Monghyr,1926)

Munger Distt. has a scenic landscape and is situated around River Ganga and Kharagpur hills. Located in the lap of the nature, the Bihar school of Yoga, at Ganga Darshan Ashram is internationally acclaimed and frequently visited by people from all over the globe[2].

[2] District Profile, Munger [Udyog Mitra]
*http://www.udyogmitrabihar.in/docs/dp/munger.pdf*



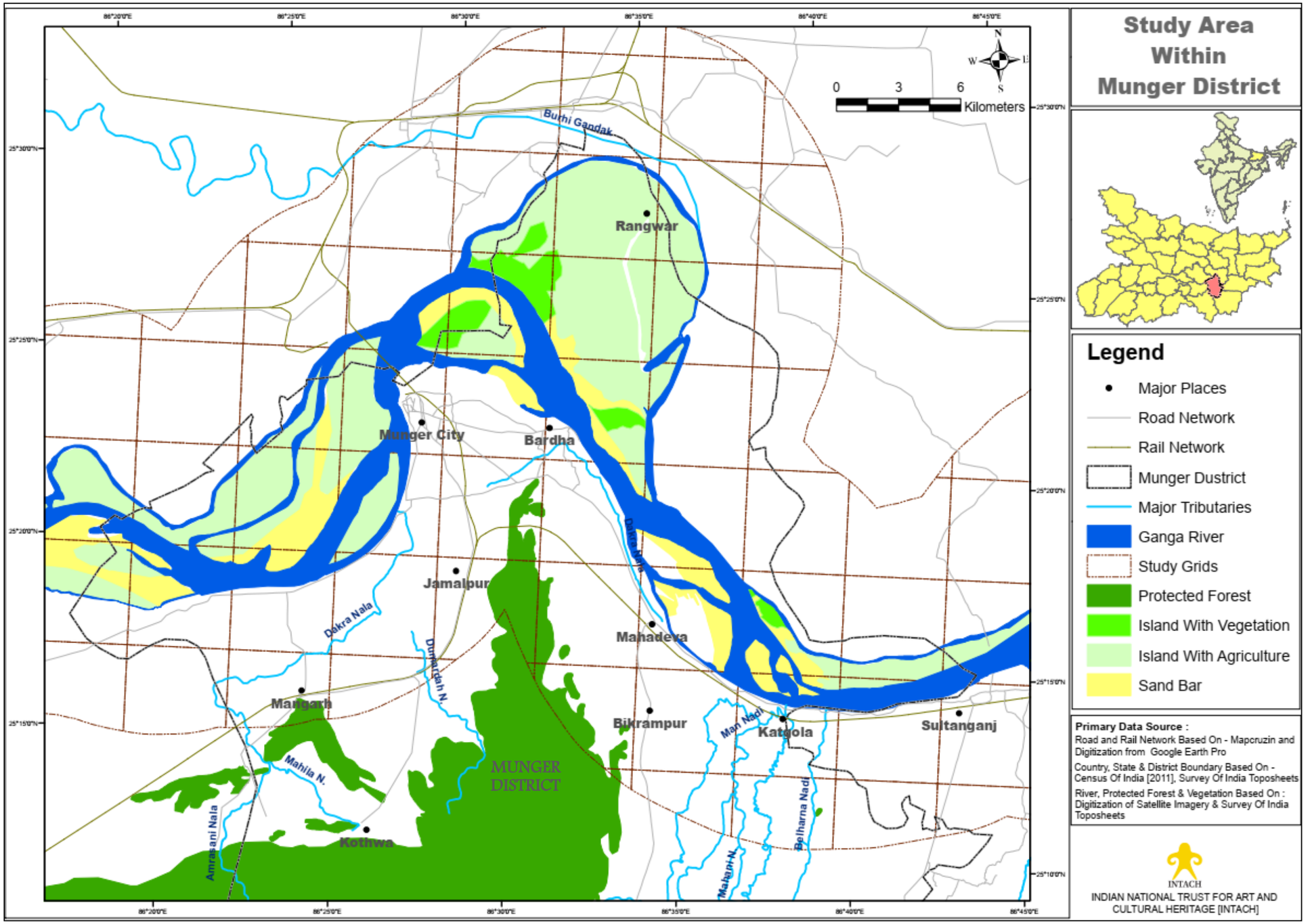

Map 1 : Location of Munger Distt

## 2.0 Ganga River In Munger Distt.

2.1 Ganga River flows through the Distt. from west to east dividing it into two portions of unequal size and different characters. The northern and smaller portion is a flat alluvial plain traversed by Burhi Gandak which flows through it from north-west to south-east. On the other hand, the southern portion of the Distt., in general, has a higher elevation with more or less undulating surface. Ganga River enters Munger Distt. from Begusarai distt. little before Kiul-Ganga confluence near Rasulpur and covers a total distance of about 62.9 km before exiting the distt. near Sultanganj.

2.2 After entering the Distt., the river flows north-eastwards forming a sharp bend upon reaching the high land near Munger town. It then turns southwards for some distance before again moving eastwards towards Bhagalpur Distt. Throughout its course in the Distt., the river is both wide and deep having shifted course several times both to the east and the west alternatively forming and washing away large areas of *diara* lands. The *diaras* are extensive in some areas such as above Munger town where the width of the river course stretches from 6-7 km. Map No. 2 shows the Ganga River stretch in Munger Distt. along with the buffer region constituting the study area.

Image 1 : View of Ganga River Near Ghorghat, Munger Distt.




Map 2 : Study Area With Ganga River Stretch

## 3.0 Methodology

3.1 For carrying out surveys, a 7 km buffer [study area] of Ganga River in Munger Distt. was marked having a total area of 1040.45 sq. km. covering right bank and left bank of River Ganga. The study area was divided into grids of 5 × 5 km for field survey. Before carrying out surveys, the study area was analysed with the help of secondary literature, mythological records, available maps [Google Earth historical satellite data, SOI old toposheets, SOI-OSM sheets]. Based on that, key features were marked in Google Earth Pro and Kml files were generated. The Kml files were further transported to mobile based QGIS field survey application. Key features were marked taking consideration of Natural Heritage documentation format.

3.2 The field survey in Kaushambi Distt. was carried out in November, 2021. Various sites were visited within the study area wherein field data was collected along with interactions with stakeholders. The co-ordinates of all localities were taken by Garmin handheld GPS eTrex30 and the representative images of various parameters were taken with the help of Sony Digital Camera Cyber-shot DSC-HX300 with 50X optical zoom. Pre-marked Google Earth's Kml files and Google Maps were used for navigation. Scanned maps of the topographic map series of Army Map Services, U.S. Army [Map NG45-10], Survey of India [SOI] Open Series Maps [OSM] and Google Earth Historical Imagery were obtained and analysed for preparation of Maps.

3.3 Field guides were used for flora and fauna identification. 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. Information regarding groundwater, agriculture, forest and wetland were obtained through informal/formal interviews and discussion with Govt. officials of Forest Department, and farmers, fishermen, boatmen and other stakeholders.

## 4.0 Tributaries of Ganga River in Munger Distt.

**4.1** Two major rivers along with a few small streams and nalas connect with Ganga River in Munger Distt. Map No. 3 provides the details of the minor and major tributaries some of which are also discussed in this section.

**4.2 Burhi Gandak River:** This river originates from Chautarwa Chaur near Bisambharpur in the district of West Champaran in Bihar and is one of the important tributaries of Ganga River joining on the left bank of Ganga. Locally known as Sikrahana in its upper reaches, the river is then augmented by contribution from some rivers rising from the foothills of the Himalayas. Near Basantpur, River Masan joins this river on its left bank and after a distance of 56 km, it is joined by **Tilawe** and **Tiur** on its left bank. After its confluence with Tiur river near Gularia, this river is known as Burhi Gandak. From this point, the river takes south-easterly direction flowing through Muzaffarpur, Samastipur Begusarai and Khagaria Distt.s before entering Munger Distt. of Bihar.

The River enters the Khagaria Distt. near Bela Village [25°31'27.31"N, 86°18'59.32"E] and flows eastward to a distance of approximately 37 Km and enters the Munger Distt. at Latitude 25°29'38.06"N and Longitude 86°34'1.56"E. The River joins a channel of Ganga River Near *Tikarampur Diara* and finally empties to the main channel of Ganga River near Jhahwabahiyar. Tikarampur Diara or *Kachhar* formed due to the dual fluvial action of Ganga and Burhi Gandak River. The confluence of the Ganga-Burhi Gandak was once located near Bishnupur and Muradpur Village at latitude 25°19'22.19"N and longitude 86°38'7.86"E. The old confluence is located 7.8 Km eastward to the current confluence of Burhi Gandak-Ganga [Main Channel] confluence [Refer Image No. 2 & 3]. The paleo-channel of the Burhi Gandak is still present near Bishnupur district [Refer Image No. 5]. The satellite imagery of the confluences [old and new] is presented in Image No. 3.

According to the District Gazetteer of Munger, this river used to be navigable throughout the year for large boats during rains and small boats during other times.

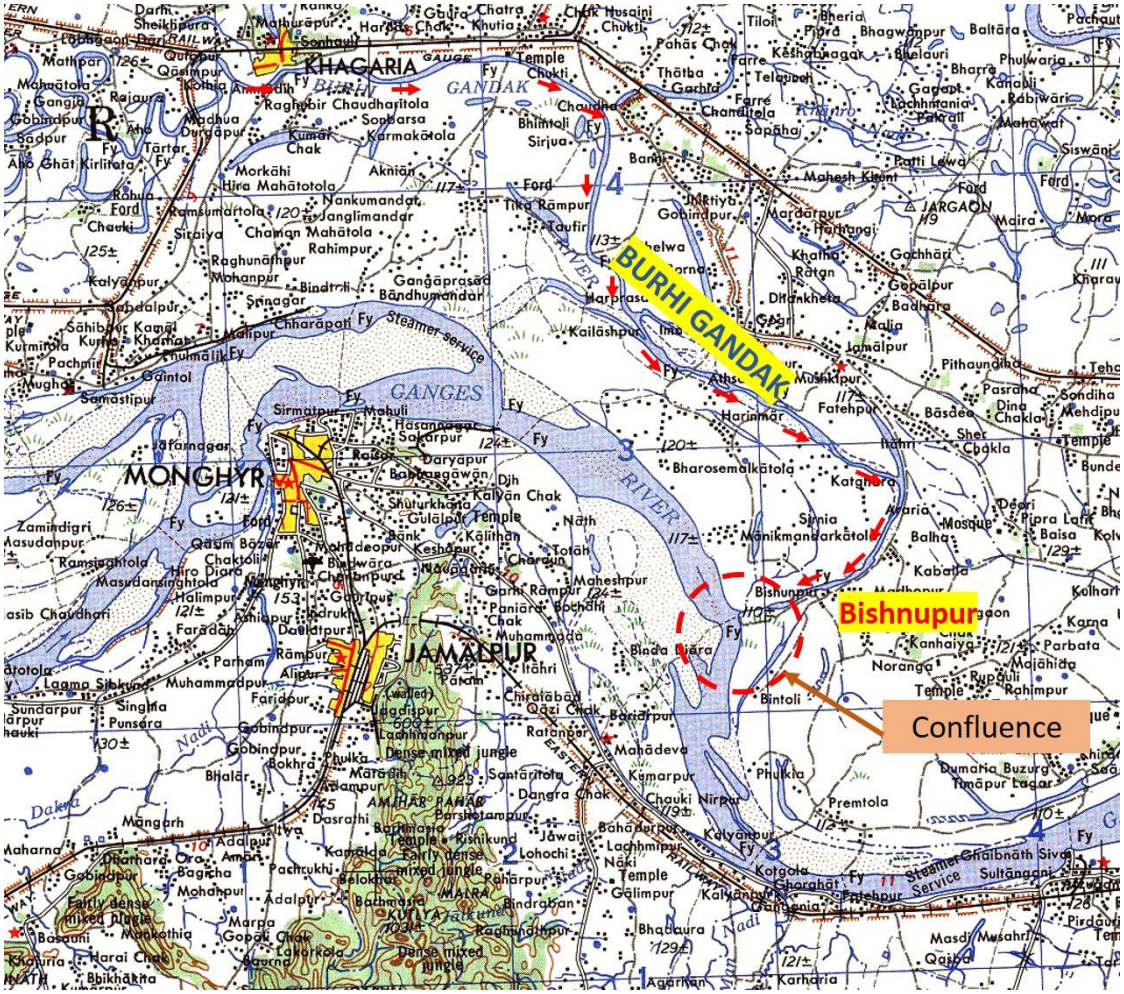



Image 2 : US Army Map Showing Old Confluence of Ganga-Burhi Gandak

*Source : Topographic Map series of Army Map Services, U.S. Army [Map NG45-10 Compiled 1955, Based On SOI 1936-1937], Scale – 1:2,50,000.

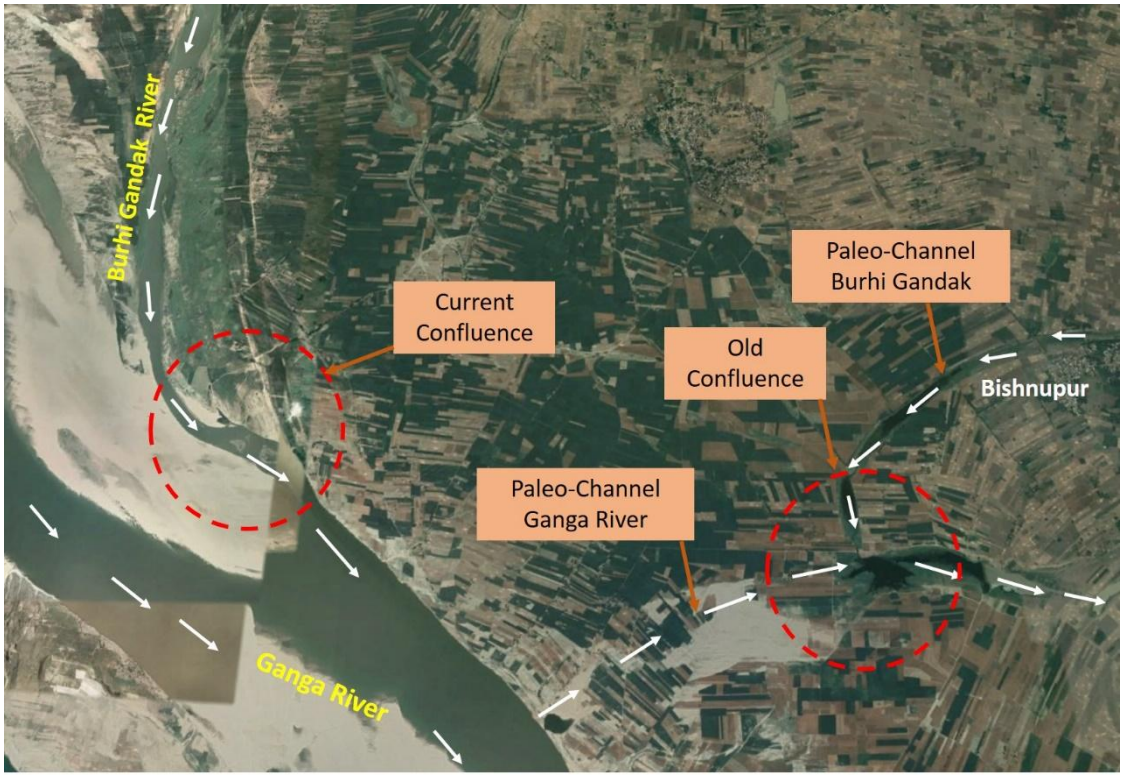



Image 3 : Old And Current Confluence of Ganga-Burhi Gandak
[Source : Google Earth Imagery, January 2022]

Image 4 : Burhi Gandak River Near Tikarampur Diara

**Image 5 : Paleo-Channel Of Burhi Gandak River As Seen From Nabe Village Bridge**

*[The Paleo-channel of Burhi Gandak River believed to be originated near Karimandantola and join the Ganga River near Bishnupur Village (at old Ganga-Burhi Gandak confluence).*
*The Nabe Village Bridge is only bridge in the region which connects rest of the region to the Ganga Ghats. Earlier boats were only means of transportation]*

4.3 **Kiul River:** Originating from the hills of Giridih district in Jharkhand state, this is one of the most important rivers of south Bihar. After its origination, it enters Jamui Distt. where it is joined by **Barnar**, **Alai** (a mountain stream) and **Anjan river** near Jamui railway station. It then flows north-east into Lakhisarai Distt. where it is joined by **Harohar** or Halahar river near Rohua village at latitude 25°13'56.11"N and longitude 86° 7'29.41"E [Refer Image No. 6]. In recent years, the confluence of Kiul-Harohar has shifted from Rohua Village to Surji Chak [Refer Image No. 7 & 8]. This is because of the breaking of narrow meander neck during monsoon. After Kiul-Harohar confluence the Kiul River enters Munger Distt. and flows for a short distance before meeting River Ganga at latitude 25°18'10.68"N and longitude 86°21'43.06"E on the right bank. A small stream named **Garkhe Nadi** originates near Bherha Village in Munger Distt. joins Kiul river near Nista Village just before its confluence with Ganga River.

The District gazetteer of Monghyr Munger][3] describes the Kiul and its tributaries as :

*"The Kiul has a broad sandy bed, and in some places is as much as half a mile wide, though it contains very little water in the hot weather. It is spanned by a large railway bridge between Kiul and Lakhisarai"*

*"The Anjan rises in the Anjan Hill to the north of the Anjan village of Barhat in the Mallepur taluk, and after passing through that taluk falls into the Kiul near Bariarpur. It has been dammed up in Barhat, and its water is diverted into an irrigation channel known as the Belia Nali, which irrigates several villages. The river receives several tributary streams viz. the Jamkhar, the Bajan, and the Chhuria, which has a sub-tributary, the Kairwar".*

Image 6 : Kiul River As Seen From Bridge Near Garhi Bishanpur Village [Before Kiul-Harohar Conflunce]

*[A small water fall has been developed due to river bed mining. Illegal sand mining is a major issue throughout the stretch of the river.]*

[3] O'Malley L.S.S. and James J.F.W. (1926), Bihar and Orissa District Gazetteers Monghyr. Government Printing, Bihar and Orissa, Gulzarbagh P.O.


Image 7 : Satellite Imagery of 2007 Showing The Kiul Harohar Confluence, Lakhisarai Distt.

[Source : Google Earth Imagery, January 2007]

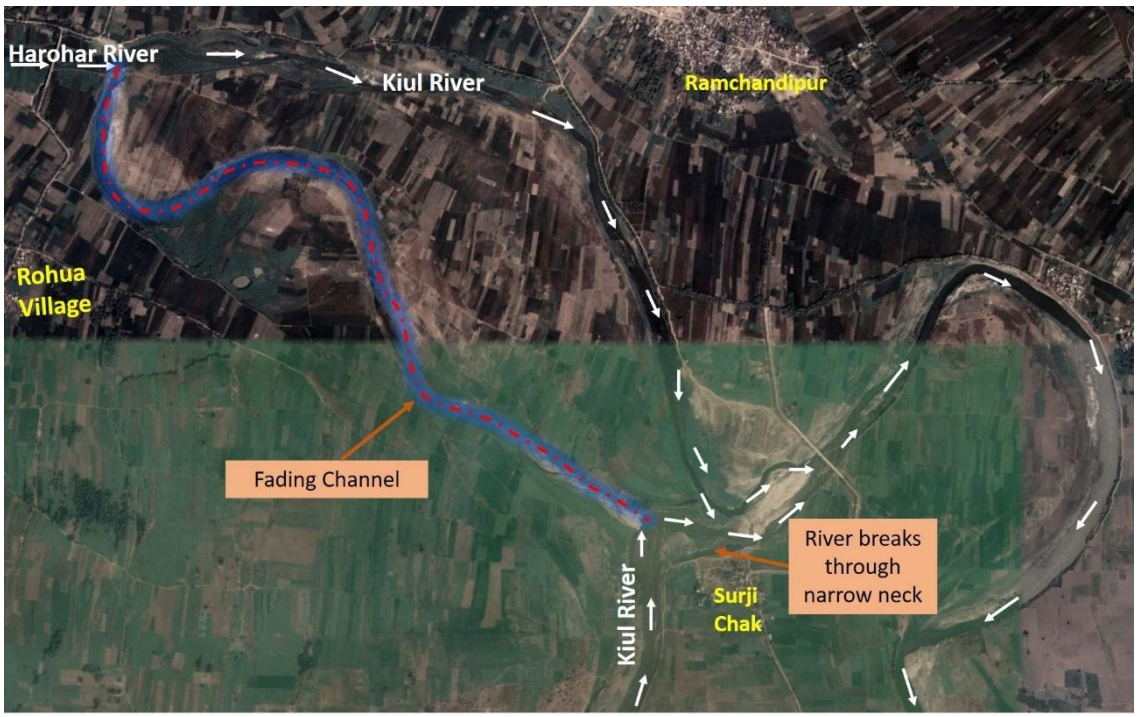



Image 8 : Satellite Imagery of 2021 Showing The Kiul Harohar Confluence, Lakhisarai Distt.

[Source : Google Earth Imagery, December 2021]


**Image 9 : Satellite Imagery Showing River Bed Mining In Lakhisarai Distt.**
[Source : Google Earth Imagery, April 2018]

**Image 10 : Harohar River As Seen Near Bahadur Village**
**[At 25°12'48.81"N, 86° 4'12.43"E]**

**4.4 Dakra Nala:** The Dakra Nala pump project was initiated in 1982 with the purpose of providing irrigation by drawing water from Ganga River with the help of high electricity power pumps. However, since its inauguration it has been unable to provide water to any of the farmers owing to the faulty location of its pumping station [Pandey, 2009]. In recent years, this empty canal carries waste water and garbage during rainy season dumping it into the Ganga River from the right bank [Refer Image No. 11].

Image 11 : Dakra Nala Near Confluence With Ganga River

**4.5 Man River:** The River originates near Jamuniyatari village in the Kharagpur Hills. Flowing south-easterly for few kilometres in Bhimbandh protected forest, a Nala joins it from the south at 25° 3'51.86"N, 86°26'56.14"E. Here, River turns to the north and flows for few kilometres, two small streams namely – **Narokol Nadi** and **Dudhpaniya Nala** joins it from the west at 25° 5'15.65"N, 86°27'2.22"E and 25° 8'17.96"N, 86°30'34.22"E respectively. Nearby the confluence of Man-Dudhpaniya Nala a huge reservoir named Kharagpur Jhil has been constructed for irrigation purposes. Moving downwards, the River leaves the Kharagpur hills and turns eastward and again northward and flows for few kilometres. A river named **Mahani Nadi** joins it from its right bank near Majhgaon Village at

25°12'24.16"N, 86°36'47.96"E. Another river named **Kharra Nadi** joins it at 25°14'13.36"N, 86°37'36.50"E. Just before the Ganga-Man confluence a channel of Badua River which originates near Manlan Village joins Man River. Man River debouches in the Ganges near Ghorghat. The confluence of the river is a Major fishing site. Also, confluence serves as feeding ground to the Gangetic Dolphin [*Platanista gangetica*].

**The district gazetteer of Monghyr [1926] describes the Man River as:**

*"The Man river rises in the Kharagpur Hills, not far from the Bhimbandh springs, and pursues a winding north-easterly course to the east of those hills till it debounches in the Ganges near Ghorghat. The lower reaches, however, contain but little water, for a great dam has been built about two miles south of Kharagpur, where the man runs through a narrow gorge. To the south the george widens out into a valley, hemmed in by low but abrupt hills, which the dam has converted into a large reservoir".*

**Francis Buchanan a British scientific explorer mentioned the Mohane [Mahani] river in his report named - An Account of the Districts of Bhagalpur [1810-1811] as :**

*"The Mohane river rises on the frontier of the Tarapur and Mellupur divisions, towards the north side of the Ganda cluster of hills about 25 miles south from its junction with the Man, runs for above ten miles through a very wild country, and passes at some distrance to the East of the temple named Ungchanth, where it is very inconsiderable. Lower down it receives two torrents from the concavity of the long hill named Biram or Khoranda. The uppermost torrent, named Khutiya has a very short course. The lower named Auraha, joins it at the road between Tarapur and Kharakpur, where both in March are small streams, containing a little dirty water in narrow channels. The Auraha rises by three channels called Bamura, Gaighata, and Subarhi, the first farthest North the Last farthest South".*

Image 12 : Man River Near Kalyanpur Village [After Joining Kharra River]

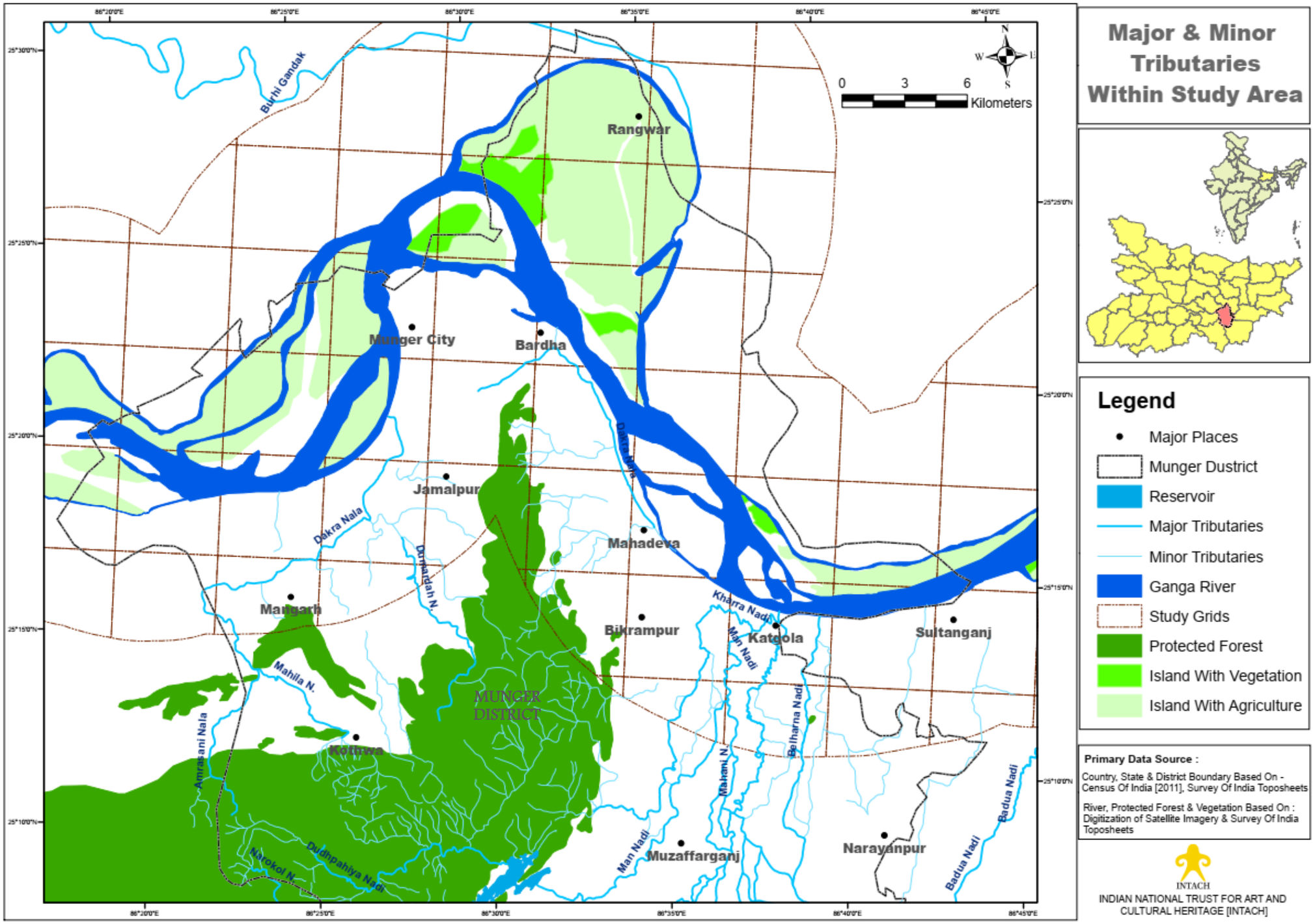
4.6 There are ten minor streams reported within the study area. Out of which two streams are completely faded, four are partially faded and four are flowing within the study area. The lengths of these streams range between 2 Km. to 12.8 Km. Documentation of these small streams are important because most of them carries water from hilly areas empties to River Ganga and serve as migratory route for fish species and helps in flood management. The Details of flowing streams are provided in Table 1 and partially faded and faded streams in section 6 of this report.

Table 1 : Streams Within The Study Area

| Stream | Origin | Confluence | Length and Potential Threat |
|---|---|---|---|
| **Nala** | At 25°16'44.25"N, 86°24'3.47"E | Empties to Ganga near Singhia Village [25°18'17.93"N, 86°24'19.46"E] | Stream Length approximately 3.5 Km. Potential Threat : Siltation, encroachment for construction and brick kiln |

| | | | |
|---|---|---|---|
| **Nala** | At 25°15'46.14"N, 86°26'43.74"E | Empties to Dumardah Nadi at 25°17'21.95"N, 86°26'55.39"E | Stream Length approximately 4.1 Km. Potential Threat : Siltation, encroachment for construction |
| **Dumardah Nadi** | At Kusumba Pahar [25°12'12.77"N, 86°28'35.51"E] | Empties to Dakra nala at 25°17'28.84"N, 86°26'49.45"E | Stream Length approximately 12.8 Km. Potential Threat : Siltation, encroachment for construction. **Forms a waterfall called *Barmasiya Waterfall*** |
| **Nala** | Near Rishikund [Hot Spring [25°15'31.11"N, 86°31'22.43"E] | Joins Dakra Nala at 25°16'59.68"N, 86°34'55.95"E | Stream Length approximately 9.48 Km. Potential Threat : Siltation, encroachment for construction and brick kiln. |

Image 13 : Nala Near Bariyarpur [Originates From Rishikund]




Map 3 : Major and Minor Tributaries in the Study Area

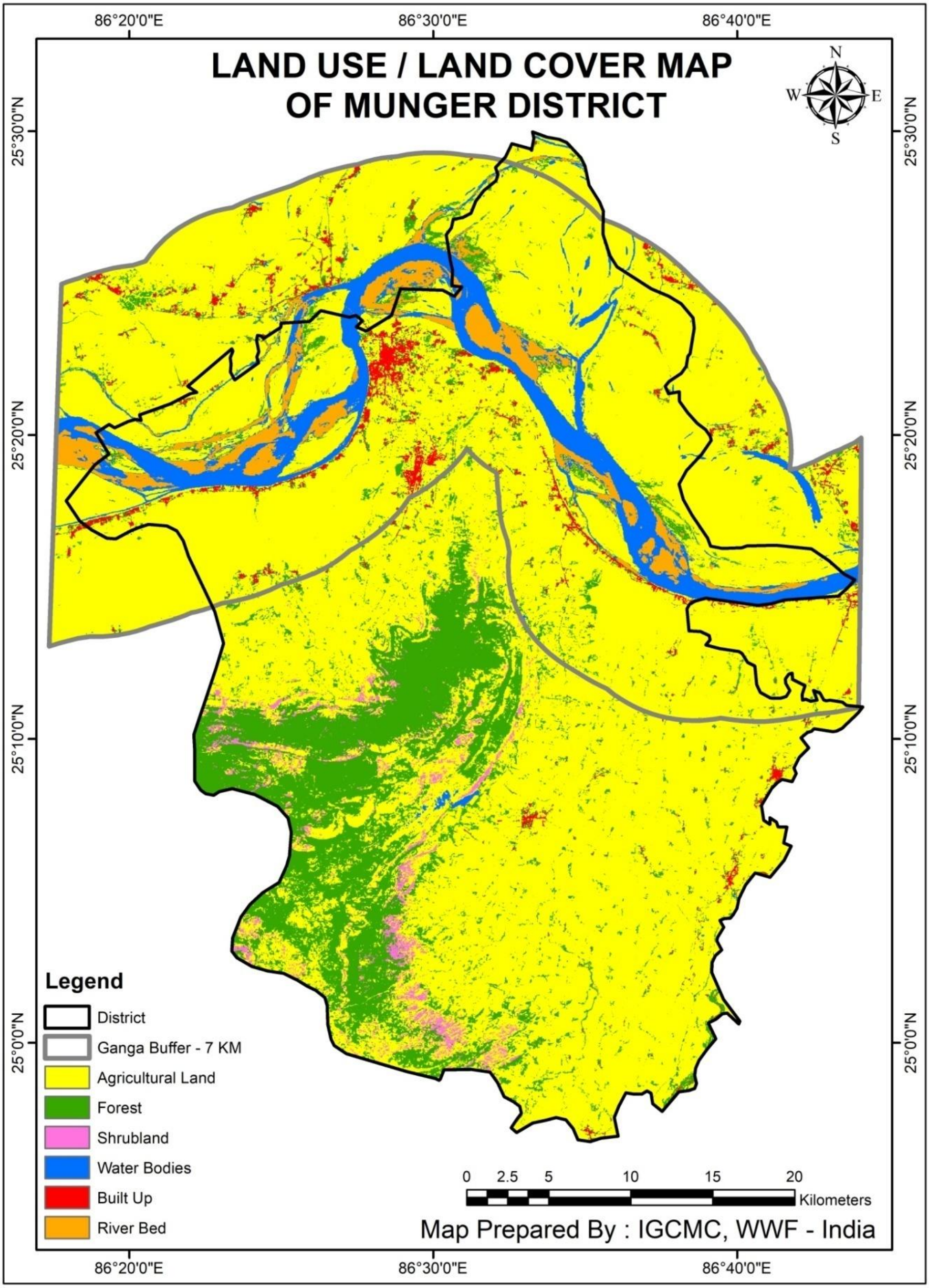
## 5.0 Land Use Land Cover [LULC]

5.1 Land Use Land Cover [LULC] map of the study area has been prepared from Landsat imagery for the year 2020 [Refer Table No. 2 & Map No. 4]. Using supervised classification system, 6 different classes were generated – agricultural land, forest, shrubland, water body, built up and riverbed/open land. [Refer Map No. 4]. Study area constitutes 1040.45 sq. km. covering right bank and left bank of River Ganga for which the following observations were drawn:

- Agriculture is the dominant class, covers 78.30% of the study area. Forest area constitutes 4.94% and is mainly found at Amjhol Pahar, Raunakabad reserved forest, riverine island with vegetation, plantation area and stone quarry sites at Peer Pahar [along Ganga River], Gulalpur and Kaithan.
- Water body constitutes 9.18 % and covers lentic and lotic system of the study area. The lentic system includes Pain area, flood affected area and Taal area.
- The built-up land constitutes 2.36% of the total study area. This class covers the urbanised area at Munger City and Jamalpur and villages and settlements [mainly along national highway]
- The stone quarry activities along Amjhol Pahar and Peer Pahar, near Gulalpur and Kaithan have been closed for last 30 years [based on interaction with local communities]. The vegetation at these places is in journey of revival. Thus, these sites have been covered under forest area.

Table 2 : Land Use Land Cover of Study Area In Munger distt. [2020]

| Munger (Ganga 7 Km Buffer) | | |
|---|---|---|
| **Class** | **Area (In Sq. Km)** | **Area (%)** |
| Agricultural Land | 814.6700 | 78.2998 |
| Forest (Scrub Forest) | 51.3909 | 4.9393 |
| Shrubland | 0.0877 | 0.0084 |
| Water Body | 95.4689 | 9.1757 |
| Built up | 24.5500 | 2.3596 |
| Riverbed/ Open Land | 54.2827 | 5.2172 |
| **Total** | **1040.4501** | **100** |




Map 4 : Land use/Land cover map of Munger distt.

## 6.0 Paleochannels of Ganga River

6.1 Palaeochannels are the remnants or old channels of once active rivers or streams, some of which are lie buried under the cover of younger sediments. They are formed when the river or stream migrate their courses and form new ones. Paleochannels are important to understand area geology, old river routes, sediment deposition and are considered suitable areas for ground water recharge. In Munger Distt. factors such as stone quarrying, mining, encroachment, extensive agricultural practices, brick kilns and loss of vegetation act as a catalyst for the fading of river channels and wetlands. Within these factors, stone quarry, brick kiln and loss of vegetation are the main reason behind the fading of streams. Loss of vegetation allows the soil to erode easily, which finally ends up in filling of the wetlands and accelerate the rate of migration of river.

6.2 In order to identify paleo-channels and threatened river channels in the study region, US Army Map [NG45-10, compiled 1953-1955] based on Survey of India (SOI) maps 1936-1937, SOI (OSM) 2005-2006 and Google Imagery upto December, 2021 were analysed [Refer Map 5 & 6]. Further, ground truthing carried out in January, 2022. Based on that, it has been found that :

- River channel of Ganga in Munger Distt. has migrated between 1936-1937 to 2005 - 2006 [Ref. Map No. 6].
- Major migration was recorded near Bansgarh [25°17'6.73"N, 86°18'34.94"E (Right bank)], Tikarampur (Rangwar) [25°23'29.09"N, 86°32'26.16"E (Left Bank)], Jhalwabahiyar Village [25°20'22.46"N, 86°36'9.47"E (Left Bank)].
- Between 2005-2006 and 2019-2020, a channel of Ganga River has completely faded near Bishnupur village and the main channel of the river has shifted southward. Near Bishnupur Village there was confluence of Ganga and Burhi Gandak, now it has shifted eastward [details provided in section 4 of this report]. The paleo-channel of Ganga River is shown in Image No.15 & 16.
- In recent years it has been observed that a channel of Ganga River has started fading between Nurpur [Right Bank and Kala Tola [Right bank]. Fading channel is navigable in few months of the year.

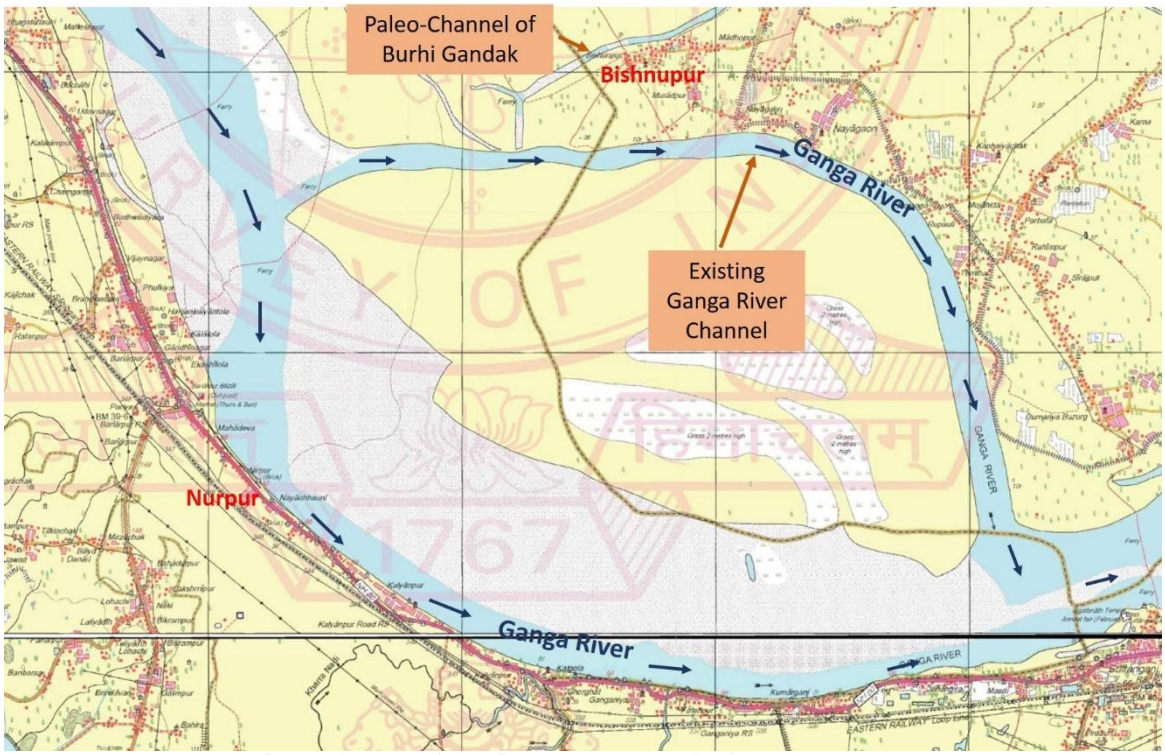



Image 14 : SOI [OSM] Toposheet [G45O11 & 12] Showing Existing Ganga River Channel At Left Bank

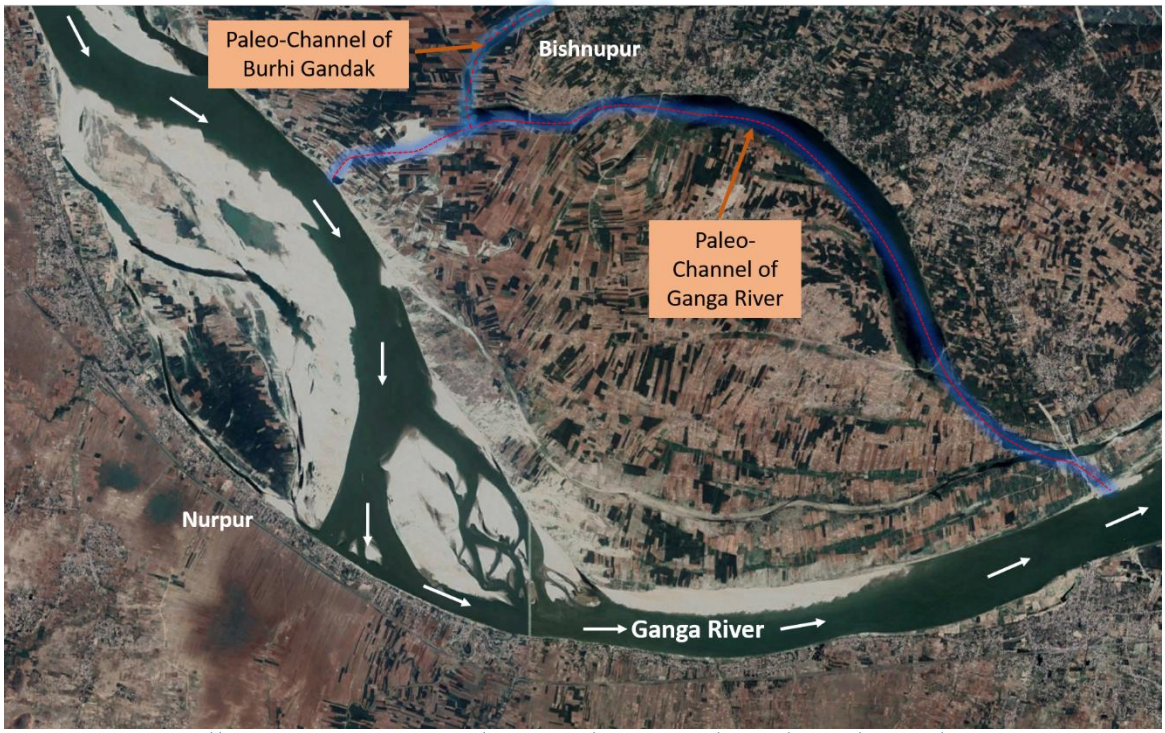
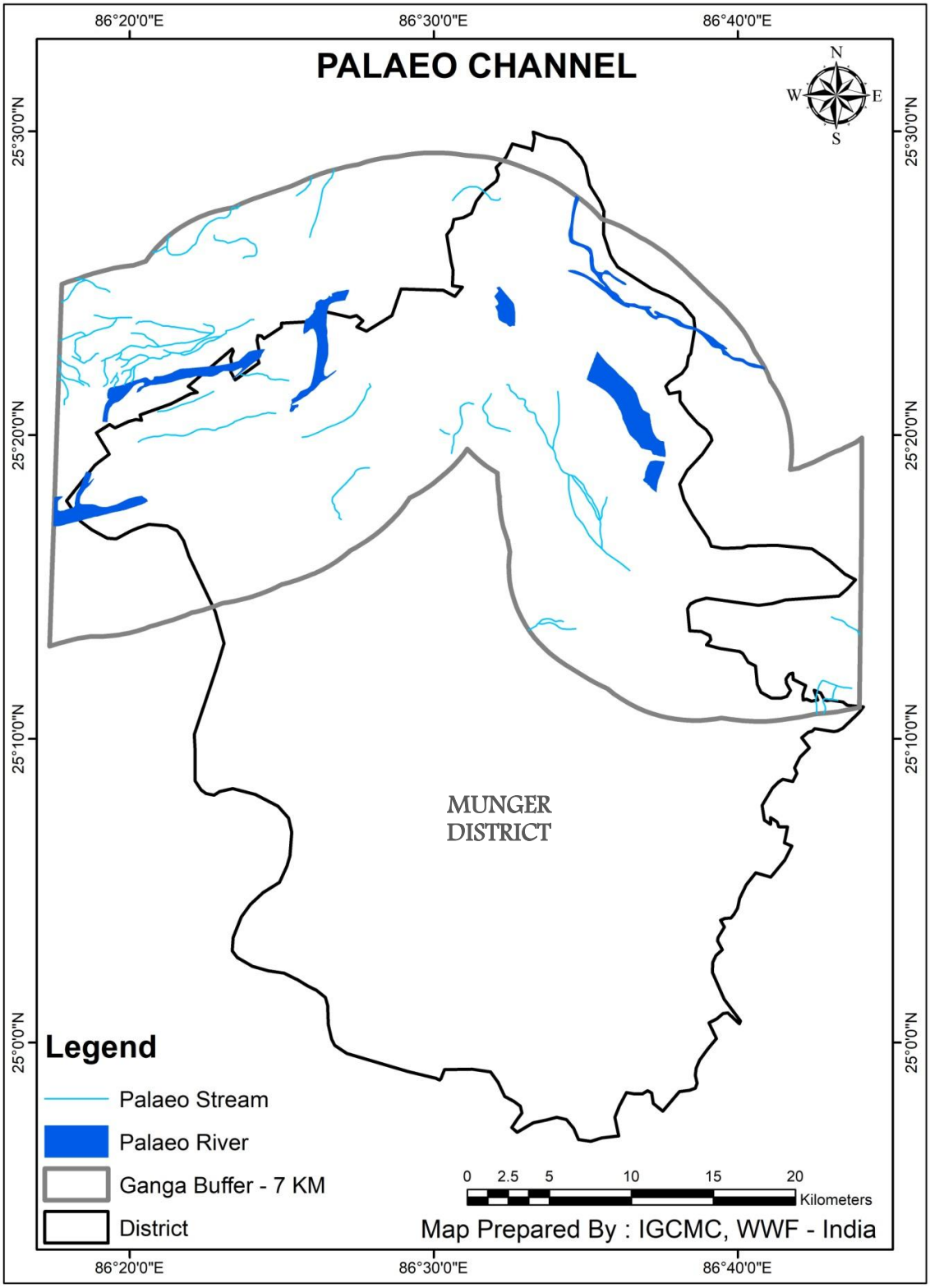



Image 15 : Satellite Imagery Of April 2020 Showing The Paleo-Channel Of Ganga River
[Source : Google Earth Imagery , Dated April 2020]

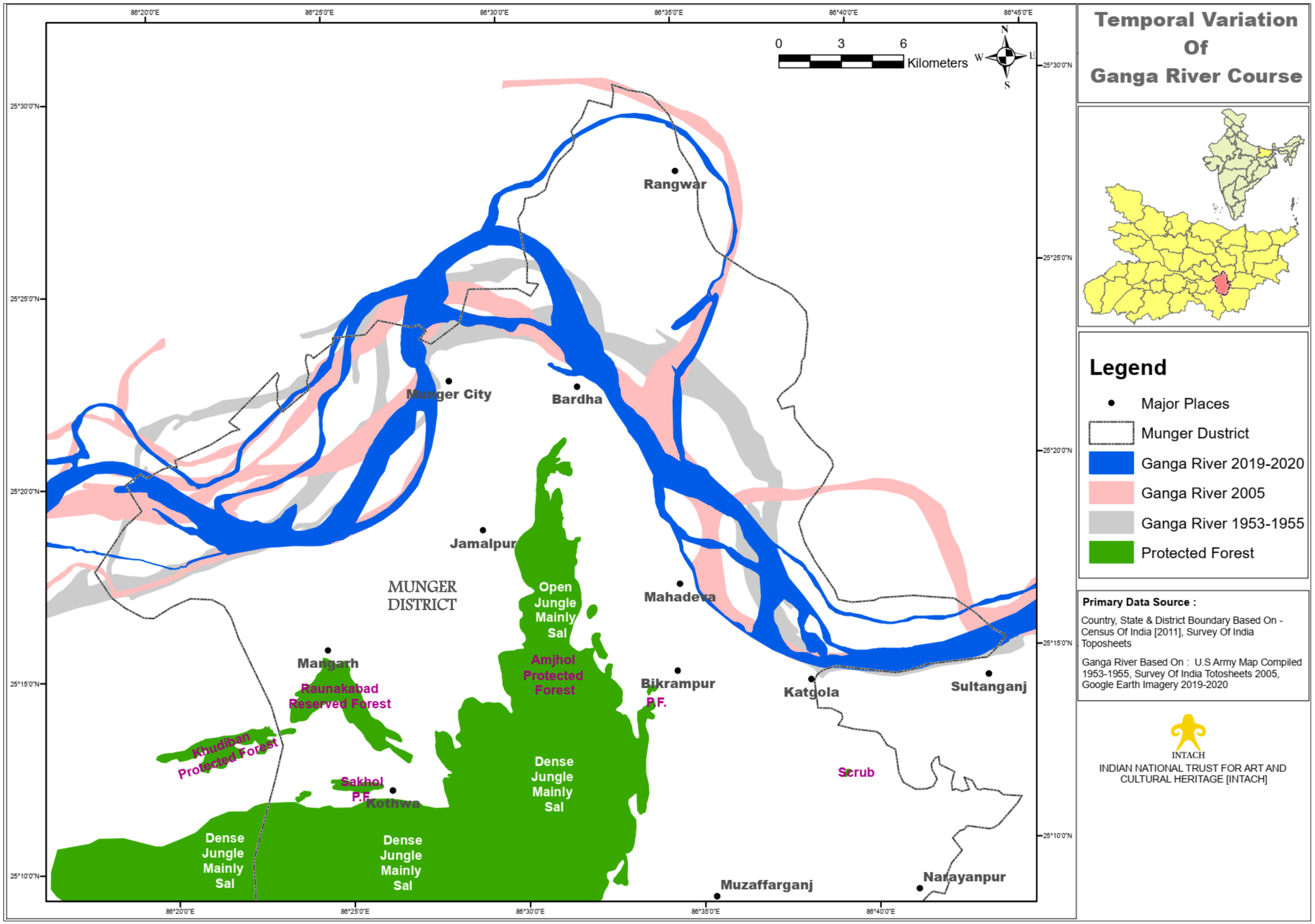
❖ The study of SOI map series, Google Imagery (in time series) and ground survey highlighted there are four small streams whose courses has partially faded and two streams whose course has completely faded or disappeared altogether. The disappearing channels are small and seasonal but are equally important because they drain to River Ganga. Streams have faded maybe due to extensive agricultural practices, encroachment and high silt load. Details of faded streams provided in table No. 03 and images 8-11.

Table 3 : Faded Streams Within The Study Area

| Stream | Origin | Confluence | Reason for the fading of the stream |
|---|---|---|---|
| **Nala** | Jamalpur [25°15'56.75"N, 82°14'51.75"E] | At 25°19'9.02"N 86°27'49.25"E | High silt load and encroachment **Completely faded** |
| **Nala** | Near Benigir [25°22'31.12"N, 86°30'29.70"E] | Near Hasannagar [25°23'15.75"N, 86°30'31.62"E] | High silt load encroachment for construction, dumping of waste. **Partially faded** |
| **Dakra Nala** | Near Harpur [25°20'43.50"N, 86°30'4.33"E] | Near Nurpur [25°16'17.52"N, 86°35'30.98"E] | Nala flows parallel to Ganga. **Partially faded** due to Brick kilns and erosion. *As per SOI toposheets there are two Nala with name Dakra exists in the distt. |
| **Nala** | At 25°18'56.54"N, 86°31'5.65"E | At 25°19'7.66"N, 86°33'54.81"E | High silt load and encroachment **Completely faded** |
| **Nala** | At Amjhol Pahar [25°16'3.80"N, 86°31'17.34"E] | At 25°16'54.47"N, 86°33'3.99"E | Stone quarry **Partially faded** |
| **Nala** | At Amjhol Pahar [25°17'22.06"N, 86°31'9.36"E] | Near Brahihasthan 25°18'12.70"N, 86°33'38.53"E | Stone quarry **Partially faded** |




Map 5 : Paleochannels In Study Area [Munger Distt.]

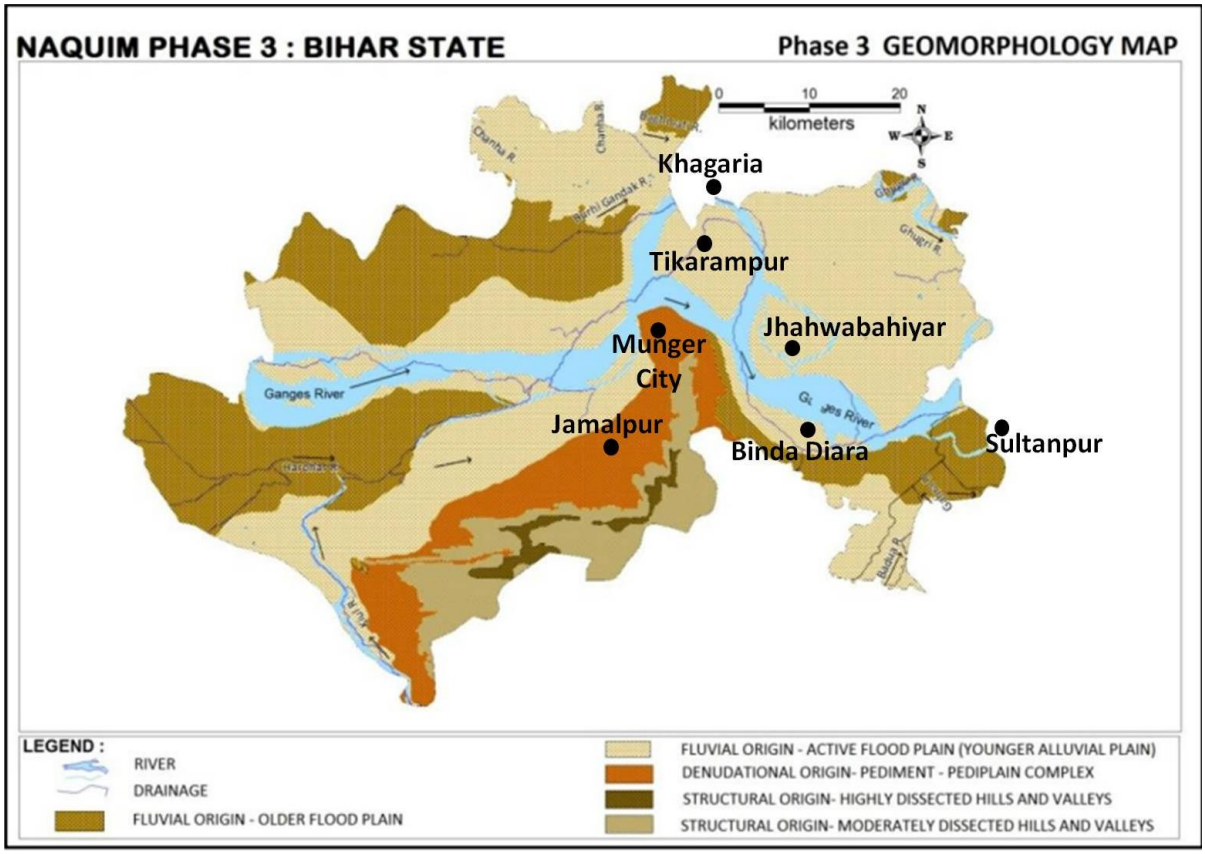



Map 6 : Temporal And Spatial Variation of Ganga River Course In Munger Distt.

## 7.0 Floodplain of River Ganga in Munger

7.1 The active flood plain of a river is defined as an area on either side of the river channel with regular flooding on a periodic basis. Maintaining active flood plain of a river is critical for assuring equilibrium in ecosystem. The floodplains harbour rich biodiversity including riparian vegetation as well as many other groups of organisms which help in maintaining fertility of this region. Along with this, the floodplains have been of great cultural and economic importance with many early civilizations having risen in these fertile lands. As the rivers naturally meander through the landscape over a period of time, they deposit sand, silt and other soil forming materials in the floodplain region which make them ideal for agricultural production. Throughout history, people have learned to cultivate in the fertile floodplains and use their rich resources for sustaining livelihoods. Even today, in most of the riverine regions, especially in India, the floodplains have been occupied by local farmers for carrying out their agricultural activities especially in the non-monsoon season. Ganga River floodplain is one such important floodplain in India which has been extensively utilized in almost all the districts, where it passes through, for agricultural purposes.

7.2 Munger Distt. is part of Middle Ganga plain. Geo-morphologically, the study area in Munger Distt. has been characterised into Younger alluvial plain [Active floodplain], older alluvial plain [Older floodplain], pedplain complex and highly dissected hills and valleys [Refer Map No. 7]. Active floodplain is a geomorphic unit in left bank of River Ganga in the study corridor while older floodplain dominates the right bank of the study area. The pedplain complex dominates the Jamalpur and Munger city area including the Peer Pahar area. Moving westward to the Munger city, the Younger alluvial plain or active flood plain forms the entire area. ***In the right bank of Ganga River near Munger-Lakhisarai border upto Begusarai, there is a vast stretch of backwaters known as the Tal lands. This area represents the active flood plain and is highly fertile and prone to floods during the monsoon season. This is due to the silt deposited from the River Ganges almost every year.*** The alluvium deposits covering the entire region are of Quaternary period.




Map 7 : Geomorphology Map

[Source : Report On Aquifer Mapping, CGWB, 2017]

Image 16 : Image Showing The Active Flood Plain Within The Study Area [Right Bank]

7.3 Munger Distt. is predominantly an agrarian Distt. falling in agro-climatic Zone 3A (South Alluvial Plain Zone) with the major soils being clayey soil, fine loamy soil, coarse loamy soil and calcareous sandy soil [NICRA-ICAR, 2013]. It is divided into four different clusters based on topography, soil resources and water table – *Diaras* (Lands of Ganges), *Tal* (Lands south of Ganges), Plains (Old alluvial plain south of Ganges) and Hilly (Shallow alluvium) [Vandana, 2010]. Ganga river floodplain in the Distt. is abundant with numerous small and big agricultural fields some of which are represented in Images 18, 19 & 20.

**Image 17 : Agricultural Activities In Active Flood Plain Of Ganga River Near Shankarpur And Hasannagar Village**

*[Image showing Rabi crops mainly wheat, barley, linseed, mustard and vegetables and Maize in few areas. Maize is major crop in active floodplain area and is grown in both seasons [rabi and kharif]. The area inundates four to five months in a year. Utilized of large amount of chemical fertilizers [100-120 Kg urea] is major environmental concern. The visible sand bars in the image are used for sowing Zaid crops].*

7.3 The left bank and right bank of river of River Ganga within the Distt. falls under the Agroclimatic Zone II & III. Common cropping sequence practised within this zone includes:

- Zone II [Left Bank of River Ganga]: Rice-Wheat-Moong [Maize within active floodplain]

- ❖ Zone III [Right Bank of River Ganga]: Rice-Wheat, Rice-Gram, Rice-Lentil, Rice Rai [Shallow Tal area are major site for rice cultivation]

7.4 Crop cultivation throughout the study corridor differs as per the flood inundation. The active floodplain area is used for sowing *rabi* and *zaid* crops. The *kharif* crops are restricted in high land areas. Tal areas in the study region support crops mainly in *rabi* season. Pulses are the major crops of ***Tal*** **area***. High water demanding crops are grown mainly nearby the ***Pain*** **or** ***Pan*** **area***. Some vegetables such as potato, tomato, green peas, cabbage, cauliflower and brinjal are also cultivated in the Distt. Besides this, the agro-ecology of Munger Distt. is also suitable for elephant foot yam [locally called oal or suran] cultivation which is a high returns crop usually grown in summer season with proper irrigation facilities [Kumar & Kumar, 2019]. Maize is a major crop of active floodplain is and is grown in a large scale in left bank of Ganga River. Floodplain produce recorded within the villages in study corridor are provided in the table no. 4.

**Tal Area : Tal area is termed as the stretch of land having bowl shaped depression inundated in kharif season due to spill/overflow from rivers or runoff from upstream.*
**Pan or Pain : Artificial water bodies constructed along linear infrastructure [roads, railway trcak etc.] due to construction activities are locally called Pan or Pain.*

**Agriculture in Tal Area**

Generally, single crop is taken during Rabi season and this pattern is called mono cropped area. In Tal area crops like gram, lentil, lathyrus and pea are popular *rabi* crops. Rai and tora are grown as mixed crop with main pulse crop while wheat is grown with gram. In some areas where farmers gets facility of tube wells, usually grow onions in summer season. Earlier farmers used to get rice during summer months. In recent years the pattern has changed due to early monsoon break.

Table 4 : Floodplain Agricultural Produce Of Villages In Munger Distt.

| Village | Floodplain produce |
|---|---|
| Rampur & Gobindpur | Wheat, Mustard, Gram, Green peas, vegetables in few areas, Maize [in low lying areas] |
| Hamilpur village | Wheat and Mustard [with wheat and pulses], pulses, Maize, Potato |
| Bariarpur Village | Rabi crops only - Wheat, Mustard, Gram, Green peas, vegetables in few areas, |
| Ratanpur [Tal area] | |

| | |
|---|---|
| Athsaiya, Harinmar, Nabe, Jhahwabahiyar Village | Wheat, Mustard, Flax seed, Pulses, Barley Maize, Jowar [grown mainly with maize], Potato [few areas], vegetables |

**Image 18 : Active Floodplain Agricultural Fields In Jhahwabahiyar Village [Left Bank]**
*[Image Showing Wheat With Mustard And Maize Crops]*

**Image 19 :Some Floodplain Agricultural Fields Near Tikarampur In Munger Distt.**
*[Image Showing Vegetable, Mustard And Banana Fields].*

## 8.0 Wetlands In Munger Distt.

***As per the Wetlands (Conservation and Management) Rules, 2017 - "Wetland means an area of marsh, fen, peatland or water; whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters, but does not include river channels, paddy fields, human-made water bodies/ tanks Specifically constructed tor drinking water purposes and structures specifically constructed for aquaculture, salt production, recreation and irrigation purposes.''***

8.1 Wetlands are highly productive ecosystems and help in maintaining ecological balance by providing food and habitat to large number of living organisms. They also help in controlling floods, recharging groundwater, nutrient recycling, climate stabilization and carbon sequestration. According to National Wetland Atlas [Bihar], Wetlands constitute 4.4% geographic area of Bihar state and 3.28% area of the Munger Distt. The majority [93.12%] area within the wetlands covered by the lotic system i.e., River/stream. The remaining 6.88% area is covered by oxbow lakes/ cut-off meanders [0.03%], riverine wetlands [1.62%], tanks [1.04%], reservoir/barrages [2.94%], lakes/ponds [0.18%] and waterlogged area [0.03%][4].

8.2 In the current exercise, 162 wetlands have been mapped in the study area with the help of Google Earth satellite imagery and SOI-OSM available maps. **Total area of the mapped wetlands is 539.58 Hectares i.e. 0.51% of the study area excluding the lotic system and** flood **inundation area**. The area of identified wetlands ranges between 0.10 ha to 153 ha. Out of 162 wetlands, the area of 108 wetlands is less than 1 ha, 29 wetlands have area between 1 ha and 2.5 ha and 25 wetlands have area greater than 2.5 ha. Area of the five largest wetlands constitutes 59.53% of the total study area. The list of identified wetlands is provided in Table No. 5 and their spatial distribution is shown in Map No. 8.

[4] National Wetland Atlas: Bihar, SAC/RESA/AFEG/NWIA/ATLAS/23/2010, Space Applications Centre (ISRO), Ahmedabad, India, 222p.
*https://vedas.sac.gov.in/en/National_Wetland_Inventory_and_Assessment_(NWIA)_Atlas.html*

Table 5 List of Water Bodies within Study Area

| Sr. No. | Wetland Name/ Number | Coordinates | | Area [Hectares] |
|---|---|---|---|---|
| | | Latitude | Longitude | |
| 01 | 1 | 25°17'30.26"N | 86°20'12.67"E | 0.26 |
| 02 | 2 | 25°17'4.09"N | 86°19'48.01"E | 0.26 |
| 03 | 3 | 25°17'5.00"N | 86°19'57.91"E | 0.41 |
| 04 | 4 | 25°17'8.78"N | 86°20'1.11"E | 0.49 |
| 05 | 5 | 25°17'5.37"N | 86°20'10.37"E | 0.41 |
| 06 | 6 | 25°17'9.75"N | 86°20'6.67"E | 0.22 |
| 07 | 7 | 25°17'5.97"N | 86°20'15.55"E | 0.34 |
| 08 | 8 | 25°17'0.68"N | 86°20'7.07"E | 0.20 |
| 09 | 9 | 25°16'38.54"N | 86°19'41.82"E | 153 |
| 10 | 10 | 25°16'3.20"N | 86°42'4.64"E | 3.89 |
| 11 | 11 | 25°17'34.55"N | 86°20'27.47"E | 0.25 |
| 12 | 12 | 25°18'3.76"N | 86°22'5.72"E | 0.38 |
| 13 | 13 | 25°21'12.59"N | 86°22'8.12"E | 0.90 |
| 14 | 14 | 25°18'7.42"N | 86°22'48.76"E | 0.29 |
| 15 | 15 | 25°18'13.22"N | 86°22'55.93"E | 0.38 |
| 16 | 16 | 25°14'41.39"N | 86°23'16.92"E | 0.19 |
| 17 | 17 | 25°15'22.02"N | 86°23'35.71"E | 0.59 |
| 18 | 18 | 25°18'10.59"N | 86°23'45.24"E | 0.28 |
| 19 | 19 | 25°18'11.97"N | 86°23'48.31"E | 0.50 |
| 20 | 20 | 25°18'14.38"N | 86°23'54.63"E | 0.37 |
| 21 | 21 | 25°18'13.10"N | 86°24'0.38"E | 0.32 |
| 22 | 22 | 25°18'15.50"N | 86°24'34.52"E | 0.31 |
| 23 | 23 | 25°18'12.77"N | 86°24'40.00"E | 0.21 |
| 24 | 24 | 25°18'3.52"N | 86°24'38.27"E | 0.54 |
| 25 | 25 | 25°15'31.87"N | 86°24'14.41"E | 0.92 |
| 26 | 26 | 25°15'34.74"N | 86°23'58.72"E | 0.48 |
| 27 | 27 | 25°15'36.58"N | 86°23'46.54"E | 0.24 |
| 28 | 28 | 25°14'54.69"N | 86°25'23.27"E | 0.63 |
| 29 | 29 | 25°15'9.30"N | 86°25'38.56"E | 0.61 |
| 30 | 30 | 25°18'14.64"N | 86°25'50.91"E | 0.34 |

| | | | | |
|---|---|---|---|---|
| 31 | 31 | 25°22'59.95"N | 86°27'48.31"E | 1.32 |
| 32 | 32 | 25°23'1.15"N | 86°27'55.82"E | 3.38 |
| 33 | 33 | 25°23'10.83"N | 86°28'7.93"E | 8.51 |
| 34 | 34 | 25°23'11.93"N | 86°28'15.20"E | 1.41 |
| 35 | 35 | 25°23'23.48"N | 86°28'25.64"E | 0.34 |
| 36 | 36 | 25°23'23.65"N | 86°28'39.63"E | 0.52 |
| 37 | 37 | 25°20'25.49"N | 86°27'57.76"E | 0.82 |
| 38 | 38 | 25°20'22.68"N | 86°28'11.94"E | 2.58 |
| 39 | 39 | 25°19'34.03"N | 86°28'9.94"E | 0.62 |
| 40 | 40 | 25°19'19.56"N | 86°28'2.90"E | 2.97 |
| 41 | 41 | 25°16'29.64"N | 86°27'7.70"E | 1.0 |
| 42 | 42 | 25°16'41.33"N | 86°27'22.15"E | 0.53 |
| 43 | 43 | 25°16'32.06"N | 86°27'28.61"E | 0.35 |
| 44 | 44 | 25°16'28.14"N | 86°27'25.20"E | 0.28 |
| 45 | 45 | 25°16'8.20"N | 86°27'19.97"E | 0.39 |
| 46 | 46 | 25°16'0.29"N | 86°27'20.20"E | 0.16 |
| 47 | 47 | 25°15'57.24"N | 86°27'9.58"E | 0.17 |
| 48 | 48 | 25°16'8.07"N | 86°27'29.90"E | 0.18 |
| 49 | 49 | 25°15'31.59"N | 86°27'14.10"E | 0.26 |
| 50 | 50 | 25°15'32.16"N | 86°27'9.58"E | 0.22 |
| 51 | 51 | 25°15'25.94"N | 86°27'24.90"E | 0.40 |
| 52 | 52 | 25°15'31.87"N | 86°27'43.02"E | 0.53 |
| 53 | 53 | 25°15'45.68"N | 86°27'42.05"E | 0.1 |
| 54 | 54 | 25°15'37.67"N | 86°27'46.07"E | 0.1 |
| 55 | 55 | 25°23'33.22"N | 86°28'48.71"E | 2.91 |
| 56 | 56 | 25°19'57.10"N | 86°28'37.64"E | 0.98 |
| 57 | 57 | 25°19'54.61"N | 86°28'46.99"E | 0.42 |
| 58 | 58 | 25°19'45.22"N | 86°28'43.51"E | 0.57 |
| 59 | 59 | 25°18'20.35"N | 86°28'21.05"E | 1.81 |
| 60 | 60 | 25°17'3.10"N | 86°28'42.99"E | 0.70 |
| 61 | 61 | 25°18'15.93"N | 86°28'55.89"E | 1.55 |
| 62 | 62 | 25°18'21.12"N | 86°28'59.25"E | 0.53 |
| 63 | 63 | 25°19'52.45"N | 86°28'59.10"E | 0.59 |
| 64 | 64 | 25°20'40.82"N | 86°28'52.27"E | 1.22 |

| | | | | |
|---|---|---|---|---|
| 65 | 65 | 25°21'17.72"N | 86°28'51.64"E | 0.52 |
| 66 | 66 | 25°23'37.97"N | 86°29'25.75"E | 1.66 |
| 67 | 67 | 25°16'33.15"N | 86°28'59.64"E | 0.40 |
| 68 | 68 | 25°16'29.93"N | 25°16'29.93"N | 0.35 |
| 69 | Southern Tank | 25°18'0.94"N | 86°29'31.06"E | 12.9 |
| 70 | Northern Tank | 25°18'52.27"N | 86°29'43.46"E | 4.53 |
| 71 | 71 | 25°20'19.85"N | 86°29'17.75"E | 3.00 |
| 72 | Manshi Hazari Talab | 25°20'35.69"N | 86°29'53.29"E | 1.66 |
| 73 | 73 | 25°20'21.38"N | 86°29'43.14"E | 1.89 |
| 74 | 74 | 25°20'26.66"N | 86°29'32.14"E | 1.00 |
| 75 | 75 | 25°20'17.24"N | 86°29'49.35"E | 0.58 |
| 76 | 76 | 25°20'45.92"N | 86°29'33.27"E | 1.00 |
| 77 | 77 | 25°21'27.48"N | 86°29'33.85"E | 0.88 |
| 78 | 78 | 25°21'38.08"N | 86°29'39.43"E | 1.00 |
| 79 | 79 | 25°22'12.47"N | 86°30'37.84"E | 0.95 |
| 80 | 80 | 25°21'39.17"N | 86°30'35.72"E | 3.70 |
| 81 | 81 | 25°20'57.93"N | 86°30'6.44"E | 0.23 |
| 82 | Water Filter Talab/ Kali Pahari Talab | 25°18'37.77"N | 86°30'24.26"E | 24.9 |
| 83 | 83 | 25°20'17.38"N | 86°30'32.75"E | 0.73 |
| 84 | 84 | 25°20'44.26"N | 86°30'55.76"E | 1.00 |
| 85 | 85 | 25°21'35.79"N | 86°31'1.33"E | 1.41 |
| 86 | 86 | 25°27'20.39"N | 86°32'27.95"E | 19.0 |
| 87 | 87 | 25°22'13.79"N | 86°32'13.37"E | 0.70 |
| 88 | 88 | 25°21'27.82"N | 86°31'37.28"E | 56.4 |
| 89 | 89 | 25°20'47.02"N | 86°31'28.68"E | 1.59 |
| 90 | 90 | 25°15'25.60"N | 86°31'24.42"E | 0.26 |
| 91 | 91 | 25°15'27.92"N | 86°31'22.99"E | 0.10 |
| 92 | 92 | 25°25'18.75"N | 86°32'51.47"E | 9.00 |
| 93 | 93 | 25°20'24.55"N | 86°32'32.31"E | 1.15 |
| 94 | 94 | 25°19'53.42"N | 86°32'16.39"E | 0.86 |
| 95 | 95 | 25°18'41.43"N | 86°32'59.88"E | 1.97 |
| 96 | Ram Kala Talab | 25°18'41.43"N | 86°32'59.88"E | 3.75 |
| 97 | 97 | 25°20'28.92"N | 86°32'45.92"E | 0.30 |

| | | | | |
|---|---|---|---|---|
| 98 | 98 | 25°23'11.87"N | 86°33'40.70"E | 3.10 |
| 99 | 99 | 25°25'27.49"N | 86°35'48.25"E | 35.0 |
| 100 | 100 | 25°13'57.24"N | 86°32'58.36"E | 18.7 |
| 101 | 101 | 25°14'57.45"N | 86°33'45.24"E | 0.95 |
| 102 | 102 | 25°22'51.17"N | 86°34'16.84"E | 2.89 |
| 103 | 103 | 25°17'42.14"N | 86°34'23.26"E | 6.00 |
| 104 | 104 | 25°17'46.89"N | 86°34'27.74"E | 0.80 |
| 105 | 105 | 25°15'4.25"N | 86°34'27.10"E | 0.55 |
| 106 | 106 | 25°14'35.05"N | 86°34'33.77"E | 0.29 |
| 107 | 107 | 25°14'37.09"N | 86°34'38.01"E | 0.45 |
| 108 | 108 | 25°14'33.26"N | 86°34'40.73"E | 0.17 |
| 109 | 109 | 25°14'17.25"N | 86°34'21.40"E | 0.49 |
| 110 | 110 | 25°13'7.23"N | 86°34'51.28"E | 0.42 |
| 111 | 111 | 25°12'39.46"N | 86°34'46.59"E | 1.38 |
| 112 | 112 | 25°12'1.20"N | 86°35'3.67"E | 1.35 |
| 113 | 113 | 25°12'26.16"N | 86°35'7.12"E | 2.31 |
| 114 | 114 | 25°16'6.93"N | 86°35'17.29"E | 0.39 |
| 115 | 115 | 25°21'36.89"N | 86°35'50.85"E | 9.72 |
| 116 | 116 | 25°20'32.66"N | 86°36'12.36"E | 0.66 |
| 117 | 117 | 25°13'38.10"N | 25°13'38.10"N | 0.21 |
| 118 | 118 | 25°13'29.54"N | 86°35'16.31"E | 0.41 |
| 119 | 119 | 25°13'18.13"N | 86°34'54.32"E | 0.27 |
| 120 | 120 | 25°13'21.94"N | 86°34'54.89"E | 0.10 |
| 121 | 121 | 25°12'39.23"N | 86°35'16.03"E | 0.21 |
| 122 | 122 | 25°15'17.59"N | 86°35'27.63"E | 0.34 |
| 123 | 123 | 25°13'36.96"N | 86°35'43.93"E | 0.33 |
| 124 | 124 | 25°15'50.49"N | 86°35'46.22"E | 0.11 |
| 125 | 125 | 86°35'46.22"E | 86°36'35.81"E | 2.77 |
| 126 | 126 | 86°36'35.81"E | 86°36'34.78"E | 0.14 |
| 127 | 127 | 25°11'24.50"N | 86°37'33.96"E | 0.28 |
| 128 | 128 | 25°12'45.07"N | 86°37'58.40"E | 0.17 |
| 129 | 129 | 25°11'47.76"N | 86°38'36.55"E | 0.65 |
| 130 | 130 | 25°12'4.98"N | 86°38'36.83"E | 0.67 |
| 131 | 131 | 25°19'16.84"N | 86°38'19.98"E | 51.9 |

| | | | | |
|---|---|---|---|---|
| 132 | 132 | 25°16'7.28"N | 86°40'23.88"E | 0.47 |
| 133 | 133 | 25°12'48.75"N | 86°37'30.14"E | 0.34 |
| 134 | 134 | 25°12'33.28"N | 86°40'10.93"E | 1.14 |
| 135 | 135 | 25°11'14.11"N | 86°40'7.86"E | 0.35 |
| 136 | 136 | 25°10'57.47"N | 86°40'10.19"E | 1.22 |
| 137 | 137 | 25°16'3.86"N | 86°41'37.89"E | 1.00 |
| 138 | 138 | 25°20'22.28"N | 86°30'48.34"E | 0.21 |
| 139 | 139 | 25°20'19.63"N | 86°31'2.41"E | 0.14 |
| 140 | 140 | 25°20'25.14"N | 25°20'25.14"N | 0.27 |
| 141 | 141 | 25°22'18.37"N | 86°31'44.93"E | 0.96 |
| 142 | 142 | 25°20'11.52"N | 86°32'24.39"E | 4.51 |
| 143 | 143 | 25°20'57.73"N | 86°33'11.06"E | 0.50 |
| 144 | 144 | 25°17'43.25"N | 86°32'25.19"E | 0.34 |
| 145 | 145 | 25°17'51.51"N | 86°32'57.58"E | 0.64 |
| 146 | 146 | 25°19'16.40"N | 86°33'49.11"E | 0.35 |
| 147 | 147 | 25°13'27.36"N | 86°33'10.39"E | 0.86 |
| 148 | 148 | 25°13'28.63"N | 86°33'35.65"E | 0.47 |
| 149 | 149 | 25°14'48.64"N | 86°33'30.67"E | 1.73 |
| 150 | 150 | 25°13'20.53"N | 86°34'10.98"E | 2.50 |
| 151 | 151 | 25°15'1.27"N | 86°34'13.33"E | 0.44 |
| 152 | 152 | 25°14'10.99"N | 86°35'24.77"E | 0.39 |
| 153 | 153 | 25°10'50.44"N | 86°40'39.01"E | 0.92 |
| 154 | 154 | 25°11'2.17"N | 86°41'27.33"E | 2.24 |
| 155 | 155 | 25°11'16.84"N | 86°41'12.87"E | 1.27 |
| 156 | 156 | 25°11'9.08"N | 86°41'43.45"E | 1.39 |
| 157 | 157 | 25°11'2.90"N | 86°42'20.39"E | 0.89 |
| 158 | 158 | 25°11'18.59"N | 86°42'6.48"E | 0.52 |
| 159 | 159 | 25°11'1.35"N | 86°41'2.48"E | 0.51 |
| 160 | 160 | 25°11'3.77"N | 86°41'13.52"E | 0.84 |
| 161 | 161 | 25°11'40.20"N | 86°39'48.97"E | 0.45 |
| 162 | 162 | 25°14'57.27"N | 86°25'52.20"E | 1.54 |
| Total Area | | | | 539.58 Hectares |

8.3 The identified wetlands may be classified into the sacred wetlands [Kunds], village ponds, riverine wetlands, man-made wetlands [wetlands constructed for drinking water purpose, wetlands constructed for agricultural purposes under govt. schemes]. The details of wetlands surveyed in Bhadohi District are provided below :

8.3.1 **Sacred Kunds :** There are nine sacred kunds identified within the study area. Out of which, four kunds are of hot water spring. Sita Kund temple complex has 5 sacred kunds namely - Ram Kund, Sita Kund, Bharat Kund, Lakshman Kund and Satrughan Kund. This is one of the important places for which Munger Distt. is renowned and numerous tourists/pilgrims visit this site every year. Situated close to Ganga River at a distance of about 8 kms from Munger town, this historical site is known for the hot water springs known as Sita Kund. According to mythological belief, Sita underwent Agni Pariksha and came out of it unharmed. Then she took bath in this pool which absorbed all the heat she had garnered from the fire. Today, this site contains clear and transparent water having numerous bubbles from its rocky bed. Owing to its religious importance, it is protected by a boundary and grills from all sides and is visited by many local residents and tourists especially during auspicious occasions[5]. The outflow of the Sita Kund goes to Ganga River through a Nala from its Northern end. The location and coordinates of the identified kunds are provided in the table below.

Table 6 : List Of Sacred Kunds Within Study Area In Munger Distt.

| Location | Coordinates | | Sacred Kund And Hot Water Springs |
|---|---|---|---|
| | Latitude | Longitude | |
| Sita Kund Temple Complex | 25°22'5.70"N | 86°32'15.04"E | Sita Kund [Hot Water Kund] |
| | 25°22'6.87"N | 86°32'15.52"E | Ram Kund |
| | 25°22'5.28"N | 86°32'13.95"E | Lakshman Kund |
| | 25°22'6.23"N | 86°32'14.34"E | Bharat Kund |
| | 25°22'5.58"N | 86°32'14.40"E | Satrughan Kund |
| Amjhol Pahar | 25°15'25.43"N | 86°31'24.61"E | Rishi Kund [Hot Water Spring] |
| | 25°15'36.91"N | 86°31'24.97"E | Bhurka Kund [Hot Water Spring] |

[5] Munger District Profile [Accessed dated 13.02.2022] https://munger.nic.in/

| | | | |
|---|---|---|---|
| | 25° 9'8.55"N | 86°30'57.26"E | Bhawra Kund [Hot Water Spring] |
| Jamalpur | 25°18'26.88"N | 86°30'30.18"E | Shiva Kund [Near Kali Temple] |

Image 20 : Sita Kund [Hot Water Spring]

Image 21 : Lakshman Kund

Image 22 : Ram Kund

Image 23 : Out Flow Of Sita Kund Goes To Ganga River

**8.3.2 Machhli Talab:** This sacred pond is located at latitude 25°23'8.31"N and longitude 86°28'14.14"Ein the heart of Munger town and comprises of a Lord Shiva temple located in the midst of this water body with a small bridge connecting it. The pond is well known for the presence of large number of fish due to which its popularly known as 'Machhli

Talab'. The wetland is under ownership and water level of the wetland is maintained by diverting Ganga River Water. On auspicious occasions such as Shivratri, worshippers visit this Shiva temple in large numbers and also consider the fish residing in this pond to be sacred, thereby not disturbing or harming them.

8.3.3 **Wetland group of Jamalpur :** There are four wetland identified within Jamalpur [Refer Map 8 & Table No. 5 (Wetland No. 69, 70 & 82)]. Out of which, three wetlands has been constructed for drinking purposes. The wetlands are – **Northern Tank** [25°18'52.27"N, 86°29'43.46"E (4.53 hectares)], **Southern Tank** [25°18'0.94"N, 86°29'31.06"E (12.9 ha)], and **Water Filter Talab** [25°18'37.77"N, 86°30'24.26"E (24.9)]. The wetlands get water from Ganga River through a pipeline. The pumping system is installed at Munger City. A wetland named **Kali Pahadi Talab** is located adjacent to water filter Talab; gets water through runoff from Amjhol Pahar and surrounding areas. The outflow of this wetland goes to water filter Talab. The surrounding of kali Pahadi Talab is a focal centre for the local communities during festival season. Surrounding area of Kali Pahadi Talab is used as resting place during trekking to Kali temple [Amjhol Pahar].

Image 24 : Northern Tank

Image 25 : Water Filter Talab

Image 26 : Kali Pahadi Talab

8.3.4 **Manshi Hazari Talab :** It is a village pond located near Safiabad Village at latitude 25°20'35.69"N and longitude 86°29'53.29"E [Refer Map 8 & Table No. 5 (Wetland No. 72)] having water spread area of 1.66 hectares. The wetland gets its water from rainfall and runoff from the surrounding areas. Outflow of the wetland goes to a canal which opens into Dakra Nala. Maximum depth of the wetland found as 12-15 feet. Currently, wetland is on lease and used for the fish farming. Fish species found in the wetland includes – Rohu [*Labeo rohita]*, Catla [*Labeo catla]*, Brigid, Silver carp, Sawri, Padhina, Bhakur and Tengra [*Mystus tengara].*

Image 27 : Mansi Hazari Talab

**8.3.5 Ram Kala Talab :** It is a village pond located in Ram Kala Village at latitude 25°18'41.43"N and longitude 86°32'59.88"E [Refer Map 8 & Table No. 5 (Wetland No. 96)] having water spread area of 3.75 hectares. The wetland gets its water from rainfall and runoff from the surrounding areas and sewage from the nearby villages Maximum depth of the wetland found as 8-10 feet. Trees, mainly Mahua [*Madhuca longifolia*], *Peepal* [*Ficus religiosa*] *and Banyan* [*Ficus benghalensis*], Arjun [*Terminalia arjuna*], Mahogany [*Swietenia macrophylla*], Chatwan, Karanj [*Millettia pinnata*], Mango

[*Mangifera Indica*] are found along the wetland provide bank protection. Currently, wetland is in eutrophic condition and is covered with *Eichhornia crassipes*. Wetland has been fragment into three parts due to construction of road and some of its area is encroached for construction activities.

In recent years, the forest department have planted 200 trees along its bank under the project 'Forestry Interventions for River Ganga'.

Image 28 : Eutrophic Condition Of Ram Kala Talab

**8.3.6 Flood inundated Area : Apart from the identified wetlands there is a huge area which inundates and remains under water for four-six month in a year. This is because there are several rivers in the right bank of River Ganga which drain the rain water of the tract and accumulate them behind the high bank of Ganga. The area which is under inundation is locally termed as *Tal or Taal area.*** The accumulated water has resulted in formation of tals viz. Mokama group of Tals, the area just on the south of the high Ganga bank extending from Fatuha [Patna District] to Barahia [Lakhisarai], which comprises of Fatuha Tal, Bakhtiyarpur Tal, Barh Tal, More Tal, Mokama Tal, Barahiya Tal and Singhaul Tal. The Barahia Tal extends upto Garkhe Nadi [Left to the Munger City]. **Two**

major depressions called *Tals* exist right to the Munger City formed due to the accumulation of rainwater by the Nalas originating from Amjhol Pahar. These *Tals* also receive backwater of the Ganga when the latter is in high spate. Therefore, the *Tals* get submerged in water during monsoon season and are thus deprived from kharif cultivation in most of the area.

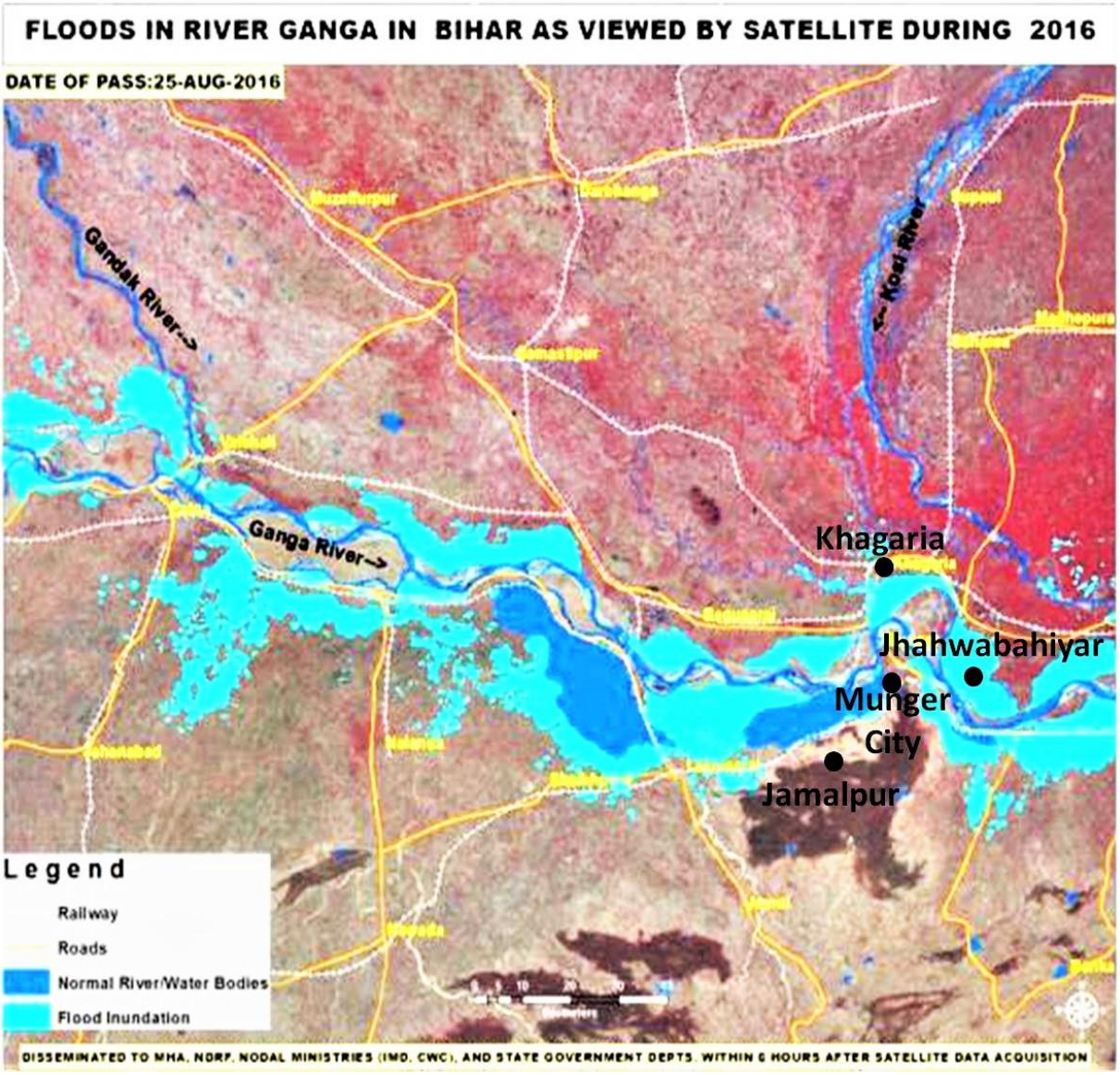
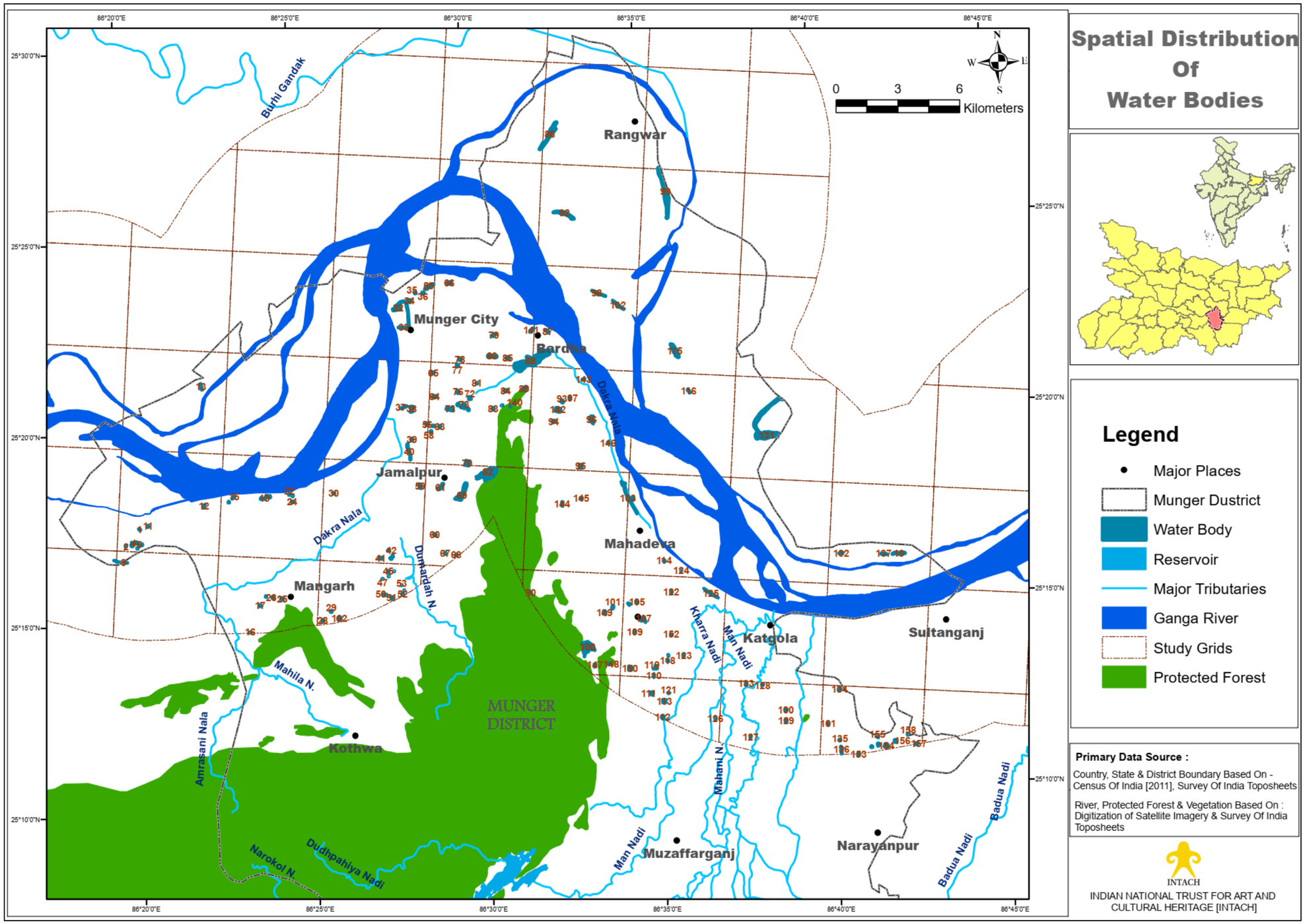



Image 29 : Satellite Imagery Of August 2016 Showing The Flood Inundated Area
[Source : Flood Hazard Atlas - Bihar - A Geospatial Approach]



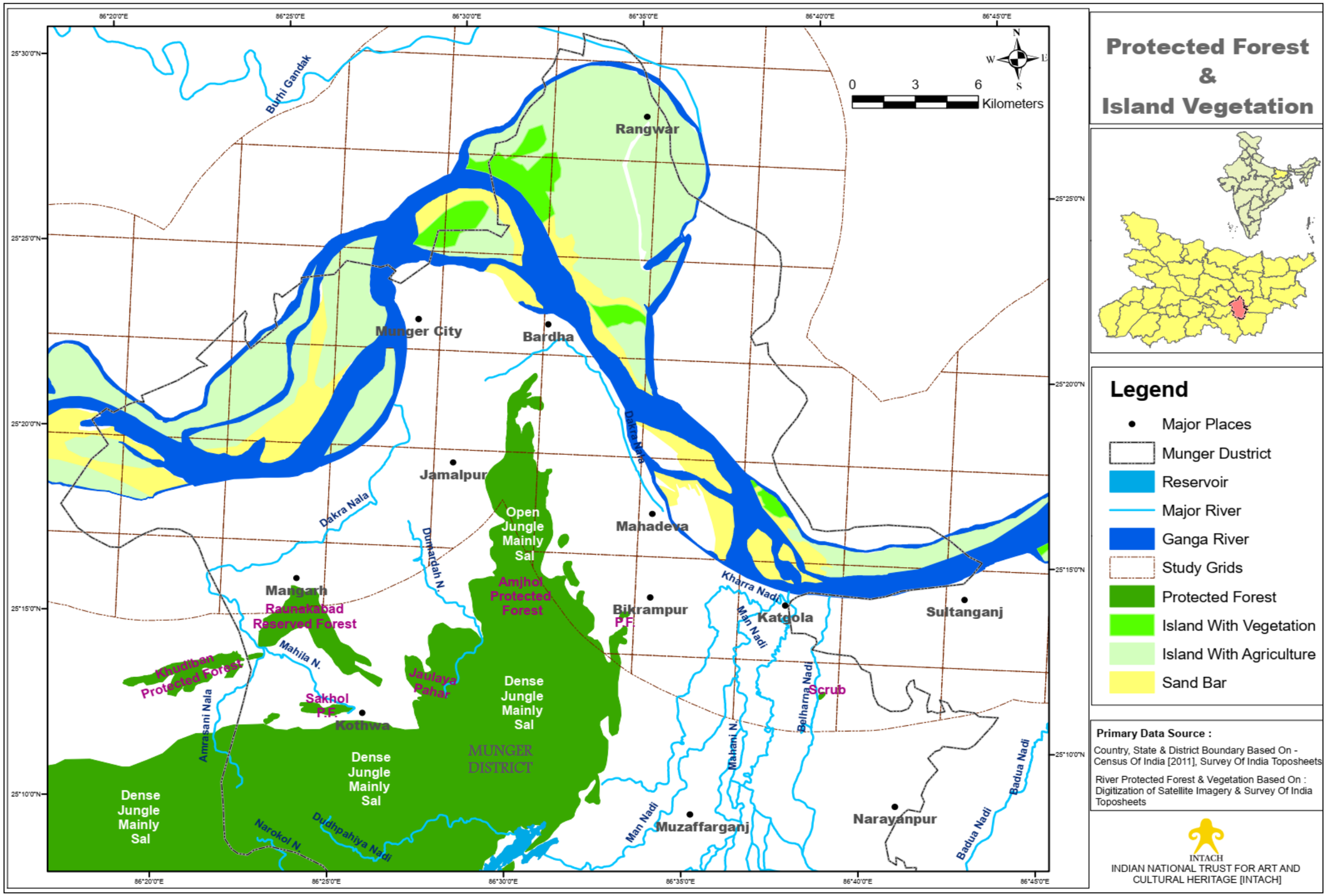

Map 8 : Water Bodies In Munger Distt.

## 9.0 Forests in Munger Distt.

9.1 As per the Indian State of Forest Report (2019) Munger Distt. has a total forest cover of 283.60 sq.km. which forms almost 20% of the total geographical area of the Distt. Amongst this, 37.97 sq.km. of forest area is classified as very dense forest, 223.67 sq.km. is moderately dense forest and 21.96 sq.km. is open forest. Among the different forest areas of Munger, parts of Raunakabad Reserved Forest and Amjhol protected forest fall in the study area [Refer Map No. 9]. Among these, illegal mining and other anthropogenic activities have been reported from Raunakabad Reserved Forest which have impacted the forest composition and caused changes in the animal habitats [Singh, 2002]. The details of forest areas and other vegetation occurring in the study area is provided in Map No. 9.

9.2 The land use/land cover analysis of the tropical deciduous forest of Munger Distt. was carried out by Sinha et al. (2013) which highlighted that the dominant forests in the Distt. are mixed *Shorea robusta* (Sal) forests, *Acacia catechu* (Khair) dominated forests and *Dendrocalamus* sp. (Bamboo) dominated forests. Some of the major tree species found in these forests are – *Shorea robusta* (Sal), *Madhuca latifolia* (Mahua), *Acacia catechu* (Khair), *Diospyros melanoxylon* (Tendu/Kendu), *Terminalia tomentosa* (Asan) and *Boswellia serrata* (Sellai). Other commercially important tree species in these forests are *Dalbergia sisoo* (Shisham), *Phyllanthus emblica* (Amla), *Azadirachta indica* (Neem) and *Mangifera indica* (Mango).

Image 30 : Amjhol Pahar As Seen From Kali Pahadi Talab




Map 9 : Forest Cover And Other Vegetation Occurring In The Study Area

## 10.0 Riparian flora along Ganga River in Munger

10.1 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].

10.2 Till some time ago, no proper systematic sampling had been undertaken or record had been maintained for the riparian plant diversity all along Ganga river. There are however, some scattered but significant works of Pallis [1934], Auden [1941], Sahai [1953], Gupta [1960], Bhattacharyya and Goel [1982], Groffman*et al.* [1990], Krishanmurti [1991], Castelle *et al.* [1994], Shyam [2008], Gangwar and Joshi [2006] and Gangwar and Gangwar [2011] which have explored the biodiversity of Ganga river basin. Also, a detailed study published in the form of a book titled – "The Ganga – A Scientific Study" edited by Krishnamurti [1991] documents 475 riparian plant species from Rishikesh [Uttarakhand] to Chinasura [West Bengal].

10.3 Munger forms a part of Munger – Farakka stretch of Ganga River having humid, sub-tropical and tropical climatic conditions [Prasad et al., 2012]. A study conducted by Bilgrami [1991] reported 212 different macrophyte species along Ganga River in this stretch. The pattern of riparian vegetation within study area is similar to study regions in Patna, Begusarai, Lakhisarai and Khagaria District. The right bank of River Ganga is lacking the riparian vegetation [Refer Image No.32]. This is because of the extensive agricultural practice and settlements along the river bank. The number of settlements along the National Highway [runs parallel to the Ganga] is still increasing. Upon detail analysis few patches of riparian vegetation found near Shankarpur village which is dominated by *Saccharum spontaneum*

[Kaas/ Kans], *Saccharum munja* [Munj], *Ziziphus nummularia* [Wild Ber], Sesbania spp. [Dhaicha], *Desmostachya bipinnata* [Kusha] and *Pithecellobium dulce* [Jungle Jalebi]. Riparian vegetation along the left bank of River Ganga is mainly restricted to Ganga-Burhi Gandak confluence and the riverine islands. This is because the entire study area at left bank is mainly under the flood inundation.

10.4 The canopy in this stretch main comprises of trees such as *Bombax ceiba* [Semal], *Mangifera indica* [Aam], *Ficus religiosa* [Peepal] and *Azadirachta indica* [Neem]. The common shrub species in this region include *Calotropis* sps., *Lantana camara*, *Polygonum glabrum, Ricinus communis* and *Sida* sp. while the common herb species include *Achyranthes aspera*, *Boerhavia diffusa*, *Cassia* sp., *Ocimum* sp. and *Solanum* sps. The grasses in this region are mainly members of Cyperaceae and Poaceae plant families. List of recorded riparian species are provided in Table No.

9.6 Some riparian grasses are economically valuable in the district. *Saccharum spontaneum* and *Saccharum munja* are used for making huts, basket and ropes. Small sized baskets are locally called daliya and larged sized baskets are called Dala. A large sized basket costs around 100-200 and is sold at local market in Munger City and Mansi, Khagaria Distt. Ropes [locally called Baadh] made of *Saccharum spontaneum* are more durable. A bundle of rope of nearly 1.5 Kg weight costs around 35 rupees and is also sold at local market.

Table 7 : Recorded Riparian Plant Species Within Study Area

| Sr. No. | Botanical Name | Family | Common Name |
|---|---|---|---|
| 1. | *Saccharum spontaneum* L. | Poaceae | Kaans |
| 2. | *Saccharum munja* Roxb. | Poaceae | Munj |
| 3. | *Butea monosperma (Lamb.) Taub.* | Fabaceae | Palash |
| 4. | *Desmostachya bipinnata* | Poaceae | Kusha |
| 5. | *Ipomea carnea* | Convolvulaceae | Besaram |
| 6. | *Ipomea aquatica* | Convolvulaceae | Besaram |
| 7. | *Ziziphus nummularia (Burm.f.) Wight & Arn.* | Rhamnaceae | Ber |
| 8. | *Pithecellobium dulce* | Fabaceae | Jungle Jalebi |
| 9. | *Acacia nilotica* (L.) Delile | Fabaceae | Babool |
| 10. | *Aegle marmelos* (L.) Corrêa | Rutaceae | Bel or sirphal |
| 11. | *Azadirachta indica* A. Juss. | Meliaceae | Neem |

| | | | |
|---|---|---|---|
| 12. | *Bombax ceiba* L. | Bombacaceae | Semal/Semar |
| 13. | *Dalbergia sissoo* DC. | Fabaceae | Shisham |
| 14. | *Delonix regia* (Hook.) Raf. | Fabaceae | Gulmohar |
| 15. | *Ficus benghalensis* L. | Moraceae | Banyan |
| 16. | *Ficus religiosa* L. | Moraceae | Peepal |
| 17. | *Ficus virens* Aiton | Moraceae | Pakad/Pakar |
| 18. | *Borassus flabellifer L.* | Arecaceae | Taad/Tar |
| 19. | *Phoenix dactylifera* | Arecaceae | Khajur |
| 20. | *Madhuca longifolia var. latifolia* (Roxb.) A.Chev. | Sapotaceae | Mahua |
| 21. | *Peltophorum pterocarpum* (DC.) K.Heyne | Fabaceae | Peela Gulmohar |
| 22. | *Sesbania aculeata* | Fabaceae | Dhaicha |
| 23. | *Polyalthia longifolia* (Sonn.) Thwaites | Annonaceae | False Ashok |
| 24. | *Tectona grandis* L.f. | Lamiaceae | Teak |
| 25. | *Nyctaanthes arbor-tristis* | Oleaceae | Harsringar |
| 26. | *Thevetia peruviana* | Apocynaceae | Kaner |
| 27. | *Calotropis gigantea* (L.) Dryand. | Apocynaceae | Safed Aak |
| 28. | *Calotropis procera* (Aiton) Dryand. | Apocynaceae | Aak |
| 29. | *Lantana camara* L. | Verbenaceae | ~~~~~ |
| 30. | *Malvastrum coromandelianum* (L.) Garcke | Malvaceae | False Mallow |
| 31. | *Psidium guajava* | Myrtaceae | Guava |
| 32. | *Carica papaya* L. | Caricaceae | Papaya |
| 33. | *Phyllanthus emblica* | Phyllanthaceae | Amla or Awla |
| 34. | *Magnifera Indica* | Anacardiaceae | Mango |
| 35. | *prosposis julifora* | Fabaceae | Vilayti Keekar |
| 36. | *Ocimum tenuiflorum L.* | Lamiaceae | Tulsi |
| 37. | *Polygonum glabrum* Willd. | Polygonaceae | Common marsh buckwheat |
| 38. | *Ricinus communis* L. | Euphorbiaceae | Arandi |
| 39. | *Ziziphus nummularia* (Burm.f.) | Rhamnaceae | Wild Ber |

| | | | |
|---|---|---|---|
| | *Wight &Arn.* | | |
| 40. | *Achyranthes aspera* L. | Amaranthaceae | Chirchira |
| 41. | *Amaranthus spinosus* L. | Amaranthaceae | Prickly Amaranth |
| 42. | *Croton bonplandianus* Baill. | Euphorbiaceae | Ban Tulsi |
| 43. | *Parthenium hysterophorus* L. | Asteraceae | Congress grass |
| 44. | *Rumex dentatus* L. | Polygonaceae | Jungli Palak |
| 45. | *Solanum xanthocarpum* Schrad. & H. Wendl. | Solanaceae | Kateli |
| 46. | *Tephrosia purpurea* (L.) Pers. | Fabaceae | Sharpunkha |
| 47. | *Tridax procumbens* (L.) L. | Asteraceae | ~~~~~ |
| 48. | *Xanthium strumarium* L. | Asteraceae | Chhota Dhatura |
| 49. | *Cyperus difformis* L. | Cyperaceae | ~~~~~ |
| 50. | *Cyperus rotundus* L. | Cyperaceae | Nut grass |
| 51. | *Dicanthium annulatum* | Poaceae | ~~~~~ |

**Image 31 : Agricultural Field Along Ganga River Bank [Near Ghorghat]**

[Riparian vegetation area has been gradually converted into agricultural fields throughout the river bank]

**Image 32 : A Small Patch OF Riparian Vegetation Along Ganga River**

[Riparian Species : Saccharum sp, Ipomea sp. and Phrahmites sp., Canopy cover – *Acacia nilotica and Aegle marmelos*]

**Image 33 : Phoenix dactylifera [Khajur]**

[Polythene bags are attached to get *Khajur Tari*]

## Palm Juice (Toddy)

Taad or Tar tree or doub palm, scientific name *Borassus flabellifer* is commonly found in the Magadh, Angika and Mathili region of Bihar. Taad tree has a long grey trunk and reaches a height of 30 meters. Juice obtained from Taad tree is a very famous local beverage called "toddy". "Pasi" a local community, is associated with collection of toddy from the sap and are famous for their Taad tree climbing skill. This is the major source of income for Pasi community.

Pasi community collects juice from the sap twice a day where fermentation starts naturally as soon as the juice begins to trickledown in the earthenware or gourd. Fresh palm juice is non-alcoholic and is healthy for the digestive system but as time passes fermentation takes place and the juice becomes alcoholic in nature.

As Alcohol is prohibited in Bihar, a few awful practices have been observed to compensate for the alcohol, some medicine such as *Alprazplam, Codine*, etc. are mixed with toddy to enhance the fermentation process to make it more alcoholic.

To discourage consumption of toddy, the Bihar government is commercially licensing the production of Neera (toddy), under ***Bihar Neera (Unfermented Juice of Palms) Rules, 2017***. Under the law it has been mentioned that the Inspecting officer shall inspect the palm tree product (toddy) for the presence of intoxicants and alcohol content and any adulteration may leads to cancellation of license. All those applying for a license have to submit to test, showing whether they can climb palm trees.

## 11.0 Faunal Diversity in Munger Distt.

**11.1** Forest area within the Munger Distt. is 285.24 Sq. Km is distributed South to North upto Jamalpur. Few kilometres from the Amjhol Pahar there is a wildlife sanctuary named "Bhimbandh Wildlife Sanctuary". The Sanctuary supports diverse mammalian fauna as Tiger [*Panthera tigris*], Leopard [*Panthera pardus*], Sloth bear [*Melursus ursinus*], Sambar [*Rusa unicolor*], Four-horned antelope [*Tetracerus quadricornis*] and Chital [*Axis axis*]. Acclaimed for its rich bird diversity, over 100 species of birds have been reported from here including a number of winter migratory birds that take refuge in the water bodies of the Sanctuary[6].

**11.2** The district gazetteer of Monghyr [1926] mentions the presence of Tigers [in scarce], Leopords, Sloth Bear, Indian Civet, Jackal, Indian Fox, Indian Ratel [Badger], Fungivorus Bats, Palm Squarrel, Long-Tailed, Langur, Shorter-Tailed Bengal Monkey, Sambhar, Chital, Ravine Deer, Barking Deer and Nilgai. Apart from the protected areas, the hilly areas turned quarry sites are habitat to Fox [*Vulpes bengalensis*], Hare [*Lepus ruficaudatus*], Indian Porcupine [Hystrix leucura], Golden Jackal [*Canis aureus*], Indian wild boar [*Sus scrofa*], Monkey [*Rhesus macaque*] and Langur [*Semnopithecus spp.*].

**11.**3 The riverine island and active floodplain area at left bank of River Ganga provides the habitat to Smooth-coated Otter. This species is kept under Schedule I of wildlife (protection) act. Otters are considered as apex predators and are found to be hunting in packs. The Munger-Bhagalpur stretch of River Ganga provided suitable habitat to crocodile species: the Gharial [*Gavialis gangeticus*] and Mugger [*Crocodylus palustris*]. Upon interaction with fishermen community they mentioned that crocodiles are often sited at sand bars and their several encounters are reported in habituated area during flood.

11.4 Wild Boars [*Sus scrofa* L.] are one of the most widely distributed species in the world. Their highly adaptive behaviour and wide range of habitat have led the species' population to flourish. In recent years, wild boar has become a regular menace for farmers, causes crop damage right from planting till the maturity of the crop [Vasudeva Rao et. al., 2015]. Famous for attacks on human, the wild boars are

[6] Wildlife Institute of India [Web access dated 13.02.2022]
*https://wii.gov.in/nmcg/protected-areas-along-ganga/bhimbandh-wildlife-sanctuary*

usually nocturnal species. The presence of wild boars area reported at left bank of River Ganga mainly at Munger-Khagaria boarder. During the survey, the locals stated that the boars are responsible for destroying the crops and other vegetables.

11.5 **Gangetic Dolphin:** The Gangetic River Dolphin is exclusively aquatic and piscivorous, occasionally found in small groups. The Ganges River Dolphin is one of the three freshwater dolphin species in the world and is distributed in the Ganges–Brahmaputra–Meghna and Sangu–Karnaphuli River systems in India, Nepal, and Bangladesh (Sinha & Kannan, 2014). It has been declared as the National Aquatic Animal by Govt. of India (Sinha & Kannan, 2014) and is classified as 'Endangered' in the IUCN Red List owing to the decrease in its population in the last 3-4 decades. A detailed dolphin survey carried out by Sinha (2013) in Bihar state revealed the presence of 83 dolphin individuals in Ganga river stretch between Munger and Hamzapur. The study considered this region as a 'Critical Stretch' for dolphins and recommended to declare it as **Dolphin Conservation Reserve**. Major sighting occurred at Ganga-Man Confluence, Ganga-Burhi Gandak Confluence and the Kashtharni Ghat.

Image 34 : Gangetic Dolphin Sighted At Ganga-Man Confluence

**11.6 Nilgai Conflict:** The Nilgai antelope – *Boselaphus tragocamelus* is widely distributed throughout the country. However, due to prolonged breeding activity and lack of potential predators, the numbers of Nilgai have increased considerably and become locally overabundant in states of Gujarat, Bihar, Uttar Pradesh, Haryana, Punjab, Rajasthan, Madhya Pradesh and Delhi (Meena, 2017). In the due course of time, this species has been successful in adjusting to the human-altered landscapes and in many places have become serious pests of agricultural crops. It is found extensively foraging on the agricultural fields in the riverine areas of Ganga River and Gandak River in Munger and other districts of Bihar state thereby destroying crops such as wheat, maize, pulses and vegetables [Anonymous, 2016]. A huge population Nilgai in floodplain area [Left Bank] is reported during field visit.

11.7 **Avian Diversity :** Munger District has a rich diversity of avian species. The area at right bank of River Ganga in Khagaria, Munger and Bhagalpur is liable to flood. After flood the small depressions, paleo-channels and meanders usually filled up and provide the suitable habitat to migratory, local migratory and resident birds. The Tal area at right bank, water filter Talab at Jamalpur acts as suitable habitat for the avian diversity. In current study, the avian diversity survey was conducted in January 2022. The diversity 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 list of identified birds are provided in the Table No. 8.

Table 8 : Recorded Avian Specie

| Common Name | Scientific Name | IUCN Red List Status |
|---|---|---|
| Little Cormorant | *Phalacrocorax niger* | Least Concern |
| Indian Cormorant | *Phalacrocorax fuscicollis* | Least Concern |
| Great Cormorant | *Phalacrocorax carbo* | Least Concern |
| **Oriental Darter** | ***Anhinga melanogaster*** | **Near Threatened** |
| Red-naped Ibis | *Pseudibis papillosa* | Least Concern |
| Indian Pond Heron | Ardeolagrayii | Least Concern |

| | | |
|---|---|---|
| Little Egret | Egretta garzetta | Least Concern |
| Red - Wattled Lapwing | *Vanellus indicus* | Least Concern |
| White-Breasted Waterhen | *Amaurornis phoenicurus* | Least Concern |
| Common Moorhen | *Gallinula chloropus* | Least Concern |
| Purple Mooorhen | *Porphyrio porphyrio* | Least Concern |
| Common Greenshank | *Tringa nebularia* | Least Concern |
| Common Redshank | *Tringa totanus* | Least Concern |
| Common Kingfisher | *Alcedo atthis* | Least Concern |
| Greater Coucal | *Centropus bengalensis* | Least Concern |
| Black Kite | *Milvus migrans* | Least Concern |
| Asian openbill stork | *Anastomus oscitans* | Least Concern |
| **Black-necked Stork** | ***Ephippiorhynchus asiaticus*** | **Near Threatened** |
| **Lesser Adjutant** | ***Leptoptilos javanicus*** | **Vulnerable** |
| **Greater Adjutant** | ***Leptoptilos dubius*** | **Endangered** |
| Little Stint | *Caldris minuta* | Least Concern |
| **Woolly-necked Stork** | ***Ciconia episcopus*** | **Near Threatened** |
| Lesser Whistling-duck | *Dendrocygna javanica* | Least Concern |
| Cotton Pygmy-goose | *Nettapus coromandelianus* | Least Concern |
| Bar-headed Goose | *Anser indicus* | Least Concern |
| Tufted Duck | *Aythya fuligula* | Least Concern |
| **River Lapwing** | ***Vanellus duvaucelii*** | **Near Threatened** |
| Scaly-breasted Munia | *Lonchura punctulate* | Least Concern |
| Indian Roller | *Coracias benghalensis* | Least Concern |
| Green Bee-Eater | *Meropsorientalis* | Least Concern |
| Common Hoopoe | *Upupa epops* | Least Concern |
| Common Myna | *Acridotherestristis* | Least Concern |

| | | |
|---|---|---|
| Bank Myna | *Acridotheres ginginianus* | Least Concern |
| Asian Pied Starling | *Sturnus contra* | Least Concern |
| Common Stonechat | *Saxicola torquatus* | Least Concern |
| Pied Bushchat | *Saxicola caprata* | Least Concern |
| Indian Bushlark | *Mirafra erythroptera* | Least Concern |
| Paddyfield Pipit | *Anthus rufulus* | Least Concern |
| Common Babbler | *Argya caudata* | Least Concern |
| Jungle Babbler | *Argya striata* | Least Concern |
| Large Grey Babbler | *Argya malcolmi* | Least Concern |
| Black-hooded Oriole | *Oriolus xanthornus* | Least Concern |
| Indian Golden Oriole | *Oriolus Kundoo* | Least Concern |
| White Wagtail | *Motacilla alba* | Least Concern |
| Black Drongo | *Dicrurus macrocercus* | Least Concern |
| Eurasian Collared Dove | *Streptopelia decaocto* | Least Concern |
| Spotted Dove | *Spilopelia chinensis* | Least Concern |
| House Sparrow | *Passer domesticus* | Least Concern |
| House Crow | *Corvus splendens* | Least Concern |

Image 35 : Group Of Lesser Whistling-Duck [Dendrocygna javanica]

Image 36 : Lesser Adjutant, Jungle Crow And House Crow

Image 37 : Group Of Asian Openbill Stork

## 12.0 Ganga Riverine Islands/Diaras in Munger Distt.

*The riverine fluvial islands are present in many major rivers and are defined as 'land masses within a river channel that are separated from the floodplain by water on all sides and exhibiting some kind of stability' [Osterkamp, 1998]. Islands may not be permanent on the geologic time scale owing to the river meandering, climate change, etc. but can remain in place over decadal or century time scales and hence exhibit stability [Wyrick & Klingeman, 2011].*

12.1 Many riverine islands are existent in the Ganga River stretch throughout Bihar state which are locally referred to as *Diaras*. This term is derived from the word *Diya* (which means an earthen oil lamp) and has been coined for a land where a *Diya* is never lit [Udas *et al.*, 2018]. In local parlance in different parts of Bihar state, it symbolizes a village which is located outside the embankments of Ganga River floodplain. Some of the major *Diaras* surveyed in the study are described in this section.

12.2 There are eleven major islands identified and documented within the district. Jurisdiction of the riverine islands lies in Munger-Begusarai and Munger-Khagaria Distt.. The species – *Saccharum spontaneum, Saccharum munja* and *Ziziphus spp.* dominates the riparian flora of the island. Details of the riverine island are provided in Table No. 9.

Table 9 : Details Of The Riverine Island Within Munger District

| Sr. No. | Nearest Settlement | Coordinates | | Status |
|---|---|---|---|---|
| | | Latitude | Longitude | |
| 1 | Risalpur [Right Bank]<br><br>[Refer Image No. 39] | 25°19'9.86"N | 86°19'33.94"E | Area approx. 4.19 Sq. Km.<br>Jurisdiction: Munger and Begusarai Distt.<br>Land Use: Agriculture<br>Vegetation: Mainly *Saccharum spp.* |
| 2 | Shivnagar, Masudhanpur [Left Bank] | 25°20'50.39"N | 86°23'44.56"E | Area approx. 5.84 Sq. Km.<br>Jurisdiction: Munger and Begusarai Distt. |

| | | | | |
|---|---|---|---|---|
| | [Refer Image No. 40] | | | Land Use: Mainly Agriculture<br>Vegetation : Few hectares only [*Saccharum spontaneum*, Saccharum munja] |
| 3 | Shivnagar, Masudhanpur [Left Bank]<br>[Refer Image No. 40] | 25°21'38.17"N | 86°24'52.51"E | Area approx. 0.96 Sq. Km.<br>Jurisdiction: Munger and Begusarai Distt.<br>Land Use: Mainly Agriculture |
| 4 | Shivnagar, Masudhanpur [Left Bank]<br>[Refer Image No. 40] | 25°19'22.93"N | 86°22'16.46"E | Area approx. 2.0 Sq. Km.<br>Jurisdiction: Munger and Begusarai Distt.<br>Land Use: Mainly Agriculture |
| 5 | Near Munger City [Right Bank]<br>[Refer Image No. 41] | 25°21'59.60"N | 86°26'12.83"E | Area approx. 8.44 Sq. Km.<br>Jurisdiction: Munger and Begusarai Distt.<br>Land Use: Mainly Agriculture<br>Vegetation : Few hectares only [*Saccharum spontaneum*, Saccharum munja] |
| 6 | Near Munger City [Right Bank]<br>[Refer Image No. 41] | 25°20'7.94"N | 86°26'54.28"E | Area approx. 2.83 Sq. Km.<br>Jurisdiction: Munger and Begusarai Distt.<br>Land Use : Mainly Agriculture<br>Vegetation: Few hectares only [*Saccharum spontaneum*, Saccharum munja] |
| 7 | Near Munger | 25°20'7.94"N | 86°26'54.28"E | Area approx. 7.84 Sq. Km. |

| | | | | |
|---|---|---|---|---|
| | City<br>[Right Bank]<br><br>[Refer Image No. 42] | | | Jurisdiction: Munger, Khagaria and Begusarai Distt.<br>Land Use: Mainly Agriculture<br>Vegetation: Few hectares only [*Saccharum spontaneum*, Saccharum munja]. Vegetation is shrinking due extensive agricultural activities. |
| 8 | Ghorghat<br>[Right Bank]<br>[Refer Image No. 43] | 25°15'21.41"N | 86°40'26.05"E | Area approx. 16.0 Sq. Km.<br>Jurisdiction: Munger and Khagaria Distt.<br>Land Use: Agriculture |
| 9 | Tikarampur Diara<br>[Refer Image No. 44] | 25°25'41.41"N | 86°33'41.91"E | Area approx. 90.5 Sq. Km.<br>Jurisdiction: Munger and Khagaria Distt.<br>Island formed at the confluence of Ganga-Burhi Gandak River<br>Land Use: Mainly Agriculture<br>Vegetation: Dominant species - *Saccharum spontaneum*, Saccharum munja]. |
| 10 | Nurpur<br>[Right Bank]<br>[Refer Image No. 45] | 25°16'55.90"N | 86°35'40.78"E | Area approx. 6.11 Sq. Km.<br>Jurisdiction: Munger Distt.<br>Land Use: Mainly Agriculture |
| 11 | Vijaynagar<br>[Right Bank]<br>[Refer Image No. 45] | 25°18'33.98"N | 86°35'2.26"E | Area approx. 3.10 Sq. Km.<br>Jurisdiction: Munger Distt.<br>Land Use: Agriculture |

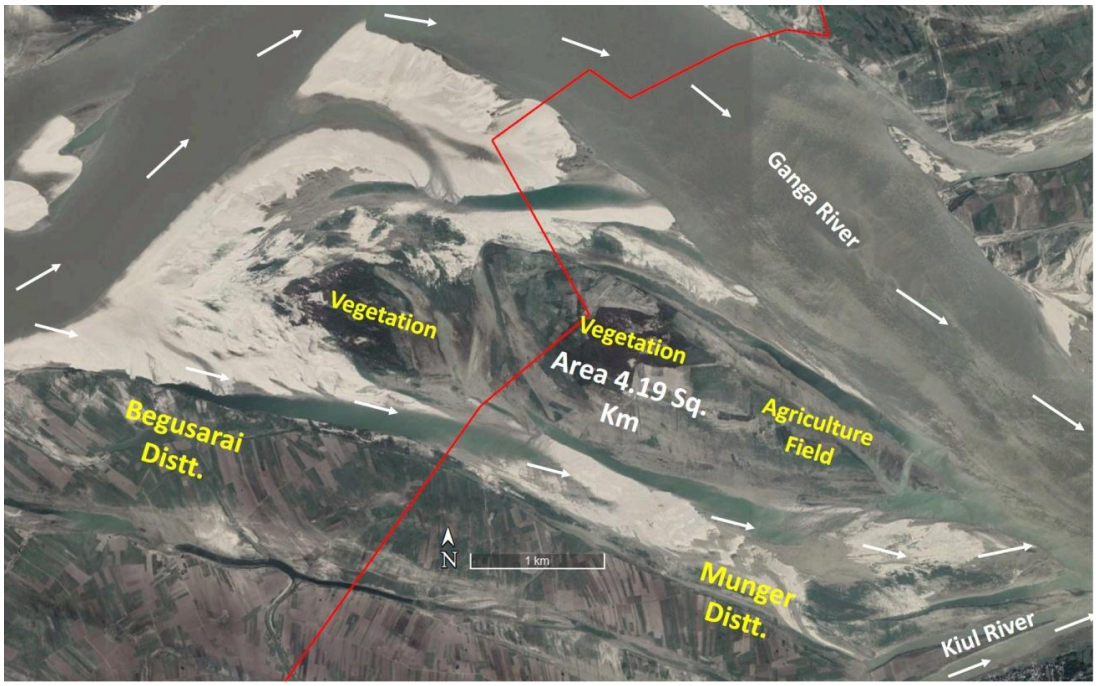



Image 38 : Riverine Island Near Risalpur [Refer Table 9, Sr. No. 1]
[Source : Google Earth Imagery, November 2021]

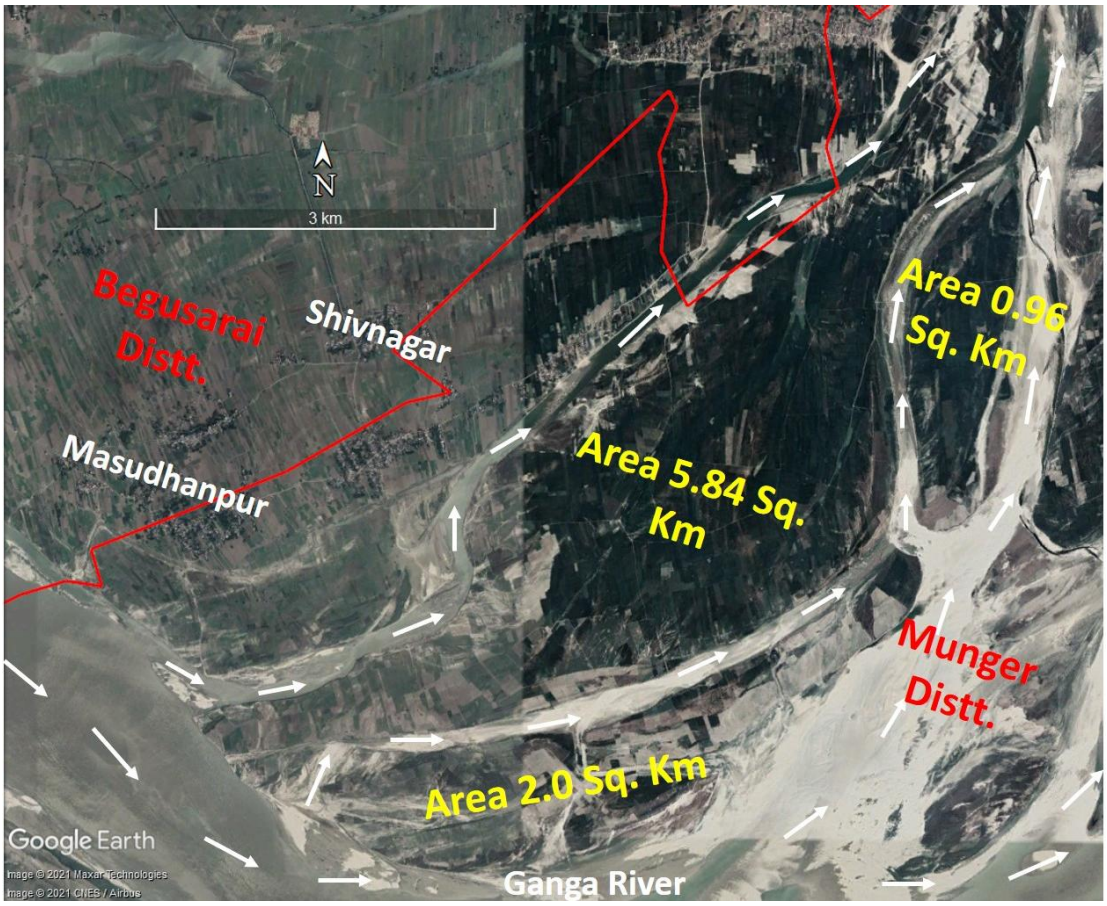



Image 39 : Riverine Island Near Masudhnagar [Refer Table 9, Sr. No. 2,3 & 4]
[Source : Google Earth Imagery, November 2021]

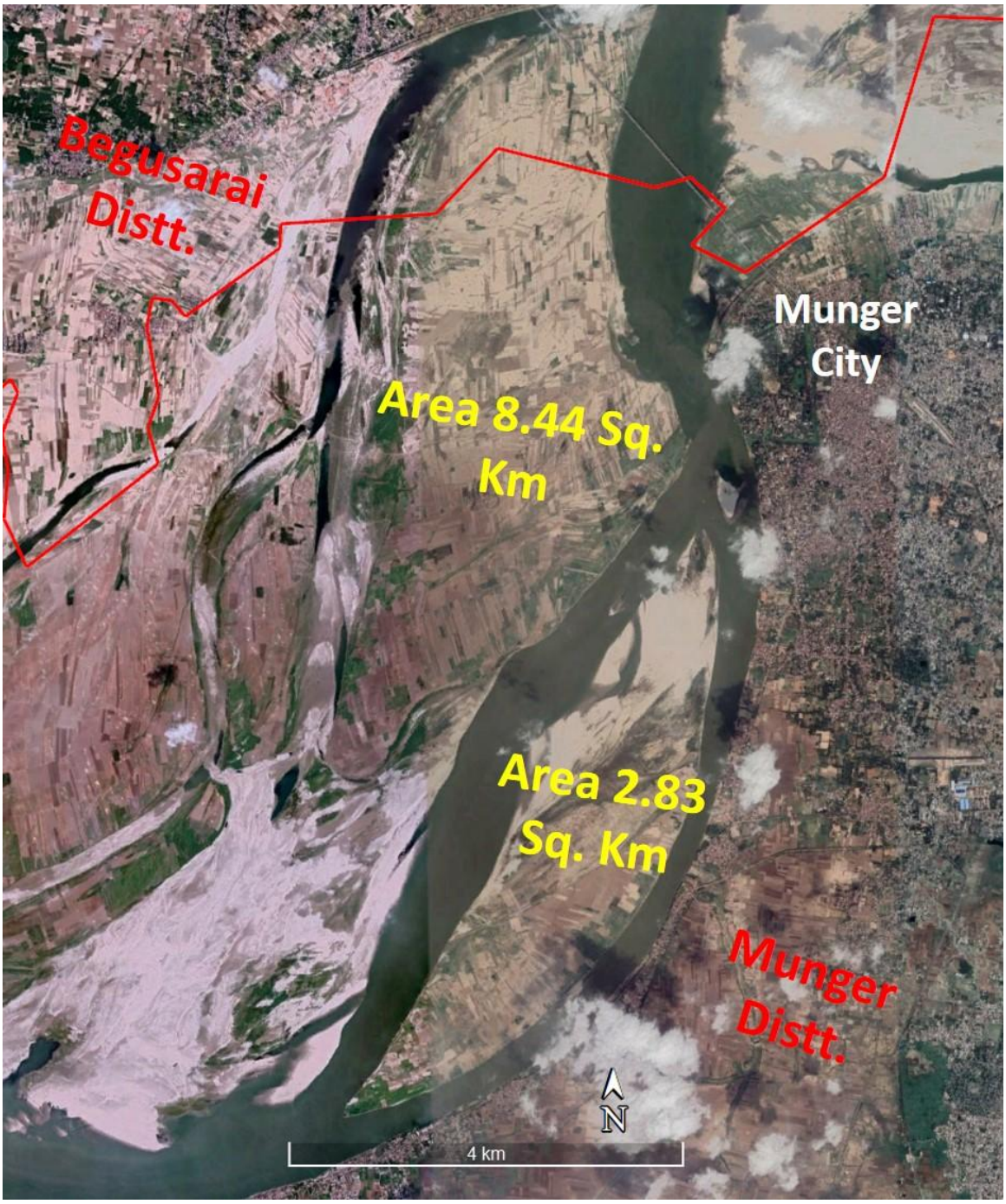



**Image 40 : Riverine Island Near Munger City [Refer Table 9, Sr. No. 5 & 6]**

[Source : Google Earth Imagery, May 2021]

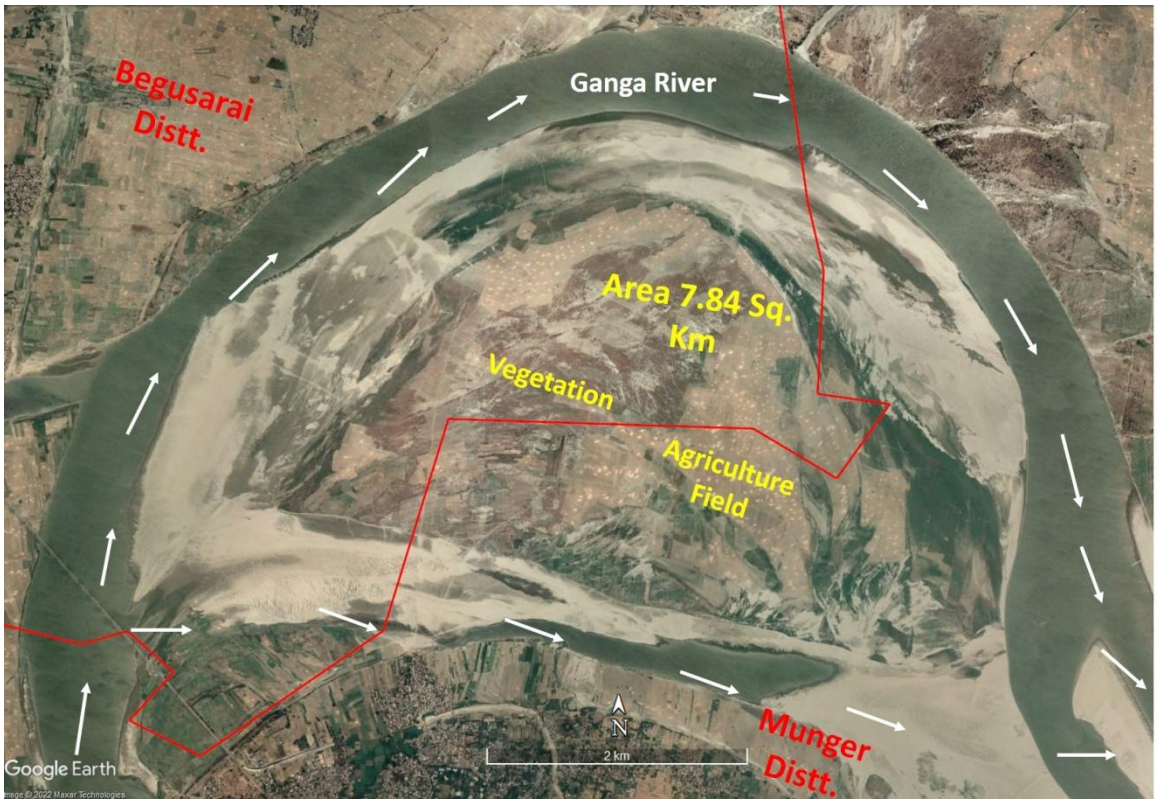



Image 41 : Riverine Island Near Munger City [Refer Table 9, Sr. No. 7]
[Source : Google Earth Imagery, May 2021]

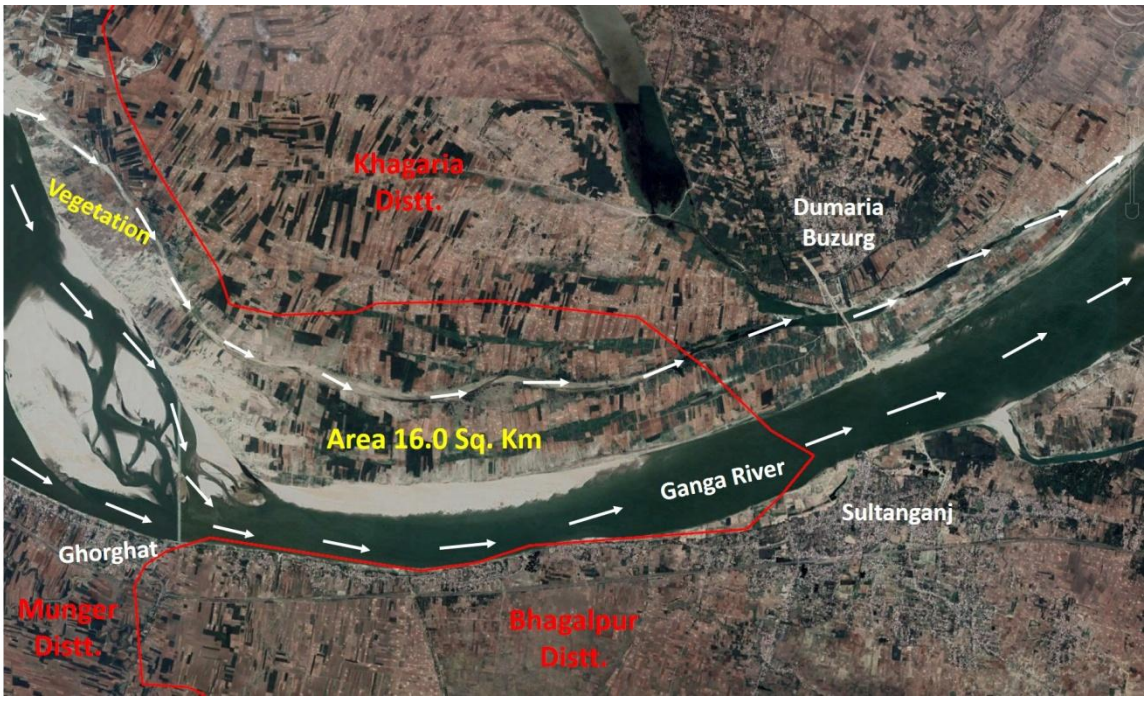



Image 42 : Riverine Island Near Ghorghat [Refer Table 9, Sr. No. 8]
[Source : Google Earth Imagery, May 2021]

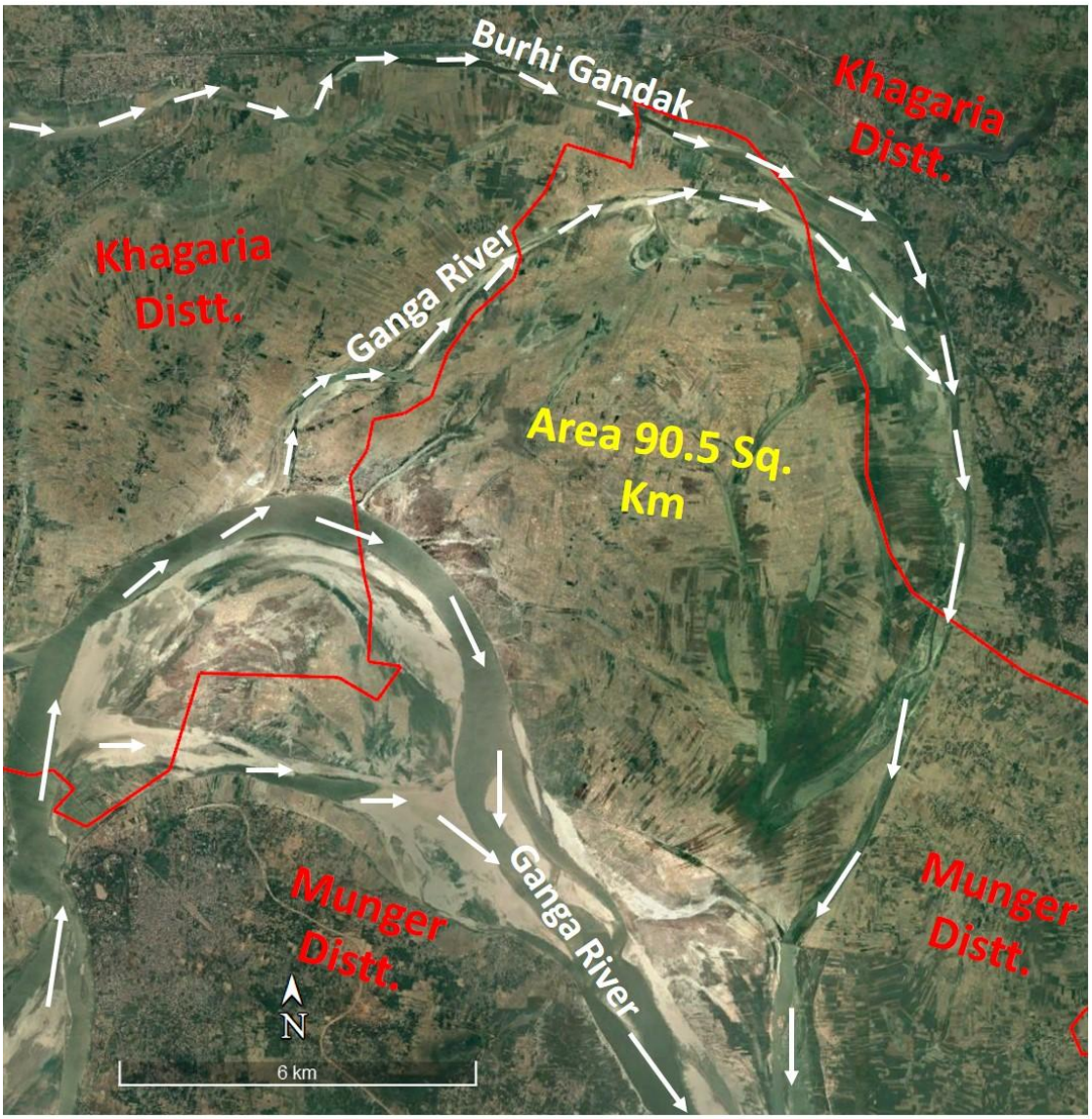



Image 43 : Tikarampur Diara [Refer Table 9, Sr. No. 9]
[Source : Google Earth Imagery, May 2021]

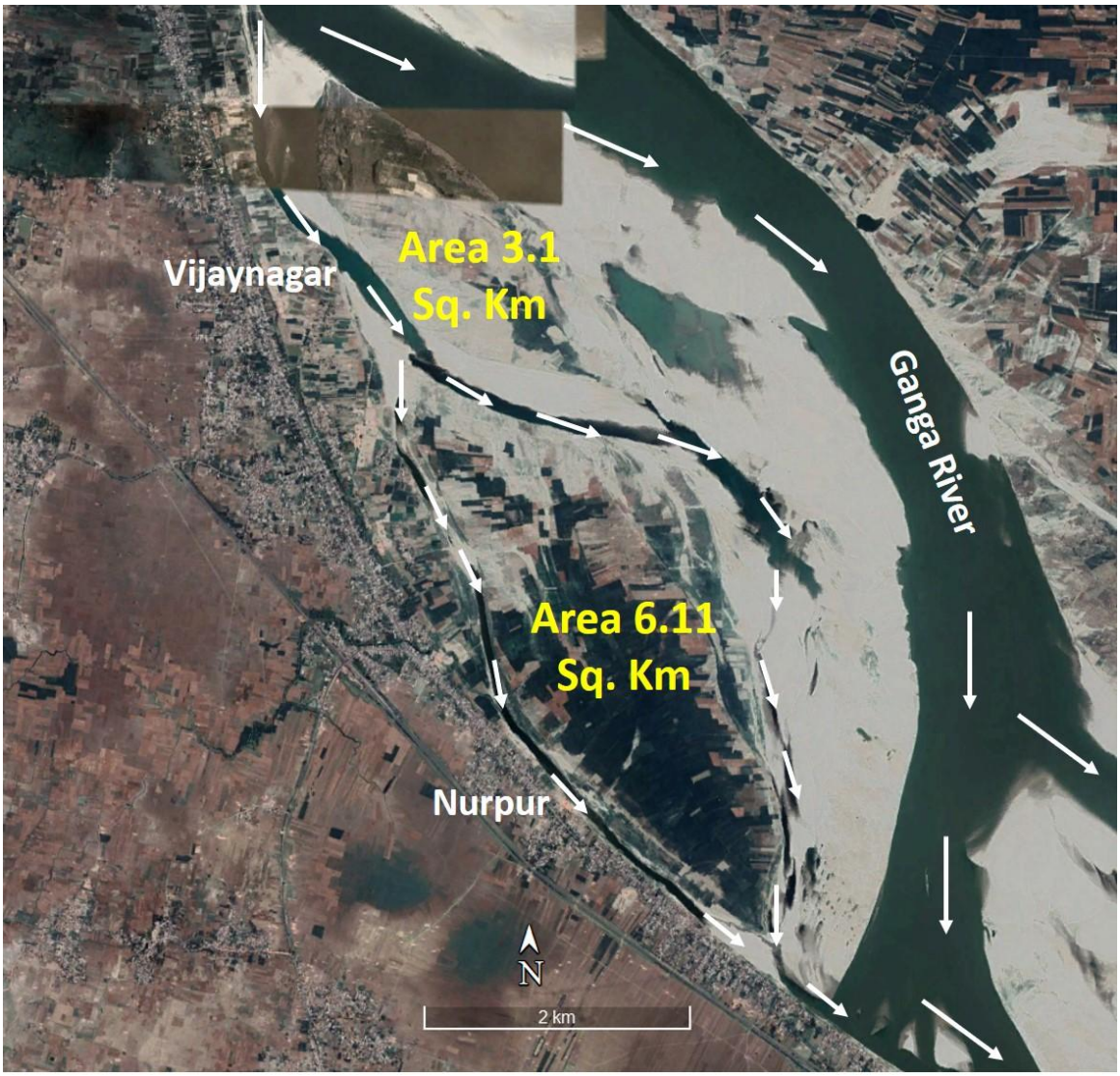



Image 44 : Binda Diara [Refer Table 9, Sr. No. 10 & 11]
[Source : Google Earth Imagery, May 2021]

12.3 Apart from the identified islands there are few sand bars and emerging islands present within the district [Refer Image No. 34]. These islands are not stable and changes continuously. Area of most of the sand bar is under cultivation for *Rabi Zaid crops* and vegetables, Maize and wheat, Mustard [Refer Image No. 46 & 47].

Image 45 : Emerging Sand Bar Near Ghorghat
[Source : Google Earth Imagery, January 2022]

Image 46 : Emerging Sand Bar In Kalyanpur Village

Image 47 : Wheat Field At Binda Diara

Image 48 : Riparian Vegetation And Mustard Field At Binda Diara

## 13.0 Fishing in Munger Distt.

13.1 Ganga River supports a rich diversity of fish fauna with about 260 fish species reported for Indian waters [Sinha & Khan, 2001]. About 35 species have been identified as having highest commercial value, including carps (Cyprinidae), snakeheads (Channidae), and catfishes (Siluriformes) [Islam et al. 2006]. However, most of these high value fish species have declined in numbers and many are also on the brunt of extinction today owing to a variety of environmental and anthropogenic factors. In Munger Distt., fishing is carried out by local communities often for their own consumption and for selling in nearby areas. Some of the important fishing gears used in this region include scoop nets, gill nets [Mathur et al., 2012] and hook and line technique.

13.2 A detailed study carried out by Sarkar et al., [2012] highlighted the presence of 59 different fish species in Ganga river stretch of Patna to Bhagalpur including Munger Distt. Some of the common fish species occurring in Munger stretch of Ganga include – *Aspidoparia morar*, *Mystus tengara*, *Mystus cavasius*, *Mystus menoda* and *Nangra punctata*. However, the major economically important fish species caught in this region included – *Labeo rohita*, *Labeo bata*, *Ailia coila*, *Cirrhinus mrigala* and *Mystus vittatus*. The study also reiterated the changes in fish diversity, overall decline in fish catch, and increasing number of exotic fishes in the region and pressed for improved conservation efforts to conserve the native species.

13.3. The most common category of fishes that are consumed by localities are Rehu & Catla, which are moderate in price, varying from Rs 200 -300 per kg. These fishes are found abundantly in River Ganga; also the fisher community reared them in the pond and pain. These are the fast growing fishes with minimal maintenance and have good economic return value.

13.4 The most expensive fish found in the region is Dawrf Goonch or devil catfish, the price varies from Rs 800- 1000 per kg. This is a species of catfish whose size has been recorded up to 6 ft. Generally, Dawrf Goonch is found in the main course of the River Ganga. Due to its size and aggressive nature, it is hard to catch. As per IUCN, Dwarf Goonch has been marked as near threatened species. Fish species recorded during field visit are listed below :

Table 10 : Recorded Fish Species

| Sr. No. | Scientific Name | Common Name |
|---|---|---|
| 1. | *Labeo rohita* | Rohu |
| 2. | *Systomus sarana* | Olive Barb |
| 3. | *Mystus vittatus* | Striped Dwarf Catfish |
| 4. | *Pseudeutropius atherinoides* | Indian Potasi |
| 5. | *Anabas testudineus* | Climbing Perch |
| 6. | *Labeo catla* | Catla |
| 7. | *Wallago attu* | Buari/Barari |
| 8. | *Mystus cavasius* | Tengra |
| 9. | *Mystus tengara* | Tengra |
| 10. | *Cyprinus carpio* | Common/Chinese carp |
| 11. | *Channa punctata* | Garai |
| 12. | *Eutropiichthys vacha* | Bachwa |
| 13. | *Anguilla bengalensis* | Baam |
| 14. | *Cirrhinus mrigala* | Naini |
| 15. | *Mastacembelus armatus* | Gaichi/ Spiny Eel |
| 16. | *Chitala chitala* | Indian knifefish |
| 17. | *Labeo bata* | Bata |
| 18. | *Channa striata* | Snakehead Murrel |
| 19. | *Cabdio morar* | Chepua |
| 20. | *Heteropneustes fossilis* | Singhi |
| 21. | *Puntius chola* | Pothiya |
| 22. | *Sperata seenghala* | Singhara |
| 23. | *Bagarius Bagarius* | Bhagar/Gooch |
| 24. | *Bagarius yarrelli* | Gosta/Gooch |
| 25. | *Hypophthalmichthys nobilis* | Bighead carp |

Image 49 : Spiny Eel or Gaichi [*Mastacembelus armatus*] In Man River

Image 50 : Tengra Fish [*Mystus spp.]*

Image 51 : Installed Fishing Nets [Locally Called Jalad] In Man River

Image 52 : Fishing In A Channel Of Ganga River Near Binda Diara

## 14.0 Groundwater in Munger Distt.

14.1 Ground water characteristics of a particular area are subject to several natural factors like precipitation, drainage, topography, lithology and hydrogeological conditions of the region. It is also influenced by human induced factors like groundwater withdrawal and changes in land use pattern. According to the report of CGWB (2013), Munger distt. forms a part of Badua-Chandan, Sunder-Gumani subbasin of the Ganga Basin and is bestowed with diverse landscapes ranging from hills to the floodplains. Hydrogeologically the distt. is divided into two major parts – Hard rock/Fissured formation and Unconsolidated/Porous formation. The fissured formations are made up of the rocks comprising of granite gneisses, quartzite and phyllites and in general possess poor aquifiers. On the other hand, the porous formations constitute of quarternary alluvium which occupies a major part of the distt. The CGWB explorations have indicated six to seven sets of good aquifiers in these formations within the depth of 200 m bgl. In general the depth of tubewells in the region ranges from 50-235 m bgl and the ground water discharge ranges between 2-45 litres per second.

14.2 Furthermore, CGWB (2013) had recorded the net annual replenishable ground water resource of the district to be 309.07 mcm. Maximum ground water development is in Tarapur block (50.7%), while minimum is in Dharhara block (12.1%). The chemical analysis of ground water samples from various parts in the distt. reveal that the ground water is by and large suitable for drinking and irrigation purposes. Based on groundwater resource utilization, Central Ground Water Board (CGWB) has assessed blocks throughout the country. As per 2017 & 2020 assessment, blocks fall in the study area namely – Kharagpur, Jamalpur, Bariarpur, Munger and Asarganj are under safe category[7][8].

14.3 During field visits, the survey team has interacted with local communities throughout the study corridor. Currently dug wells are not preferred source for the ground water withdrawal. People prefer hand pumps; also most of the house hold at right bank of River Ganga has the access of supply water. The villages located at the left bank are mostly dependent on hand pumps and are still waiting for supply water.

[7]Dynamic Ground Water Resources of India, CGWB (As on 31 March 2017).
[8] Dynamic Ground Water Resources of India, CGWB (As on 31 March 2020).

Dug wells in flood plain lacking maintenance. Based on the interaction with the local communities it has been found that people usually bore between 110-220 ft for ground water at right bank. At left bank they usually get good drinking water at 40-60 ft. Based on local interaction ground water levels recorded at different villages are provided in the table below.

Table 11 : Water Levels (Based on interactions with local communities)

| Location | Coordinates | GW Level (in feet) |
|---|---|---|
| Ghorghat | 25°14'37.67"N, 86°38'16.73"E | 200-220 |
| Kalyanpur | 25°14'43.81"N, 86°38'0.48"E | 200-220 |
| Nurpur | 25°16'24.99"N, 86°35'20.03"E | 180-190 |
| Barhitiasthan | 25°17'57.09"N, 86°34'1.27"E | 150-180 |
| Kahthan [Near Quarry Site], Dug Well | 25°20'47.6"N, 86°31'53.6"E | 80 |
| Jhahwabahiyar | 25°21'17.87"N, 86°37'22.19"E | 40-60 |

Image 53 : Dug Well Near Quarry Site In Kaithan

## 15.0 Ganga River Bank in Munger Distt.

15.1 Ganga River bank in Munger district may be classified on the basis of land use and land cover. The possible classes could be – Built-up area [Settlements, brick kiln sites, Temple Complexes and cremation sites], Vegetation [Plantation and riparian vegetation patches] and agricultural fields. Out of three classes, the vegetation area especially the riparian vegetation area along the River Ganga and streams/ Nara is almost negligible. The bank at Ganga-Kiul confluence and Ganga-Man confluence is used for brick making processes. Some area especially Ganga-Dakra confluence which were covered with riparian grasses are now converted into agricultural fields. River bank area, which has recently converted into agricultural fields, is prone to lateral erosion. A National Highway which runs along Ganga River bank [Right Bank] throughout the district has provided easy access to the River Bank. This has resulted into decrease in riparian vegetation. The temple complex of almost every village is located at Ganga River Bank.

Image 54 : A Patch Of Riparian Vegetation At Erosion Prone Bank

15.2 The left bank of River Ganga is less disturbed and is mostly covered with riparian grasses of width ranges between 50 metres to 0.5 Km [at Ganga-Burhi Gandak confluence]. This area inundated every year; this is why the area lacking the infrastructure. ***Defecation at Ganga River bank and utilization of banks for cattle shelters are major issue at both banks.***

Image 55 : A Cattle Shelter At Bank In Ghorghat

## 15.3 Cremation And Burial Ground

**15.3.1** Ganga River Banks are used for cremation and burial ground for generations. Burial is not a common practice in Munger Distt.. However, few burial sites are reported near Jhahwabahiyar Ghat [25°20'11.62"N, 86°35'19.60"E]. During field visits it has been observed that burial ground is not restricted to particular site and can been done at any sand bar of the Ganga River. This is because Ganga River and its active floodplain is considered as sacred and burial within the region is equivalent to the cremation. There are no dedicated cremation ghats in Munger Distt.. People cremate at any site as per the convenience. The ongoing cremation at ghats lack basic infrastructure. There are three major cremation sites identified within distt. along the river. Out of that, two are cremation sites and one is cremation and burial ground.

Image 56 : Cremation At Munger Ghat

Image 57 : Cremation At Ghorghat

Table 12 : Cremation And Burial Sites In The Study Area

| Site | Location | | Burial Site/ Cremation Site |
|---|---|---|---|
| | Latitude | Longitude | |
| Munger Ghat | 25°23'17.81"N | 86°27'33.31"E | Cremation Site |
| Ghorghat | 25°14'41.71"N | 86°38'9.34"E | Cremation Site |
| Jhahwabahiyar Ghat | 25°20'11.62"N | 86°35'19.60"E | Burial and Cremation Site |

## 15.4 Ganga Bank Erosion

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

15.4.2 Depending on the intensity and severity of erosion, the study area [7km Buffer] maybe grouped under slight erosion category. However, increasing number of brick kilns, decrease in riparian vegetation and extensive agricultural activities may increase the rate of erosion. The lateral erosion of the banks occurs under intense rainfall accompanied by torrential flow in rivulets generating vast quantities of sediment transported downstream.

15.4.3 There are 48 lateral erosion sites marked within the study area with the help of satellite imagery [2020-2021] and is provided in Table 13.

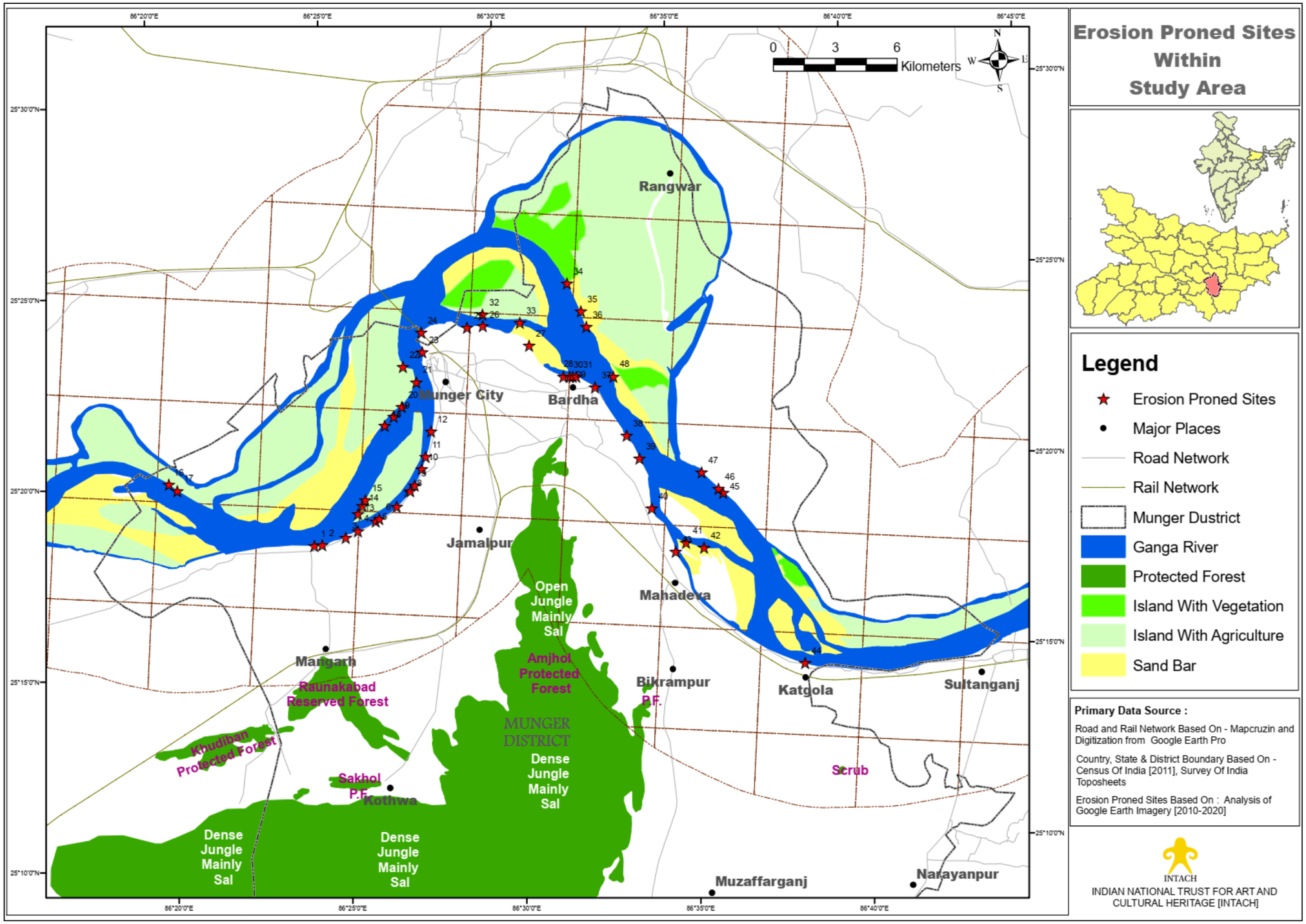
Table 13 : Erosion Prone Sites

| Sr. No. | Latitude [N] | Longitude [E] | Nearest Settlement |
|---|---|---|---|
| *1* | 25°18'18.20"N | 86°24'17.28"E | Shivkund |
| *2* | 25°18'18.77"N | 86°24'31.22"E | [Right Bank] |
| *3* | 25°18'29.06"N | 86°25'12.31"E | |
| *4* | 25°18'38.79"N | 86°25'33.36"E | |
| *5* | 25°18'52.40"N | 86°26'4.94"E | Between Janipur and Phorda |
| *6* | 25°18'56.01"N | 86°26'11.57"E | [Right Bank] |
| *7* | 25°19'14.19"N | 86°26'42.16"E | |
| *8* | 25°19'37.24"N | 86°27'7.29"E | Navtoliya |
| *9* | 25°19'46.38"N | 86°27'14.90"E | [Right Bank] |
| *10* | 25°20'11.38"N | 86°27'28.31"E | HeruDiyara |
| *11* | 25°20'30.37"N | 86°27'35.72"E | [Right Bank] |
| *12* | 25°21'9.97"N | 86°27'47.05"E | |
| *13* | 25°19'5.38"N | 86°25'35.08"E | |
| *14* | 25°19'17.04"N | 86°25'42.99"E | Riverine Island |

| | | | |
|---|---|---|---|
| 15 | 25°19'26.20"N | 86°25'48.87"E | |
| 16 | 25°20'3.36"N | 86°20'10.29"E | Left Bank |
| 17 | 25°19'53.24"N | 86°20'24.22"E | |
| 18 | 25°21'22.42"N | 86°26'27.48"E | |
| 19 | 25°21'35.03"N | 86°26'43.35"E | |
| 20 | 25°21'50.13"N | 86°26'58.01"E | |
| 21 | 25°22'28.87"N | 86°27'24.68"E | Riverine Island |
| 22 | 25°22'53.67"N | 86°27'2.72"E | |
| 23 | 25°23'15.75"N | 86°27'37.42"E | Near Laldarwaja |
| 24 | 25°23'45.83"N | 86°27'36.67"E | [right Bank] |
| 25 | 25°23'51.57"N | 86°28'56.55"E | Between Dalhatta and Shyampur |
| 26 | 25°23'51.94"N | 86°29'24.30"E | [Right Bank] |
| 27 | 25°23'19.12"N | 86°30'42.94"E | Near Hasannagar [Right Bank] |
| 28 | 25°22'28.46"N | 86°31'40.00"E | |
| 29 | 25°22'27.26"N | 86°31'50.52"E | Between Shitalpur and Bardha |
| 30 | 25°22'27.57"N | 86°31'55.73"E | [Right Bank] |
| 31 | 25°22'26.72"N | 86°32'2.04"E | |
| 32 | 25°24'11.06"N | 86°29'24.60"E | Riverine Island |
| 33 | 25°23'55.40"N | 86°30'27.96"E | |
| 34 | 25°24'54.25"N | 86°31'52.17"E | Tikarampur |
| 35 | 25°24'9.81"N | 86°32'14.55"E | [Left Bank] |
| 36 | 25°23'44.55"N | 86°32'22.56"E | |
| 37 | 25°22'9.03"N | 86°32'33.53"E | Near Sitakund [Right Bank] |
| 38 | 25°20'50.87"N | 86°33'24.90"E | Maniyarchak [right Bank] |
| 39 | 25°20'14.47"N | 86°33'44.95"E | Maheshpur [Right Bank] |
| 40 | 25°18'54.63"N | 86°34'2.61"E | Budgwadiyara [Right Bank] |
| 41 | 25°17'58.45"N | 86°34'59.96"E | Phulkiya [Right Bank] |
| 42 | 25°17'49.71"N | 86°35'30.17"E | Riverine Island |
| 43 | 25°17'45.20"N | 86°34'41.05"E | Harijankalyantola [Right Bank] |
| 44 | 25°14'42.00"N | 86°38'16.45"E | Katgola [Right Bank] |
| 45 | 25°19'14.93"N | 86°36'7.29"E | Near Jhahwabahiyar and Nabe |
| 46 | 25°19'21.09"N | 86°35'59.60"E | [Left Bank] |
| 47 | 25°19'48.74"N | 86°35'31.62"E | |
| 48 | 25°22'25.19"N | 86°33'5.67"E | Near Tirasi [Left Bank] |

Image 58 : Eroded Bank At Ghorghat

Image 59 : Eroded Bank Stabilied With Geotubes




**Map 10 : Erosion Prone Sites In Munger Distt.**

## 16.0 Mining & Brick Kilns in Munger

**16.1 Mining/Stone Quarry :** Munger has rich mineral deposits which play an important role in the industrial, social and economic development of this Distt. The major available mineral resources are – stones, quartzite and sand. Some major stone deposit areas in the Distt. are Jamalpur hill, Bakarpur hill, Sikandarpur hill, Sankarpur hill, Sitalpur hill, Patam hill, Pashichak hill and Nawagarhi hill. The Kharagpur Hill tract in the Distt. comprises of mainly quartzite and phyllite of Kharagpur Formation. This unit is made up of the rock of Chotanagpur Gneissic Complex (CGC) and Kharagpur Formation, which is mainly composed of granite gneisses, quartzite and phyllite. The mining activities within study area are now stopped and quarry sites are abandoned. Some sites especially parts of Shankarpur Hill is under encroachment. The location of mining sites is provided in Table No. 14.

Table 14 : Location Of Mining Sites

| Sr. No. | Nearest Settlement | Coordinates | |
|---|---|---|---|
| | | Latitude | Longitude |
| 1 | Shankarpur [Refer Image No. 60 & 61]] | 25°22'46.41"N | 86°30'42.74"E |
| 2 | Jamalpur [Refer Image No. 62 & 63] | 25°18'45.90"N | 86°30'37.30"E |
| 3 | Kaliasthan | 25°20'45.29"N | 86°31'27.67"E |
| 4 | Nauwagarhi [Refer Image No. 64 & 65] | 25°20'40.08"N | 86°31'51.15"E |
| 5 | Garhirampur | 25°20'13.22"N | 86°31'42.12"E |
| 6 | Keshopur | 25°21'19.61"N | 86°31'43.31"E |
| 7 | Gulalpur | 25°21'39.40"N | 86°30'35.84"E |
| 8 | Shitalpur | 25°22'17.48"N | 86°31'44.00"E |


Image 60 : Satellite Image Showing Stone Quarry Site At Shankarpur
[Source : Google Earth Imagery, May 2021]

Image 61 : Stone Quarry Site At Shankarpur


Image 62 : Satellite Image Showing Stone Quarry Site At Jamalpur
[Source : Google Earth Imagery, May 2021]

Image 63 : Stone Quarry Site At Jamalpur


Image 64 : Satellite Image Showing Stone Quarry Site At Naugarhi
[Source : Google Earth Imagery, May 2021]

Image 65 : Stone Quarry Site At Naugarhi

**16.2 Sand Mining :** Sand is one of the major minerals resource extracted from the Ganga River and its tributaries. The demand is ever increasing due to rapid expansion of settlements and their upgradation across the country. Often carried out illegally and excessively to earn large profits, sand mining is altering rivers' overall health. Excessive sand mining results in the destruction of aquatic and riparian habitats and poses threat to bridges, river banks and nearby structures[9]. Sand mining from Ganga River within the district is reported at three sites – Near Udainagar [25°19'00.1"N 86°34'05.1"E], Between Nayachhauni and Kalyanpur [25°15'46.95"N, 86°36'11.56"E] and Near Jhawabahiyar [25°20'38.22"N, 86°36'10.78"E].

Image 66 : Sand Mining Near Kalyanpur Village

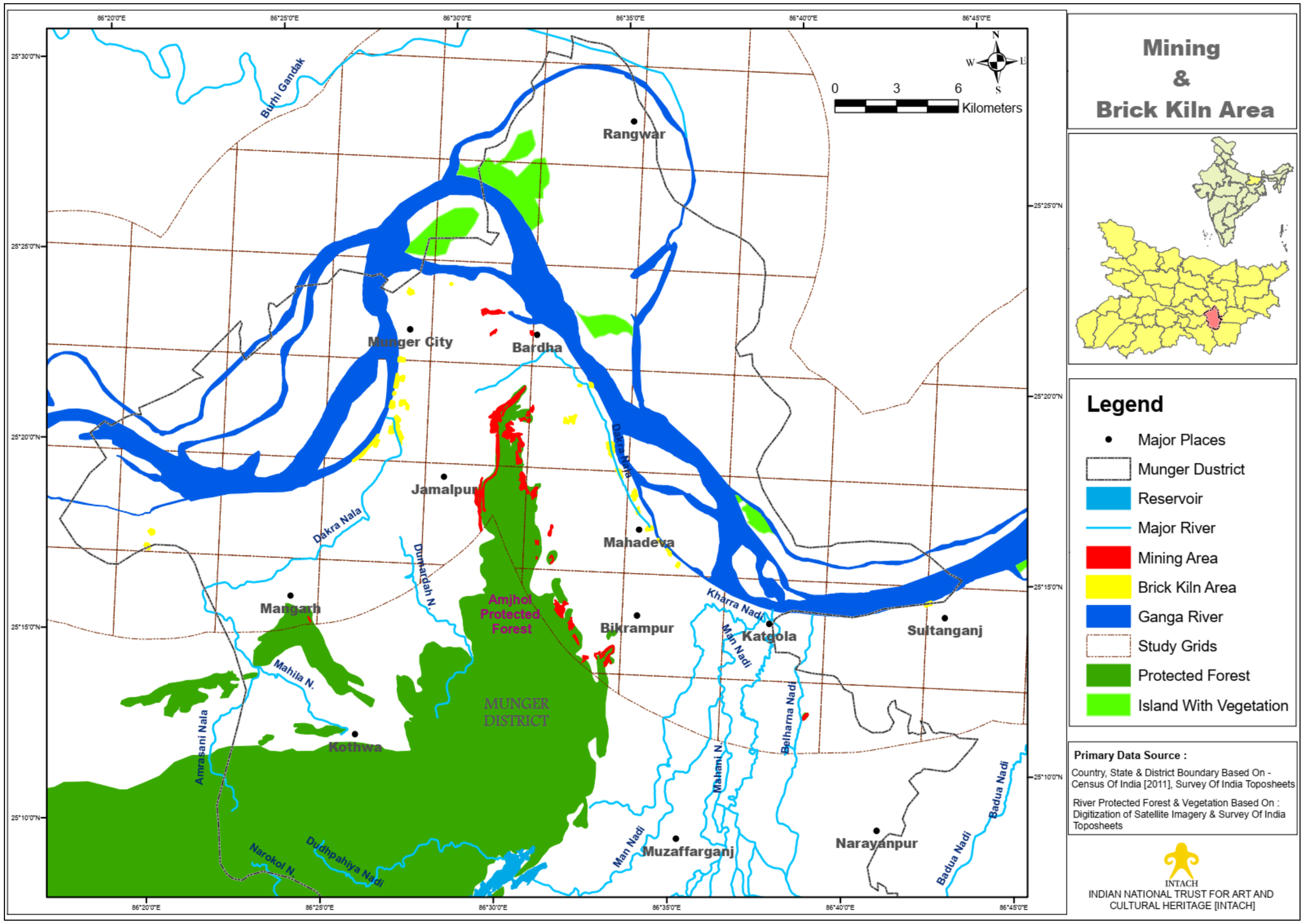
**16.3 Brick Kilns:** With rapid development bricks have become one of the important building materials for construction activities. Brick kilns in the study area provide livelihood opportunity to the local community. However, this industry has posed current and potential future threats to the soil, air, biota and water system of the region. The clay digging process deteriorates the soil quality and productivity of the soil because the bricks are made from the top soil. It has been found that brick kiln sites in floodplain areas increases the rate of soil erosion.

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

16.4 Brick kiln sites within Munger distt. is spatially distributed throughout the study area [Refer Map No. 11]. Major sites are located along Dakra Nala, Mahadeva Village and Ekashi Kala.

Image 67 : Cluster Of Brick Kilns Along Dakra Nala

Image 68 : Brick Kiln Along Ganga River Bank [Right Bank]




Map 11 : Mining And Brick Kilns In The Study Area

## 17.0 Boatmaking in Munger Distt.

17.1 Boat making is a popular and profit-making profession in Munger and nearby districts. Village carpenters belonging to *Badhai community* are generally under the profession of boat construction. Small sized boats are used only in wetlands. Medium sized to large sized boats having capacity of 30-40 to 100-120 people are used for ferry services. Boats are mainly made up of Sal (locally known as Sekhua) wood [*Shorea robusta*] and Jamun [*Syzygium cumini*] as it is very durable. However, the smaller dongis were also made from Babool [*Acacia nilotica*] and mango [*Mangifera indica*] wood. Iron boats, which are common and popular options in Uttar Pradesh is not in practice in eastern Bihar.

17.2 Boat making expenditures are same in Munger, Khagari and Begusarai District. Medium sized traditional boats cost around Rs.3, 00,000/- to Rs.4, 00,000/- While large sized boats costs upto 1, 00, 000/-. Construction of large sized boat requires atleast two months.

Image 69 : Repaired Fishing Boat At Ganga-Man Confluence

# 18.0 Inland Navigation in Munger Distt.

18.1 The stretch of Ganga River in Munger Distt. is a part of 1620 km long National Waterway [NW-1]. The waterway covers approximately 62.9 km within Munger District. Ganga-Bhagirathi-Hooghly River system from Allahabad to Haldia was declared as National Waterway No.1 vide National Waterway (Allahabad-Haldia stretch of the Ganga Bhagirathi-Hooghly River) Act 1982. It became operative from 27th Oct 1986 after the formation of the Inland Waterways Authority of India (IWAI)[10].

**18.2 Ferry Services :** Ferrying is a crucial livelihood activity of the Mallah community living in the villages on the banks of river Ganga. Historically, people of Mallah community in Munger Distt. have been ferrying passengers for generations. In current days, ferry service at most of the places is on lease. There are 8 sites reported in the study area where ferry services are available. There is one sites where ferry services were once operated is now stopped due to development of sand bar. Details of Ferrying sites are provided in the table no.15.

Table 15 : Details of Ferry Sites And Status Within The Study Area

| Sr. No. | Latitude | Longitude | Nearest Settlements | No. of Boat & Ferry Season |
|---|---|---|---|---|
| 01 | 25°18'4.14"N | 86°21'39.67"E | Between Durgapur and Bahadurnagar | October to June |
| 02 | 25°17'40.99"N | 86°20'29.24"E | Between Salarpur and Shivnagar | Ferrying stopped |
| 03 | 25°21'33.50"N | 86°27'53.00"E | Between Belwa Ghat and Riverine Island | Two-four Boats (October to June) |
| 04 | 25°22'2.60"N | 86°27'53.72"E | Between Kankar Ghat and Munger Ghat [Begusarai | 15-15 (October to June). Major site for sand transport |
| 05 | 25°22'25.48"N | 86°27'49.03"E | Between Sonjhi Ghat | Four –Six Boats |

[10] Inland Waterways Authority of India [Website Accessed December 2021] *https://iwai.nic.in/waterways/national-waterways/national-waterways-1?id=2523*

| | | | | |
|---|---|---|---|---|
| | | | and Rivernine Island/Munger Ghat | (October to June) |
| 06 | 25°22'57.46"N | 86°27'32.98"E | Between Kashtharni Ghat and Riverine Island [mainly tourism purpose] | Two-four Boats (October to June) |
| 07 | 25°23'14.13"N | 86°27'38.07"E | Between Munger Ghat [Munger Distt.] and Munger Ghat [Begusarai Distt.] | Eight-Twelve Boats (October to June) |
| 08 | 25°19'54.92"N | 86°35'19.30"E | Between Jhahwabahiyar and Munger Ghat and Sultanpur [Bhagalpur] | Four –Six Boats (October to June) |

Image 70 : Goods Loaded On Boats At Kankar Ghat

Image 71 : Ferrying At Munger Ghat

Image 72 : Boats Waiting For Tourists At Kashtharni Ghat

## 19.0 Sacred trees in Munger Distt.

19.1 Plant species *Ficus benghalensis* [Bargad], Ficus *religiosa* [Peepal], *Ficus virens* [Pakad] *Mangifera indica* [Aam], *Azadirachta indica* [Neem], *Phyllanthus emblica* [Awla] are considered as sacred and is found in association with ashrams, ghats, cremation sites and temple complexes across the study corridor. Out of all sacred trees, Ficus *religiosa* [Peepal] is most sighted species, generally found to be associated with temple. Peepal tree is also used to perform different rituals after cremation. Apart from the sacred trees, there are several old imli trees [*Tamarindus indica*] present at ghats and in villages.

Table 16 : Sacred And Old Trees

| Plant Species | Location and Nature of Tree | Coordinates | |
|---|---|---|---|
| | | Latitude | Longitude |
| Peepal *[Ficus religiosa]* | Janipur Village Sacred tree | 25.307542 | 86.420036 |
| Peepal *[Ficus religiosa]* | Barai Tola, Tree associated with temple | **25°19'03.1"N** | **86°26'32.4"E** |
| Peepal *[Ficus religiosa]* | Sandalpur, Tree located along road | **25°21'30.4"N** | **86°29'57.5"E** |
| Imli *[Tamarindus indica]* | Sandalpur, Tree associated with Hanuman Temple | **25°21'37.9"N** | **86°29'47.4"E** |
| Bargad *[Ficus benghalensis]* | Naugarhi | **25°20'53.7"N** | **86°31'30.4"E** |
| Peepal *[Ficus religiosa],* | Kashtarni Ghat, 100 years old tree | 25°44'00.4"N | 81°22'44.3"E |
| Peepal *[Ficus religiosa], Neem [Azadirachta indica],* Bargad *[Ficus benghalensis], Ficus virens* [Pakad], Imli *[Tamarindus indica],* | Trees scattered at different locations in Munger fort area | 25°22'56.19"N | 86°27'45.32"E |

| | | | |
|---|---|---|---|
| *Phyllanthus emblica* [Awla] | | | |
| Bargad *[Ficus benghalensis]* | Maa Chandika Asthan, Tree more than 200 years old | 25°23'32.0"N | 86°28'51.2"E |
| Imli *[Tamarindus indica]* | Shitalpur | 25°22'09.5"N | 86°31'25.7"E |
| Imli *[Tamarindus indica]* | Shitalpur | 25°22'05.5"N | 86°31'43.4"E |
| Peepal *[Ficus religiosa]* | Shitalpur | 25°22'07.0"N | 86°31'51.6"E |
| Peepal *[Ficus religiosa]*, *Neem [Azadirachta indica]*, Bargad *[Ficus benghalensis]*, *Ficus virens* [Pakad] | Sitakund Temple complex Group of sacred trees associated with temple | 25°22'5.09"N | 86°32'15.91"E |
| Peepal *[Ficus religiosa]* | Ekashi Tola, Sacred Teee | 25°17'16.1"N | 86°34'33.4"E |
| Peepal *[Ficus religiosa]* | Ekashi Tola, Old tree | 25°17'08.5"N | 86°34'38.6"E |
| Peepal *[Ficus religiosa]* | Mahadeva Village, Old tree of 100 years associated with village temple | 25°16'52.5"N | 86°34'50.4"E |
| Peepal *[Ficus religiosa]* | Ghorghat, Old tree of associated with Kali Temple | 25°14'35.25"N | 86°38'19.70"E |
| Peepal *[Ficus religiosa]* | Sacred tree associated with temple | 25°19'44.8"N | 86°29'29.4"E |
| Bargad *[Ficus benghalensis]* | Sacred tree associated with temple | 25°19'27.7"N | 86°29'32.1"E |
| Peepal *[Ficus religiosa]* | Sacred tree associated with temple | 25°19'18.7"N | 86°29'33.7"E |
| Bargad *[Ficus benghalensis]* | Old Banyan Tree | 25°19'08.7"N | 86°29'35.4"E |
| Bargad *[Ficus benghalensis]* | Jamalpur, old tree | 25°19'02.0"N | 86°29'43.4"E |

| | | | |
|---|---|---|---|
| Peepal *[Ficus religiosa]* | Jamalpur, old tree | 25°19'00.9"N | 86°29'41.7"E |
| Bargad *[Ficus benghalensis]* | Jamalpur, old tree | 25°18'48.4"N | 86°29'46.0"E |
| Bargad *[Ficus benghalensis]* | Water Filter Talab, Old tree | 25°18'33.0"N | 86°30'10.1"E |
| Peepal *[Ficus religiosa]* | Kali Pahadi Talab, Old tree | 25°18'44.77"N | 86°30'32.93"E |

Image 73 : Old Imli Tree In Shitalpur Village

Image 74 : Sacred Peepal Tree In Sita Kund Temple Complex

Image 75 : Old Banyan Tree Near Water Filter Talab, Jamalpur

## 20.0 Key Observation And Recommendations

**20.1 Fading of Stream/Nara :** Small stream/ Nala which directly drain within study area are under threat due to removal of riparian vegetation, agriculture activities on stream bank, brick kiln, high silt load and encroachment. Due to mentioned threats, two streams have completely faded while four are partially faded. Stream/Nala holds the vulnerable riparian zone, which protect from erosion, provides habitat to riparian fauna and serve as migratory routes to fish species in monsoon season. Disappearing of streams may damage local biota.

**20.2 Conversion of riparian vegetation into agricultural fields :** Products and finished products manufactured from Saccharum spp. are sources of income to the local communities. During the field visits, it has been reported that riparian vegetation area is under threat and is continuously decreasing. In some areas riparian zone is converted into agricultural fields. The newly developed agricultural fields accelerate the runoff and trigger lateral erosion. Lateral erosion is very prominent in Ghorghat and Narayanpur village.

**20.3** The bank at Ganga-Kiul confluence and Ganga-Man confluence is used for brick making processes. Some area especially Ganga-Dakra confluence which were covered with riparian grasses are now converted into agricultural fields. A National Highway which runs along Ganga River bank [Right Bank] throughout the district has provided easy access to the River Bank. This has resulted into decrease in riparian vegetation.

**20.4 Groundwater Conditions** : The study area is going through fluoride contamination. It is required to install community based fluoride removal plant to tackle the fluoride menace. Nalgounda technique may also a simple and effective technique.

**20.5 Cremation and Burial :** Cremation of dead bodies and immersion of their remains is reported throughout the stretch. Lack of cremation infrastructure, their maintenance and lack of awareness are reason behind such ongoing practices. Proper cremation infrastructure including the modern crematoria is required atleast at Ghorghat, Munger Ghat and Jhahwabahiyar Ghat. Proper site should be provided and area should be demarcated for burial.

**20.6 Threats to Wetlands :** Riverine wetlands at left bank of River Ganga is facing serious threat due to loss of riparian vegetation, high silt load, encroachment and conversion of wetland area into agricultural field. Wetlands in villages and city area are mostly under eutrophic condition. Wetland like Ram Kala Talab has been fragment into three parts due to construction of road and some of its area is encroached for construction activities. Below-mentioned points may be a path for the conservation of the wetlands in the study area :

- ❖ Inventory of wetlands should be maintained with the details highlighting the current land use, ownership and values of the wetland.
- ❖ There is a need of the hour to notify the riverine wetlands under the provisions of the Wetlands (Conservation and Management) Rules, 2017.
- ❖ A Comprehensive Management and Action Plan (CMAP) should be prepared for each wetland or group of wetlands. CMAP should focus on the ecological, hydrological, social, and economic and tourism aspects of the wetland.
- ❖ Local communities should be encouraged and their participation in wetland conservation should be fixed.
- ❖ Lease of wetland to fishermen community maybe an alternative to maintain water level.
- ❖ Forest department and concerned agencies should plant native riparian flora along the wetland.
- ❖ Developmental activities may be restricted at least 500 m from the riverine wetland area.

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