Arth Ganga Project: District Murshidabad

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National Mission for Clean Ganga (NMCG)

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EXECUTIVE SUMMARY

Murshidabad district, a centre for historians, agriculture, handicrafts and sericulture is located in the Indian state of West Bengal. Situated on the left bank of the river Ganges.

The total geographical area of the district is around 5,341 km^2. The primary sector contributes, on average, 36.02% to the district GDP with its share decreased from 41.74% in 2007-08 to 30.54% in 2013-14 and with an average annual growth rate from 2007-08 to 2013-14 to be 1.34. The share of the secondary sector increased from 16.62% in 2007-08 to 17.28% in 2013-14, with an annual growth rate of 7.22%. The tertiary sector grew with a remarkable annual growth rate of 10.48%, and its share in the total GDP increased from 41.64% in 2007-08 to 52.18% in 2013-14. Overall, the district economy grew by 6.49% annually during the study period.

The cropping intensity of the district is 240.68 %. Major crop types are rice, cereals, pulses, jute, along with oilseeds, etc. The livestock consists of cattle, buffalos, pigs, sheep goats, and fisheries. The total number of cattle increased from 1133 thousand in 2003 to 1200 thousand in 2019, a net increase of 5.91%. Total buffaloes decreased from 195 thousand in 2003 to 67 thousand in 2019, a net decrease of 65.84%. Total sheep decreased from 123 thousand in 2003 to 51 thousand in 2019, with a net decrease of 58.10%. Total goats went up from 1594 thousand in 2003 to 1751 thousand in 2019, with a net increase of 9.86%. Total pigs decelerated from 29 thousand in 2003 to 8.24 thousand in 2019, with a net decrease of 71.75%. Overall, the total livestock population went down from 30776.76 thousand in 2003 to 3077.53 thousand in 2019.

The share of cultivable wasteland and barren and uncultivable land decreased from 0.28% and 0.32% in 2011-12 to 0.04% and 0.24%, respectively in 2019-20. The fallow land has decreased went down over the years, from 0.21% in 2011-12 to 0.15% in 2019-20, which is good for the district economy. The net sown area increased over the years, from 74.23% in 2011-12 to 74.95% in 2019-20. The non-agricultural use area decreased from 24.58% to 24.02 in 2019-20. In 2019-20, the nitrogen share decreased to 56.15%, while the phosphorus and potassium share increased to 25.63% and 18.22%, respectively. As the overall use of chemical fertilizers has increased in the district from 111.16 kg/ ha GSA in 2013-14 to 137.85 kg/ ha GSA in 2019-20.

In 2021, forest cover of the district was 6.45% out of the total geographical area which is 5324 sq. km. With respect to 2019 forest assessment there has been decrease in the forest area of the district by 1.41 sq. km. The district has a total of 343.48 sq. km. under the forests out of which 52.33 sq. km. is under moderately dense forests and 291.15 sq. km under the open forests. The district does not has any land area under very dense forests. The area under trees and gardens also increased in 2019-20. There are 382 bird species and twenty threatened/rare species and two introduced species of bird in the district.

Murshidabad is an important district in the tourism map of West Bengal. Mosques, Tombs, Temples, Churches, Historical sites, Forest, Bird sanctuary and magnificent handicrafts make Murshidabad District a great tourist destination. The town still bears memories of Nawabs with mosques, tombs, and gardens, and retains such industries as carving in ivory, gold and silver embroidery and silk weaving. Of historic

interest are Nizamat Kila (the Fortress of the Nawabs) also known as the Hazaarduari Palace (Palace of a Thousand Doors), the Moti Jhil (Pearl Lake), the Muradbagh Palace and the Khushbagh Cemetery.

There are a total of 6845 natural and man-made wetlands of mainly lakes/ponds, oxbow/meanders and tanks/ponds type. Kerosene is the most important source of lightning in the state, with 63.90% of the households using it. Electricity is the next important source of lightning, with 34.60% of the total households dependent on it. Solar energy is used by 0.70% of the households. The type of fuel used by the households for cooking, 49.70% of the households use crop residue. Biogas potential from animal waste and agricultural waste was calculated approximately as three crore m^3/year and fourteen crores m^3/year. No hydropower plant exists, nor the site has been identified in the district.

The active measures should be taken to support and promote sustainable economy and development. The district lacks systematic tourism planning. There is a necessity for conservation / preservation of many historic exhibits, utilization of natural and anthropic resources, exploring of new destination, tagging of potential household industries and organized institutional initiatives. Various measures such as eco-tourism and afforestation should be taken to improve tourism and forest cover of the district and enhance the use of renewable energy especially by creating awareness. Use of micro-irrigation, technology, Vermicomposting, adopting greenhouse farming with organic farming, and encouraging farmers for adapting different crop cultivation and various irrigation methods. Along with focusing on agriculture practices Bee culture, poultry, fisheries, etc. needs encouragement as they have high economic potential. Promoting micro and small units for horticulture products processing, new technologies, such as Bioflock, etc.

1. DISTRICT OVERVIEW

1.1 INTRODUCTION

Murshidabad district is a district of in the Indian state of West Bengal. Situated on the left bank of the river Ganges, the district is very fertile. Covering an area of 5,341 km^2 (2,062 sq mi) and having a population 7.103 million (according to 2011 census), it is a densely populated district and the ninth most populous in India (out of 640). Baharampur city is the headquarters of the district. It is located between Latitude 240 50’20” N & 230 43’30” N & between 880 46’00”E and 870 49’17”E longitude. The Murshidabad city, which lends its name to the district, was the seat of power of the Nawabs of Bengal. All of Bengal was once governed from this town. A few years after Nawab Siraj-ud-Daula lost to the British at the Battle of Plassey, the capital of Bengal was moved to the newly founded city of Calcutta.

The last capital city of independent Bengal before British rule was named after Nawab Murshid Quli Khan, the Dewan of Bengal, Bihar and Odisha. Situated on the banks of the Bhagirathi, it is a city of

splendour and is famous for its silk. It was made the capital of Bengal in 1717. The British shifted the capital to Kolkata in 1773. Plassey (Palashi), where the historic battle was fought in 1757 between Nawab Siraj-ud-Doula and Lord Clive of the East India Company, is only 40 km south of Murshidabad. (*Murshidabad*, n.d.-a).

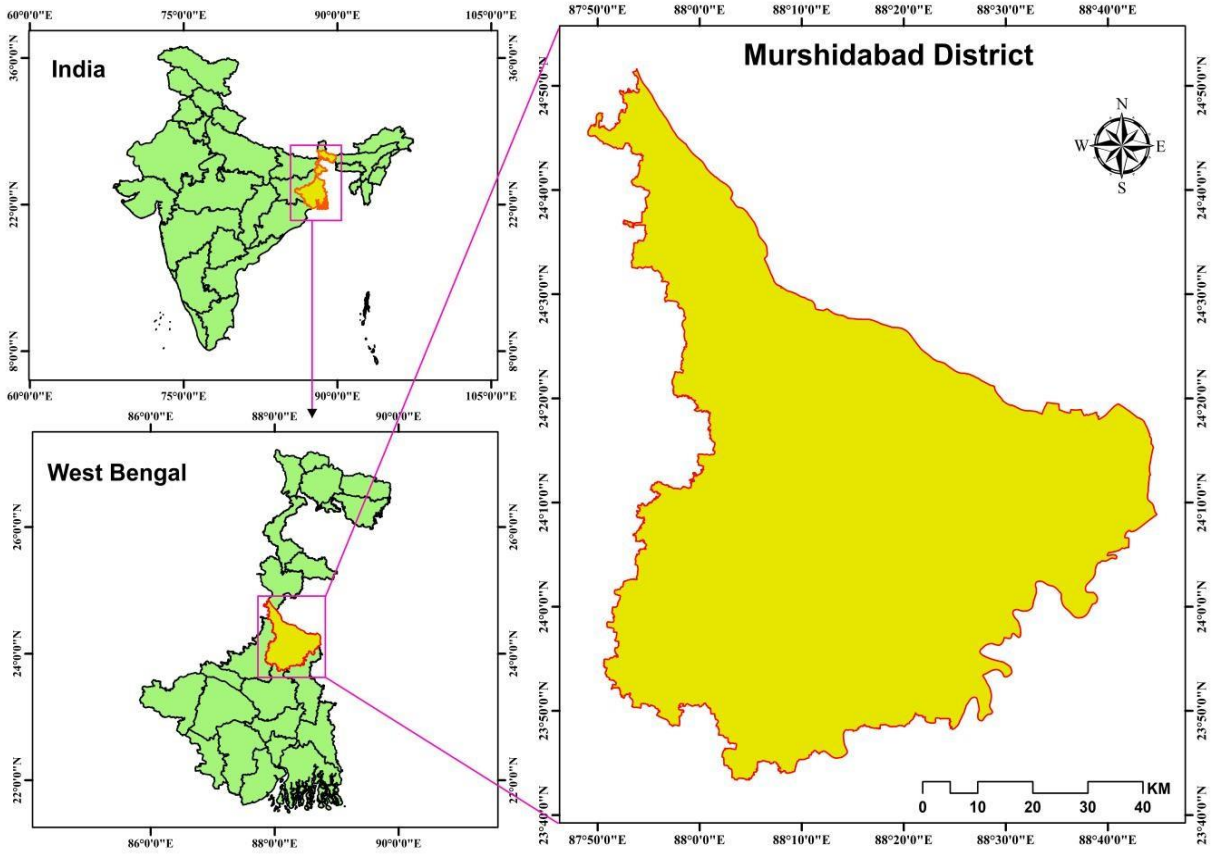


Figure 1 Map of the district

1.2 DEMOGRAPHIC PROFILE OF MURSHIDABAD

Murshidabad district is a densely populated district and the ninth most populous in India (out of 640). Baharampur city is the headquarters of the district. It borders Malda district to the north, Jharkhand's Sahebganj district and to the north-west, Birbhum to the west, Bardhaman to the south-west and Nadia district due south. The international border with Bangladesh's Rajshahi division is on the east. According to the 2011 census Murshidabad district has a population of 7,103,807.

The district comprises five subdivisions: Barhampur, Domkol, Lalbag, Kandi and Jangipur. Other than municipality area, each subdivision contains community development blocks which in turn are divided into rural areas and census towns. In total there are 29 urban units: 8 municipalities and 22 census towns. Baharampur and Kasim Bazar together form an urban agglomeration. There are 26 police stations 26 development blocks, 8 municipalities, 254 gram panchayats and 1937 villages in this district.

The entire district is belonging to plain region. The average height of the district is 300 metre. The river Bhagirathi, flowing from north to south through the district, which divides it into two equal portions.

Rice, jute, legumes, oilseeds, wheat, barley, and mangoes are the chief crops in the east; extensive mulberry cultivation is carried out in the west. The district is known for the quality and diversity of Mango produced. However, Mango is not a major produce of the Murshidabad district, unlike the adjoining district of Malda.

1.3 ECONOMIC PROFILE OF MURSHIDABAD

The primary sector significantly impacts the district economy because it contributes, on average, 36.02% to the district GDP. However, the average annual growth rate in this sector from 2007-08 to 2013-14 is 1.34% only. Its share in the total GDP decreased from 41.74% in 2007-08 to 30.54% in 2013-14 because other sectors grew faster than the primary sector. The share of the secondary sector increased from 16.62% in 2007-08 to 17.28% in 2013-14, with an annual growth rate of 7.22%. The tertiary sector grew with a remarkable annual growth rate of 10.48%, and its share in the total GDP increased from 41.64% in 2007-08 to 52.18% in 2013-14. Overall, the district economy grew by 6.49% annually during the study period. Steps should be taken to increase the productivity of the primary sector so that it can grow at a higher rate.

Table 1: Trends in Gross District Domestic product in Murshidabad at Constant Prices (base 2004-05), Millions in Rs.

Year	Sector-wise GDDP				Annual Growth Rates			
	Primary Sector	Secondary Sector	Tertiary Sector	Total GDDP	Primary Sector	Secondary Sector	Tertiary Sector	Total GDDP
2007	44654 (41.74)	17780 (16.62)	44541 (41.64)	106975 (100)	-	-	-	-
2008	42402 (39.03)	17281 (15.91)	48962 (45.07)	108645 (100)	-5.04	-2.81	9.93	1.56
2009	50157 (39.90)	19864 (15.80)	55674 (44.29)	125695 (100)	18.29	14.95	13.71	15.69
2010	45685 (35.62)	21226 (16.55)	61331 (47.82)	128242 (100)	-8.92	6.86	10.16	2.03
2011	45109	22448	67270	134827	-1.26	5.76	9.68	5.13

	(33.46)	(16.65)	(49.89)	(100)				
	45959	24275	73811	144045	1.88	8.14	9.72	6.84
2012	(31.91)	(16.85)	(51.24)	(100)				
	47371	26811	80955	155136	3.07	10.45	9.68	7.70
2013	(30.54)	(17.28)	(52.18)	(100)				
Average Growth Rate					1.34	7.22	10.48	6.49

Source: http://data.icrisat.org/district-level-data/
Note: Figures in Parenthesis are percentage share of total GDDP

2. Quantitative Data Analysis

2.1 Agriculture and Allied Activities

2.1.1 Trend in Land Use Pattern

The total declared area of the district is 5325.40 sq. km². The Forest area represents 0.15% of the total reported area. The share of cultivable wasteland decreased from 0.28% in 2011-12 to 0.04% in 2019-20, which is a good sign. Barren and uncultivable land share decreased from 0.32% in 2011-12 to 0.24% in 2019-20. The fallow land has decreased went down over the years, from 0.21% in 2011-12 to 0.15% in 2019-20, which is good for the district economy. Moreover, the net sown area (NSA) increased over the years, from 74.23% in 2011-12 to 74.95% in 2019-20. The non-agricultural use area decreased from 24.58% to 24.02 in 2019-20 (Table 2). The area under trees and gardens also increased in 2019-20. Overall, the land use pattern shows that the area under fallow land has decreased while the NSA increased over the years.

Table2: Trends in land use pattern in Murshidabad (as % of the total reported area)

Year	TOTAL REPORTED AREA (in 1000 Ha)	AREA UNDER FOREST	CULTIVABLE WASTELAND	TOTAL FALLOW	BARREN AND UNCULTIVABLE LAND	LAND OTHER THAN AGRICULTURE	AREA UNDER TREES AND GARDENS	NET SOWN AREA
1	2	3	4	5	6	7	8	9
2011	532.5	0.15	0.28	0.21	0.32	24.58	0.23	74.23
2012	532.5	0.15	0.24	0.11	0.30	24.60	0.21	74.38
2013	532.5	0.15	0.15	0.17	0.28	24.66	0.21	74.37
2014	532.5	0.15	0.09	0.17	0.28	24.51	0.28	74.55
2015	532.5	0.15	0.06	0.17	0.26	24.32	0.34	74.72
2016	532.5	0.15	0.04	0.15	0.24	24.22	0.39	74.78
2017	532.5	0.15	0.04	0.11	0.24	24.11	0.53	74.80
2018	532.5	0.15	0.06	0.13	0.24	24.06	0.47	74.93

2019	532.5	0.15	0.04	0.15	0.24	24.02	0.47	74.95
Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/								

2.1.2 Trends in Operational Land Holdings

In Murshidabad district, the total number of operational farms increased from 599 thousand in 2010-11 to 614 thousand in 2015-16, a net increase of 2.50%. While in the state, their numbers increased from 7123 thousand in 2010-11 to 7242 thousand in 2015-16, a net increase of 1.67%. Most land positions in the district are marginal and small. These two size categories represented around 96.80% in the district in 2015-16, while the corresponding proportion in the state was 96.22% (Table 3). The two agricultural censuses of 2010-11 and 2015-16 show a decline in the percentage share across the small, semi-medium, and medium land holding and an increase in the share of the marginal land holdings.

Table3: Distribution of Operational Holdings by Size-categories of farms (in %) in Murshidabad

	Agri Census	Marginal Holdings (0-1 Ha)	Small Holdings (1-2 Ha)	Semi-Medium Holdings (2-4 Ha)	Medium Holdings (4-10 Ha)	Large Holdings (10 & above Ha)	Total Holdings ('000 No.)
Murshidabad	2010-11	81.47	15.15	3.22	0.15	0.01	599
	2015-16	82.03	14.77	3.1	0.09	0.01	614
							[2.50]
West Bengal	2010-11	82.16	13.76	3.75	0.32	0.01	7123
	2015-16	82.81	13.41	3.53	0.24	0.01	7242
							[1.67]
Source: Compiled from https://agcensus.nic.in/. Figures in [] are percentage increase/ decrease in 2015-16 over 2010-11.							

2.1.3 Trends in Area, Production, and Yield of Principal Crops

2.1.3.1 The Trend in Cropping Patterns

Rice dominates the agriculture of the district. Table 4 shows the area devoted to various crops over the last seven years. In 2019-20, Rice made up the highest share of GCA (33.92%), followed by Wheat (5.46%). These two crops constituted around 39.38% of the GCA in 2019-20. The area shared by the total cereals decreased from 49.98% in 2013-14 to 45.02% in 2019-20. The main pulses produced are black gram, Masoor and khesari. The total pulses acreage went up from 5.69% in 2013-14 to 9.00% in 2019-20. The total food grain acreage decreased slightly from 55.67% in 2013-14 to 54.02% in 2019-20. Moreover, the food grains cover a majority (average, 57.84%) of the GCA. Mustard is the only major oilseeds crop produced, and the total oilseed acreage has increased from 11.55% in 2013-14 to 14.14% in 2019-20. Jute is a major fiber crop of West Bengal, and Murshidabad is one of the prime districts that grows Jute. However, area shared by Jute decreased from 16.74% in 2013-14 to 15.07% in 2019-20. In general, there was no significant change in the cultivation pattern reported in the district during the study period. The

average cropping intensity is 240.68, indicating that the farmers are practicing an intensive farming system.

Table 4: Trends in cropping pattern (as % GSA) and cropping intensity

Crop/Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Rice	37.98	38.80	38.03	38.18	39.05	37.80	33.92
Wheat	11.30	11.07	11.67	10.79	11.13	11.27	5.46
Other Cereals	0.70	0.82	0.73	1.31	1.49	2.18	5.64
Total Cereals	49.98	50.70	50.43	50.28	51.67	51.24	45.02
Black gram (urad)	2.10	2.02	1.98	2.20	2.38	2.52	2.10
Masoor (Lentil)	1.70	1.78	2.46	2.10	4.29	4.51	3.79
Khesari (Lathyrus)	1.00	0.97	2.38	0.88	1.64	1.75	1.38
Other Pulses	0.89	0.90	1.24	1.36	1.75	1.76	1.73
Total Pulses	5.69	5.67	8.06	6.54	10.06	10.54	9.00
Total Food Grains	55.67	56.37	58.49	56.82	61.73	61.78	54.02
Mustard	9.44	9.35	9.45	9.37	13.74	13.55	11.78
Other Oilseeds	2.10	2.27	2.17	2.29	2.53	2.28	2.36
Total Oilseeds	11.55	11.62	11.63	11.66	16.27	15.83	14.14
Jute	16.74	16.34	14.81	15.76	16.48	16.67	15.07
Net Sown Area	42.89	41.91	39.51	40.51	42.33	42.56	41.35
Gross Sown Area (in 1000 Ha)	923.3	947.2	1007.1	983.1	941.0	937.4	965.2
Cropping Intensity	233.16	238.59	253.10	246.87	236.25	234.94	241.84

Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/

2.1.3.2 Trends in per hectare yield of principal crops

Table 5 shows that the yield per hectare of most crops varies yearly. Rice and Wheat are the major crops in the district, and their per hectare yield, 30.60 qtls and 25.90 qtls, respectively, in 2019-20, are quite low. The per hectare yield of total cereals increased from 31.04 qtls in 2013-14 to 34.34 qtls in 2019-20. On the other hand, the per hectare yield of total pulses decreased from 10.21 qtls in 2013-14 to 9.52 qtls in 2019-20. The yield of total oilseeds slightly decreased from 10.77 qtls in 2013-14 to 10.64 qtls in 2019-20. The yield of Jute went up from 26.62 qtls in 2013-14 to 27.20 qtls in 2019-20. Moreover, the yield of total food grains increased from 28.91 qtls in 2013-14 to 30.20 qtls in 2019-20. In summary, all crop yields show yearly fluctuations. The instability in yields makes farmers' income riskier and more unstable, requiring a solid insurance protection measure.

Table 5: Trends in yield of Principal Crops in Murshidabad District (in Qtl per Ha)

Crop/Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Rice	31.84	32.39	32.83	32.93	32.06	30.16	30.60
Wheat	27.64	28.65	18.49	26.37	25.00	27.36	25.90

Total Cereals	31.04	31.84	29.69	31.90	30.78	30.49	34.34
Black gram (urad)	8.66	8.22	8.74	8.89	7.54	7.71	7.44
Masoor (Lentil)	10.32	11.48	4.64	10.44	12.03	8.30	8.96
Khesari (Lathyrus)	11.20	8.91	6.58	12.07	9.03	8.41	9.85
Total Pulses	10.21	10.20	6.42	10.06	10.84	8.69	9.52
Total Food Grains	28.91	29.66	26.49	29.39	27.53	26.77	30.20
Mustard	11.00	11.77	11.76	13.16	12.94	11.81	11.95
Total Oilseeds	10.77	11.33	11.01	12.26	12.25	11.43	10.64
Jute	26.62	25.87	24.91	29.91	24.33	23.72	27.20
Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/							

2.1.3.3 Trends in Production of Principal Crops

Table 6 shows the trends in the production of the main crops over the years. Rice and Wheat dominate the production. In 2019-20, Rice (1001.90 thousand tonnes) and Wheat (136.5 thousand tonnes) formed a major part of the total cereal production (1492.00 thousand tonnes). Moreover, there is an increase in the production of total cereals from 1432.5 thousand tons in 2013-14 to 1492.00 thousand tons in 2019-20. Coming to pulses, Masoor, black gram, and khesari occupied the highest production, with 32.8 thousand tons, 15.1 thousand tons, and 13.1 thousand tons, respectively, in 2019-20. Although these pulses show variation in production across years, they still represent 73.76% of the total pulse production. Mustard production was 135.9 thousand tons, representing 93.53% of the total oilseed production in 2019-20. Jute production decreased from 411.5 thousand tons to 395.8 thousand tons, over the years. Looking at the annual production data of various crops, we find that the production of total cereals, pulses, and oilseeds increased, which can be further increased by providing proper insurance arrangements so that farmers can take more risks and diversify their production.

Table 6: Trends in Production of Principal Crops in Murshidabad District (in 1000 Tons)

Crop/Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Rice	1,116.70	1,190.50	1,257.30	1,235.70	1,178.20	1,068.50	1,001.90
Wheat	288.3	300.5	217.3	279.8	261.8	288.9	136.5
Other Cereals	27.50	37.90	33.60	61.40	56.60	106.90	353.60
Total Cereals	1432.5	1,528.90	1,508.20	1,576.90	1,496.60	1,464.30	1,492.00
Black gram (urad)	16.8	15.7	17.4	19.2	16.9	18.2	15.1
Masoor (Lentil)	16.2	19.4	11.5	21.5	48.6	35.1	32.8
Khesari (Lathyrus)	10.3	8.2	15.8	10.5	13.9	13.8	13.1
Other Pulses	10.3	11.5	7.4	13.5	23.3	18.8	21.7
Total Pulses	53.6	54.8	52.1	64.7	102.7	85.9	82.7
Total Food Grains	1486.1	1583.7	1560.3	1641.6	1599.3	1550.2	1574.7
Mustard	95.9	104.3	112	121.2	167.3	150	135.9
Other Oilseeds	18.9	20.4	16.9	19.3	20.2	19.6	9.4
Total Oilseeds	114.8	124.7	128.9	140.5	187.5	169.6	145.3
Jute	411.5	400.5	371.7	463.3	377.4	370.7	395.8
Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/							

2.1.3.4 Variability assessment in the area, production, and yield

To understand the variability across the years (Table 7), we calculated the mean, standard deviation (SD), and coefficient of variation (COV) of the area, production, and yield of the main crops. Among different crops, the lowest variability in the area is observed in Rice (5.13%), followed by black gram (8.03%) and Mustard (17.42%), and the highest in Masoor (40.23%). The variability in the area under jute is 2.61%. The variability in the area under total pulses (25.20%) is much higher than in the area under total cereals (4.98%).

Table 7: Variability in Area, Production, and Yield of Principal Crops (2013-14 to 2019-20)

	Area (1000 Ha)			Production (1000 Ha)			Yield (Qtl/Ha)		
Crop	**Average**	**SD**	**COV**	**Average**	**SD**	**COV**	**Average**	**SD**	**COV**
Rice	360.81	18.50	5.13	1149.83	92.18	8.02	31.83	1.07	3.36
Wheat	99.40	21.11	21.24	253.30	58.36	23.04	25.63	3.37	13.14
Total Cereals	477.84	23.81	4.98	1499.91	46.05	3.07	31.44	1.49	4.74
Black gram (urad)	20.90	1.68	8.03	17.04	1.40	8.22	8.17	0.61	7.45
Masoor (Lentil)	28.19	11.34	40.23	26.44	12.96	49.03	9.45	2.49	26.36
Khesari (Lathyrus)	13.74	5.51	40.07	12.23	2.64	21.56	9.44	1.82	19.26
Total Pulses	76.01	19.16	25.20	70.93	19.69	27.76	9.42	1.49	15.77
Total Food Grains	553.86	30.75	5.55	1570.84	47.81	3.04	28.42	1.48	5.21
Mustard	104.73	18.25	17.42	126.66	25.73	20.32	12.06	0.75	6.20
Total Oilseeds	126.63	19.07	15.06	144.47	25.86	17.90	11.38	0.66	5.76
Jute	152.91	3.99	2.61	398.71	32.46	8.14	26.08	2.09	8.02

Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/

The variability of production depends on the variability of the cultivated area and the variability of the yield. The highest variability in production is observed in Masoor (49.03%), followed by Wheat (23.04%) and khesari (21.56%). The variability in the production of total oilseeds is 17.90%. The variability in Jute production is 8.14%. Improvement in crop insurance conditions and better market accessibility can lower this variation. Variability is lowest in Rice (8.02%) and in black gram (8.22%).

In the case of yield, the highest variability is estimated in Masoor (26.36%), followed by Khesari (19.26%), and Wheat (13.14%). The variability in yield of jute is 8.02%. Yield variability in total pulses (15.77%) is much higher than in total cereals (4.74%). Several factors, such as climate change, market prices, rainfall patterns, etc., influence the variability in agricultural production.

2.1.4 Consumption of Chemical Fertilizers

Table 8 shows the trends in the use of chemical fertilizers in agriculture. The recommended nitrogen to phosphorus and potassium ratio is 4:2:1, which is not maintained in the district. For example, in 2013-14, nitrogen represented 68.33% of the total fertilizers used, while the proportions of phosphorus

and potassium were 18.01% and 13.65%, respectively. In 2019-20, however, the nitrogen share decreased to 56.15%, while the phosphorus and potassium share increased to 25.63% and 18.22%, respectively. The use of nitrogen and potassium is more than the recommended ratio, while the Phosphorous usage is less than the recommended ratio. The table also shows that fertilizer consumption varies across years, which can be due to several factors such as rainfall patterns, cultivation patterns, etc. As the overall use of chemical fertilizers has increased in the district from 111.16 kg/ ha GSA in 2013-14 to 137.85 kg/ ha GSA in 2019-20, steps need to be taken to reduce their consumption as the chemicalization of agriculture degrades soils and water resources. There is a need to incentivize the farmers to use organic and bio fertilizers.

Table 8: Trends in Use of Chemical Fertilizers in Agriculture (Kgs/per ha GSA)

Fertilizer/Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Nitrogen	75.96	80.18	81.84	78.94	78.06	81.90	77.40
Phosphorous	20.02	30.16	36.48	33.89	38.86	37.79	35.33
Potassium	15.17	19.82	20.86	22.08	27.38	27.75	25.12
Total	111.16	130.15	139.18	134.90	144.30	147.44	137.85
GSA (1000 Ha)	923.3	947.2	1,007.10	983.1	941	937.4	965.2

Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/

2.1.5 Trends in Livestock Sector

The total number of cattle increased from 1133 thousand in 2003 to 1200 thousand in 2019, a net increase of 5.91%. However, the adult male cattle population decreased from 367 thousand to 81 thousand during the same period. The increase in total cattle has been due to an increase in adult female cattle (from 326 thousand to 438 thousand) and young cattle (from 440 thousand to 681 thousand). Cattle represent around 92.3% of the total large ruminants. Moreover, cattle's share in large ruminants went up from 85.28% in 2003 to 94.73% in 2019. On the other hand, total buffaloes decreased from 195 thousand in 2003 to 67 thousand in 2019, a net decrease of 65.84%. Buffaloes represent 7.7% of the total large ruminants. Total sheep decreased from 123 thousand in 2003 to 51 thousand in 2019, with a net decrease of 58.10%. Total goats went up from 1594 thousand in 2003 to 1751 thousand in 2019, with a net increase of 9.86%. Total pigs decelerated from 29 thousand in 2003 to 8.24 thousand in 2019, with a net decrease of 71.75%. Overall, the total livestock population went down from 30776.76 thousand in 2003 to 3077.53 thousand in 2019.

Notably, the number of female cattle substantially increased over the period, indicating the growth of livestock products, including milk. The substantial decline in the number of male cattle and male buffaloes also shows the rising farm mechanization and declining relevance of animal power, mainly because of the high maintenance cost of livestock.

Table 9: Trends in Livestock population (in 1000 numbers) in Murshidabad

Category	2003	2007	2012	2019
CATTLE TOTAL	1132.82	1331.15	951.33	1199.82
CATTLE ADULT MALE	366.67	181.56	117.8	80.99

CATTLE ADULT FEMALE	325.72	463.2	368.74	437.83
CATTLE YOUNG TOTAL	440.44	686.4	464.8	681
CATTLE SHARE IN LARGE RUMINANT (Percent)	85.28	94.65	94.54	94.73
BUFFALO TOTAL	195.53	75.28	54.93	66.78
BUFFALO ADULT MALE	110.48	42.84	25.61	18.66
BUFFALO ADULT FEMALE	46.47	14.55	15.04	18.67
BUFFALO YOUNG TOTAL	38.58	17.89	14.28	29.46
BUFFALO SHARE IN LARGE RUMINANT (Percent)	14.72	5.35	5.46	5.27
SHEEP TOTAL	122.75	117.69	61.26	51.42
SHEEP SHARE IN SMALL RUMINANT (Percent)	7.15	5.56	5.34	2.85
GOATS TOTAL	1593.96	1997.15	1085.1	1751.28
GOATS SHARE IN SMALL RUMINANT (Percent)	92.85	94.44	94.66	97.15
PIGS TOTAL	29.17	22.66	11.79	8.24
LIVESTOCK TOTAL	3077.76	3545.19	2165.16	3077.53
Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/				

2.1.6 Trends in Milk Production

Table 10 shows the trends in Milk Production in Murshidabad over the years. Cow milk has the largest share in milk production. However, cow milk production significantly decreased by 33.33% from 2011-12 to 2015-16. Buffalo milk production decreased from 20 thousand tons in 2011-12 to 19 thousand tons in 2015-16. Moreover, the total milk production went down from 563 thousand tons in 2011-12 to 381 thousand tons in 2015-16, majorly due to a decrease in cow milk production. There is a need to incentivize dairy farming to improve the cattle and buffaloes' milking capacity.

Table10: Trends in Milk Production (1000 tons)

Source/Year	2011	2012	2013	2014	2015
TOTAL COW MILK PRODUCTION	543	572	582	455	362
TOTAL BUFFALO MILK PRODUCTION	20	21	22	20	19
TOTAL MILK PRODUCTION	563	593	604	475	381
Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/					

2.1.7 Trends in Fishery Production

Table 11 shows the trends in Fish Production in Murshidabad as compared to the total fish production in West Bengal. Fish Production was 78734 tons in 2011-12 in Murshidabad which increased to 113147 tons in 2014-15. Murshidabad represented 5.34% of the total fish production in West Bengal in 2011-12. Moreover, its share increased to 6.99% in 2014-15.

Table11: Trends in fish production (in tons) in Murshidabad

District/Year	2011-12	2012-13	2013-14	2014-15
Murshidabad	78734	79680	103062	113147
West Bengal	1472069	1488811	1580647	1617319
Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/				

2.2 FORESTRY

Baseline Data

According to the Forest Survey 2021, the total Forest Cover in the State is 16831.87 sq km which is 18.96 % of the State's geographical area. The state has 3036.51 sq. km. under very dense forests, 4208.37 sq. km. under moderately dense forests and 9586.99 sq. km. under open forests. In recent years, massive plantation programs have been taken up in the State to increase the forest & tree cover.

According to the 2021 Forest survey, forests cover of the district is 6.45% out of the total geographical area which is 5324 sq. km. With respect to 2019 forest assessment there has been decrease in the forest area of the district by 1.41 sq. km.

The district has a total of 343.48 sq. km. under the forests out of which 52.33 sq. km. is under moderately dense forests and 291.15 sq. km under the open forests. 0.12 sq. km. of the area of the district is under the scrubs. The district does not has any land area under very dense forests (Fig. 1).

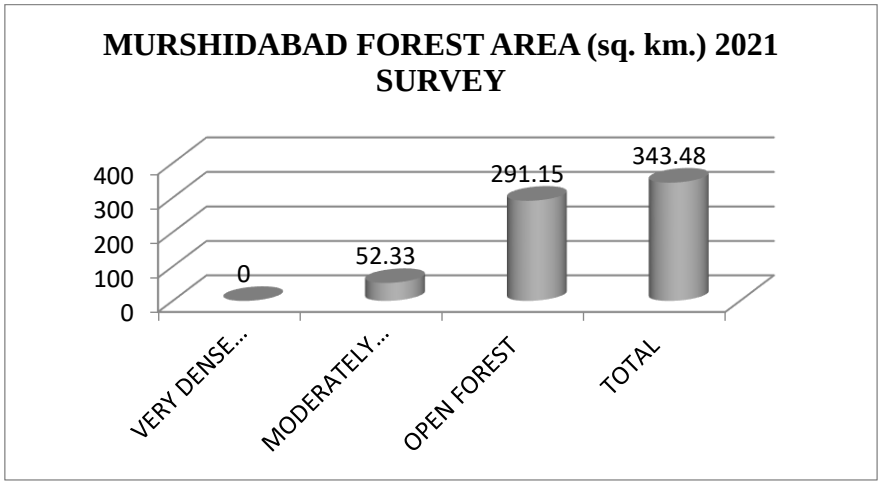


Fig. 1

The district has 800 ha of cultivable wasteland, 300 ha of land as current fallow and 10 ha under other fallow.

2.2.1. Biodiversity

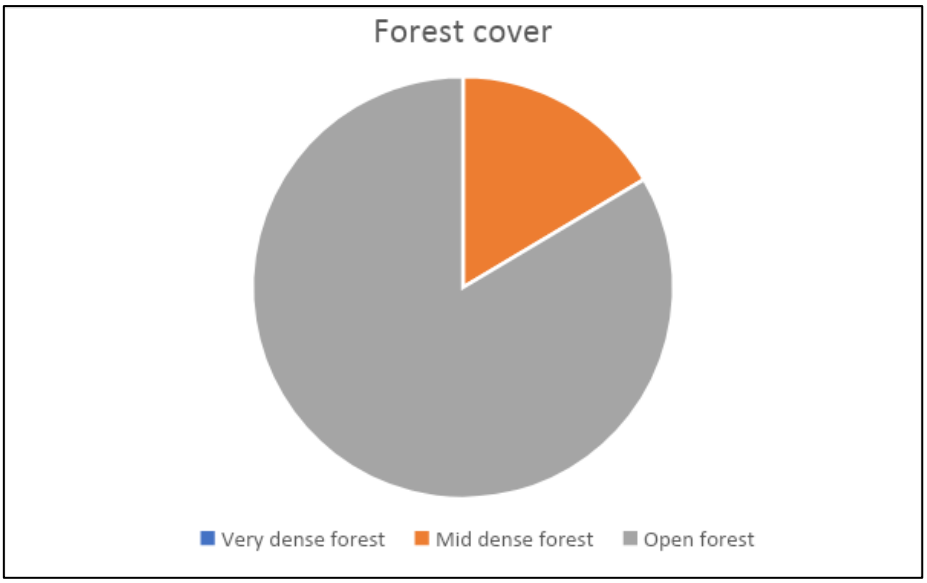
The district's biodiversity data includes various crop production, livestock population, bird species, and forest cover. The crop production trend shows an increase in crop production. Forest data shows that forest cover was decreased by 1.11 % in 2019. There are 382 bird species and twenty threatened/rare species and two introduced species of bird in the district.

Table 1 Bird species recorded in the district.

Number of species	382
Number of rare/accidental species	20

Table 2 Forest cover in a square kilometer.

Geographical area	Very dense forest	Mid dense forest	Open forest	Total	% of Geographical area `	Change with respect to 2017 assessment	Scrub
5324	0	53.06	291.83	344.89	6.48	-1.11	0



2.3 TOURISM

WEST BENGAL: YEAR WISE TOURIST ARRIVALS (2001 TO 2020)

Table: 1 West Bengal Year Wise Tourists Arrivals (2001 to 2020)

Year	Domestic	Growth	Foreign	Growth	Total	Overall Growth
2001	4943097	0.00%	284092	0.00%	5227189	0.00%
2002	8844232	78.92%	529366	86.34%	9373598	44.23%
2003	11300763	27.78%	705457	33.26%	12006220	21.93%
2004	12380389	9.55%	775694	9.96%	13156083	8.74%

2005	13566911	9.58%	895639	15.46%	14462550	9.03%
2006	15808371	16.52%	998029	11.43%	16806400	13.95%
2007	18580669	17.54%	1154770	15.71%	19735439	14.84%
2008	19314440	3.95%	1133671	-1.83%	20448111	3.49%
2009	20528534	6.29%	1180418	4.12%	21708952	5.81%
2010	21072324	2.65%	1192187	1.00%	22264511	2.50%
2011	22256968	5.62%	1213270	1.77%	23470238	5.14%
2012	22730205	2.13%	1219610	0.52%	23949815	2.00%
2013	25547300	12.39%	1245230	2.10%	26792530	10.61%
2014	49029590	91.92%	1375740	10.48%	50405330	46.85%
2015	70193450	43.17%	1489500	8.27%	71682950	29.68%
2016	74460250	6.08%	1528700	2.63%	75988950	5.67%
2017	79630345	6.94%	1574915	3.02%	81205260	6.42%
2018	85657365	7.57%	1617105	2.68%	87274470	6.95%
2019	92366025	7.83%	1656145	2.41%	94022170	7.18%
2020	28841732	-68.77%	463285	-72.03%	29305017	-220.84%

Source: Data Compiled from Tourism Report of India

Figure: 1 West Bengal: Year Wise Tourists Arrivals (2001 to 2020)

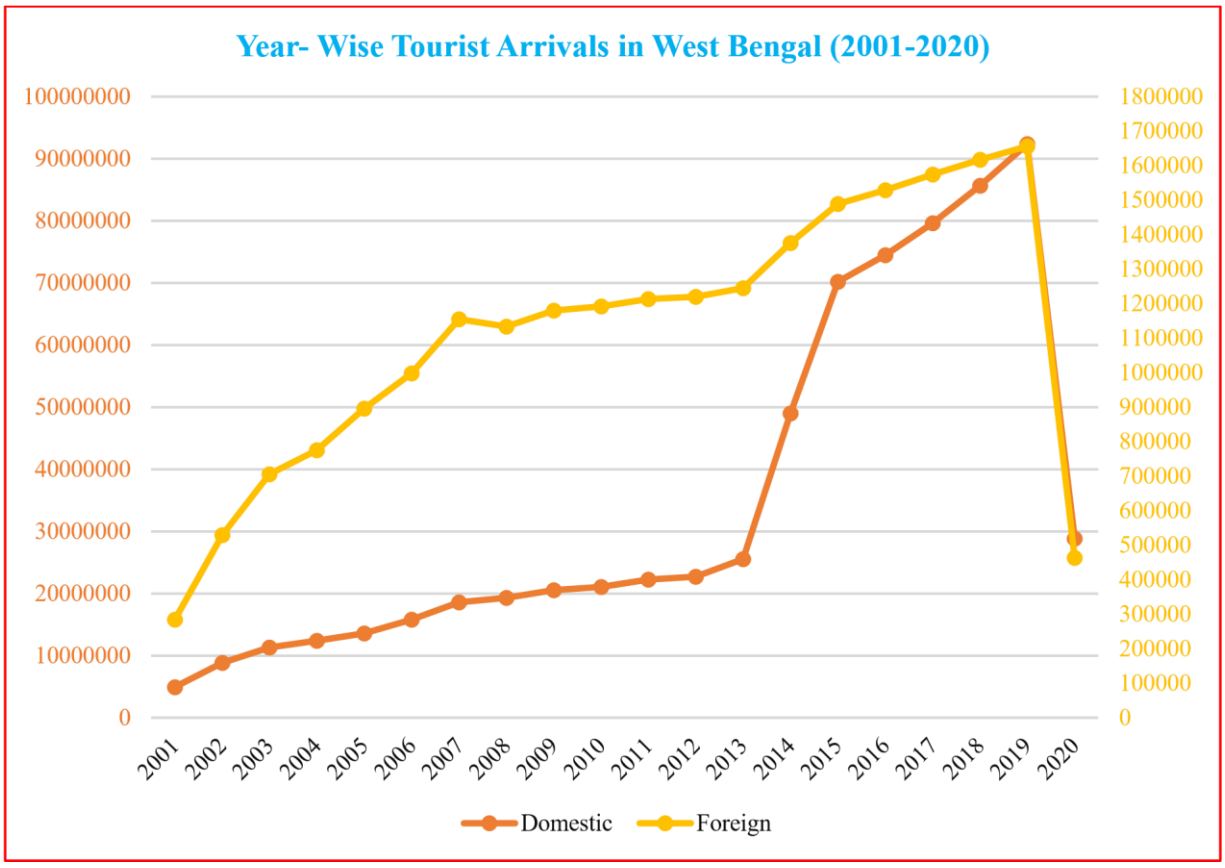


Figure: 2 West Bengal: Year Wise Domestic Tourists Arrivals (2001 to 2020)

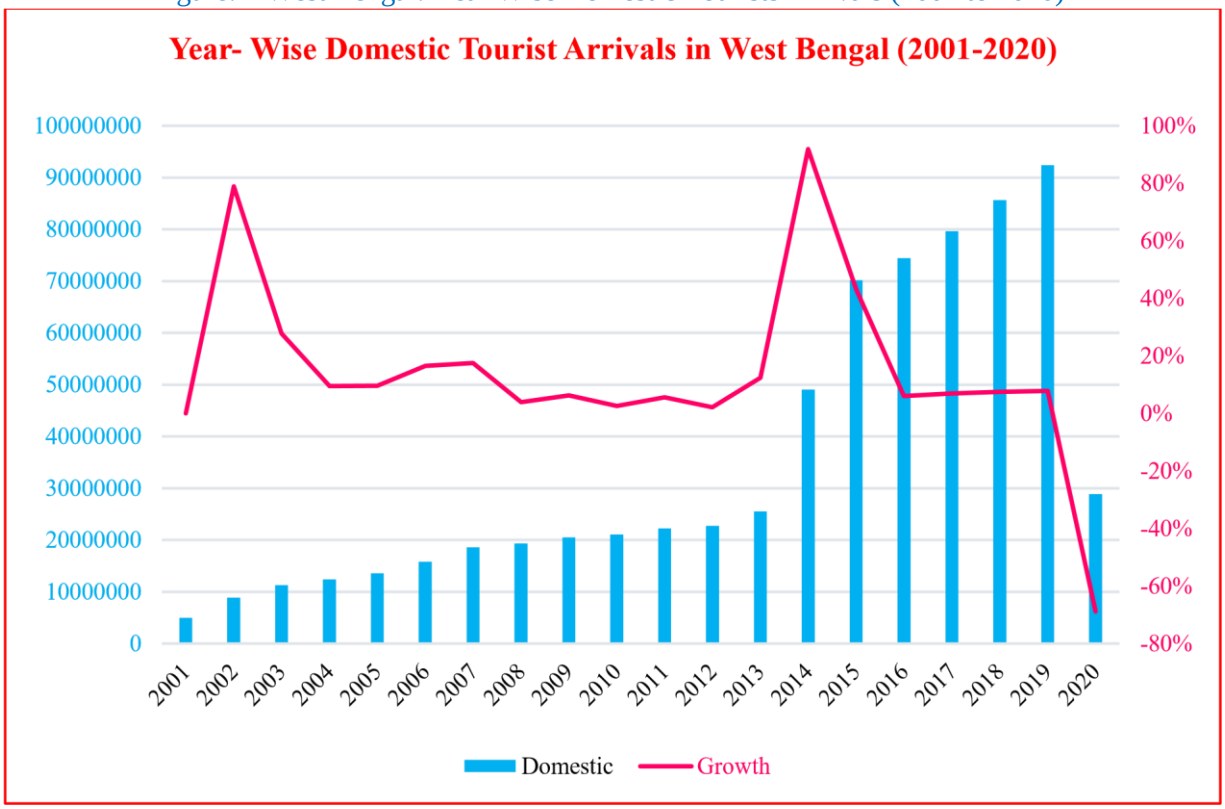


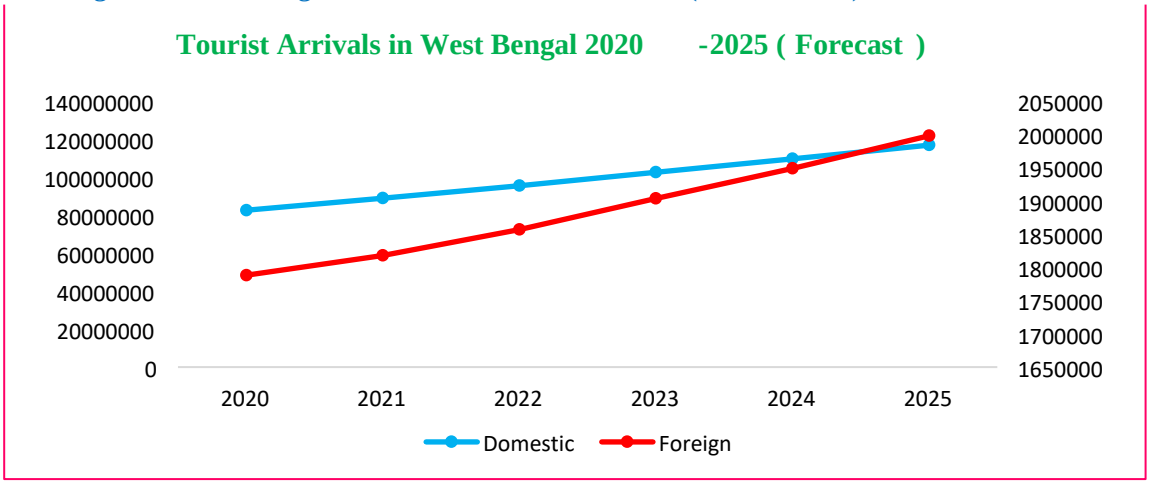
Figure: 3 West Bengal: Year Wise Foreign Tourists Arrivals (2001 to 2020)

Table: 2 West Bengal: Year Wise Tourists Arrivals (2020 to 2025) Forecast

Year	Domestic	Foreign	Total
2020	82494891	1788061	84282952
2021	88746279	1817462	90563741
2022	95432278	1856789	97289067
2023	102425745	1903421	104329166
2024	109548115	1948298	111496413
2025	116735901	1997568	118733469

- *Source: Data Compiled from Tourism Report of India*

Figure: 4 West Bengal: Year Wise Tourists Arrivals (2020 to 2025) Forecast



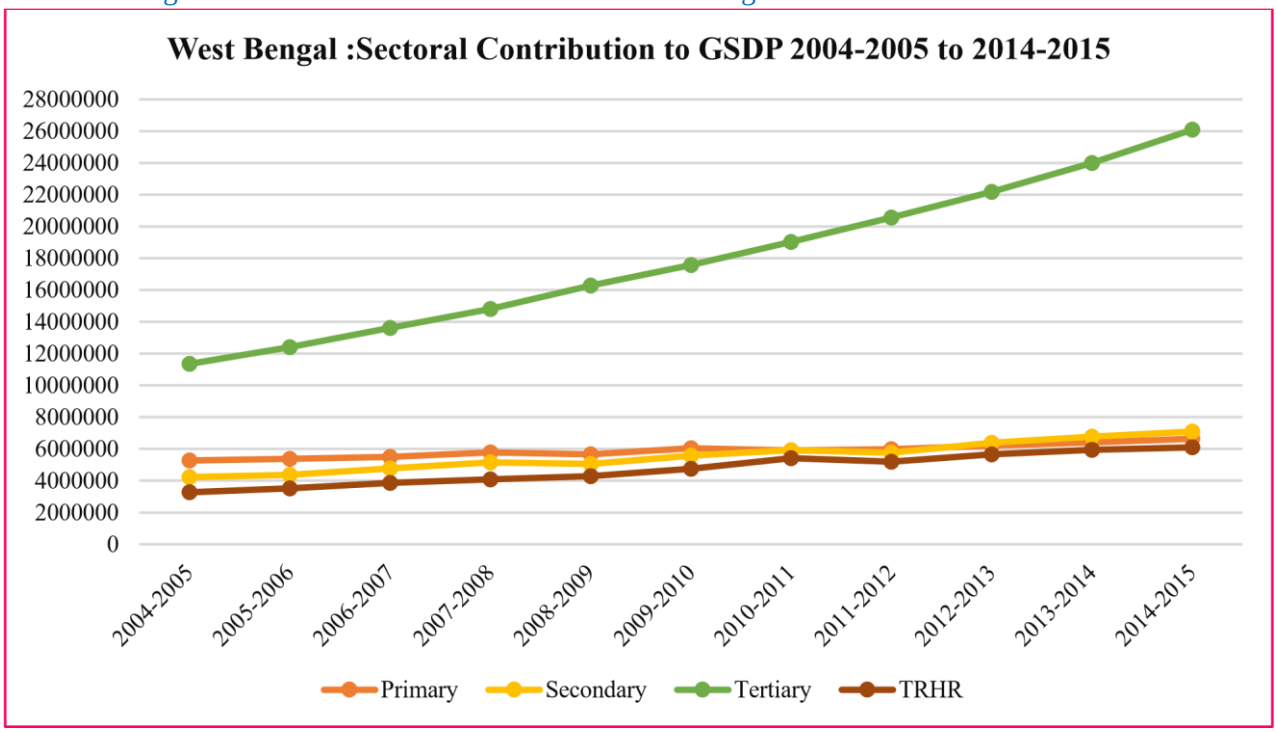
WEST BENGAL: SECTORAL CONTRIBUTION TO GSDP (2004-2005 TO 2014-2015)

Table: 3 Sectoral Contribution to GSDP West Bengal 2004-2005 to 2014-2015

Year	Primary	Secondary	Tertiary	TRHR as % of Tertiary
2004-2005	5278473 (25.30%)	4234524 (20.29%)	11352639 (54.41%)	3273915 (28.84%)
2005-2006	5390443 (24.30%)	4382665 (19.76%)	12405838 (55.94%)	3532336 (28.47%)
2006-2007	5511599 (23.05%)	4776433 (19.98%)	13619680 (56.97%)	3871373 (28.42%)
2007-2008	5796117 (22.50%)	5163277 (20.04%)	14803824 (57.46%)	4091828 (27.64%)
2008-2009	5673653 (20.99%)	5060784 (18.73%)	16290389 (60.28%)	4295703 (26.37%)
2009-2010	6048283 (20.72%)	5577042 (19.10%)	17570171 (60.18%)	4751684 (27.04%)
2010-2011	5913982 (19.15%)	5930348 (19.20%)	19039375 (61.65%)	5429283 (28.52%)
2011-2012	5993306 (18.53%)	5773705 (17.85%)	20574687 (63.62%)	5429283 (25.30%)
2012-2013	6205056 (17.84%)	6394459 (18.39%)	2217868 (63.77%)	5205976 (25.52%)
2013-2014	6404277 (17.23%)	6776865 (18.24%)	23995362 (64.54%)	5658897 (24.82%)
2014-2015	6645064 (16.68%)	7099285 (17.82%)	26094302 (65.50%)	6102731 (23.39%)

Source: Data Compiled from Department of Planning & Statistics, Govt. of West Bengal

Figure: 5 Sectoral Contribution to GSDP West Bengal 2004-2005 to 2014-2015



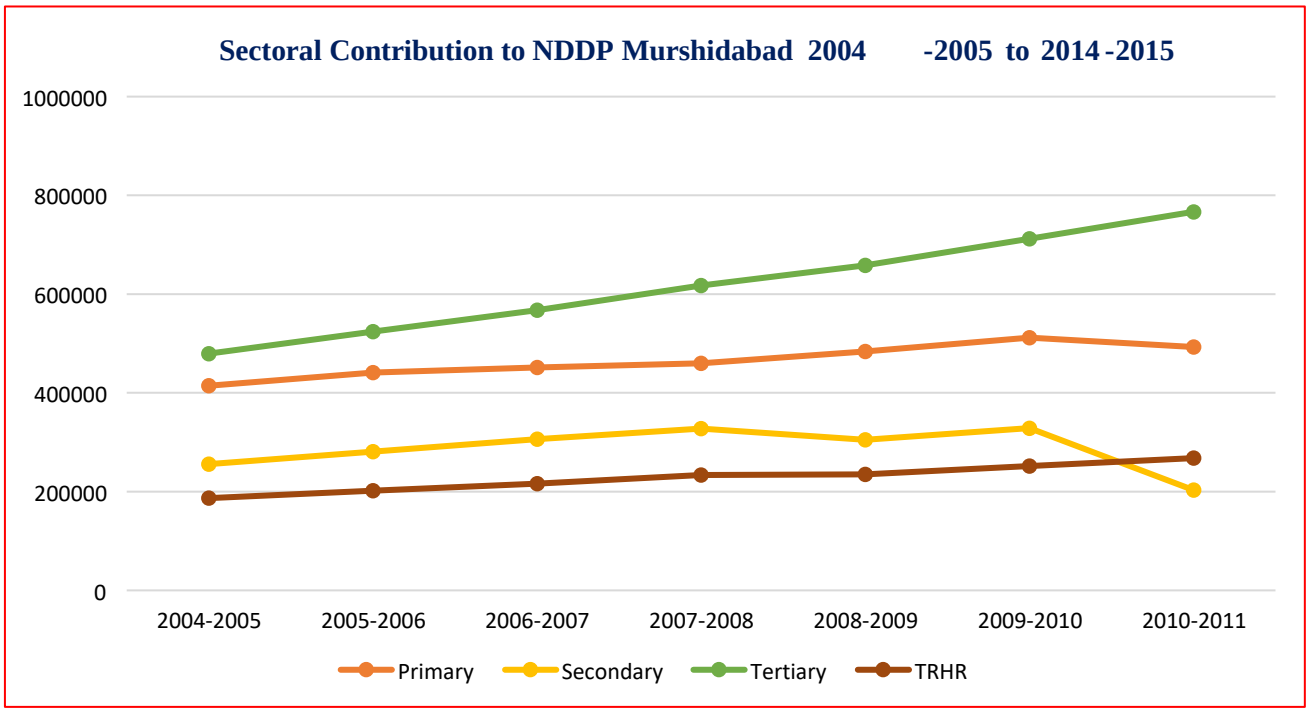
MURSHIDABAD: SECTORAL CONTRIBUTION TO NDDP (2004-2005 TO 2010-2011)

Table: 4 Sectoral Contribution to NDDP Murshidabad 2004-2005 to 2010-2011

Year	Primary	Secondary	Tertiary	TRHR as % of Tertiary
2004-2005	414445 (36.05%)	255533 (22.23%)	479530 (41.72%)	186864 (38.97%)
2005-2006	441445 (35.42%)	280862 (22.53%)	524074 (42.05%)	201870 (38.52%)
2006-2007	451226 (34.05%)	306309 (23.12%)	567583 (42.83%)	216113 (38.08%)
2007-2008	459912 (32.73%)	327905 (23.33%)	617478 (43.94%)	233525 (37.82%)
2008-2009	484149 (33.44%)	305220 (21.08%)	658311 (45.47%)	234704 (35.65%)
2009-2010	511896 (32.97%)	328669 (21.17%)	711813 (45.85%)	252091 (35.42%)
2010-2011	492845 (33.69%)	203244 (13.89%)	766758 (52.42%)	267879 (34.94%)

Source: Data Compiled from Department of Planning & Statistics, Govt. of West Benga

Figure: 6 Sectoral Contribution to NDDP Murshidabad:2004-2005 to 2014-2015



WEST BENGAL: GSDP GROWTH RATE AT CONSTANT PRICE (2004-2005 TO 2014-2015)

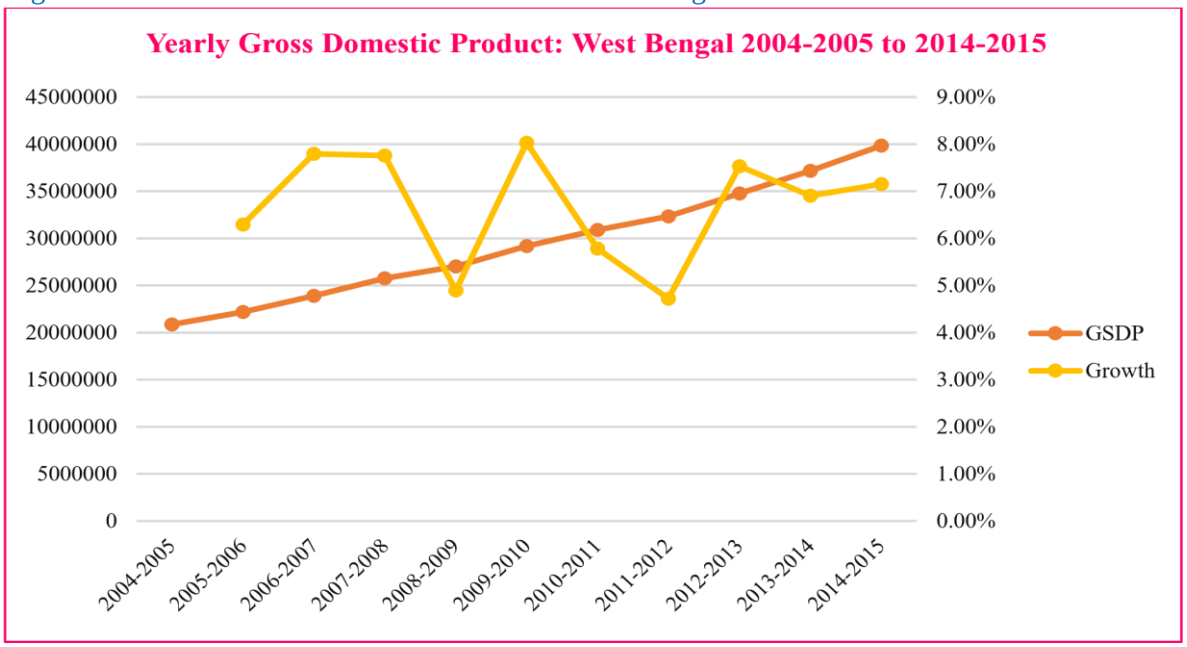
Table: 5 GSDP Growth Rate at Constant Price: West Bengal 2004-2005 to 2014-2015

Year	GDDP	Growth
2004-2005	20865636	-
2005-2006	22178946	6.29%
2006-2007	23907712	7.79%
2007-2008	25763218	7.76%
2008-2009	27024826	4.90%
2009-2010	29195496	8.03%
2010-2011	30883705	5.78%
2011-2012	32341698	4.72%
2012-2013	34777383	7.53%
2013-2014	37179504	6.91%

2014-2015	39838651	7.15%

Source: Data Compiled from Department of Planning & Statistics, Govt. of West Bengal

Figure: 7 GSDP Growth Rate at Constant Price: West Bengal 2004-2005 to 2014-2015



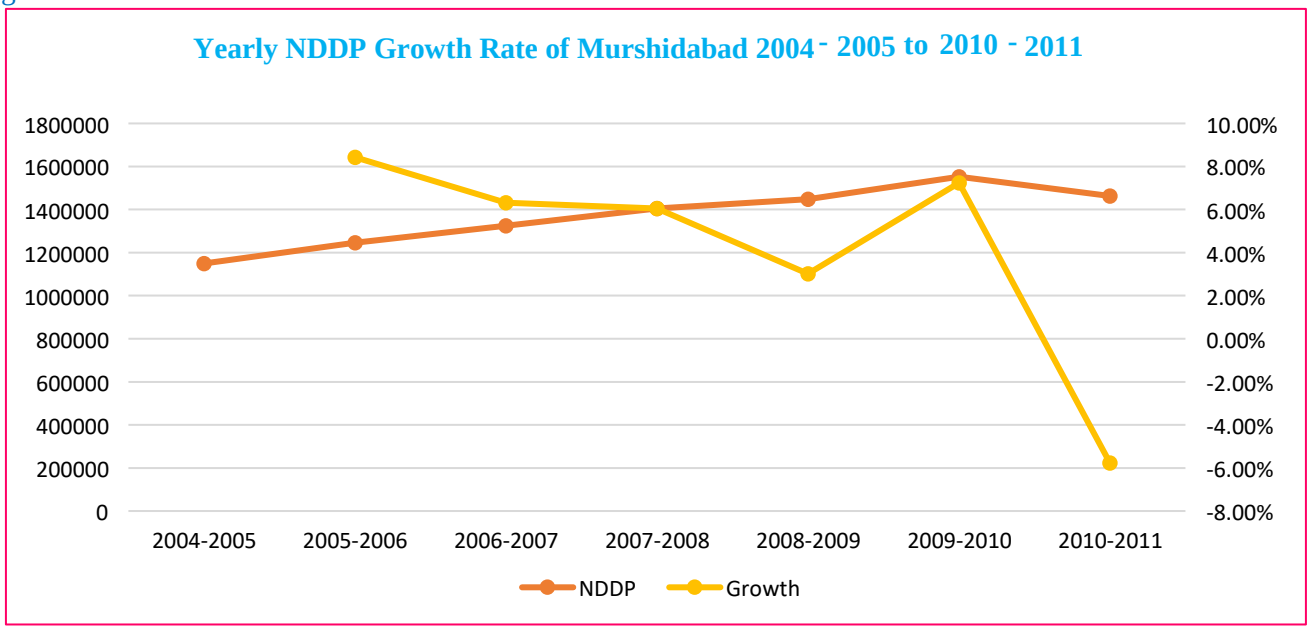
MURSHIDABAD: NDDP GROWTH RATE AT CONSTANT PRICE (2004-2005 TO 2010-2011)

Table: 6 NDDP Growth Rate at Constant Price: Murshidabad 2004-2005 to 2010-2011

Year	NDDP	Growth
2004-2005	1149508	-
2005-2006	1246381	8.43%
2006-2007	1325118	6.32%
2007-2008	1405295	6.05%
2008-2009	1447680	3.02%
2009-2010	1552378	7.23%
2010-2011	1462847	-5.77%

Source: Data Compiled from Department of Planning & Statistics, Govt. of West Bengal

Figure: 8 NDDP Growth Rate at Constant Price: Murshidabad 2004-2005 to 2010-2011



MURSHIDABAD: CONTRIBUTION OF TRHR TO THE NDDP AT CONSTANT PRICE (2004 TO 2023)

Table: 7 Contribution of TRHR to the NDDP at Constant Price Murshidabad (2004 to 2023)

Year	TRHR	Tertiary	TRHR as % of Tertiary	NDDP	% of TRHR to NDDP
2004	186864	479530	38.97%	1149508	16.26%
2005	201870	524074	38.52%	1246381	16.20%
2006	216113	567583	38.08%	1325118	16.31%
2007	233525	617478	37.82%	1405295	16.62%
2008	234704	658311	35.65%	1447680	16.21%
2009	252091	711813	35.42%	1552378	16.24%
2010	267879	766758	34.94%	1462847	18.31%
2011 F	279303	807634	34.58%	1609111	17.36%
2012 F	291412	856716	34.01%	1651363	17.65%
2013 F	303665	906065	33.51%	1693618	17.93%
2014 F	316233	954738	33.12%	1735909	18.22%

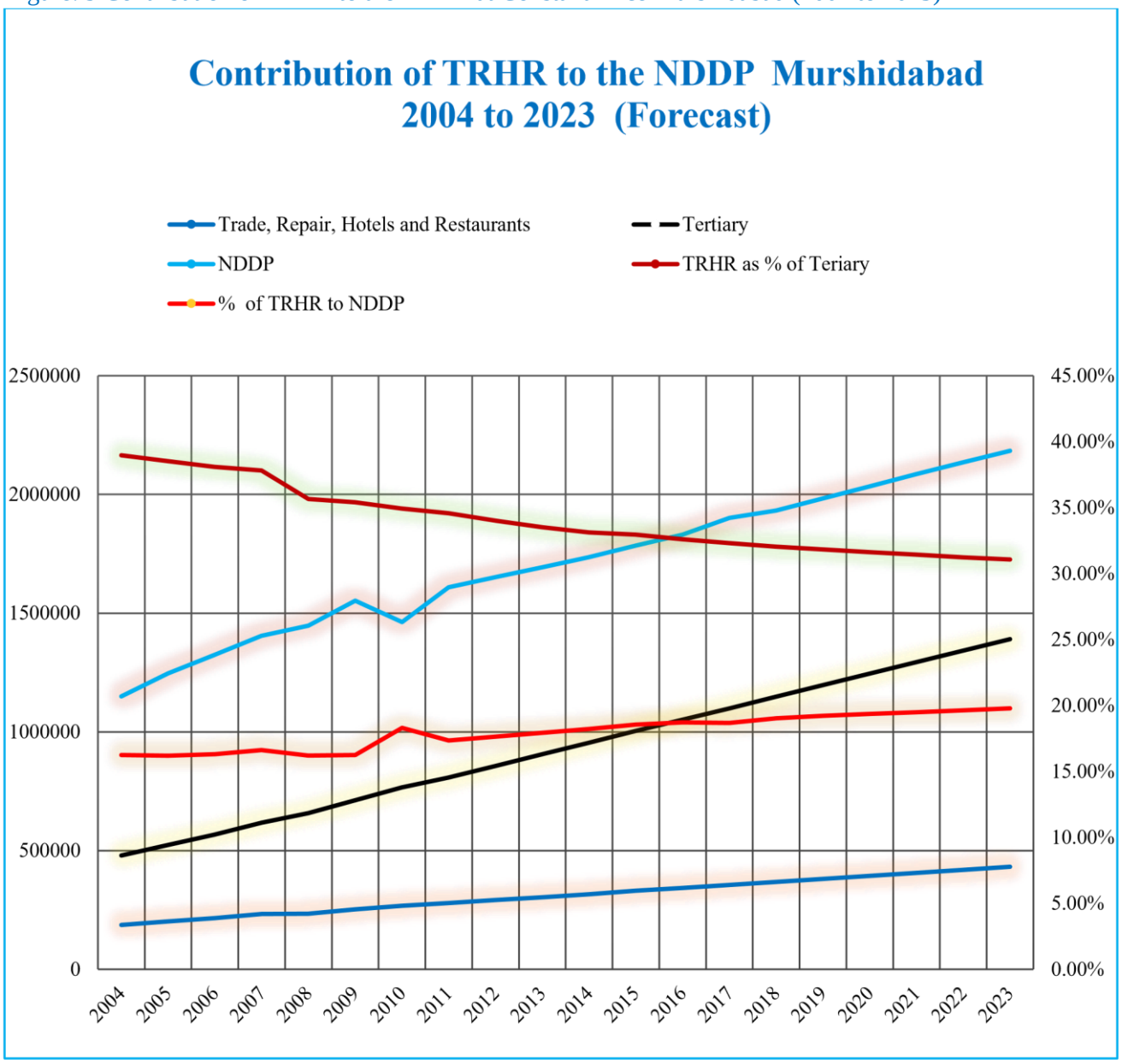
2015 [F]	330936	1004254	32.95%	1784084	18.55%
2016 [F]	342732	1051385	32.60%	1830723	18.72%
2017 [F]	354972	1098956	32.30%	1900825	18.67%
2018 [F]	368025	1148749	32.04%	1932852	19.04%
2019 [F]	380990	1197055	31.83%	1983295	19.21%
2020 [F]	393878	1245271	31.63%	2034423	19.36%
2021 [F]	406586	1293567	31.43%	2085458	19.50%
2022 [F]	419054	1341864	31.23%	2135093	19.63%
2023 [F]	432040	1390576	31.07%	2183803	19.78%

Source: Data Compiled from Department of Planning & Statistics, Govt. of West Bengal

**(TRHR: Trade Repair Hotel and Restaurant, NDDP: Net District Domestic Product)*

Forecast Formula=FORECAST.LINEAR(x, known_y's, known_x's)

Figure: 9 Contribution of TRHR to the NDDP at Constant Price Murshidabad (2004 to 2023)



2.4 WETLANDS

The district has vast wetlands; the majority of them are ox-bow lake and tanks/ponds. Table 1 shows the number of wetlands and their area representation in the district.

Table 1: Wetland Data of Murshidabad district

Wetland Types	Total Number of Wetlands:			Area (ha)									Aquatic Vegetation
Natural Wetlands	NRCD	NWIA	Diff.	<2.25	<5	<10	<20	<50	<200	<500	<1000	>1000	
Lake/ponds	82	82	0	0	6	18	13	23	16	1	5	0	48
Ox-bow lakes/cut off meanders	96	96	0	0	18	33	23	15	7	0	0	0	62

High altitude Wetlands	0	0	0	0	0	0	0	0	0	0	0	0	0
Riverine Wetlands	39	40	1	0	19	12	1	5	1	1	0	0	16
Waterlogged	19	19	0	0	0	4	7	5	3	0	0	0	12
River/Stream	0	19	19	0	0	0	0	0	0	0	0	0	0
Man-made Wetlands	**NRCD**	**NWIA**	**Diff.**	**<2.25**	**<5**	**<10**	**<20**	**<50**	**<200**	**<500**	**<1000**	**>1000**	**AV**
Reservoirs/Barrages	0	0	0	0	0	0	0	0	0	0	0	0	0
Tanks/ponds	114	131	17	0	91	18	5	0	0	0	0	0	10
Waterlogged	5	5	0	0	0	1	0	0	4	0	0	0	2
Salt pans	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (6845)	**355**	**392**	**37**	**6453**	**134**	**86**	**49**	**48**	**31**	**2**	**5**	**0**	**150**

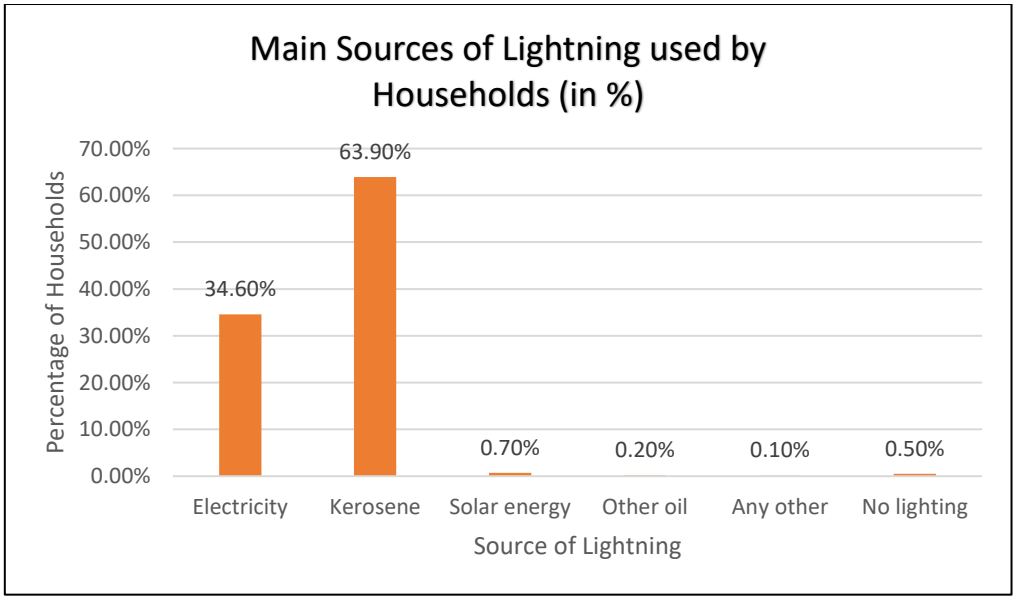
Source: National River Conservation Directorate (NRCD), National Wetland Inventory and Assessment (NWIA) Atlas

2.5. ENERGY

2.5.1. Solar

West Bengal Renewable Energy Development Agency (WBREDA) has the sole authority to undertake and promote renewable energy in the state of West Bengal.

The main sources of lightning used by the percentage of households has been shown in the graph below, which has incorporated data from Census of India 2011. Kerosene is the most important source of lightning in the state, with 63.90% of the households using it. Electricity is the next important source of lightning, with 34.60% of the total households dependent on it. Solar energy is used by 0.70% of the households, other oil has been used by 0.20% of the households, other sources of lightning has been used by 0.10% of the households. 0.50% of the households do not have any source of lightning.



2.5.2. Biomass

West Bengal Renewable Energy Development Agency (WBREDA) is the authority to promote renewable energy in West Bengal.

The net sown area of the district is 398700 hectares, area sown more than once is 577500 hectares, and gross cropped area is 976200 hectares. The cropping intensity is 245%. The forest cover of the district is 770 hectares.

The major crops grown in the district are rice, wheat, pulses, oilseeds, jute, and potato. Potato has the highest productivity of 15225 kg/ha in the district.

Crop	**Productivity (kg/ha)**
Rice	2678
Wheat	2295
Pulses	705
Oilseeds	983
Jute	3048
Potato	15225

Table 1

The pie-chart has been drawn from the Census 2011 data of the type of fuel used by the households for cooking. 49.70% of the households use crop residue, 18.40% of the households use cow dung cake, 15.90% of the households use fire-wood, 6.40% of the households use coal, lignite, charcoal, and 5.90% of the households use LPG/PNG as a fuel for cooking.

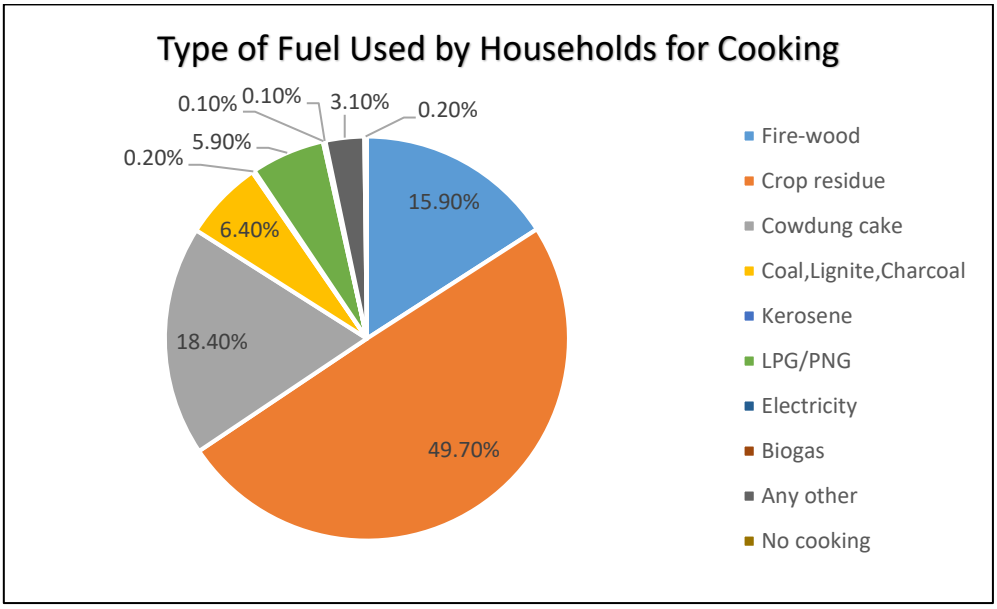


Fig. 1

2.5.3. Biogas

Biogas data is not available for the district. Based on the livestock population and agricultural waste biogas potential calculated. Biogas potential from animal waste and agricultural waste was calculated approximately as three crore m^3/year and fourteen crores m^3/year. This amount of biogas generation can efficiently complete the energy demand of the district.

2.5.4. Hydro Power

No hydropower plant exists, nor the site has been identified in the district. The district is part of the massive Ganga plan, where the delta-building process is either in its development or has just recently attained maturity. The land only rises to around one meter above sea level in the active delta region in the south, which is a maze of uncountable twisting rivers and tidal creeks dividing several islands, and barely climbs to 5 meters above sea level in the north, i.e., in the mature section of the delta. The hydropower potential needs to be identify in these sites.

3 QUALITATIVE DATA ANALYSIS

3.1 FORESTRY

Forests are great allies for not just carbon sinks and reserves for biodiversity but also when tackling pollution, food supply, economic growth, to name just a few. Keeping this in mind the inhabitants of the Murshidabad district have drawn the framework of their own for years after years, through nature-based

solutions, launched to show which trees are best for tackling economic crisis through mitigation of poverty of the people of the grass root level. Certainly, the people of Murshidabad chose the cultivation of mango and lichi, irrespective of much interest in the plantation programme under agroforestry schemes managed and planned by the government's agricultural department. Further, the forest has been degraded over hundred years and land use pattern, thereon, has gradually been changing. At present, the area of green canopy of the district is moderately nice because of the agroforestry of both mango and lichi that enhances the economic growth of the people of the district of Murshidabad. Forest degradation and deforestation accelerate the issue of land degradation of the Murshidabad district. A few forests, at present, is still there, namely Jitpur forest at Domkal, Deer forest at Farakka, Islampur forest, Aahiran forest, but with fewer trees, plants, or animals, though the green cover is seen in the border area of the district like Lalgola etc through the scheme of agroforestry strategy by the orchard plantation of mango, lichi, banana etc in the district of Murshidabad (Das GK, 2021).

3.1.1 Biodivesity

Murshidabad lost 6ha of tree cover between 2010 and 2021, resulting in a 3.5 percent loss in tree cover and 2.20kt of CO2e emissions. Murshidabad acquired 3ha of tree cover in the region from 2001 to 2012, accounting for 0.17 percent of all tree cover growth in West Bengal. Murshidabad received a total of 297 VIIRS Alarms fire alerts between June 10, 2019 and June 6, 2022. Motijheel, the cradle of British rule in India, stands witness to a remarkable turning point in Indian history. A 350 acre oxbow lake formed out of an abandoned bed of river Bhagirathi, the Motijheel, derived its name from extensive pearl cultivation during the Nawabi period. The Jheel was famous for raising golden tinted pearls extracted from unino margaritifera species.

3.2. ENERGY

3.2.1. Solar

According to the West Bengal State Electricity Distribution Company Limited (WBSEDCL), Murshidabad has a potential of 2010 kW of energy through off-grid solar power. Letter of Authorisation has been taken however, there has been no reports of installation of off-grid solar in the district.

According to the Sovandab Chattopadhyay, the Power Minister of West Bengal had reported that largest grid-connected solar powered floating project would be developed in West Bengal’s Murshidabad district at Sagardighi Thermal Power Plant, which would cost Rs. 22 crores.

West Bengal Renewable Energy Development Agency (WBREDA) had selected 100 schools in the districts of Murshidabad, South 24 Parganas and North 24 Parganas to install solar PV systems and improved chulhas.

Moreover, five solar-powered eye care centres or the Green Vision Centres have been opened in the district of Murshidabad, which were continuously impacted by the power cuts, and the project has been funded by the United States Agency for International Development.

3.2.2. Biomass

The total agricultural residue for biomass energy generation in Murshidabad district is 2161.86 (10^3 ta^{-1}). Moreover, the biomass residues from rice husk from rice mills/ hullers in the district is 274 (10^3 ta^{-1}), residues from saw mills is 12.50 (10^3 ta^{-1}), and residues from non-forest land is 485.57 (10^3 ta^{-1}). The net surplus biomass in the district is 836.98 (10^3 ta^{-1}). Furthermore, the net surplus biomass power generation potential in the district is 106.28 MW (Das & Jash, 2009).

In the district, one rice mill installed gasifier has been installed having a capacity of 175 kW (Majhi & Jash, 2013). Almost all the rice mills in the state are in poor condition, due to improper maintenance, improper water quality for cooking the gasifier system, and less skilled labourers to work in the biomass gasifier units.

Moreover, Rice husk-based Biomass Project could be established in Murshidabad district, having a capacity of 10 MW, which would be privatised grid-connected project (WBGEDCL).

3.2.3 Biogas:

Livestock and agricultural data show a great potential of biogas in the district. Around 214 household biogas plant of capacity 2 cummec was installed in year 2010-11 in the district. Up until December 2011, roughly 11,000 household biogas plant installations had been completed in West Bengal.

3.2.4. Hydropower:

CWC has a specific design section for the East and North-eastern regions, which works on multipurpose, irrigation, water supply, and hydroelectric projects. Preparation of pre-feasibility and comprehensive project studies for schemes studied by CWC field offices in the Northeast or projects performed by Brahmaputra Board, NEEPCO, State Government departments, and others are also included in the scope of work. In hilly locations, WBREDA has taken the lead in harnessing small and micro hydel energy in partnership with WBSEDCL.

3.3 TOURISM

Tourism is one of the fastest growing industries of the world in the 21st century. It has emerged as one of the major sources of employment and foreign exchange earnings for many developing countries, including India. North 24 Parganas is an important district in the tourism

map of West Bengal. Ancient temples, mosques, historic forts and magnificent handicrafts make North 24 Parganas District a great tourist destination.

Located on the banks of the Bhagirathi River, Murshidabad was the last capital city of independent Bengal and is known for its Mughal and British colonial history. Among several historical structures built during the Mughal and British rules is the Hazarduari palace. Built by Duncan McLeod, it is now a museum showcasing armory, paintings and portraits of Nawabs and is one of the prime attractions of the city.

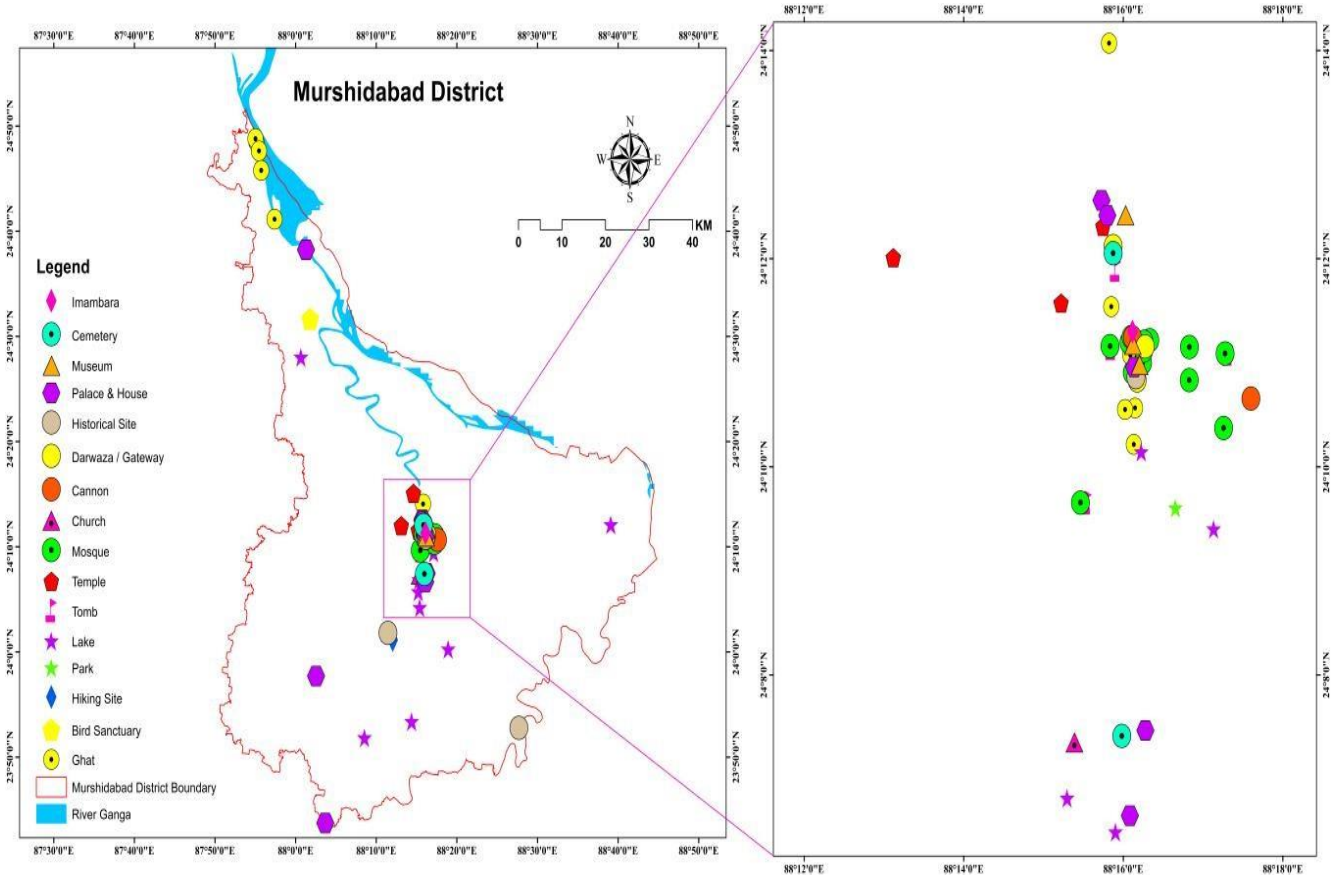
Famous for its silk textiles, the Murshidabad silk saris made from ivory and sholapith are light, vibrant and a must-buy. The annual festival, Bera Utsav, celebrated on the last Thursday of the Bengali month of Bhadra (mid-September), is conducted on the banks of the Bhagirathi River near the palaces of the Nawabs. The town is named after Nawab Murshid Quli Khan, the Dewan of Bengal, Odisha and Bihar, who in 1704 transferred his administration from Dhaka to Maqsudabad and renamed the city after himself. (*Murshidabad Tourism*, n.d.)

The shops in Murshidabad is the best place for those who love shopping. Murshidabad is famous for brass and bell metal ware, for traditional Bengali muslin and silk weaves, brocades and Jamdanis. There are plenty of shops offering mouthwatering bengali sweets to take home for family and friends. (*Shopping in Murshidabad*, n.d.-a)

From the Nawabs of the pre-British era to the Lords from England, Murshidabad has seen history from its core. This small tourist haven in West Bengal serves as a place that manages to combine the beauty of the past with the beliefs of the present.

Calling it a religious or a monument city would mean limiting its beauty and restricting it magnificence. This district reminds us that no matter how forward technology has brought us, some things are best experienced on foot. The district will transport us to a beautiful, ancient time and give us a great sense of peace and awe. (*Murshidabad*, n.d.b)

Map: 2 Tourism Sites of Murshidabad District



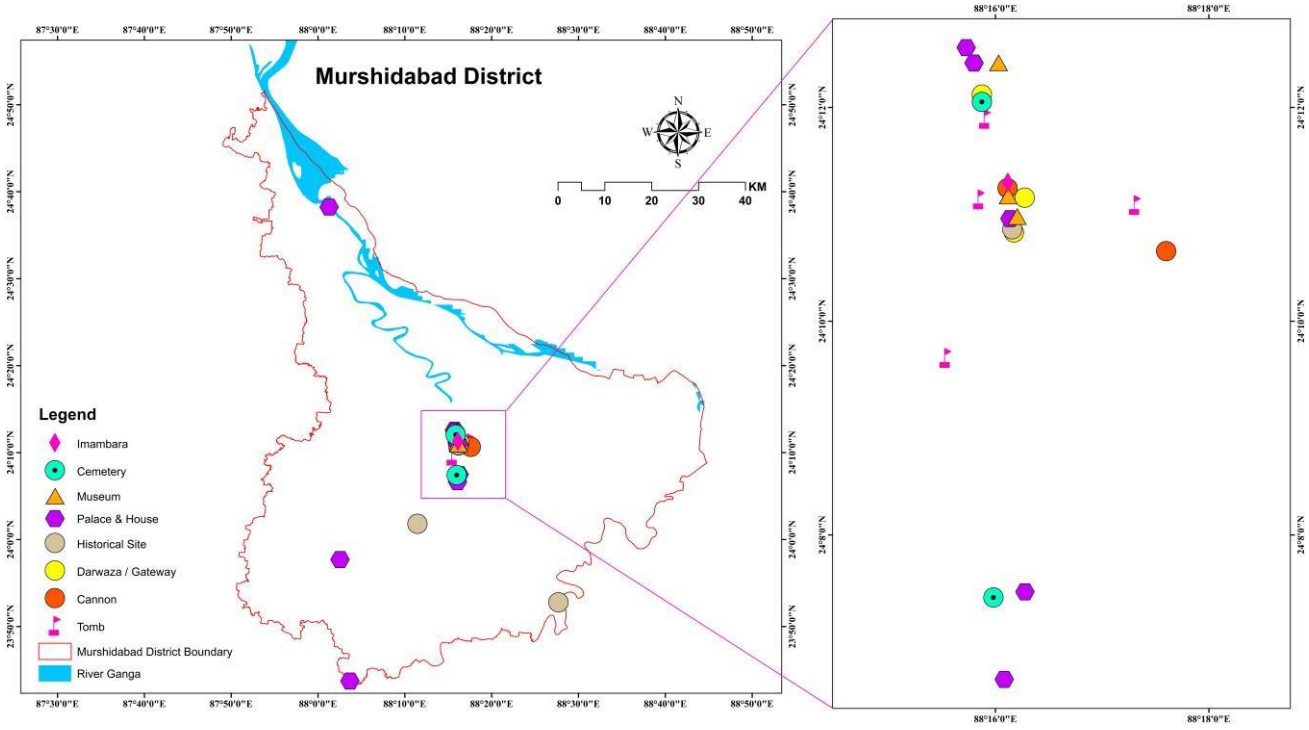
Source: Prepared by Author

ARCHAEOLOGICAL & HISTORICAL TOURISM

- ★ Jafarganj Cemetery
- ★ Dutch Cemetery
- ★ Hazarduari Palace Museum
- ★ Kathgola Palace Museum
- ★ Murshid Quli Khan Palace Museum
- ★ Kandi Rajbari
- ★ Cossimbazar Palace of Roys
- ★ Wasif Manzil
- ★ Jagat Seth House
- ★ Bishnupur Kalibari
- ★ Nimtita Zamindar Mansion
- ★ Sonarundi Rajbari Palace

- ★ Nashipur Rajbari Palace
- ★ Tomb of Nawab Shuja Uddin Khan
- ★ Tomb of Murshid Kuli Khan
- ★ Tomb of Siraj ud Daula
- ★ Tomb of Azimunnisa Begum
- ★ Roshni Bagh Mosque
- ★ Yellow Mosque
- ★ Hazarduari Mosque
- ★ Katra Mosque
- ★ Madina Mosque
- ★ Kadam Sharif Mosque
- ★ Nara Bano Masjid
- ★ White Masjid
- ★ Fauti Masjid
- ★ Khosbag Masjid
- ★ Begum Mosque
- ★ Jama Masjid Shahnagar
- ★ Azakhana Mosque
- ★ Bachhawali Tope
- ★ Jahan Kosha Cannon
- ★ Nizamat Imambara
- ★ Armenian Church
- ★ Tripolia Gate
- ★ Dakhin Darwaza
- ★ Namak Haram Darwaza
- ★ Chandipur Tetultala
- ★ Ghari Ghanta
- ★ Karna Subarna

Map: 3 Archaeological & Historical Tourism Sites of Murshidabad District



Source: Prepared by Author

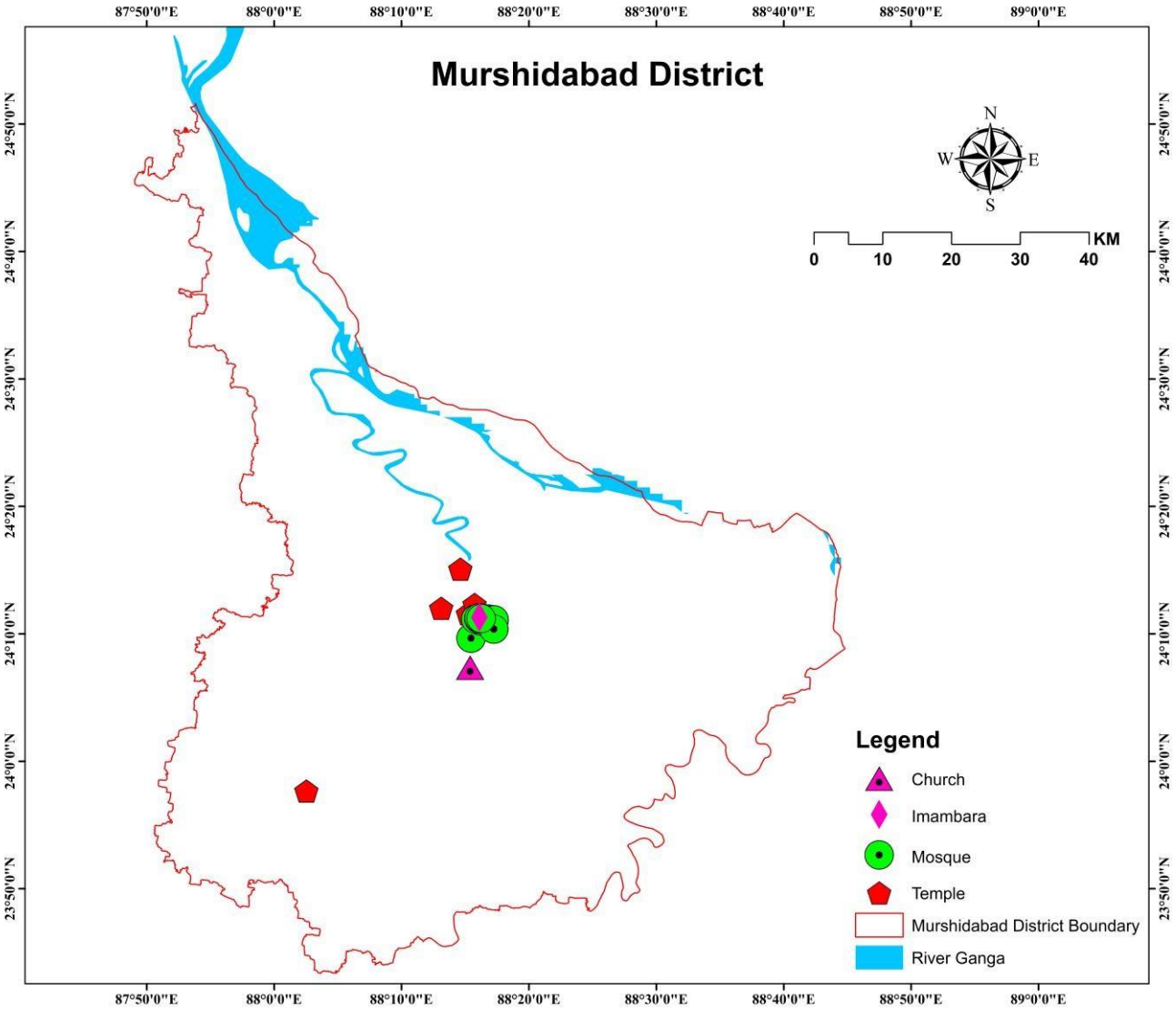
RELIGIOUS & SPIRITUAL TOURISM

- ★ Radhaballav Mandir
- ★ Char Bangla Dham
- ★ Dahapara Dham
- ★ Raghnath Temple
- ★ Shaktipeeth Sri Kiriteshwar Temple
- ★ Nizamat Imambara
- ★ Roshni Bagh Mosque
- ★ Yellow Mosque
- ★ Hazarduari Mosque
- ★ Katra Mosque
- ★ Madina Mosque
- ★ Kadam Sharif Mosque
- ★ Nara Bano Masjid
- ★ White Masjid

- ★ Fauti Masjid
- ★ Khosbag Masjid
- ★ Begum Mosque
- ★ Jama Masjid Shahnagar
- ★ Azakhana Mosque

- ★ Armenian Church

Map: 4 Religious Tourism Sites of Murshidabad District

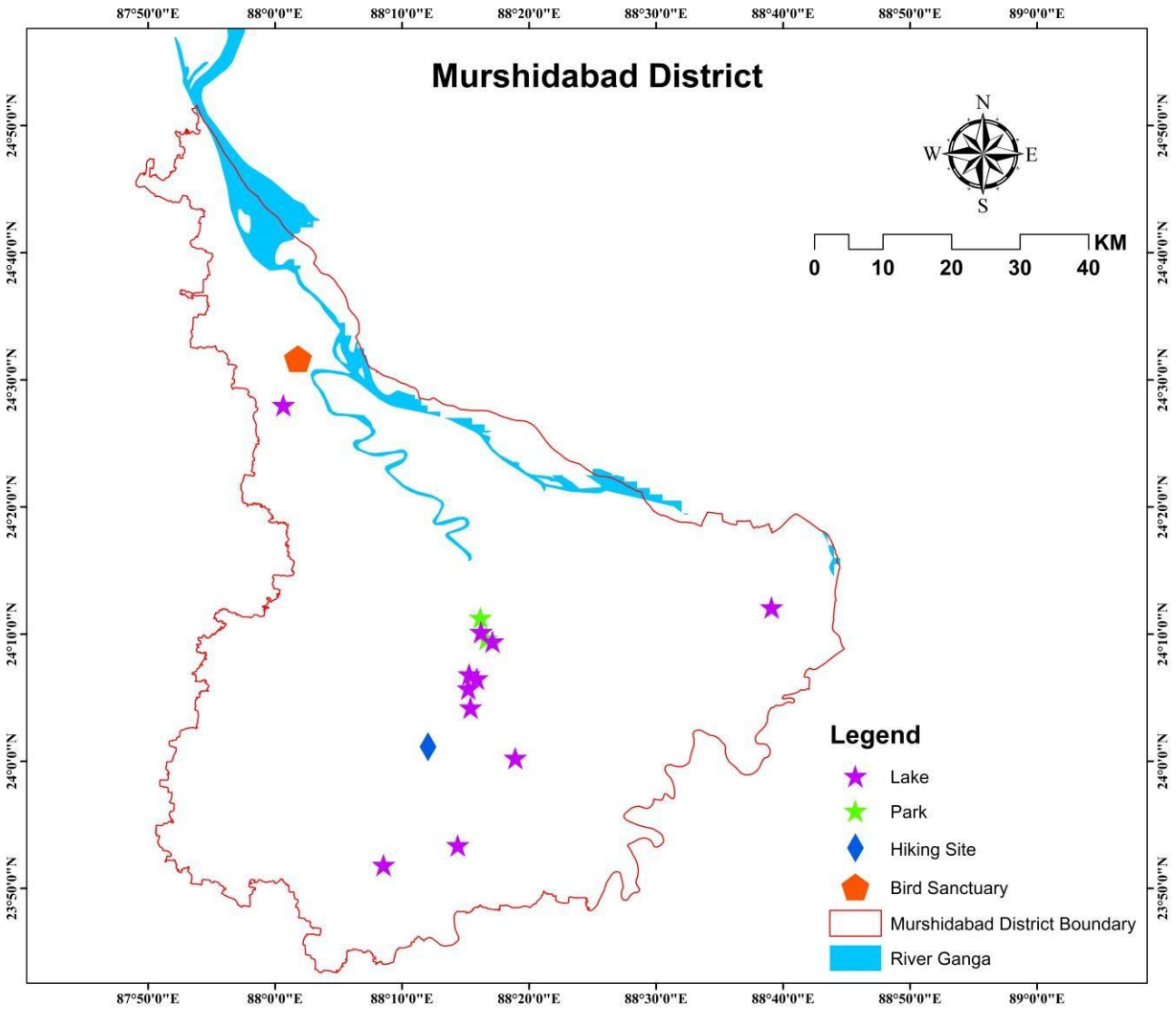


Source: Prepared by Author

ADVENTURE, NATURE & ECO TOURISM

- ★ Bishnupur Jheel
- ★ Motijheel
- ★ Sheeal Lake
- ★ Chhatiani Lake
- ★ Chaltia Bill
- ★ Damas Bill
- ★ Chatrar Bill Lake
- ★ Shahpur Bill Lake
- ★ Bhandar Daha Bill Lake
- ★ Lila Gotto Lake
- ★ Laldighi Lake
- ★ Motijheel Park
- ★ Siraj Garden
- ★ Ahiron Bill Bird Sanctuary
- ★ Jitpur Forest
- ★ Farakka Picnic Spot
- ★ River Padma/ Ganga

Map: 5 Adventure, Nature & Eco Tourism Sites of Murshidabad District

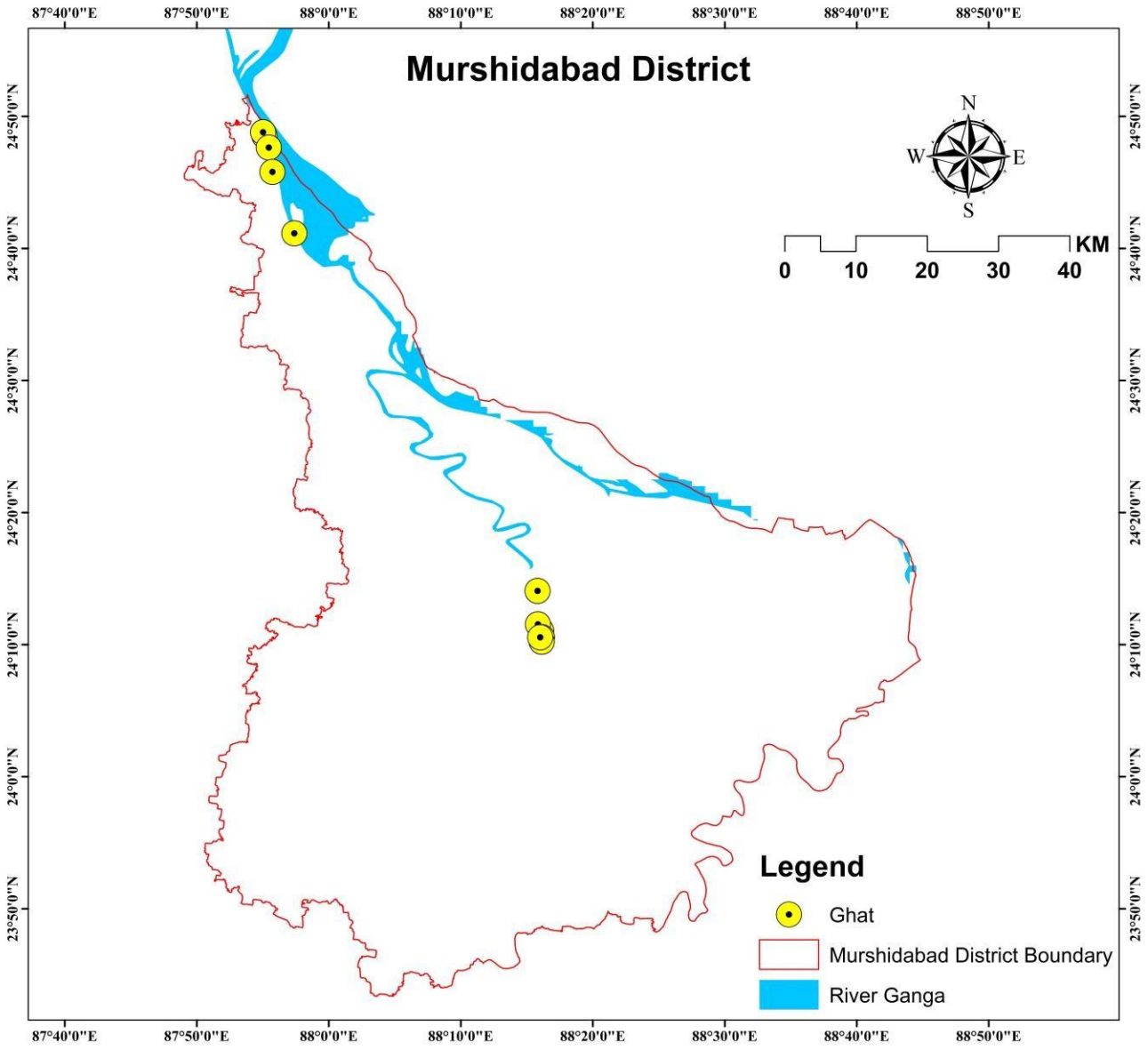


Source: Prepared by Author

GHAT TOURISM

- ★ Gandhi Ghat
- ★ Taaltala Ghat
- ★ Farakka Sosan Ghat
- ★ Beniagram Ghat
- ★ Dhulian Ghat
- ★ Balirghat
- ★ Bidge Ghat
- ★ Ichhaganj Ferry Ghat
- ★ Sahanagar Ghat
- ★ Lalbag Sadar Ferry Ghat
- ★ Elahigange Ferry Ghat

Map: 6 Ghat Tourism Sites of Murshidabad District



Source: Prepared by Author

CULTURE, ARTS & MARKET TOURISM

Murshidabad has a rich array of beautiful and unique locally made handicrafts. Jute is used to make many products like carpets, bags, wall decorations and quality paper. Ivory and Woodcraft is also popular here, which has its origins during the reign of the Nawabs. Another renowned handicraft are the Sholapith items or items made from shola - which is a white coloured spongy wood and is lustrous with a beautiful texture. It is carved into many decorative items like peacocks, elephants, palanquins, garlands and also into exquisite jewellery. Sholapith items are especially on prominent display during the time of Durga Puja. Bell metal or Kansa is used to make utensils and is one of the other popular items here. It is also used to make good quality locks, iron chests and traditional betel cutters. There is also a Bengali tradition of gifting bell metal items to a bride during her wedding, which is considered to be auspicious. Murshidabad is also famous for its Baluchari silk saris, which are patterned with intricate designs of animals, court scenes etc. Floral motifs along the borders of the sari is a common pattern, and they are available in many gorgeous colours.(*Murshidabad*, n.d.-b)

- **Fairs and Festivals:** Durga Puja, a five-day-long puja is the most important festival of the Hindus. Other pujas like Diwali, Kali puja, and Saraswati Puja are also celebrated here. Eid-ul-Fitr and Eid-ul-Adha (Bakri-eid, locally), Ashura are prominent Muslim festivities in this district.
- **Bera Utsav:** The grand celebrations of 'Bera Utsav' are conducted at Lalbagh, on the banks of river Bhagirathi, near the palace of Nawabs. The beautiful celebration is adorned by traditional dance and music. The splendid fireworks on Bhagirathi embankment make the venue a picturesque vista that impresses the visitors no end. The festival is enjoyed by people of different age-groups, religions and cultural backgrounds. It not only tells the tale of the city's age-old splendor, but also marks the unity of its people and their love towards their cultural and traditional inheritance.
- **Hazarduari Mela:** Hazarduari Mela is conducted by West Bengal State Tourism Department alongwith the Murshidabad District administration. Hazarduari Mela is held on an open air stage keeping the Hazarduari palace in the backdrop. Between the palace and the Imambara on southern flank of the palace ground, the stalls are set up with various

handicrafts of Murshidabad district. The Mela also includes songs by local artists of Bauls and Fakirs of Murshidi and Marfati genre. (*Culture and Heritage: Murshidabad*, n.d.)

- **Market Tourism:** An opportunity to shop in Murshidabad is perhaps too tempting to pass up on. Colored in the rich culture of Bengal, this city has a lot to offer when it comes to shopping. Ranging from fine handicrafts to beautiful saris, you can find almost anything and everything in this destination. The brass and bell metal ware of this place is also quite popular and makes up for a great souvenir of this charming city. The shopping experience in Murshidabad is unique. This destination is quite famous for its brassware and bell metal ware, so don't forget to skim through the large collection present here. If traditional is the way for you to go, you can buy Bengali muslin and silk sarees here, which are gorgeous, to say the least. Indulge our senses in the subtle textures of the 'Jamdani' variety of Bengali muslin cloth and clothing. Murshidabad also has a little something for gastronomy enthusiasts. Ranging from mouthwatering 'sondesh' to scrumptious 'rosogullas', you can find plenty of delicious traditional Bengali sweets in this destination. (*Shopping in Murshidabad*, n.d.-b)

- **Handicraft:** The skill of gifted craftsmen can be seen in the district markets. Ivory carving has been patronized from the Nawabs time and about 99% of total production of ivory is exported, which draws a significant amount of Murshidabad`s income. Sandalwood etching has become more popular than ivory carving now. Murshidabad is famous for brass and bell metal ware also.

Silk weaving industry constituted to be the principal cottage industry in Murshidabad. The raw silk weaving has been growing prominently since the pre – historic times. However the silk industry in West Bengal is concentrated in Murshidabad. The brand “Murshidabad silk” is not only famous across India, but also has a great demand throughout the world. Sericulture industry is the principal agro-based rural industry in Murshidabad.

3.4. WELANDS:

The wetlands create a unique ecosystem that supports many species simultaneously like aquatic, terrestrial, and human beings. Local stakeholders directly or indirectly depend on the wetland for their income and small-scale business. Murshidabad is a centre for agriculture, handicrafts and sericulture. The data collected and analyzed shows the region's production and possible product that can be derived from the raw product. The list of sources and the possible products are mentioned below:

- The district consist of many jheel and bil. One of the renowned jheel is moti jheel
- The principal crops are rice and Jute of the district.
- District has rich production of sugarcane, mulberry, tobacco and potatoes.
- Murshidabad is the second-largest traditional silk-producing district in West Bengal.

4 ACTION PLAN DEVELOPMENT

4.1 FORESTRY

According to the report of FSI, 2021 there has been decrease in the forest cover in the district. The decrease is although only 1.41 sq. km. which is an alarming situation. The district also has cultivable wastelands, fallow lands etc. which can be brought under plantations. The district is mainly agricultural and hence can take up agroforestry to preserve the forests as well as to increase the income of the farmers. The first thing that needs to be done is to make people aware of the requirement of forests in the district and to educate them on how can they increase the forest cover. The district can also take up Sub-Mission on Agroforestry (SMAF) Scheme. Agroforestry should be encouraged in the district and eventually agroforestry can create opportunities for setting up agri-based small enterprises such as pickle production, and juice/pulp extraction of these fruits. The district also has cultivable wasteland, which should be brought under plantation drive under the National Afforestation Mission. There is also a need to include technology like geo-tagging. GPS etc. to monitor the plants which have been planted and the already planted trees. Along with the technology, the local governments should appoint agents who would look after and monitor the plants.

4.1.1 Biodiversity –

West Bengal biodiversity board completed project: Monitoring of Migratory Birds at selected water bodies of Murshidabad district and documentation and development of database of indigenous Mango (MangiferaindicaL.) varieties of Murshidabad and Malda districts: Towards establishment of Mango Orchard Network and ex situ conservation initiative.

4.2 TOURISM

SWOT ANALYSIS: MURSHIDABAD DISTRICT TOURISM

STRENGTHS

- ★ Rich cultural heritage through footprints of different ruling dynasties under various religious communities like Buddhism, Brahmanism, Vaishnavism, Islam and Christianity for centuries.
- ★ The district is predominantly characterized by remarkable heritage precincts. Outstanding scenic places, picnic spots, beautiful Mosques, Tombs with marvellous natural beauty of Wetland/lakes, Bird sanctuary, Forest and Parks.
- ★ The district is well connected with other parts of the states and the country.
- ★ Presences of natural features (Rivers, Wetland, Wildlife and Lakes dominate the landscape) and unique ecosystems are valuable scenic and recreational resources and can contribute to environmental services.

WEAKNESS

- ★ The district has lack tourism statistics undeveloped and unexploited.
- ★ There was not much awareness about the heritage scenario of the destination.
- ★ Inadequate infrastructure facilities for tourists.
- ★ Congestion and Traffic problems.
- ★ Lack of maintenance of Historical, Cultural and Natural heritage.
- ★ Lack of proper access, signages on roads, undeveloped river front, lack of guide, visual connections of exhibits.
- ★ Social and Gender Discrimination, Illiteracy and Poverty.

OPPORTUNITIES

- ★ Potential for historically inclined tourist, interested in history and culture seeing knowledge enhancement.

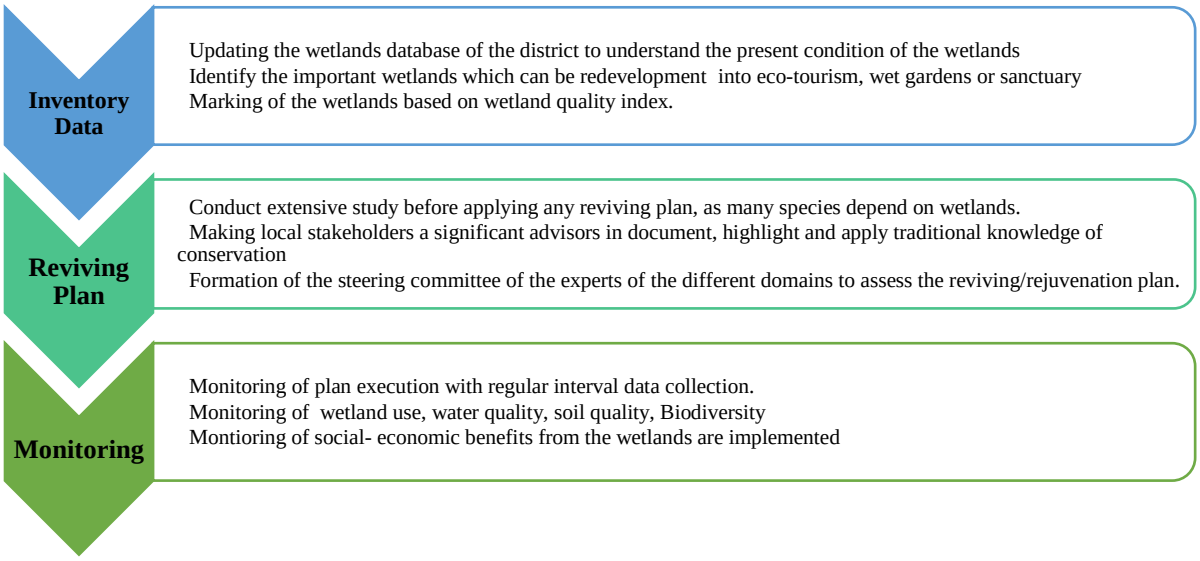
- ★ High future potential in Eco tourism, requires extensive development in physical infrastructure and advertisement.
- ★ High opportunity for Market and eco-Tourism development.
- ★ Obtaining grants for provision of best infrastructure and housing.
- ★ Encourage Public – Private partnership for provision of infrastructure services.

THREATS

- ★ Lack of maintenance tourism infrastructure and tourist information centres.
- ★ The district is prone to different kinds of disasters, which include floods and Cyclone etc.
- ★ Degradation of Natural Environment and Encroachment of Urban ecosystems.
- ★ Lack of governmental response towards tourism infrastructure such as tourism centre, tourism promotion and tourism accommodation.
- ★ There are areas in some parts of the district which remain vulnerable to inundation during rainy season largely due to over silting of rivers, canals, baors and beels.
- ★ The district faces a major challenge in providing proper conditions of living for its residents.
- ★ Arsenic Prone Area, Illegal Migration and Crime.

4.3 WETLANDS

Some of the known wetlands in the district need to be taken care and action on different fronts must be taken. The action plan below gives a glimpse of the action and development required to protect, conserve, and rejuvenate the wetlands existing and extinct.



4.4. ENERGY

4.4.1. Solar

According to the Input Survey 2016-17, the net sown area in the district is 445998 hectares, out of this, the irrigated net sown area is 364525 hectares, which is 81.73% of the total net sown area, and the rest unirrigated net sown area is 81473 hectares, which is 18.26% of the total net sown area. Due to this reason, the irrigation demand is less (CEEW, 2020).

According to CEEW (2020), the district has greater crop revenue per holding and high disbursement of credit, however, the groundwater level is below the limit, which suggests to implement drip irrigation to efficiently reduce the consumption of water for irrigation purposes and this could be employed under 'Per Drop More Crop' scheme of Pradhan Mantri Krishi Sinchayee Yojana (PMKSY-PDMC) .

As per the Agriculture Contingency Plan for District: Murshidabad (2011), the district has an area of 2000 hectares of barren and uncultivable land, which could be used to install ground-mounted solar or any renewable energy product, through component A of the PM-KUSUM scheme, to utilise the barren land in the best possible manner and to produce renewable source of energy for the district's development.

PROJECTION AND MONITORING MATRIX

Firstly, limited awareness has halted the growth of solar products in the district, so awareness should be generated.

Secondly, component A of PM-KUSUM scheme needs to be implemented at the barren lands of the district to promote green energy.

Thirdly, there is a need to popularise Per Drop More Crop scheme which would irrigate the farmland efficiently.

Lastly, government offices and private buildings should install rooftop solar panels, and it should be available at a competitive costs.

By implementing these solar products, the district can become developed in terms of renewable energy.

4.4.2. Biomass

The biomass plants in the district are low, which might be due to unawareness. There is a need to aware people about the bioenergy in the district. Moreover, more than half of the households use fire-wood and crop residue as a fuel for cooking, which is traditional biomass and produces carbon dioxide, which is not good for the indoor air. It is important that the farmers who have excess agriculture residue should give for bioenergy generation and the households should shift to the other cleaner fuels for cooking, like LPG, and for that PM Ujjwala Yojana needs to be stressed upon in the district. There is also a need for storage facility for crop residue and other biomass in the district, which could be near the farmlands, and then all the raw materials can be transported to the various biomass plants. Moreover, encouragement is needed to establish new biomass plants in the district.

Firstly, it is essential that the awareness among the farmers and households is required to understand the importance of bioenergy and also to know the difference of traditional biomass energy and the advanced biomass energy.

Secondly, for clean cooking fuels PM Ujjwala Yojana need to be emphasised in the district.

Thirdly, support in the form of funding and working of biomass plants is needed from the government.

Lastly, storage units need to be created in the district for proper management of biomass raw materials.

The biomass energy could serve the purpose of generating electricity in the district and also help in employment opportunities.

4.4.3. Biogas:

- A cluster of municipal authorities with a shared waste processing plant might be developed. This will significantly reduce expenditures and eliminate the need for land in every local body.
- Construction of community biogas and compost plants should be promoted until the cluster concept is adopted.

4.4.4. Hydropower:

In hilly locations, WBREDA has taken the lead in harnessing small and micro hydel energy in partnership with WBSEDCL.

5 RECOMMENDATIONS

5.1 AGRICULTURE AND ALLIED SECTORS

- Jute cultivation is one of the district's major practices, and it should be improved by adopting retting techniques and providing a by-market facility.
- In the district, there is a need to encourage and aid in revitalizing the jute industry.
- Out of 26 blocks in the district, 24 are afflicted by the arsenic problem; measures should be taken.
- Farmers are benefitted much from the production of ginger, turmeric, and foot yam in mango orchards, and these activities should be encouraged.
- Resources conservation practices: zero tillage, mulching should be adopted by the farmers.
- The district's main fruit is the mango, although there is also scope for banana, guava, litchi, lemon, and other crops, which need to be promoted.
- Micro-irrigation for vegetable growing, such as brinjal, should be encouraged to improve water efficiency.
- The district has a good scope in the commercial production of mushrooms, which needs to be promoted on a large scale.
- The district has a large scope for fish culture. New technologies, such as Bioflock, should be introduced to boost fish farming.
- Low-cost vermicompost production should be promoted on a large scale to improve soil health.
- Government assistance and certification are required to encourage organic farming.
- Beekeeping should be encouraged among the local farmers.
- Crop advisory should follow by the farmers.
- The district has scope for food processing units, particularly mango processing.
- Greenhouse and poly house are recommended for the high revenue crops like capsicum, strawberry, tomato, etc., and orchids like rose, Gerbera, etc.

5.2 FORESTRY

People should be made aware of the importance of forests and how can they be the part of the drive of managing forests sustainably. Agroforestry should be encouraged in the district, which would help in increasing the tree cover in the district. There should be proper monitoring of forests with the help of officials as well as technology like GPS, geo tagging, etc. NAP and SMAF can play big roles in maintaining sustainability in the district.

5.2.1 Biodiversity

- As the forest area decrease by 1.11 % in 2019, afforestation program should be held on regular basis and strict action should be taken towards poachers and wood mafias.
- Agricultural best practices (Bio-village program, IPM demonstration etc.) are recommended.
- Diversification of crops (Demonstration with low water requiring crops etc.) are recommended.
- Micro irrigation with supplemental water management activities are good irrigation strategies are recommended.
- Conservation of soil and water (water harvesting structure, excavated well, gully blocking, check dam, and so on.) are recommended.

5.3 WETLAND

The wetlands need to be intact, but at the same time, they need to be planned wisely to support the district economically, socially and environmentally, which will lead to indirectly relieving stress from the Ganga River to a large extent. It will also lower the local people's dependence on the Ganga River for their small-scale industry or basic daily needs. The following recommendation and interventions are required to get valuable products and solve the issues/ challenges faced by the local people of that region.

- The district consists of many wetlands. It is recommended to rejuvenate and restore these water bodies, leading to the solution to water scarcity and water quality in the region.
- It is recommended to promote organic farming and a scientific approach near the wetlands to lower the pollution of the wetlands. Also, these practices help attract the market and increase the yield of rice and jute products.
- It is recommended to promote small-scale industries like beekeeping, boat making and net making under the schemes by the Ministry of Micro, Small & Medium Enterprises.
- Aquaculture needs to be promoted under the Fisheries and Aquaculture Infrastructure Development Fund (FIDF) scheme, and the fishing industry needs to be boosted under Pradhan Mantri Matsya Sampada Yojana (PMMSY)
- It is recommended to promote the cultivation of mulberry and mango.
- It is recommended to promote sericulture and handicraft work like handicrafts made from wood.

5.4 ENERGY

5.4.1. Solar

- ❖ Awareness regarding various solar policies and schemes need to be made available to the rural people.
- ❖ Per Drop More Crop needs to be promoted in the district, having low ground water level
- ❖ Component A of PM-KUSUM scheme need careful inspection and installation at the barren lands in the district.
- ❖ Solar rooftop panels needs to be encouraged and should be made mandatory by the government to install at the government and private institutional buildings.

5.4.2. Biomass

- ❖ Awareness among farmers is needed, so that they could give their crop residues for generating bioenergy.
- ❖ Storage units and other logistic needs should be met by the government.
- ❖ Small biomass gasifiers or rice mills-based biomass plants should be encouraged to set up in the villages where the concentration of crop residue is higher, as it would save transportation costs and storage costs.
- ❖ Proper funding and guidance should be provided to the potential and existing biomass plant-holders.

5.4.3. Biogas

- Promotion of household biogas plant and different incentive scheme should be spread through posters, or slogans. Tourist attraction places should be targeted to conduct this activity.

5.4.4. Hydropower

- The Nodal Agency will identify pico/micro-hydel projects in a timely manner, and the central financial support relevant to the pico/micro-hydel project cost will be passed on to the qualified beneficiaries.
- Identification of hydel sites on Padma (Ganges), Bhagirathi, Brahmani, Bhairab, Mayurakshi, Jalangi, Dwarka, Bansloi, and Babla are some of the Padma (Ganges) families.

5.5. TOURISM

- To strengthen the tourism and attract large number of tourists, Tourism Product Diversification/Improvement is needed like, Promotion and packaging of tourist resources, Upgradation of identified tourist spots, Quality accommodations, Tourist Information Centre, Road and public transportation and Road furniture and signages etc.
- High future potential in Eco tourism, requires extensive development in physical infrastructure and advertisement.
- Development of paid picnic spots with food festivals is required in Lalgol-Jangipur.
- Project focuses on proposal of new tourist spots on Eco tourism and Market tourism.
- Maintenance of law and order, deploying tourist police force, disposing grievances, enacting suitable rules, regulation and laws for tourism development and Standardizing quality of tourism product and services.
- Cultural tourism as an important means of income and employment opportunity in and around in the district.
- High opportunity for historical, religious and eco-tourism development.
- Promotion of tourism entrepreneurship.
- Educate and aware the local community including the most vulnerable section of the society regarding alternative economic benefits derivable from tourism.
- Motivation of the young people by providing them with alternative economic and sociocultural benefits.
- Maintenance of local socio-cultural secular fabric of the district.
- Preserving the local traditions, culture values etc.
- Protection of socio-cultural and natural heritage of the district.
- Setting up a linkage between tourism and resource planning.
- Guide and Information Services at different levels e.g. licensed or local guiding training programme to the local youth by the district administration or State Tourism Department.
- Long- and short-term training program can be imparted to the students/ existing employees/ potential entrepreneurs for setting up and operating hotels, restaurants and

travel agencies with all possible technical, professional and financial support with a single window clearance facility.

- An elaborate and effective distribution system should be implemented to ensure distribution of brochures through information centres and internet.
- To create awareness campaigns, advertisements may be designed and telecasted /broadcasted in different print/electronic media.
- A strong Tie-Up with Travel Agencies and Tour Operators should be established, so that they can act as marketing agents for the tourist sites of the district.
- The aspect of availability of wayside amenities along the roads connecting various tourist spots needs particular attention with the participation of the private players.
- Skilled guide and interpreter service forms the root to the success of heritage tourism in any region.
- Government policies need to be formulated to develop the infrastructure, transportation system, information technology, green policing and revenue generation avenues for promotion and development of heritage tourism in the district.
- New projects to diversify the tourist inflow apart from the historical and religious tourism, emphasis on other tourism places for promotion of more tourism activities like, Arts & Crafts, Market Tourism, Fair & Festivals, Eco Tourism and Waterfront development etc.
- Development of combined projects involving Tourism department/ Ministry, Disaster management department and Environment, forest, and climate change section/Ministry. Stakeholder consultation & Participatory management and involvement of Municipality, and local communities and tour operators to build ecotourism options and choosing adventure and religious tourism sites.

6. Discussion during the Report Presentation

- Ensured on having DGC meeting for updates on the interventions shared in the presentation
- Textiles and Handloom can be explored for Delhi Haat.
- A proposal on Ghaat pe Haat will be submitted to the SPMG
- As per tourism is concerned, the district is known for cultural and old buildings.
- The IIML Report for Arth Ganga should be a regular Agenda item for next 6-8 DGC meetings.
- Hon'ble PM during the post-Budget webinar on Tourism had spoken about market potential of destination weddings. It was suggested that suitable Ashrams in Ganga Basin may be identified for such purpose to promote blissful experience, cost reduction, livelihood opportunities and better upkeep.
- Allocate separate space for Namami Gange Awareness and Jalaj Marketing kiosk in Melas/Congregatios/Fairs for providing better marketing opportunities to the Jalaj products.
- As Dilli Haat Centre – Namami Gange Awareness and Marketing Centre – is being launched soon, it was requested that every district to identify niche products with a creative story and link it with Jalaj in their area.
- To identify Arth Ganga Tourist Trails and organize Ganga Guide training
- Promotion of Natural Farming in Ganga Basin and training workshops should be organized on a regular basis. NMCG is supporting this initiative in coordination with MoA& FW and NCOF.
- Make plans for reuse of treated waste water for agriculture, industrial etc. purpose and also the sludge.
- Training of volunteers for Ganga awareness & Aarti workshops to promote regular aartis on Ghats.

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6 APPENDICES

Table 1 Biogas potential from animal waste.

Livestock	**Residue type**	**Total population as of 2012**	**Manure yield * (kg/day)**	**Total manure generation annually (kg)**	**Average collection (75%)**	**Dry manure after removing Moisture content**	**Manure required for biogas* (kg/m³)**	**Biogas potential (m³/yr)**	**m3/day**	**Dry matter per day**
Cattle	Manure	1199817	10	4,37,93,32,050	328449938	656899807.5	25	26275992.3	71989.02	2E+06
Buffalo	Manure	66783	15	36,56,36,925	274227693.8	548455387.5	25	21938211.55	6010.47	150262
Sheep	Manure	51415	1	1,87,66,475	14074856.25	2814971.25	25	112598.85	308.49	7712.3
Goat	Manure	1751276	1	63,92,15,740	479411805	95882361	25	3835294.44	10507.656	262691
Pig	Manure	8236	2.5	75,15,350	5636512.5	1127302.5	25	45092.1	123.54	3088.5
Total		**30,77,527**						**32462799.2**		

Table 2 Biogas potential from agricultural waste.

Crop	**residue type**	**Total crop production (tons) (2017-18)**	**Residue production ratio**	**Residue amount (tons)**	**Average collection (70%)**	**Moisture content**	**Residue amount after removing moisture (tons)**	**Biogas potential [m3/(tons of dry matter)]**	**Overall biogas potential (m3)**

Maize	straw	10763	1.5	16144.5	11301.15	15	9605.9775	800	7684782
Rice	husk	1190485	0.28	333335.8	233335.06	30	163334.542	800	130667633.6
sugarcane	bagasse	312958	0.33	103276.14	72293.298	80	14458.6596	750	10843994.7
Total		**1514206**							**149196410.3**