Arth Ganga Project: District Malda

Submitted to:

National Mission for Clean Ganga (NMCG)

Submitted by:

IIM Lucknow

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JUNE-2022

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Malda, a city in the state of West Bengal, is known for its art and cuture. Malda is lying on the confluence of the Mahananda and Kalindi rivers.

The total geographical area of the district is 3,733.66 km^2. The primary sector contributes, on average, 31.51% to the district GDP with an average annual growth rate in this sector from 2007-08 to 2013-14 was 1.25%. Its share in the total GDP decreased from 36.59% in 2007-08 to 27.86% in 2013-14. The share of the secondary sector increased from 19.73% in 2007-08 to 22.13% in 2013-14, with an average annual growth rate of 8.11%. The tertiary sector grew with a remarkable average annual growth rate of 8.33%, and its share increased from 43.67% in 2007-08 to 50.01% in 2013-14. Overall, the district economy grew with an average annual growth rate of 5.91% during the study period.

The cropping intensity of the district is 182.57%. Major crop types are wheat, rice, maize, pulses, cereals,etc. along with oilseeds, etc. The livestock consists of cattle (indigenous and crossbred), buffalos (indigenous and crossbred), pigs,fisheries. The total number of cattle increased in the district from 645 thousand in 2003 to 1039 thousand in 2019, a net increase of 60.99%. Total buffaloes have decreased from 58 thousand in 2003 to 38 thousand in 2019, a net decrease of 33.84%. Total pigs have also increased from 60.36 thousand in 2003 to 70.97 thousand in 2019, a net increase of 17.57%. The total livestock population has significantly increased in the district from 1466 thousand in 2003 to 2557 thousand in 2019, a net increase of 74.41%. The total milk production went up from 197 thousand tons in 2011-12 to 209 thousand tons in 2015-16. Fish Production was 56929 tons in 2011-12 in Malda which increased to 60758 tons in 2014-15. Malda represented around 3.86% of the total fish production in West Bengal in 2011-12 but its share decreased to 3.75% in 2014-15.

The share of cultivable wasteland remained constant at 0.03% between 2011-12 to 2019-20. The share of barren and uncultivable land remained constant (0%) over the years. The fallow land has significantly decreased over the years, from 16.12% in 2011-12 to 13.40% in 2019-20. The net sown area has slightly increased over the years, from 62.31% in 2011-12 to 62.52% in 2019-20. The area for non-agricultural use went up from 20.30% in 2011-12 to 23.29% in 2019-20. In 2019-20, the nitrogen decreased to 55.26%, while the phosphorus and potassium share has increased to 25.82% and 18.92 respectively. In 2019-20, the use of potassium was more than the recommended ratio, while nitrogen and phosphorous uses were less than the recommended ratio. The use of chemical fertilizers has increased in the district from 157.36 kg/ ha GSA in 2013-14 to 207.70 kg/ ha GSA in 2019-20

According to the 2021 Forest survey, forests cover of the district was 13.10% out of the total geographical area which is 3733 sq. km. With respect to 2019 forest assessment there has been decrease in the forest area of the district by 2.79 sq. km. The district has a total of 488.90 sq. km. under the forests out of which 208.10 sq. km. is under moderately dense forests and 280.80 sq. km under the open forests. There are 385 bird species and twenty-four threatened/rare species of bird in the district.

Malda is known for its historical, cultural, crafts and art as well as festivities. Malda has special cultural sorts like Gombhira, Alkap, Kavigan, etc. Malda is a religious hub with a lot of mosques, temples and Gurudwara located in and around the district.Historical buildings attracts millions of tourists to the

places where they have been built. There are a number of sites having eco-tourism potential, that have been developed around spot like Adina Deer Park, Gabgachi Wetland, Nawada Wetland, Rajdighi Forest, Jatradanga Forest, Malda Bill, Vatra Bill, Kumargana Bill, Nayabandh Bird Watch etc.

In the district, kerosene is used by the highest number of households, around 62.60% of the households use this source of lightning. Second major source of lightning is electricity, which is used by 35.50% of the households. Solar energy is used by 0.90% of the households, other oil by 0.40% of the households, other sources of lightning by 0.10% of the households. Around 0.60% of the households do not any source of lightning in the district. The total number of wetlands existing in the district is 4939 consisting of both Man-made and Natural. Most of them are lakes/ponds, riverine and tanks/ponds. Biogas potential from animal waste is calculated approximately as fifty-eight lakhs m3/year and one crores m3/year from agricultural waste. No hydropower plant exists in the district.

To promote sustainable development creating awareness, educating people about renewable energies, sanitation, Adopting Public-Private partnerships, upgrading staff and facilities, afforestation, combating arsenic contamination problem, etc. Drip and Sprinkler irrigation, introducing Vermicomposting, use of high-yielding seeds, micro-irrigation, zero tillage, mulching, drum seeder, constructing and maintaining harvesting structures, adopting greenhouse farming with organic farming, greenhouse and poly house and encouraging farmers for adapting different crop cultivation and various irrigation methods, adopt resources conservation technologies, Various measures such as eco-tourism should be taken to improve tourism and enhance the use of renewable energy especially by creating awareness. Along with focusing on agriculture practices Bee culture, dairy, poultry, fisheries, scientific method in fish culture, fruit cultivation, medicinal crops like ekangi, etc. needs encouragement as they have high economic potential. Monitoring and training programs and awareness and introducing Pradhan Mantri Matsya Sampada Yojana, KVKs instruction, etc.

1. DISTRICT OVERVIEW

1.1 INTRODUCTION

Malda district, also spelt Maldah or Maldaha , is a district in West Bengal, India. It lies 347 km (215 miles) north of Kolkata, the capital of West Bengal.

The district maintains the traditions of the past in culture and education. Old Maldah, the town which lies just east of the confluence of the Mahananda and Kalindi rivers, is part of the English Bazar urban agglomeration. The town rose to prominence as the river port of the old capital of Pandua. During the 18th century it was the seat of prosperous cotton and silk industries. It remains an important distributing centre for rice, jute, and wheat. Historical monuments include the mosque Jami' Masjid (1566) and the landmark Nimasari tower across the river. Constituted as a municipality in 1867, it has several colleges affiliated with the University of North Bengal. Rice, jute, legumes, and oilseed are the chief crops in the surrounding area. Mulberry plantations and mango orchards occupy large areas; mango trade and silk manufacture are the main economic activities. The Independence Day of Malda is 17 August 1947. The headquarters of Malda district is in English Bazar, also known as Malda, which was once the capital of Bengal. The latitude

range is 24°40’20" N to 25°32’08" N, and the longitude range is 87°45’50" E to 88°28’10" E. The district covers an area of 3,733.66 square kilometres (1,441.6 sq mi). The total population (as of 2001 Census) was recorded as 3,290,160.

The district comprises two subdivisions: Chanchal and Malda Sadar. Chanchal consists of six community development blocks: Chanchal–I, Chanchal–II, Ratua–I, Ratua–II, Harishchandrapur–I and Harishchandrapur–II. Malda Sadar subdivision consists of Old Malda municipality, English Bazar municipality and nine community development blocks: English Bazar, Gazole, Habibpur, Kaliachak–I, Kaliachak–II, Kaliachak–III, Manickchak, Old Malda and Bamangola. English Bazar is the district headquarters. There are 12 police stations, 15 development blocks, 2 municipalities, 146 gram panchayats and 3,701 villages in this district.

Rice, jute, legumes, and oilseed are the chief crops in the surrounding area. Malda is the largest producer of excellent quality jute in India. Mulberry plantations and mango orchards also occupy large areas; mango trade and silk manufacture are the main economic activities. Mango, jute and silk are the most notable products of this district. The special variety of mango, Fazli, produced in this region is popularly known by the name of the district and is exported across the world and is internationally acclaimed.

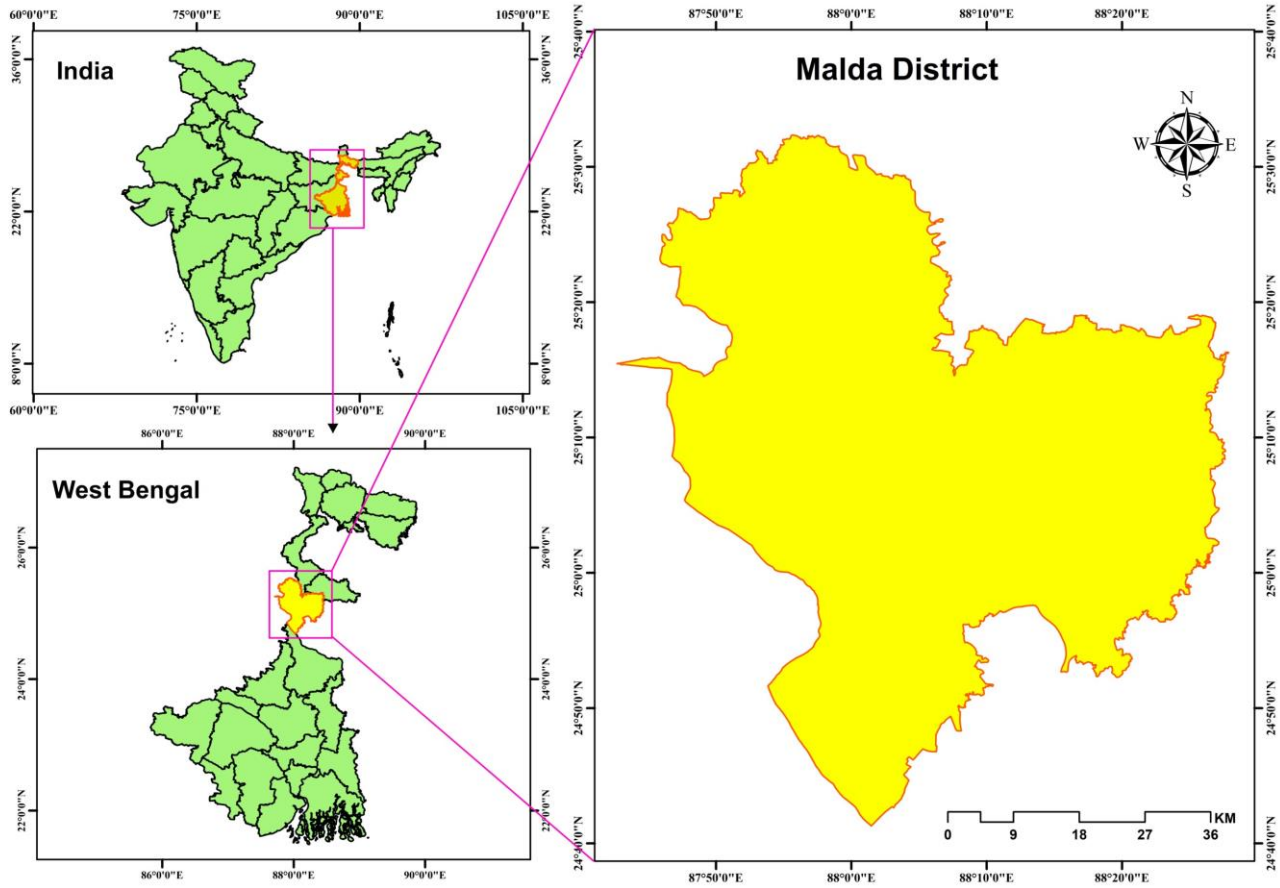


Figure 1 Map of the district

1.2 DEMOGRAPHIC PROFILE OF MALDA

Malda district is also spelt as Maldaha or Maldah. The district lies at a latitude between 24°40'20" N to 25°32'08" N and at a longitude between 87°45'50" E to 88°28'10" E. The aggregate area of the district is 3733.66 sq.km. The district is surrounded by Murshidabad district to the South, by North Dinajpur and South Dinajpur district in the North, by Bangladesh in the East, and Santhal Parganas division of Jharkhand and Purnea district of Bihar in the West. The district headquarters is situated in English Bazar. There are two subdivisions, namely; Malda Sadar and Chanchal. There are 17 blocks, namely; Harishchandrapur-I, Harishchandrapur-II, Chanchal-I, Chanchal-II, Ratua-I, Ratua-II, Gazole, Bamongola, Habibpur, Old Malda, Old Malda(M), English Bazar, English Bazar(M), Manikchak, Kaliachak-I, Kaliachak-II, and Kaliachak-III. There are 1613 villages in the district.

According to the Census of India 2011, the aggregate population of the district is 3988845. Out of this 2051541 is male population, which is around 51.43% of the total population, and 1937304 is female population, which is around 48.56% of the total population. The sex ratio is 94 females per 100 males. Moreover, there are 541660 people living in the urban areas, which is around 13.57%, and 3447185 people living in the rural areas, which is around 86.42% of the total population. According to the Directorate of Agriculture (Evaluation), Government of West Bengal, as of 2013-14, the total forest area is 1680 hectares and the net sown area is 232160 hectares.

The economy of the district depends upon agriculture sector. The major crops produced in the district are wheat, paddy, jute, rabi-crops, mangoes, and raw silk. The district is backward in infrastructural and capital accessibility.

1.3 ECONOMIC PROFILE OF MALDA

The primary sector significantly impacts the district economy because it contributes, on average, 31.51% to the district GDP. However, the average annual growth rate in this sector from 2007-08 to 2013-14 was 1.25% only. Resultantly, its share in the total GDP decreased from 36.59% in 2007-08 to 27.86% in 2013-14. The share of the secondary sector increased from 19.73% in 2007-08 to 22.13% in 2013-14, with an average annual growth rate of 8.11%. The tertiary sector grew with a remarkable average annual growth rate of 8.33%, and its share increased from 43.67% in 2007-08 to 50.01% in 2013-14. Overall, the district economy grew with an average annual growth rate of 5.91% during the study period. Steps should be taken to increase the productivity of the primary sector so that it may grow at a higher rate. The secondary and tertiary sectors performed relatively well during the study period.

Table 1: Trends in Gross District Domestic product in Malda 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
	24879	13417	29693	67988	-	-	-	-
2007	(36.59)	(19.73)	(43.67)	(100)				

	24314	12969	32963	70246	-2.27	-3.34	11.01	3.32
2008	(34.61)	(18.46)	(46.93)	(100)				
	25730	14985	35975	76689	5.82	15.54	9.14	9.17
2009	(33.55)	(19.54)	(46.91)	(100)				
	24554	16159	39348	80061	-4.57	7.83	9.38	4.40
2010	(30.67)	(20.18)	(49.15)	(100)				
	24679	18128	42619	85426	0.51	12.19	8.31	6.70
2011	(28.89)	(21.22)	(49.89)	(100)				
	25515	18957	45179	89650	3.39	4.57	6.01	4.94
2012	(28.46)	(21.15)	(50.39)	(100)				
	26700	21211	47938	95849	4.64	11.89	6.11	6.91
2013	(27.86)	(22.13)	(50.01)	(100)				
Average Growth Rate					1.25	8.11	8.33	5.91

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 3709.2 sq. km². The area under forest has remained constant (0.46%) over the years, which is quite low and needs to be increased. The share of barren and uncultivable land is reported to be (0%) of the total declared area. The share of cultivable wasteland has also remained constant (0.03%) over the years. The fallow land has significantly decreased over the years, from 16.12% in 2011-12 to 13.40% in 2019-20. Moreover, the net sown area (NSA) has slightly increased over the years, from 62.31% in 2011-12 to 62.52% in 2019-20. The area for non-agricultural use went up from 20.30% in 2011-12 to 23.29% in 2019-20 (Table 2). The area under trees and gardens decelerated from 0.78% in 2011-12 to 0.30% in 2019-20, which needs to be increased to achieve sustainable development goals. Overall, the land use pattern shows no much change over the years.

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

Year	TOTAL REPORTED AREA (in 1000 Ha)	AREA UNDER FOREST	CULTIVABLE WASTELAND	TOTAL FALLOW	LAND OTHER THAN AGRICULTURE	AREA UNDER TREES AND GARDENS	NET SOWN AREA
1	2	3	4	5	6	7	8
2011	370.9	0.46	0.03	16.12	20.30	0.78	62.31
2012	370.9	0.46	0.03	14.64	21.78	0.78	62.31

2013	370.9	0.46	0.03	14.21	21.92	0.81	62.60
2014	370.9	0.46	0.03	13.53	22.05	0.78	63.17
2015	370.9	0.46	0.03	12.73	22.19	0.73	63.87
2016	370.9	0.46	0.03	12.46	22.53	0.73	63.81
2017	370.9	0.46	0.03	13.18	22.86	0.46	63.01
2018	370.9	0.46	0.03	13.40	23.27	0.35	62.50
2019	370.9	0.46	0.03	13.40	23.29	0.30	62.52
Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/							

2.1.2 Trends in Operational Land Holdings

Malda district's total number of operational farms increased from 393 thousand in 2010-11 to 396 thousand in 2015-16, a net increase of 0.76%. 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% (Table 3). Most land positions in the district are marginal and small. These two size categories represented 96.27% in the district in 2015-16, almost representing the state average similar to the corresponding proportion in the state was (96.22%). 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 Malda

	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.)
Malda	2010-11	83.4	12.65	3.66	0.29	0	393
	2015-16	83.77	12.5	3.56	0.17	0	396
							[0.76]
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: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/							

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

2.1.3.1 The Trend in Cropping Patterns

Rice and Maize dominate 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 (42.19%), followed by Maize (11.83%). The area shared by the total cereals has decreased from 58.19% in 2013-14 to 57.36% in 2019-20. The main pulses produced are black gram, Masoor and Khesari. The total pulses acreage went up from 4.82% in 2013-14 to 6.05% in 2019-20. The total food grain acreage increased slightly from 63.01% in 2013-14 to 63.41% in 2019-20. Moreover, the food grains cover a majority of the GCA

(average, 62.71%). Mustard is the major oilseeds crop produced, and the total oilseed acreage went up from 8.03% in 2013-14 to 9.10% in 2019-20. Jute is a major fiber crop in Malda, however, area shared by Jute decreased from 5.48% in 2013-14 to 4.71% 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 199.18, indicating that the farmers are growing two crops in a year.

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	44.33	45.01	43.93	42.35	45.44	43.98	42.19
Wheat	9.97	9.79	10.77	10.14	2.06	2.29	3.33
Maize	3.61	3.57	3.64	4.27	7.80	8.99	11.83
Other Cereals	0.29	0.31	0.30	0.30	0.04	0.00	0.00
Total Cereals	58.19	58.67	58.64	57.07	55.34	55.27	57.36
Black gram (urad)	2.45	2.53	2.34	2.06	2.27	2.25	2.39
Masoor (Lentil)	0.82	0.90	1.34	1.42	1.47	1.50	1.89
Khesari (Lathyrus)	0.56	0.53	0.98	0.64	0.79	0.69	0.58
Other Pulses	0.98	1.04	1.53	1.50	0.66	1.13	1.19
Total Pulses	4.82	5.00	6.19	5.63	5.18	5.57	6.05
Total Food Grains	63.01	63.68	64.84	62.69	60.53	60.84	63.41
Mustard	7.85	7.74	6.88	8.12	9.88	9.79	8.87
Other Oilseeds	0.18	0.20	0.47	0.37	0.11	0.15	0.23
Total Oilseeds	8.03	7.93	7.34	8.48	9.99	9.94	9.10
Jute	5.48	4.89	4.81	5.20	5.33	5.50	4.71
Net Sown Area	51.77	51.64	50.43	50.83	49.65	49.64	47.73
Gross Sown Area (in 1000 Ha)	448.5	453.7	469.8	465.6	470.7	467.0	485.9
Cropping Intensity	193.15	193.64	198.31	196.72	201.41	201.47	209.53

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. Maize, Rice, and Wheat are the main crops in the district, and their per hectare yield, 80.89 qtls, 32.45 qtls, and 25.86 qtls, respectively, in 2019-20 are significant. Moreover, the yield of total cereals increased from 33.74 qtls in 2013-14 to 42.06 qtls in 2019-20. It was mainly due to a significant increase in the yield of Maize. Similarly, the per hectare yield of total pulses went up from 9.91 qtls in 2013-14 to 10.20 qtls in 2019-20. The yield of total oilseeds also increased from 10.86 qtls in 2013-14 to 13.44 qtls in 2019-20. The yield of total food grains evinced an increase from 31.92 qtls in 2013-14 to 39.02 qtls in 2019-20. The yield of Jute increased from 28.98 qtls in 2013-14 to 29.51 qtls in 2019-20. In summary, all crop yields show yearly fluctuations, with a significant rise observed in the yield of pulses and oilseeds in the later years of the study. The lack of stability in yields makes farmers' income riskier, requiring a solid insurance protection measure.

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

Crop/Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Rice	35.43	34.65	34.18	34.01	29.45	32.47	32.45
Wheat	29.46	28.36	28.12	30.93	32.47	34.95	25.86
Maize	26.36	22.90	23.27	48.99	77.52	80.52	80.89
Total Cereals	33.74	32.78	32.28	34.47	36.32	40.39	42.06
Black gram (urad)	9.27	9.22	9.00	7.92	10.65	9.33	8.88
Masoor (Lentil)	10.00	6.83	9.68	10.15	9.13	11.43	9.24
Khesari (Lathyrus)	11.60	11.25	9.78	12.33	10.54	11.88	14.64
Total Pulses	9.91	8.81	9.35	9.05	10.37	10.54	10.20
Total Food Grains	31.92	30.89	30.09	32.19	34.10	37.66	39.02
Mustard	10.88	11.94	11.24	11.75	12.67	15.69	13.50
Total Oilseeds	10.86	11.81	10.87	11.47	12.68	15.63	13.44
Jute	28.98	31.01	29.92	28.23	28.04	29.27	29.51
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 Maize dominate the production. In 2019-20, Rice (665.3 thousand tonnes) and Maize (465.1 thousand tonnes) formed a significant part of the total cereal production (1172.30 thousand tonnes). Moreover, there is an increase in the production of total cereals from 880.7 thousand tons in 2013-14 to 1172.30 thousand tons in 2019-20. Coming to pulses, black gram, masoor, and khesari occupied the highest production, with their production being 10.3 thousand tons, 8.5 thousand tons, and 4.1 thousand tons, respectively, in 2019-20. Although these pulses show variation in the production across years, they still represent 76.33% of the total pulse production. Mustard production was 58.2 thousand tons, representing around 97.97% of the total oilseed production in 2019-20. Jute production decreased from 71.3 thousand tons in 2013-14 to 67.6 thousand tons in 2019-20. Looking at the annual production data of various crops, we find that the production of total cereals, pulses, and oilseeds significantly increased, which can be further increased by providing proper insurance arrangements so that farmers may take more risks and diversify their cropping pattern.

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

Crop/Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Rice	704.4	707.6	705.4	670.6	629.9	666.9	665.3
Wheat	131.7	125.9	142.3	146	31.5	37.4	41.9
Maize	42.7	37.1	39.8	97.5	284.5	338.2	465.1
Other Cereals	1.9	1.9	1.9	1.9	0.3	0	0
Total Cereals	880.7	872.5	889.4	916	946.2	1,042.50	1,172.30
Black gram (urad)	10.2	10.6	9.9	7.6	11.4	9.8	10.3
Masoor (Lentil)	3.7	2.8	6.1	6.7	6.3	8	8.5
Khesari (Lathyrus)	2.9	2.7	4.5	3.7	3.9	3.8	4.1
Other Pulses	4.6	3.9	6.7	5.7	3.7	5.8	7.1

Total Pulses	21.4	20	27.2	23.7	25.3	27.4	30
Total Food Grains	902.1	892.5	916.6	939.7	971.5	1069.9	1202.3
Mustard	38.3	41.9	36.3	44.4	58.9	71.7	58.2
Other Oilseeds	0.8	0.6	1.2	0.9	0.7	0.8	1.2
Total Oilseeds	39.1	42.5	37.5	45.3	59.6	72.5	59.4
Jute	71.3	68.8	67.6	68.3	70.4	75.2	67.6
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) in the area, production, and yield of the main crops. Among different crops, the lowest variability in the area is observed in Rice (2.67%), followed by black gram (6.23%) and mustard (14.40%), and the highest in wheat (58.49%). The variability in the area shared by Jute is 5.62%. The variability in the area under total pulses (11.60%) is much higher than in the area under total cereals (2.94%). Since Rice dominates the production, the variability in the area under total food grains is relatively low (3.50%). Variability in the area under total oilseeds is 13.07%.

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	204.41	5.46	2.67	678.59	28.79	4.24	33.23	1.99	6.00
Wheat	31.93	18.68	58.49	93.81	53.70	57.24	30.02	3.03	10.10
Maize	29.37	16.29	55.45	186.41	174.49	93.60	51.49	27.80	53.98
Total Cereals	266.53	7.82	2.94	959.94	110.25	11.49	36.01	3.82	10.62
Black gram (urad)	10.84	0.68	6.23	9.97	1.17	11.76	9.18	0.81	8.81
Masoor (Lentil)	6.26	1.87	29.85	6.01	2.10	34.86	9.49	1.40	14.75
Khesari (Lathyrus)	3.17	0.77	24.20	3.66	0.64	17.57	11.72	1.55	13.19
Total Pulses	25.63	2.97	11.60	25.00	3.54	14.17	9.75	0.68	6.98
Total Food Grains	292.16	10.24	3.50	984.94	113.11	11.48	33.70	3.43	10.17
Mustard	39.39	5.67	14.40	49.96	13.16	26.34	12.52	1.65	13.16
Total Oilseeds	40.51	5.30	13.07	50.84	13.14	25.83	12.39	1.71	13.78
Jute	23.90	1.34	5.62	69.89	2.73	3.91	29.28	1.01	3.46
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 Maize (93.60%), followed by wheat (57.24%) and masoor (34.86%). The variability in jute production is 3.91%, that is low. The variability in the production of total oilseeds is 25.83%. Improvement in crop insurance conditions and better market accessibility can lower this variation. Variability is lowest in Rice (4.24%), followed by black gram (11.76%) and khesari (17.57%).

In the case of yield, the highest variability is estimated in Maize (53.98%), followed by masoor (14.75%), and khesari (13.19%). Yield variability in total pulses (6.98%) is much lower than in total cereals (10.62%). Several factors, such as climate change, market prices, rainfall patterns, etc., influence the variability in agricultural production.

2.1.6 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 64.65 of the total fertilizers used, while the proportions of phosphorus and potassium were 19.07% and 16.28%, respectively. In 2019-20, however, the nitrogen share decreased to 55.26%, while the phosphorus and potassium share has increased to 25.82% and 18.92 respectively. In 2019-20, the use of potassium was more than the recommended ratio, while nitrogen and phosphorous uses were less than the recommended ratio. The table also shows that fertilizer consumption varies yearly, 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 157.36 kg/ ha GSA in 2013-14 to 207.70 kg/ ha GSA in 2019-20, the authorities should take steps 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	101.73	130.48	131.53	124.64	98.56	110.00	114.78
Phosphorous	30.00	51.01	52.62	48.03	49.45	43.34	53.63
Potassium	25.62	38.38	37.51	37.77	41.18	31.64	39.29
Total	157.36	219.86	221.66	210.44	189.18	184.97	207.70
GSA (1000 Ha)	448.5	453.7	469.8	465.6	470.7	467	485.9

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

2.1.7 Trends in Livestock Sector

The total number of cattle increased in the district from 645 thousand in 2003 to 1039 thousand in 2019, a net increase of 60.99%. However, the number of adult male cattle decelerated from 153 thousand to 135 thousand in the same period. The increase in total cattle has been due to an increase in adult female cattle (from 215 thousand to 362 thousand) and young cattle (from 277 thousand to 542 thousand) in the same period. Cattle represent 94.19% of the total large ruminants. On the other hand, total buffaloes have decreased from 58 thousand in 2003 to 38 thousand in 2019, a net decrease of 33.84%. The decrease in total buffaloes has been due to a significant decline in the number of adult male buffaloes (from 39 thousand to 13 thousand). However, there is a significant increase in the number of adult female buffaloes (from 8.97 thousand to 10.77 thousand) and young buffaloes (from 10.29 thousand to 14.79 thousand) in the same period. Buffaloes represent around 5.81% of the total large ruminants. Total sheep have decreased from 37.88 thousand in 2003 to 32.92 thousand in 2019, a net decrease of 13.09%. Total goats

have drastically increased from 665 thousand in 2003 to 1376 thousand in 2019, a net increase of 107.14%. Total pigs have also increased from 60.36 thousand in 2003 to 70.97 thousand in 2019, a net increase of 17.57%. The total livestock population has significantly increased in the district from 1466 thousand in 2003 to 2557 thousand in 2019, a net increase of 74.41%.

It is significant to note that the number of female cattle and female buffaloes has 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 Malda

Category	2003	2007	2012	2019
CATTLE TOTAL	645.2	731.64	755.06	1038.76
CATTLE ADULT MALE	153.2	156.48	136.39	134.62
CATTLE ADULT FEMALE	214.66	241.76	280.96	361.96
CATTLE YOUNG TOTAL	277.35	333.4	337.71	542.18
CATTLE SHARE IN LARGE RUMINANT (Percent)	91.74	93.5	95.09	96.43
BUFFALO TOTAL	58.11	50.83	38.98	38.44
BUFFALO ADULT MALE	38.86	34.81	21.56	12.88
BUFFALO ADULT FEMALE	8.97	6.66	8.77	10.77
BUFFALO YOUNG TOTAL	10.29	9.37	8.65	14.79
BUFFALO SHARE IN LARGE RUMINANT (Percent)	8.26	6.5	4.91	3.57
SHEEP TOTAL	37.88	56.21	39.06	32.92
SHEEP SHARE IN SMALL RUMINANT (Percent)	5.39	5.45	4.15	2.34
GOATS TOTAL	664.5	975.51	901.75	1376.49
GOATS SHARE IN SMALL RUMINANT (Percent)	94.61	94.55	95.85	97.66
PIGS TOTAL	60.36	60.79	53.74	70.97
LIVESTOCK TOTAL	1466.39	1875.2	1788.72	2557.58

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

2.1.8 Trends in Milk Production

Table 10 shows the trends in Milk Production in Malda over the years. Cow milk has the largest share in milk production. Moreover, cow milk production increased by 4.76% from 2011-12 to 2015-16. Buffalo milk production also increased from 8 thousand tons in 2011-12 to 11 thousand tons in 2015-16. The total milk production went up from 197 thousand tons in 2011-12 to 209 thousand tons in 2015-16, majorly due to an increase in cow milk production. Milk production can increase further by providing incentives for 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	189	192	188	225	198
TOTAL BUFFALO MILK PRODUCTION	8	8	8	10	11
TOTAL MILK PRODUCTION	197	200	196	235	209

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

2.1.8 Trends in Fish Production

Table 11 shows the trends in Fish Production in Malda as compared to the total fish production in West Bengal. Fish Production was 56929 tons in 2011-12 in Malda which increased to 60758 tons in 2014-15. Malda represented around 3.86% of the total fish production in West Bengal in 2011-12. However, its share decreased to 3.75% in 2014-15.

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

District/Year	2011-12	2012-13	2013-14	2014-15
Malda	56929	58351	63006	60758
West Bengal	1472069	1488811	1580647	1617319

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

2.2 FORESTRY

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.

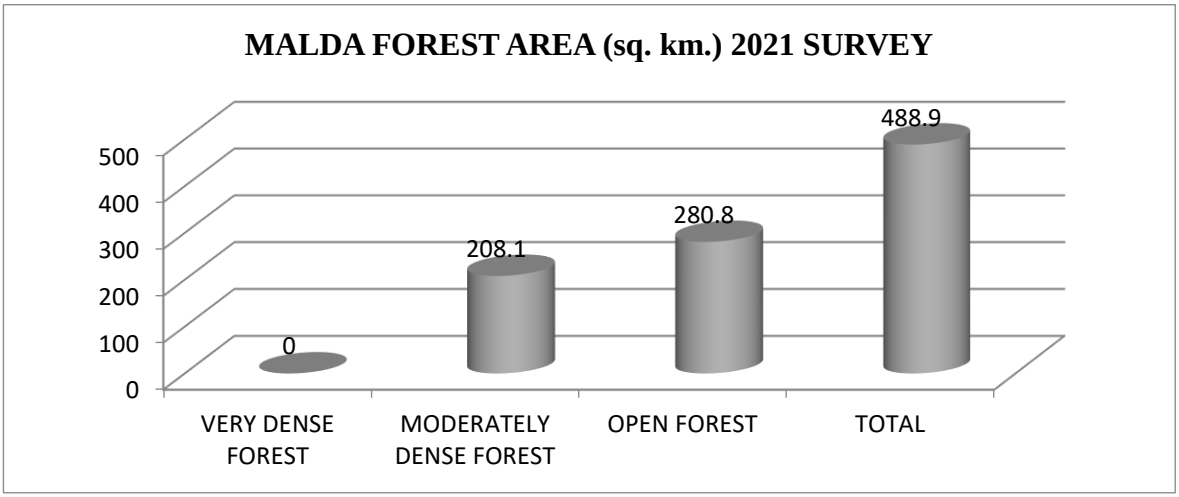


Fig. 1

According to the 2021 Forest survey, forests cover of the district is 13.10% out of the total geographical area which is 3733 sq. km. With respect to 2019 forest assessment there has been decrease in the forest area of the district by 2.79 sq. km.

The district has a total of 488.90 sq. km. under the forests out of which 208.10 sq. km. is under moderately dense forests and 280.80 sq. km under the open forests. The district does not has any land area under very dense forests and scrubs as depicted in Fig. 1.

The district has 600 ha of cultivable wasteland, 14400 ha of land under other fallows and 21500 ha under current fallow.

2.2.1. Biodiversity

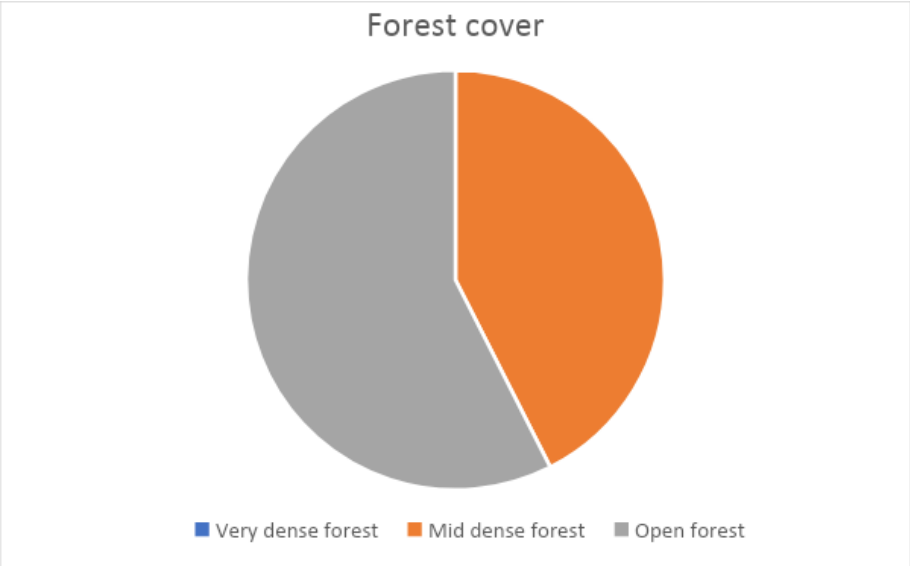
The district's biodiversity data includes various crop production, livestock population, bird species, and forest cover. The crop production trend shows an increase in crop production. Forest data shows that forest cover was increased by 13.17 % in 2019. There are 385 bird species and twenty-four threatened/rare species of bird in the district.

Table 1 Bird species recorded in the district.

Number of species	385
Number of rare/accidental species	24

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
3733	0	209.04	282.65	491.69	13.17	0.69	0



2.3 TOURISM

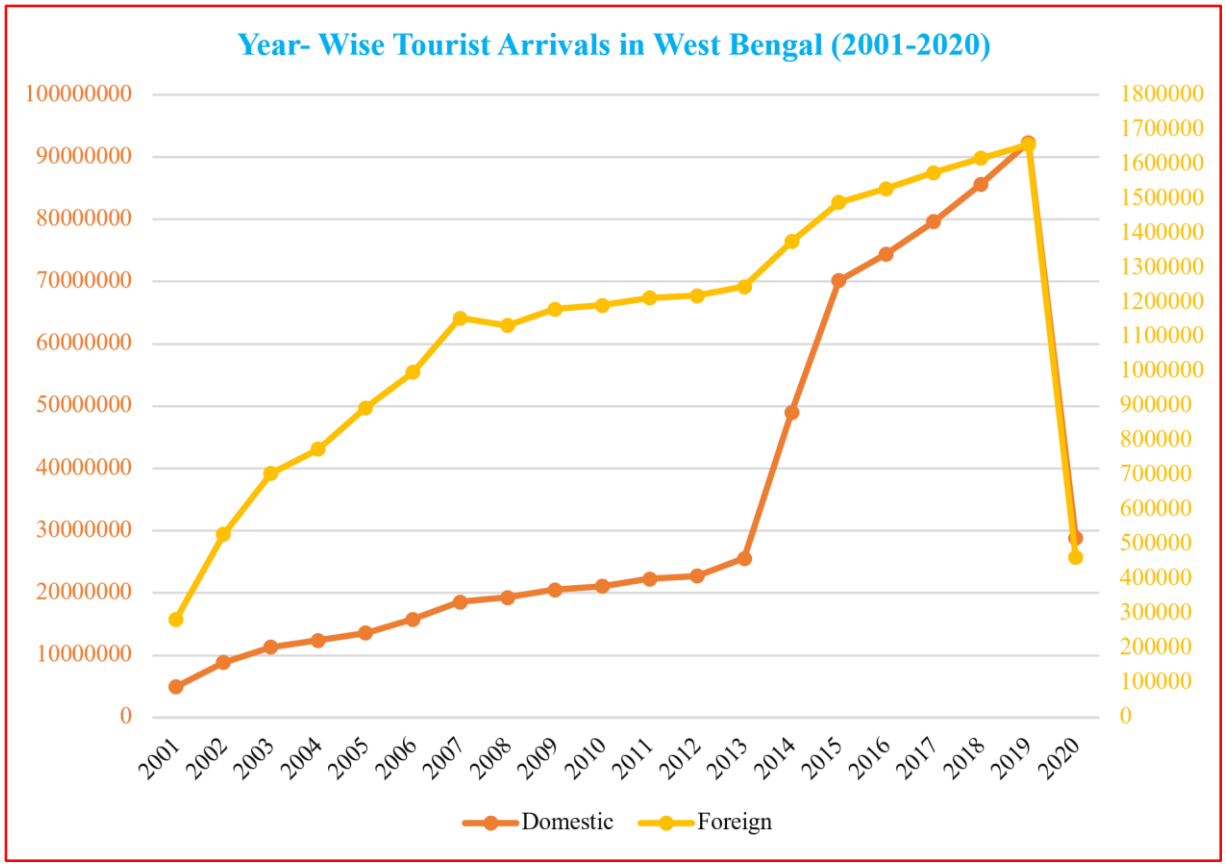
WEST BENGAL: YEAR WISE TOURIST ARRIVALS (2001 TO 2020)

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)

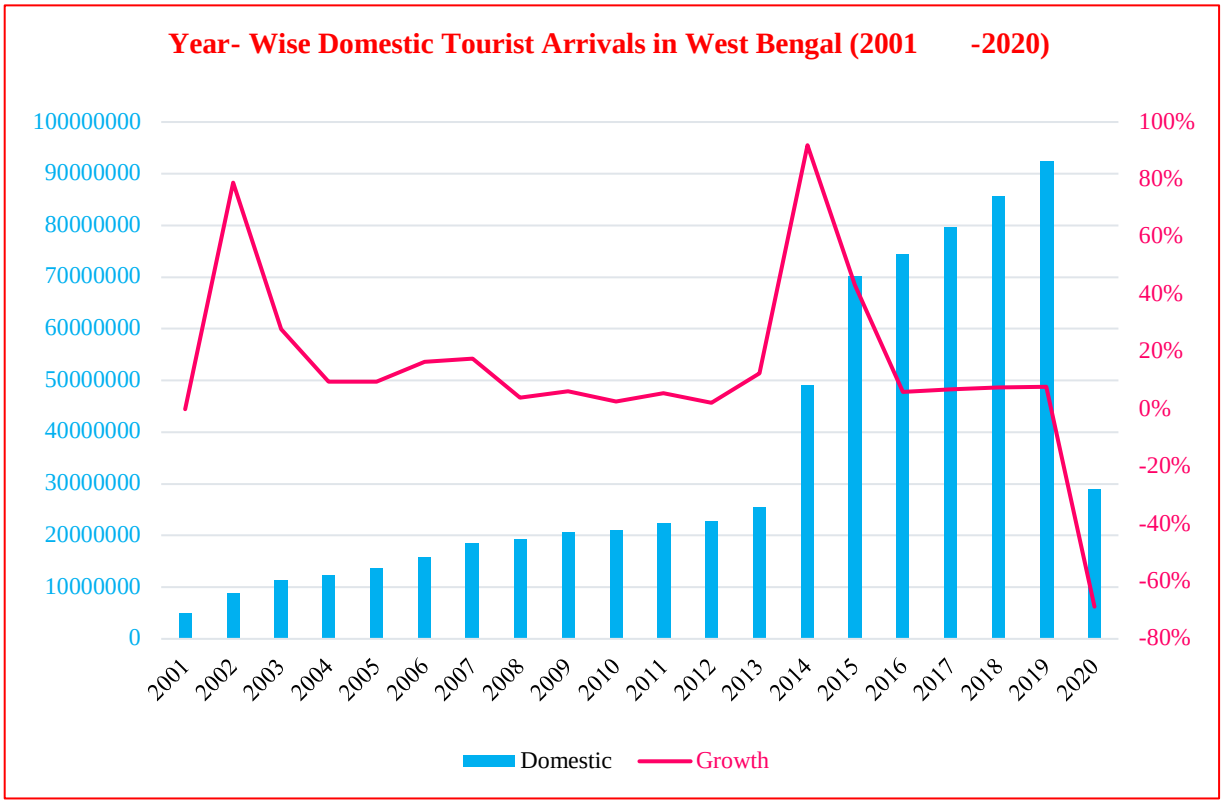


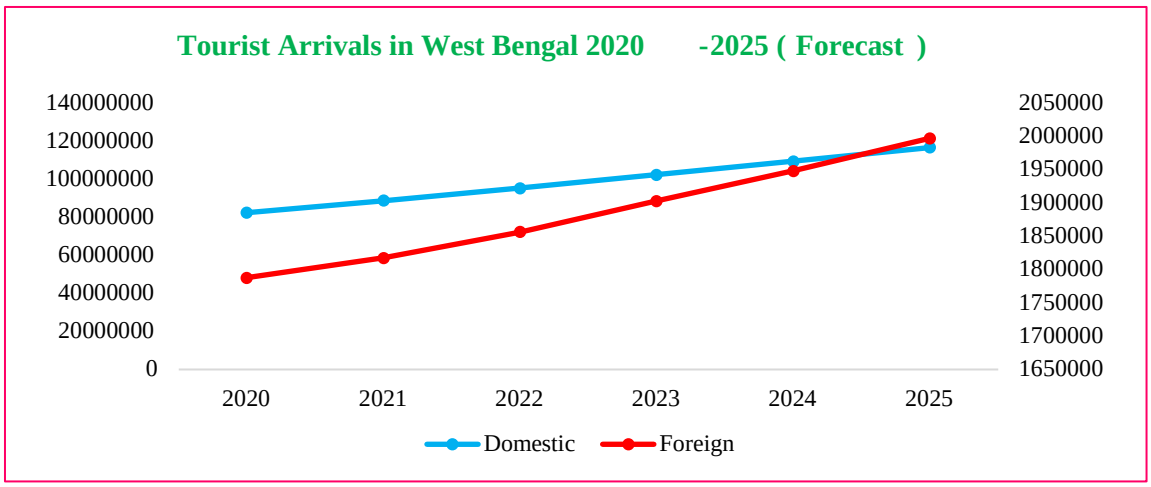
Figure: 3 West Bengal: Year Wise Foreign Tourists Arrivals (2001 to 2020)

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)

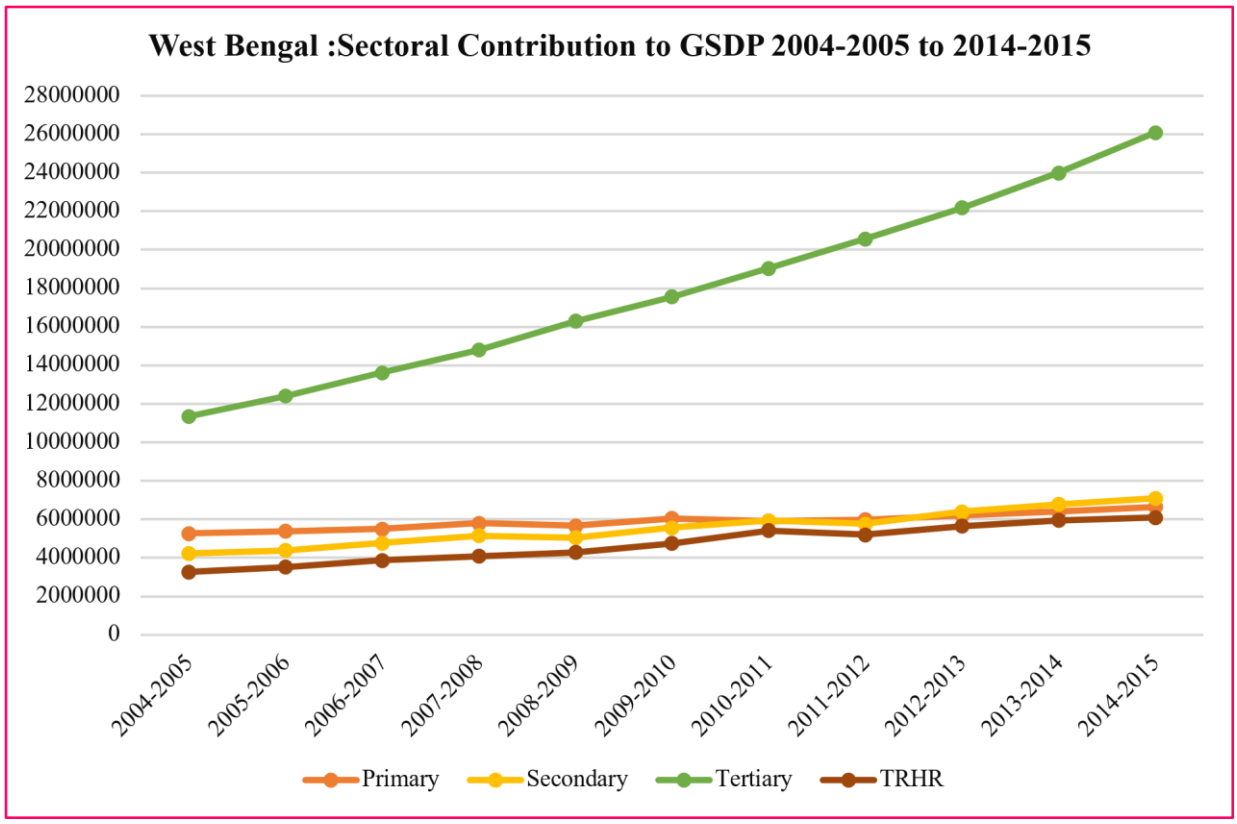
- Table: 3 Sectoral Contribution to GSDP West Bengal 2004-2005 to 2014-2015

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



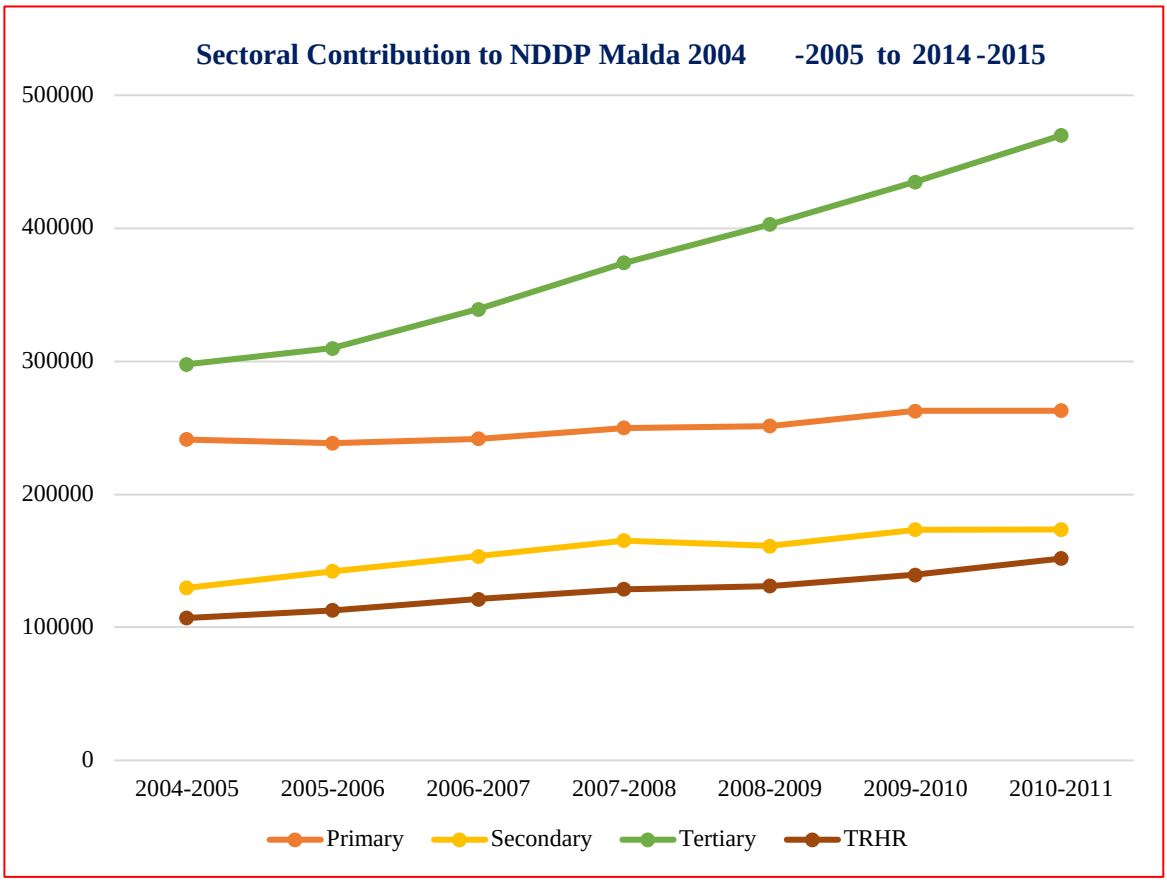
MALDA: SECTORAL CONTRIBUTION TO NDDP (2004-2005 TO 2010-2011)

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

Year	Primary	Secondary	Tertiary	TRHR as % of Tertiary
2004-2005	241356 (36.09%)	129711 (19.39%)	297723 (44.52%)	107028 (35.95%)
2005-2006	238455 (34.53%)	142256 (20.60%)	309842 (44.87%)	112936 (36.45%)
2006-2007	241738 (32.92%)	153566 (20.91%)	339108 (46.17%)	121305 (35.77%)
2007-2008	249905 (31.66%)	165299 (20.94%)	374118 (47.40%)	128728 (34.41%)
2008-2009	251279 (30.82%)	161247 (19.78%)	402805 (49.40%)	131104 (32.55%)

2009-2010	262658 (30.16%)	173326 (19.90%)	434884 (49.94%)	139575 (32.09%)
2010-2011	262802 (29.00%)	173575 (19.15%)	469797 (51.84%)	151735 (32.30%)

Source: Data Compiled from Department of Planning & Statistics, Govt. of West Bengal Figure: 6 Sectoral Contribution to NDDP Malda:2004-2005 to 2014-2015



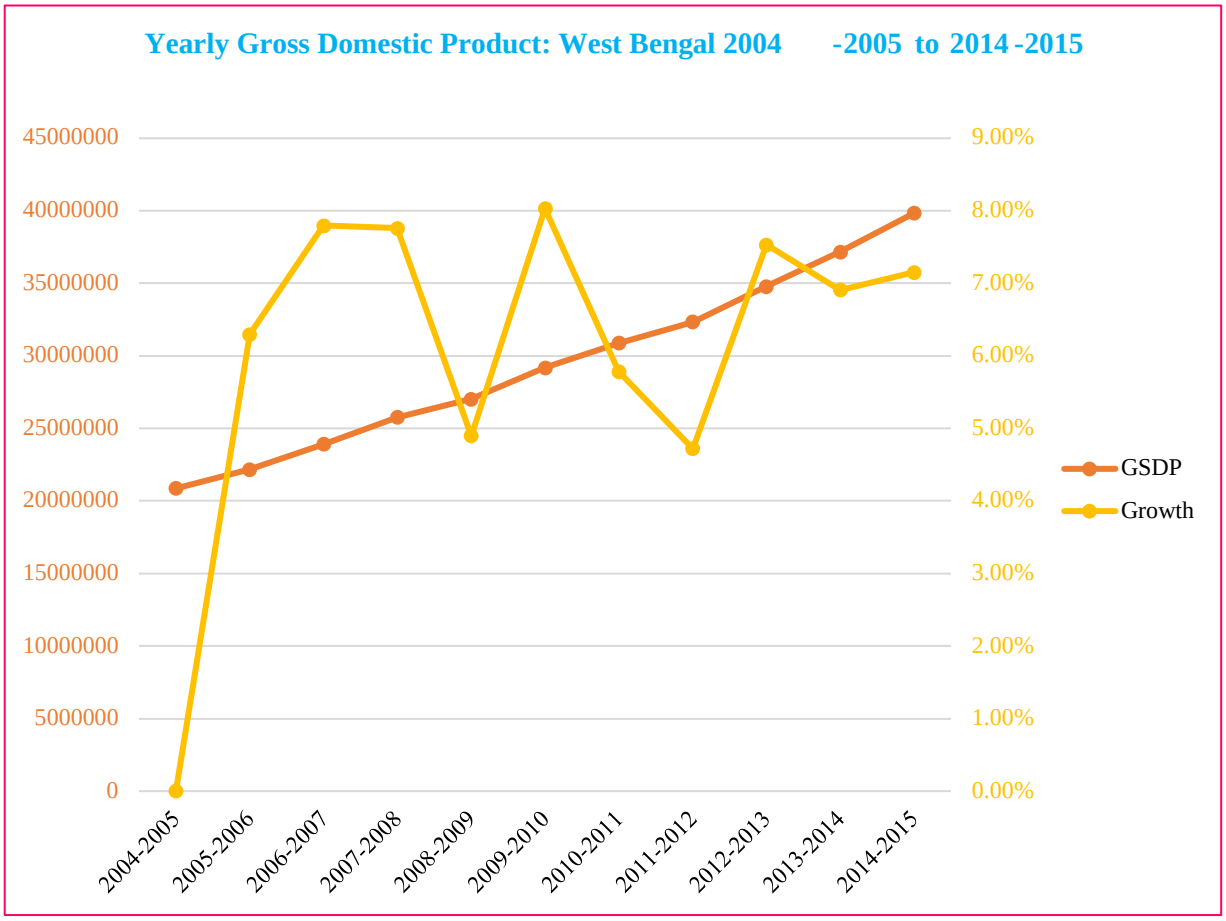
WEST BENGAL: GSDP GROWTH RATE AT CONSTANT PRICE (2004-2005 TO 2014-2015)

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

Year	GDDP	Growth
2004-2005	20865636	0
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

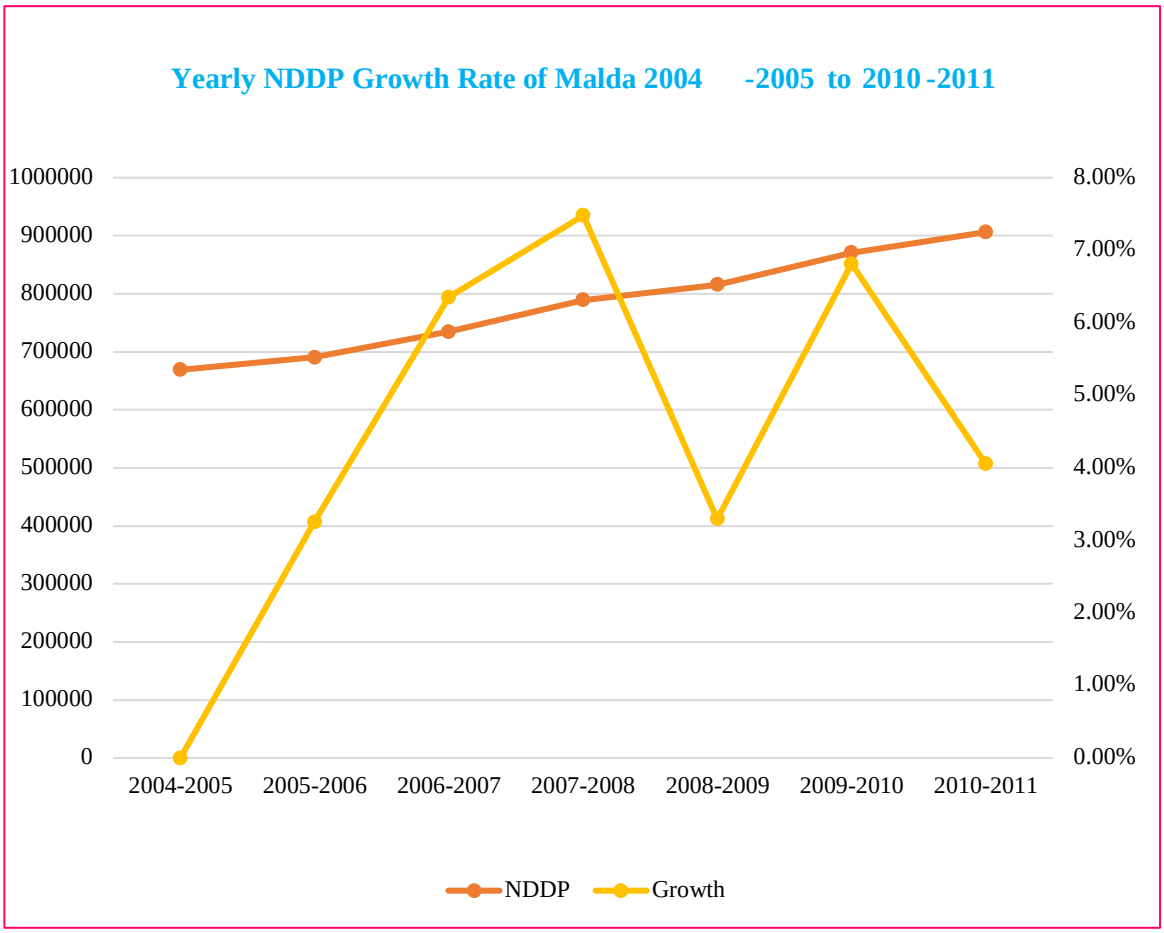


MALDA: NDDP GROWTH RATE AT CONSTANT PRICE (2004-2005 TO 20102011)

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

Year	GDDP	Growth
2004-2005	668790	0
2005-2006	690553	3.25%
2006-2007	734412	6.35%
2007-2008	789322	7.48%
2008-2009	815331	3.30%
2009-2010	870868	6.81%
2010-2011	906174	4.05%

Source: Data Compiled from Department of Planning & Statistics, Govt. of West Bengal Figure: 8 NDDP Growth Rate at Constant Price: Malda 2004-2005 to 2010-2011



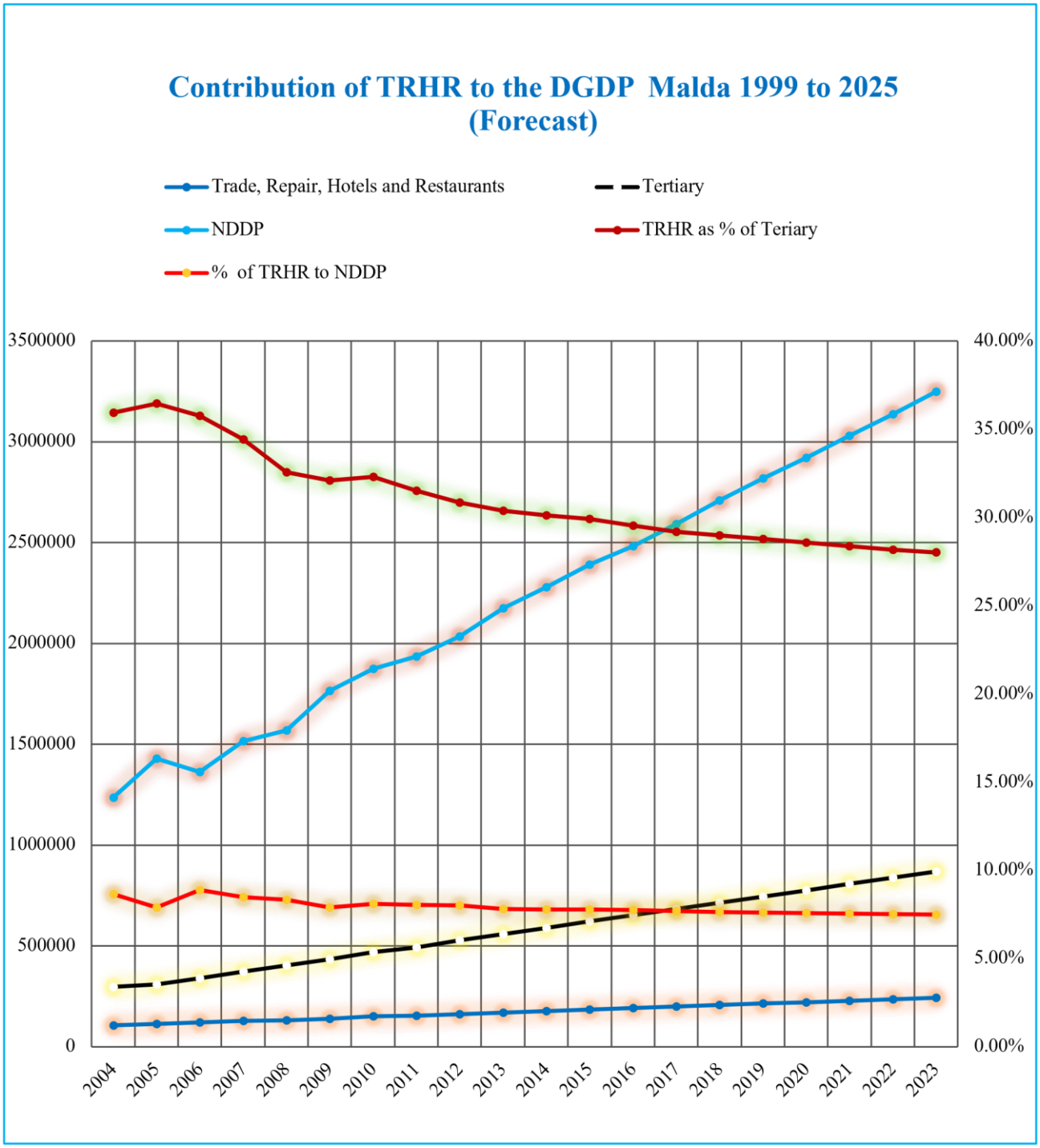
MALDA: CONTRIBUTION OF TRHR TO THE NDDP AT CONSTANT PRICE (2004 TO 2023)

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

Year	Trade, Repair, Hotels and Restaurants	Tertiary	TRHR as % of Tertiary	NDDP	% of TRHR to NDDP
2004	107028	297723	35.95%	1236183	8.66%

2005	112936	309842	36.45%	1428468	7.91%
2006	121305	339108	35.77%	1364230	8.89%
2007	128728	374118	34.41%	1515730	8.49%
2008	131104	402805	32.55%	1570184	8.35%
2009	139575	434884	32.09%	1765825	7.90%
2010	151735	469797	32.30%	1874743	8.09%
2011	155658	494040	31.51%	1935959	8.04%
2012	162988	528476	30.84%	2035533	8.01%
2013	170091	559738	30.39%	2174447	7.82%
2014	177688	590174	30.11%	2278486	7.80%
2015	185839	621487	29.90%	2391160	7.77%
2016	192672	652122	29.55%	2482590	7.76%
2017	199221	682772	29.18%	2592831	7.68%
2018	207138	714864	28.98%	2710350	7.64%
2019	214476	745259	28.78%	2818674	7.61%
2020	221794	776235	28.57%	2920945	7.59%
2021	228984	807340	28.36%	3029315	7.56%
2022	236151	838335	28.17%	3137555	7.53%
2023	243579	869439	28.02%	3248674	7.50%

Source: Data Compiled from Department of Planning & Statistics, Govt. of West Bengal Figure: 9 Contribution of TRHR to the NDDP at Constant Price Malda (2004 to 2023)



2.4 WETLANDS

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

Table 1: Wetland Data of Malda 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	123	123	0	0	13	30	36	31	12	0	0	1	91
Ox-bow lakes/cut off meanders	28	31	3	0	6	7	6	6	3	0	0	0	17
High altitude Wetlands	0	0	0	0	0	0	0	0	0	0	0	0	0
Riverine Wetlands	144	148	4	0	62	44	19	16	3	0	0	0	67
Waterlogged	48	48	0	0	25	13	8	1	1	0	0	0	27
River/Stream	0	32	32	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	102	105	3	0	70	24	5	3	0	0	0	0	14
Waterlogged	15	15	0	0	4	5	4	2	0	0	0	0	6
Salt pans	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (4939)	460	502	42	4437	180	123	78	59	19	0	0	1	222

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) is responsible to undertake and promote renewable energy in the state of West Bengal.

The graph shown below represents the main sources of lightning used by the percentage of households in the Malda district, according to the Census of India, 2011.

Kerosene is used by the highest number of households, around 62.60% of the households use this source of lightning. Second major source of lightning is electricity, which is used by 35.50% of the households. Solar energy is used by 0.90% of the households, other oil by 0.40% of the households, other sources of lightning by 0.10% of the households. Around 0.60% of the households do not any source of lightning in the district.

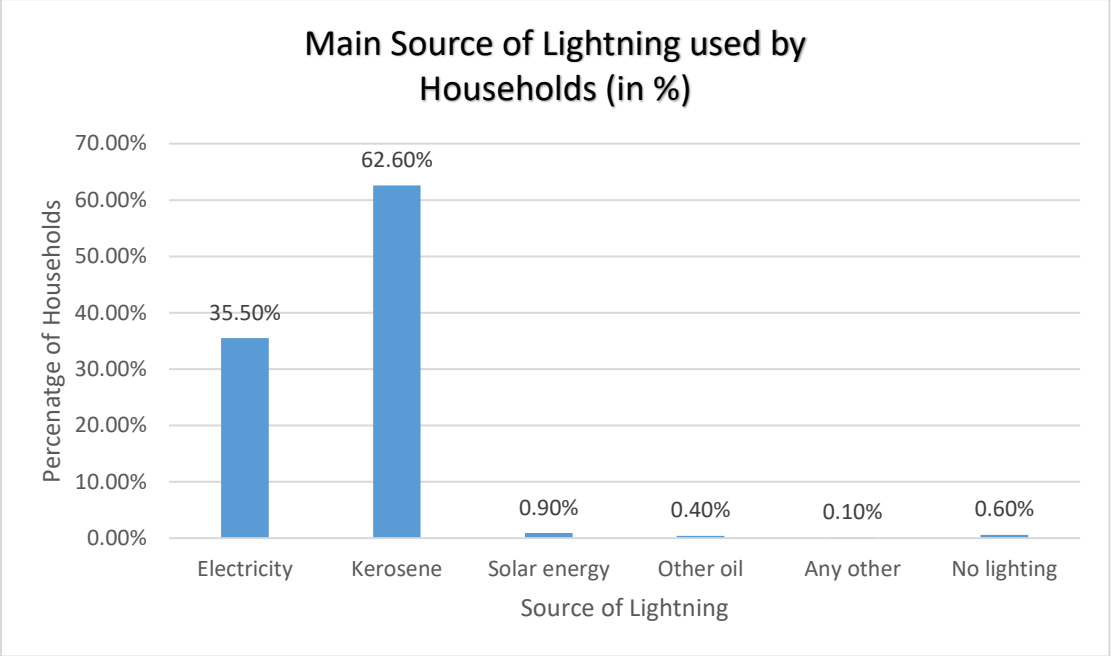


Fig. 1

2.5.2. Biomass

West Bengal Renewable Energy Development Agency (WBREDA) is responsible to undertake the promotional activities in the state with regard to increasing the uptake of renewable energy.

The net sown area of the district is 260000 hectares, area sown more than once is 214700 hectares, gross cropped area 474700 hectares. The cropping intensity is 182.57%. The total forest area of the district is 1600 hectares.

The major crops grown in the district are paddy, mustard, wheat, jute, black gram, sugarcane, and maize. Sugarcane has the highest productivity.

Crop	**Productivity (kg/ha)**
Paddy	2660
Mustard	900
Wheat	2000
Jute	2400
Black gram	720
Sugarcane	70000
Maize	2500

Table 1

The date used in the pie-chart, illustrated below has been taken from Census 2011, for the type of fuel used by the households for cooking. According to the pie-chart, 48.5% of the households use crop residue,

22.4% of the households use fire-wood, 12.6% of the households use cow dung cake, 8.1% of the households use other type of fuel, and 6.5% of the households use LPG/PNG as a fuel for cooking.

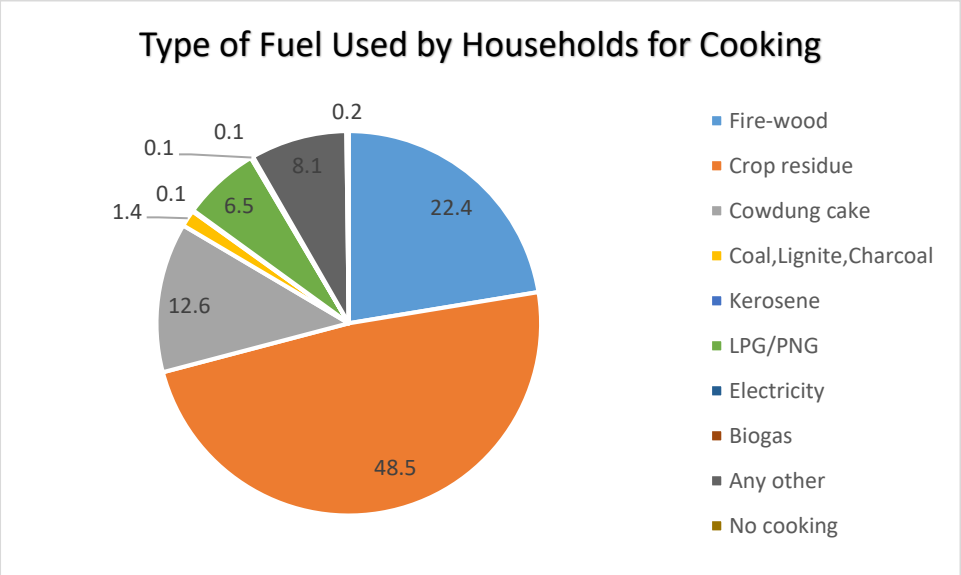


Fig. 1

2.5.3. Biogas

Based on the livestock population and agricultural waste biogas potential calculated. Biogas potential from animal waste and agricultural waste was calculated approximately as two crore m3/year and seven crores m3/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's major rivers are all Himalayan or Sub-Himalayan in origin and run southerly and south-easterly.

1) The Ganga is the district's most important river. 2) Mahananda Yogananda Yogananda Yogananda Yogan 3) The Kalindri is a kind of kalindri. 4) Tangan, and 5) Punarbhava.

2 QUALITATIVE DATA ANALYSIS

3.1 FORESTRY

Malda district is very much rich in forest canopy and dense forestry having plenty of deciduous trees. In Malda district, Tilason forest, the only natural habitat of Hizal trees (Barringtonia acutangula) is covered in an area of about 150 sq miles. Tilason forest, a Tropical Littoral Swamp natural forest of the Malda district, located in the western side of Habibpur Community Development Block at no man's land of the India-Bangladesh border area is known for its habitation of Hizal trees grown naturally with abundant occurrences. Other forests of Malda district, are Itabandha forest (Danga Akalpur, Rasikpur, Gajol);

Salbona/Rajadighi forest (Chiriyadaha, Hatimari,Alampur);Adina forest (Gajol),Altar Forest; and Raniganj Dukla forest (Das G.K, 2019).

West Bengal government's panchayat & rural development department has decided to create forests across the state using the Miyawaki method, a Japanese method of tree planting that helps in building dense, native forests. The Miyawaki method involves planting dozens of native species in the same area, which becomes maintenance-free after the first three years. The first such forest would be coming up on 1,000 acres in the village of Shibganj, in Shyampur-I block in Uluberia subdivision in Howrah. Besides Howrah, the other districts where such afforestation has been planned are Purulia, Birbhum, Murshidabad, Bankura, Jhargram, Malda, Uttar Dinajpur, Purba Bardhaman and South 24 Parganas.

3.1.1 Biodivesity

Maldah lost 5 ha of tree cover between 2010 and 2021, equating to a 3.5 percent loss in tree cover since 2010, and 2.13kt of CO2e emissions. Maldah added 10ha of tree cover in the region from 2001 to 2012, accounting for 0.49 percent of all tree cover growth in West Bengal. The peak fire season in Maldah usually starts in mid-March and lasts for around 11 weeks. Between the 14th of June 2021 and the 6th of June 2022, there were 1 VIIRS fire alarms reported, based on high confidence alerts alone. When compared to recent years, dating back to 2012, this is typical. Maldah received 74 VIIRS Alerts fire alerts between the 10th of June 2019 and the 6th of June 2022. Adina, Located in Pudua Gram Panchayet under Gazole Dev. Block is a historical place. The ruins of "Adina Mosque" are located here. Built arround the 14th century during the region of Sikandar shah of the Bengal Sultanate is a major place of attraction in the District of Maldah.

Beside this river system, a good portion of the district is occupied by 710 wetlands whose individual areas are greater than or equal to 2.25 hectares (Minimum mapable unit). Malda district has 9 big wetlands out of 23 big wetlands (covering more than 100 hectares each) of West Bengal. Tal region has 373 wetlands, Diara region has 78 and Barind region has 259 wetlands. Out of 9 big (more than 100 hectares) wetlands 3 wetlands namely Jatradanga beel, Jalkarbithan beel & East Ahora beel of Barind region are seasonal in nature. These three wetland's beds are converted into Boro cultivation area during December to May, i.e., when water is totally absent in these beels and during July to November these three wetlands are used for pisciculture and irrigation purpose also.

3.2. ENERGY:

As per the data of the year 2013, Maldah district energy consumption is around 303 TJ/year and 3.6 GJ/capita/year. GHG emission of 23,812 Ton CO_2 equivalent and 0.283 Ton CO_2 equivalent/capita has been evaluated for the district.

3.2.1. Solar

According to the NASA Surface meteorology and solar energy: RET screen data, Malda district on average annually receives solar radiation of 5.09 kWh/m2/d (Das & Balakrishnan, 2012). To improve the rural electrification in the Malda district, WBREDA has proposed to promote solar energy resources

among the rural population, which would help district in achieving the smart-grid city vision for sustainable future.

According to 'The Print', Malda railway station has got a silver rating from 'Indian Green Building Council (IGBC)', as it got an overall rating of 70 out of 100, for installing renewable sources of energy in its operating including solar, waste water reduction, and issuing bio-toilet facilities.

According to the 'Financial Express', the Eastern Railway zone in 2021, has decided to install land mounted solar panel at two locations in Malda district; at Jangipara-Sujnipara at an area of 72 acres, and at Champagram railway station at an area of 20 acres of land, which would produce 18 MW power.

As per the CEEW report 2020, the district is economically suitable for solar pumps, as the majority of the farmers are involved in horticulture. However, the average per capita monthly expenditure is low for rural agricultural households, implying that the purchasing power of the farmers is pretty low. The mechanization in the farmland of the district is significant, meaning that farmers are ready to accept the technological advancements, in this case financial assistance from the government or private stakeholders could help in adopting solar pumps in the district.

3.2.2. Biomass

"Policy on Co-generation and Generation of Electricity from Renewable Sources of Energy, 2012", launched by the government of West Bengal, with the aim of generating renewable energy. One of the objectives of the policy is to achieve a capacity of 240 MW of Biomass energy by 2017 and 662 MW of Biomass energy by 2022. Additionally, achieving a target of 355 MW of Co-generation by 2017, and 600 MW by 2022.

The total agricultural residue for biomass energy generation in Malda district is 1072.54 (10^3 ta^{-1}33). Moreover, the biomass residues from rice husk from rice mills/ hullers in the district is 116.72 (10^3 ta^{-1}), residues from saw mills is 12.75 (10^3 ta^{-1}), and residues from non-forest land is 295.74 (10^3 ta^{-1}). The net surplus biomass in the district is 316.13 (10^3 ta^{-1}). Furthermore, the net surplus biomass power generation potential in the district is 40.14 MW (Das & Jash, 2009).

According to the Census 2011, almost half of the household's population (48.5%) are dependent on crop residue for fuel for cooking, which could cause ambient pollution and is not good for the health of the people.

3.2.3 Biogas:

Livestock and agricultural data show a great potential of biogas in the district. Around 9 household biogas plant of capacity 2 cummec was installed in year 2010-11 in the district.

3.2.4. Hydropower:

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. Malda is an important district in the tourism map of West Bengal. It is one of the few places in India that features remnant culturebased influences of several civilizations like Portuguese, Dutch and British.

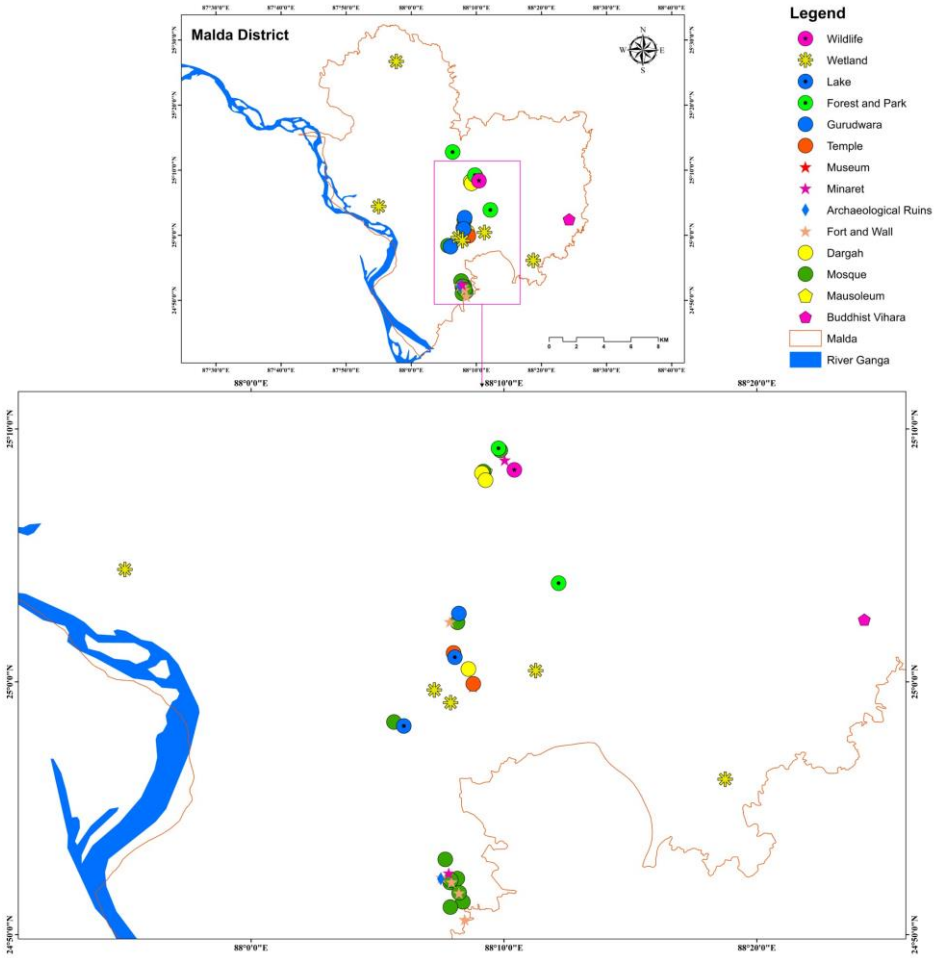
Malda is called the gateway of North Bengal. It was once the capital of Gour-Banga, which has seen three distinct eras of the glory of three dynasties of ancient Bengal - the Buddhist Palas, the Hindu Senas and the Muslim Nawabs. Malda is lying on the confluence of the Mahananda and Kalindi rivers and the Malda town rose to prominence as the river port of the Hindu capital of Pandua. District Headquarter town was formerly known as INGRAJ Bazaar as an English (British) factory was established here in 1771. During the 18th century, it was the seat of prosperous cotton and silk industries. Rice, jute, legumes, and oilseed are the chief crops of this district. Malda is also famous for its mango orchard and Mulberry plantation. Mango, jute and silk are exported across the world. (*Malda: West Bengal Heritage Commission*, n.d.)

Roots of the city can be traced back to the time of the Mauryan Empire, the city of Malda received less prominence because of the other two historical cities - Gaur and Pandua. Malda became prominent only after the Britishers arrived after the war of Palassy, in 1757. The district of Malda has been ruled by the Guptas, Palas, Senas, Mughals, and Afghans. The area has seen the influence of Islam, Buddhism, and Hinduism with each dynasty's rule. Even today, Malda serves primarily as the hub for Gaur and Pandua cities. (*Malda: West Bengal Heritage Commission*, n.d.)

Malda remains an important distributing center for rice, jute, and wheat. Rice, jute, legumes, and oilseed are the chief crops in the surrounding areas. Malda is the largest producer of the excellent quality of jute in India. Mulberry plantations and mango orchards occupy large areas. During the partition, a bulk of immigrants arrived from East Pakistan and resided in the extensive areas of Malda areas. The culture in Malda is, therefore, a mixed culture. Dominated by the Hindu Bengali prevalently, the district of Malda is also inhabited by the people belonging to the Muslim and Santali sects. (*Malda: West Bengal Heritage Commission*, n.d.)

The folk culture of gombhira is a feature of the district, being a unique way of representation of joy and sorrow of daily life of the common people, as well as the unique medium of presentation on national and international matters in a unique way through the folk drama. The diversified culture of Malda represents the very spirit of the land of Malda. Malda has special cultural sorts like Gombhira, Alkap, Kavigan, etc. The cultural folk dance is mostly related with seasons, sowing of seeds, rains, harvesting in West Bengal. It's celebrated with a lot of ardor by village folks, especially the farming community. Gombhira dance of Malda district is associated with mythology. Tushu dance, Nabanna dance, Nnoilabroto, etc. are also related to farming. Some tribal dance like Santhali dance, Rabha dance, Mundari dance, Rajbanshi dance, etc performed to the accompaniment of a number of musical instrument and are quite elaborate in nature. (*Malda: West Bengal Heritage Commission*, n.d.)

- *Map: 2 Tourism Sites of Malda District*



(Source: Nayak & Aiyazuddin, 2022)

ARCHAEOLOGICAL & HISTORICAL TOURISM

★ **Baisgazi Wall:** This massive brick-built wall with ornamental cornices and niches was probably built during the reign of Sultan Nasiruddin Mahmud Shah (c.1442-1459 AD) as a protective wall for the palace area of the Kingdom of Gaur.

★ **Bhita of Chand Sadagar:** It is a mound with a large number of stone pillars scattered throughout. The remains seem to indicate a square pillared corridor enclosing a courtyard. Recent trial trenching has shown the existence of structural activities mainly in brick in different stages. An exquisite stone pillar has been found from the trench datable to c.11th century AD. The mound appears to retain vestiges of pre-Muslim period occupations and Cunningham wrongly identified it as Belbari Madrasa. c.11th - 12th century AD.

★ **Dakhil Darwaja:** This impressive gateway built of brick was probably built by Sultan Barbak Shah (c.1459-74 AD) and served as the main entrance on north into the citadel of Gaur. It was also called 'Salami Gate' as salutes were fired from its sides. The entire structure has beautiful terracotta ornamentation and a guard example of the intermingling of Islamic thought and regional characteristic features.

★ **Firoz Minar:** Alternately known as Firoza Minar or 'Blue Tower' this tower 25.60 m high with spiral staircase having 73 steps was probably constructed by Saifuddin Firoz an Abyssinian commander of the royal forces who became the Sultan by avenging the killing of Sultan Jalaluddin Fath Shah, the last ruler of the Iliyas Shahi dynasty. This is considered as a victory tower as its builder is credited with many victories in battles. Scholars attribute it as a Bengali version of the Qutb Minar (1486 - 89 AD).

★ **Gumti Gateway:** This brick built single domed structure with stone works at the base was erected during the reign of Sultan Alauddin Hussain Shah in 1512 AD. This was used as a small gateway to the fort. On both sides of the doors on the east and west there are fluted columns of brickwork and the building has decorated cornice all round.

★ **Kotwali Darwaja:** This magnificent arched gateway top part of which collapsed long back is the central gate in the south wall of the city of Gaur. The gateway had a brick arch 30 feet high and 16 feet vine metes span. There are battlements on the east and west sides. It approximates in style to Delhi architecture and was probably built between the date of the earliest Muslim inscription found in Gaur, 1235 i.e. the time of Iltutmish and the death of Alauddin Khalji in 1315 when the influence of Delhi was strong in Lakhnauti (Gaur).

★ **Lukachuri Gateway:** It appears to have been built by Shah Suja, brother of the Mughal emperor Aurangzeb in c.1655 AD. This large double storeyed gate, with guards room on sides and a Naqqar Khana (drummers chamber) on top is built of brick and stone and is the eastern entrance into the citadel of Gaur. The high arch is cusped, while the sides are paneled showing multi-cusped arches.

★ **Tomb of Fath Khan:** This Bengali thatched hut-shaped brick-building, built between c.1658 to 1707 AD is situated within the enclosure of Quadam Rasul Mosque.

★ **Tantipara Masjid:** This brick-built Mosque ia an oblong building with stone columns in double aisles and was originally covered with 10 domes, 5 in each row. It has also bold floral panels on its surface. This mosque was probably built by Mirshad Khan in 1480 AD.

★ **Tower of Nimasarai:** This brick-built tower stands on a eight-armed platform and is studded with something like elephant tusks in stone. The height of the extant two storeys is 55' and it was probably used as a Watch or Signal Tower probably built in c.16th century AD. A spiral staircase inside leads to the top.

★ **Eklakhi Mausoleum:** This brick-built Mausoleum is the most beautiful building in this place. It forms a square roofed by a dome with a small turret at each corner. The inside plan of the structure is octagonal. The walls are exquisitely ornamented in the outer part by carved tiles and decorative motifs on bricks. Tradition runs that this construction cost 1 lakh rupees so the name. Amongst the three graves inside, one is regarded as tomb of Sultan Jalaluddin, son of Raja Kans, the other two of his wife and son Ahmad Shah. This structure was probably built in the early c.15th century AD. (*Malda: ASI*, n.d.)

★ **Adina Masjid:** This gigantic Mosque built and completed by Sikandar Shah (c.13581390 AD) in 1369 AD is the most remarkable existing example of Muslim architecture of that period.

★ **Baraduari Masjid or Great Golden Mosque:** This is a massive rectangular brick-built Mosque but stone pillars in three aisles with a corridor. It has eleven arched openings and was roofed by 44 hemispheric domes. It has earned the name Bara Sona Masjid (Great Golden Mosque) as its domes were originally gilded with gold. It was built by Sultan Nasrat Shah in c.1526 AD.

★ **Qutub Sahi Masjid:** This Masjid was built by Makhdum Sheikh in c.1582 AD. It was built of brick and stone and had ten domes. The roof has fell down, but the walls and pulpit are standing. It was called Qutub Shahi Masjid as a mark of respect to the Saint Noor Qutb Ul Alam.

★ **Qadam Rasul Masjid:** It is a misnomer to call this a mosque, in actuality is a building to contain the prophet's footprints in stone said to have been brought by a saint from Arabia. The building has a central square room with a wide verandah. An inscription over the front door records its erection by Sultan Nusrat Shah son of Husain Shah in AD 1531.

★ **Gunamant Mosque:** It is a massive structure built of rubble stone and bricks with pillars of stone constituting a vaulted central naïve with three aisles. It was probably built by Sultan Jalaluddin Fath Shah in 1484 AD suggested by an inscription found nearby.

★ **Lottan Masjid:** The Mosque was probably built by Sultan Yusuf Shah (c.1474-81 AD) but traditionally ascribed to a Royal Courtesan without much ground. This is a single domed building with a square chamber and a corridor in front. There are three arched entrances on the east and sides. It was once covered with a enamelled brick work of four colours, green, yellow, blue and white lending a colourful appearance.

★ **Chamkatti Masjid:** Erected possibly by Sultan Yusuf Shah this brick-built Mosque (damaged) is resting on stone pillars upto the height of springing point of its single dome.

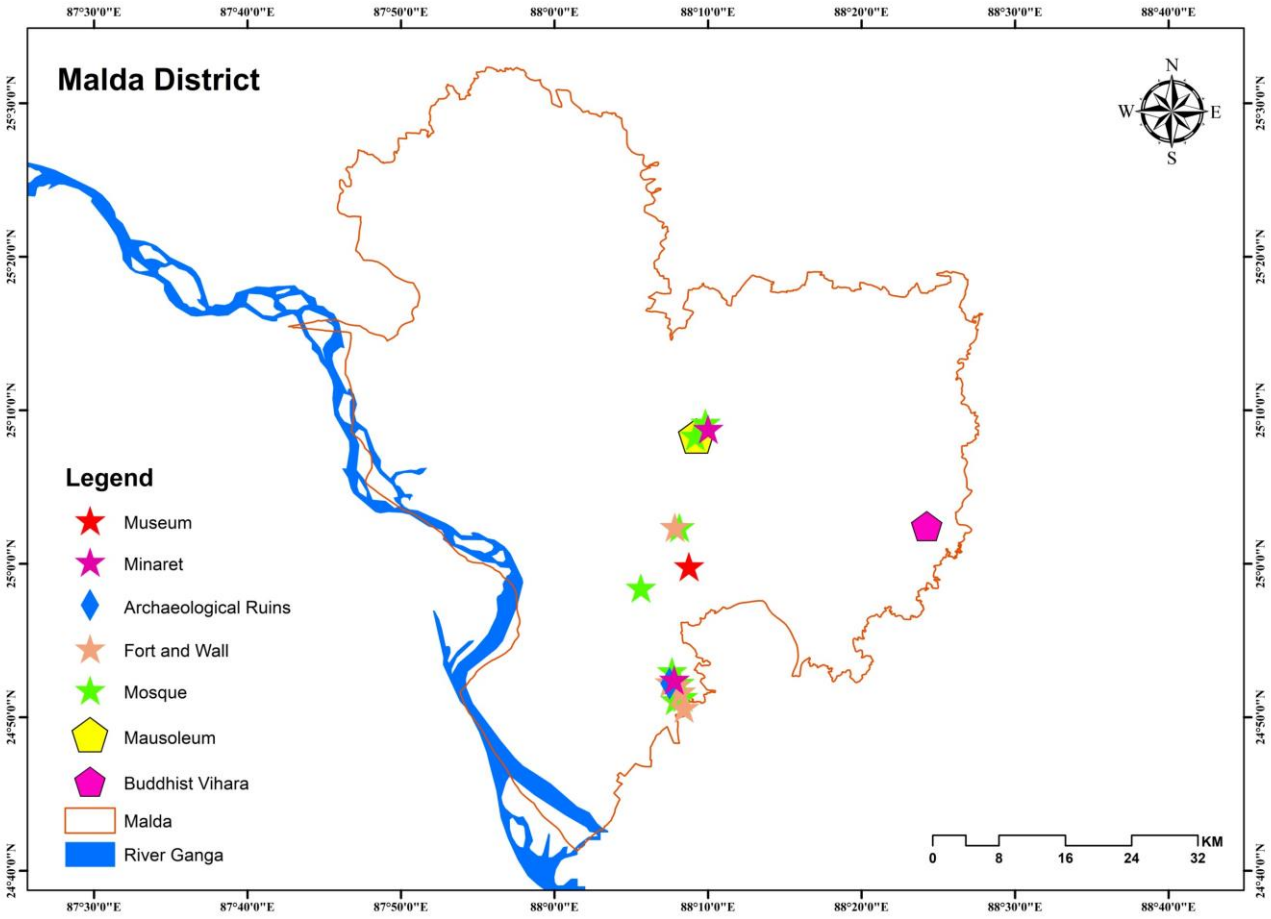
★ **Chika Mosque:** This is a single domed brick structure, called as Mosque. But it is evidently a Mausoleum architecturally similar to Eklakhi Mausoleum at Pandua, besides there is no mihrab in it. It perhaps served the purpose of the tomb of Sultan Jalaluddin Muhammad (1415-31). It was possibly built-in c.15th century AD.

★ **Juma Mosque:** The Juma Mosque is situated at Old Malda Town in Malda Sadar subdivision of Malda district. According to the plaque discovered at the Darga of Shah Gada (popularly known as Tia Pakhir Darga), the Juma mosque was established during the reign of the Hussain Shah dynasty.

★ **Lakhchhipi Darwaza or Lukochuri Gate:** The Lakhchhipi Darwaza or Lukochuri Gate is built on the Southeast corner of the Kadam Rasool Mosque. Shah Shuja is believed to have built this imposing structure back in 1655 in the Mughal architectural style.

★ **Jagjibanpur:** Situated about 35 km off Malda town, Jagjivanpur, which is now an important archaeological site was a long forgotten place until the discovery of a copperplate inscription of the Pala emperor Mahendrapaladeva and the structural remains of a 9th-century Buddhist Vihara - Nandadirghika-Udranga Mahavihara. (Places to Visit in Malda, n.d.)

Map: 3 Archaeological & Historical Tourism Sites of Malda District



(Source: Nayak & Aiyazuddin, 2022)

RELIGIOUS & SPIRITUAL TOURISM

- ★ **Temple of Jauhra Kali:** Amongst the plethora of Muslim Relics, Malda also has a famous Hindu Temple, The Temple of Jauhra Kali. The temple is beautiful, made on a raised platform and surrounded by trees.

- ★ **Gurudwara of Old Malda:** The Gurudwara is situated at Old Malda Town under Malda Sadar sub-division of Malda district. The Gurudwara was established as a mark of the legendary visit of Guru Nanak. Guru Nanak - the founder of Sikh religion halted at Malda on his way to the temple of Lord Jagannath in Puri. In memory of his visit, a Gurudwara was established and the present structure was constructed later in 1996.

- ★ **Shyam Rai Temple:** The Shyam Rai temple is situated at the Old Malda of Malda district. The temple is approximately 400 years old. Lord Shyam Rai is also known as Lord Shyam Sundarm, some says as Shyamji. The east facing temple is assumed to be of Pre-Chaitanya era. There are 6 sculptures of dancing peacocks at the pinnacle on top of the temple. Two images of peacocks can be seen at the bottom of the pinnacle. The altar of the temple is made using mosaic and stone. The deity of Shyam Rai is brought out of the sanctum and placed on the altar on the occasions Janmasthami and Dol Jatra.

- ★ **Gouranga Mahaprabhu Temple:** The Gouranga Mahaprabhu temple is located at the Old Malda town under Malda Sadar sub-division in the district of Malda. It was established by Girijakanta Das - the zamindar of Mokdumpur. He was a devoted Vaishnavite. The Tripathi family from the present-day Bihar were appointed as priests of the zamindar family. It is a brick built East facing temple dedicated to Gouranga Mahaprabhu. (*Heritage Place of Malda*, n.d.)

- ★ **Eklakhi Mausoleum:** This brick-built Mausoleum is the most beautiful building in this place. It forms a square roofed by a dome with a small turret at each corner. The inside plan of the structure is octagonal. The walls are exquisitely ornamented in the outer part by carved tiles and decorative motifs on bricks. Tradition runs that this construction cost 1 lakh rupees so the name. Amongst the three graves inside, one is regarded as tomb of Sultan Jalaluddin, son of Raja Kans, the other two of his wife and son Ahmad Shah. This structure was probably built in the early c.15th century AD. (*Malda: ASI*, n.d.)

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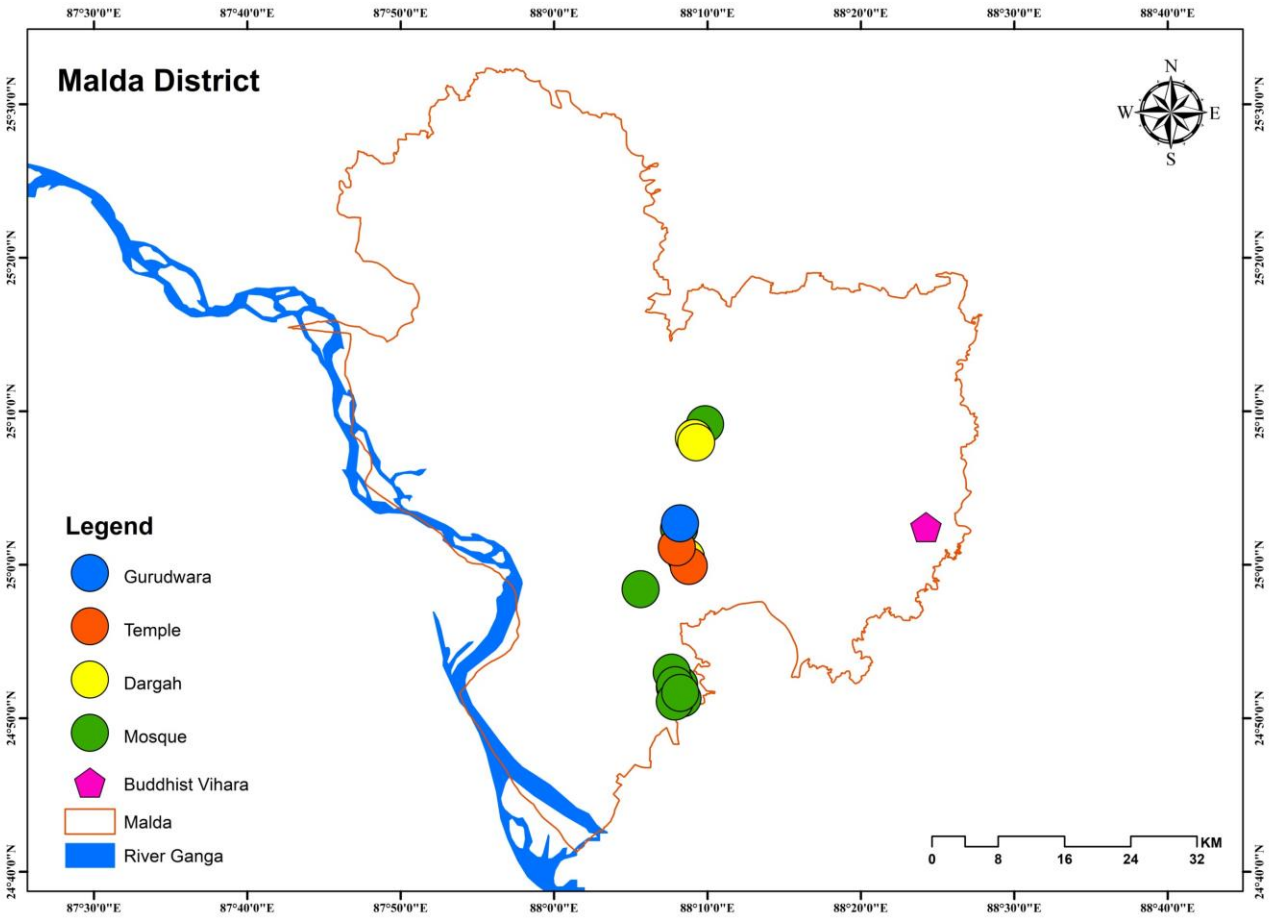
- **Jahaniya Masjid**

- **Dargah Padua Sharif**

- **Kala Pathar Dargah**

- *Map: 4 Religious Tourism Sites of Malda District*



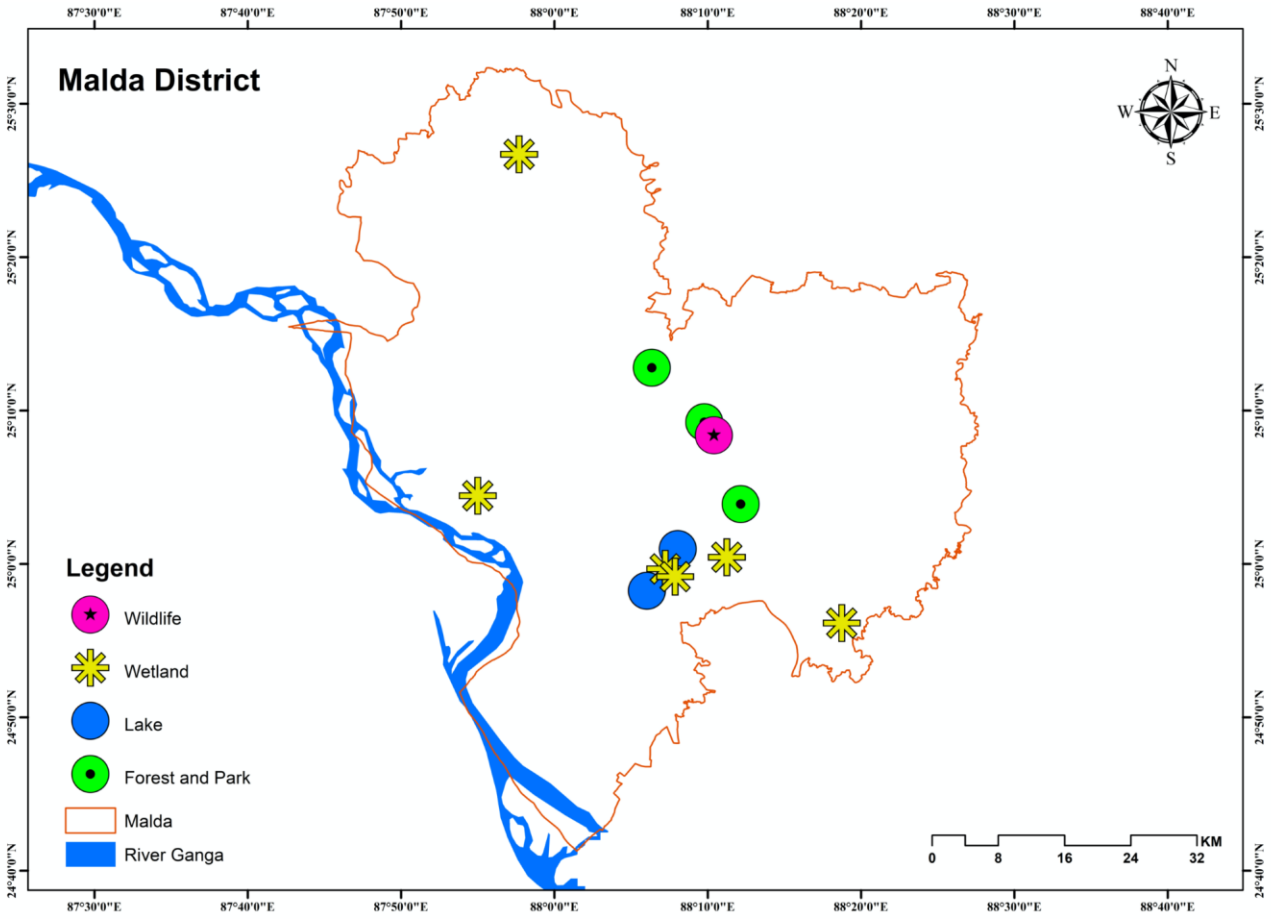
(Source: Nayak & Aiyazuddin, 2022)

ADVENTURE, NATURE & ECO TOURISM

- ★ **Gabgachi Wetland**
- ★ **Nawada Wetland**
- ★ **Malda Bill**
- ★ **Vatra Bill**
- ★ **Kumargana Bill**
- ★ **Nayabandh Bird Watch**
- ★ **Adina Deer Park**
- ★ **Rajdighi Forest**

- ★ **Adina Eco Park**
- ★ **Jatradanga Forest**
- ★ **Railway Park Lake**
- ★ **Sagar Dighi**

- *Map: 5 Adventure, Nature & Eco Tourism Sites of Malda District*

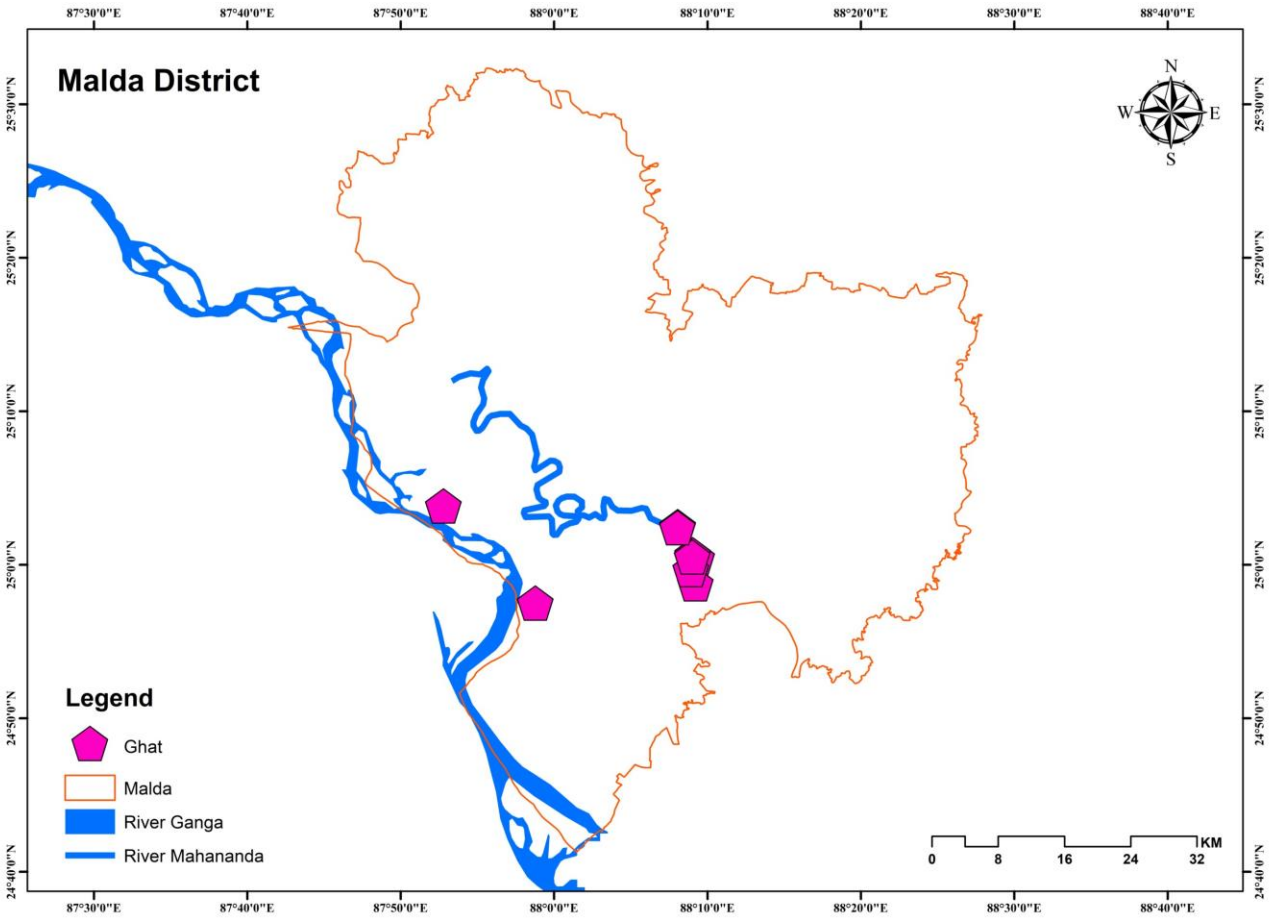


(Source: Nayak & Aiyazuddin, 2022)

- **6. GHAT TOURISM**
  - ★ **Sadarghat**
  - ★ **Manikchack Ferry Ghat**
  - ★ **Bandha Ghat**
  - ★ **Aaron Ghat**

- ★ **Char Kadipur Ferry Ghat**
- ★ **Pagla Ghat**
- ★ **Mission Ghat**
- ★ **Babupara Ghat**
- ★ **Old Malda Ferry Ghat**

- *Map: 6 Ghat Tourism Sites of Malda District*



(Source: Nayak & Aiyazuddin, 2022)

CULTURE & ARTS TOURISM

Arts & Crafts of Malda

Kantha Stich: Kantha for the Bengali folks means embroidered quilt. Kantha is said to be dorukha meaning turning the worn out and old textiles and fabrics to things of beauty. It is the way in which this stitch is used, in different arrangements, that forms the complex vocabulary of Kantha. Originally it was used to join layers of old saris to make quilts. The stitch is now extensively made on apparel also, furnishing and lifestyle products by more than 2000 women artists of Nanoor in Birbhum district. This craft brought some glimpses of the prospect of the district. This craft is spread over considerable areas in Bolpur, Labhpur, Suri, Sainthia, Illambazar, Dubrajpur, Rampurhat, Mayureswar,and Nanoor. The high-quality Kantha Stitch of these areas is quite popular in different parts of the country and also high in demand in the international market.

Sholapith: The Sholapith or the Indian cork craft has continued in Murshidabad with magnificent craftsmanship on the things that are produced using shola. Sholapith is essentially sponge wood bearing a smooth milky white colour. It is delicate and very soft in nature. Excellent pieces are produced using this wood which has a measurement of 1.5 inches and develops in the marsh lands of Murshidabad. During the festive season of Bengali Durga Puja, Durga idols are usually decorated with a huge sholapith huge backdrops and also with sholapith jewelry items. Sholapith flowers are also used to decorate the very popular Chandmala, a must require ingredient almost in all Puja Rituals observed in Bengal. un Floral motifs are very common and popular among the sholapith structures includingPalanquins, vessels, Peacock and garlandsetc.

Silk: The Malda district of West Bengal is famed for large-scale silkworm culture and the vast production of one of the finest silks in the country - Tussar. Hence, it is no surprise that one of the most in-demand sareesfrom Bengal is the Tussar silk saree that is traditional, classy, and timeless in appeal. Tussar silks are often also used as a canvas for Kantha work or as a base for Baluchari sarees. However, handloom Tussar silks with solid-coloured bodies and woven patterns on the pallu are the most popular varieties endorsed by contemporary women A textured handloom fabric made from waste mulberry silk, without removing the gum, Matka silk has gained popularity over the years. Majorly spun in the Malda and Murshidabad districts of West Bengal, these sarees are rich and elegant. Matka silk sarees, commonly available in rich colours and flaunting ornate patterns, are light-weight, strong and durable. Lately, these sarees are also embellished with embroidery, making their drapes covetable by women around the country.

Wooden Mask: It is typically associated with the 1500-year-old Gambhira Festival is one of the unique art forms observed in this region. These days the wooden masks are

often replaced by Paper made masks for ease of use. Clay made masks are also seen in the English Bazar area.

Fairs & Festival of Malda

Gambhira: Socio-religious festival: Since old eras, it has been trusted that the devotion and worshipping of Shiva will acquire for his followers, satisfaction in this world and 'Moksha' in life after death. Gombhira is basically a socio-religious celebration that is praised in the devotion of Shiva with a view to achieving the blessing of Lord Shiva, toward the finish of the Bengali year. As a part of these religious festivals, the followers wear colourful with a hope of getting the blessings of God at the beginning of the upcoming new year. The celebration started in Maldaregion, but it is also known and popular asGomeera in Jalpaiguri, as Shiva (Shib-er) Gajon or Dharma (Dharm-er) Gajon in the locale districts across the southern part of Bengal and the western banks of the Bhagirathi, and as Neel-erGajon in Bangladesh. The conventional Gombhira celebration has turned into a relic of past times, celebrated in just a couple of spots in Malda. The Pala Gombhira is a dramatized melodic portray, combining of songs and tunes, dance and parody. In this modern era of readily available television channels and programs and digital advancement and it is a forgotten art form at present.

Ramkeli Fair: Ramkeli, Situated at a distance of nearing 14 Km from Malda towards the south. Ramkeli , a small village on the way to Gour, is famous for being the temporary home of Sri Chaitanya, the great religious reformer of Bengal, where he had stayed for a few days on his way to Brindaban. A conglomeration of two 'Tamal' and two 'Kadamba' trees can still be seen, under which the saint is said to have meditated. A small temple constructed under this tree contains Sri Chaitanya's footprints on a stone. Every year, on the Jaishthya Sankranti, celebrations are held here to commemorate the arrival of Sri Chaitanya. A week-long fair also starts on this day. Vaishnav devotees from all over India gather here at this time where ritualistic songs are performed.

Music & Dance of Malda

Alkap: Alkap is a form of Bengali folk performance popular in the districts of Malda, Murshidabad and Birbhum in West Bengal. There are two main parts of an alkap performance, songs and witty dialogue in prose or verse. Kaap means 'kavya' (verse) and Aal is part of the verse. Alkap is an amalgamation of music, dance and theatrical presentation. An alkap group of ten to twelve performers is led by a sarkar (master) or guru (leader) and includes two or three young men called chhokras, one or two gayens or singers, dohar, choristers, and musicians. Alkap is presented in five parts i.e. Asar Vandana, Chhora, Kaap, BaithakiGaan and Khemta Pala. The programme is a reflection of rural society and puts the focus on the prevailing socio-economic condition of the rural masses. Though the alkap is similar to Jatra, it is more of a song-and-dance performance than the jatra which is closer to a play. The actors in a jatra have designated parts and a set dialogue to speak. In the alkap, however, the performers have a notion of the storyline and, in the manner of the Italian commedia dell' arte, improvise on stage.

Bolan (Shiber Gajan): Shiber Gajan is an extremely famous festival in Murshidabad district, observed and organized in different towns of the region during March and May. Commonly called asBolan, Charak Puja, Gajan. Gajan songs are sung in acclaim of Lord Shiva and Goddess Parvati. Dances include Natua, Bhagta,Theatre, Nanchiand Chau joined by Jhumur tunes and various folk melodies and moves are organized. Most of the dancers are dressed up as Hara Parvati and move around the village including the accompaniment of instruments like Dhol, Kanshi and Flute. Entire night programs are held from village to village during Gajan and continue for a few days.

Gambhira: Gambhira is a type of song (originating in Chapai Nawabganj, in the Northern region of Bangladesh). It is performed with a particularly distinctive rhythm and dance with two performers, always personifying a man and his maternal grandfather, discussing a topic to raise social awareness. This kind of song is also quite popular in Malda of West Bengal, India. The Gambhira dance is performed all over the Malda district of North Bengal during the festival of Chaitra Sankranti. The masks are made out of Neem and Fig trees by the local Sutradhar community. Sometimes they were also made of clay. The three-dimensional crowns are the specialty of these masks. First, the facial features are carved out from a piece of wood and then coloured according to the character. This mask dance performed with Gombhira song. The songs of Gambhira originated among the Hindu community of Maldah in West Bengal, completely in its theme formation.

Karam Dance: Karam Festival is celebrated by the Santhals in the month of Ashwin (September-October) in order to have increased 'wealth and progeny and to get rid of evil spirits. During this festival, two youths after being purified, fetch two branches of Karam tree from the forest and plant them just outside the house. The head of the household offers rice beer along with other articles and pray for the prosperity of the house. This worship is followed with singing, dancing and playing of instrumental music. All those present there, are given rice-beer.

Kavigaan: Kavigan is a form of Bengali folk performance wherein folk poets sing and perform. Kavigan is normally sung by two groups. Each group is led by a kaviyal or Sarkar. The accompanying singers called dohars often repeat what the leader said. A kaviganprogramme starts with a bandana (evocation) or gurudevergeet. The bandana can be directed to or be in praise of Saraswati, Ganesh, people, and the audience, as deemed fit by a particular kaviyal. In kavigan, also referred to as kabirlarai, two people who are lyricist plus composer at the same time answer each other in form of songs. It mainly consists of the Lahar, where the competitors personally attack each other, musicoverbally. This is followed by Radha-Krishna related song, some call it agamani. Then songs on four subjects are sung: Sakhisambad, biraha, lahar andkheur.

Cuisine of Malda

Haati Paawa Luchi: Haati Paawa Luchi is available in most fairs and haats, the oversized Haati Paawa luchi is similar to the size of the feet of an elephant.

Khaja: Shadullahpur is famous for this delicacy. Khaja is also a sweet delicacy available in parts of Kaliachak.

Makhana: Rasakadamba, Makhana - Harishchandrapur is famous for Makhana, however, both these delicacies are available all over the district.

Mango: Gour is famous as it is a delightful and nicest place in India. In 2013, Maldah had a record production of 3.5 lakhs metric tons of mangoes. Fazli mango is large and late maturing mango. Its flavour is pleasant and pulp is sweet and fibreless. Golap Khas has a rosy flavour. Langra is firm and lemon yellow in colour. There are also other types of mangoes like Kshirsapati, Mohonbhog, Dudhkumar, Begambahar, Nababpasin, Dudhiya etc. are also produced in this region. Several by-products of mangoes like Chutney, jam, jelly, mango pickle, aamswatta (dried mango pulp), mango sherbet etc. are available throughout the district.

Palm Jaggery: The liquid palm jaggery or Tal gurh is another delicacy of this region. Prepared from the extract of the palm fruits, this product is a delight for the taste buds especially in the winter session.

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. Malda, with its 3456 sq kms lay of the land classified into Tal, Diara, and Barind. 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:
Mango, jute and silk are the most notable products of this district
Malda is the largest producer of excellent quality jute in India.
Mulberry plantations and mango orchards also occupy large areas; mango trade and silk manufacture are the main economic activities.

4 ACTION PLAN DEVELOPMENT

4.1 FORESTRY

People in the district should be made aware of the importance of forests. The National Afforestation Mission (NAP) if implemented wisely in the district can help in increasing the tree cover in the district. As according to the report of FSI, 2021 there has been decrease in the forest cover in the distric. The district also has cultivable wastelands, fallow lands etc. which can be brought under plantations. NAP is being implemented for afforestation of degraded forest lands. The overall objective of the National Afforestation Programme (NAP) scheme is ecological restoration of degraded forests and to develop the forest resources with peoples' participation, with focus on improvement in livelihoods of the forest-fringe communities, especially the poor.

The district can also take up Sub-Mission on Agroforestry (SMAF) Scheme. SMAF aims to encourage farmers to plant multi-purpose trees together with the agriculture crops for climate resilience and an additional source of income to the farmers, as well as enhanced feedstock to inter alia wood-based and herbal industry. Hence there is a concerted effort to include medicinal, fruits, fodder, tree-borne oilseeds, lac host etc. in addition to the longer rotation timber species.

4.1.1 Biodiversity –

Watershed management, including catchment area treatment and afforestation programs, are being implemented.

4.2 TOURISM

SWOT ANALYSIS: MALDA DISTRICT TOURISM

STRENGTHS

- ★ Outstanding scenic places, picnic spots, beautiful temples with marvellous architecture lakes and gardens.
- ★ Rich Bengali culture and Bengali cuisines of Malda.
- ★ The district has fertile soil and diversified agriculture.
- ★ The district has large number of Cultural heritage sites.
- ★ Human capital and skilled labour force.

- ★ The district is well connected with other parts of the states and the country.
- ★ Presences of natural features (Rivers, Wetland and Lakes dominate the landscape) and unique ecosystems are valuable scenic and recreational resources and can contribute to environmental services.
- ★ Cohesive Community.

WEAKNESS

- ★ Tourism in the district is 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 Cultural and Natural heritage.
- ★ Social and Gender Discrimination, Illiteracy and Poverty.

OPPORTUNITIES

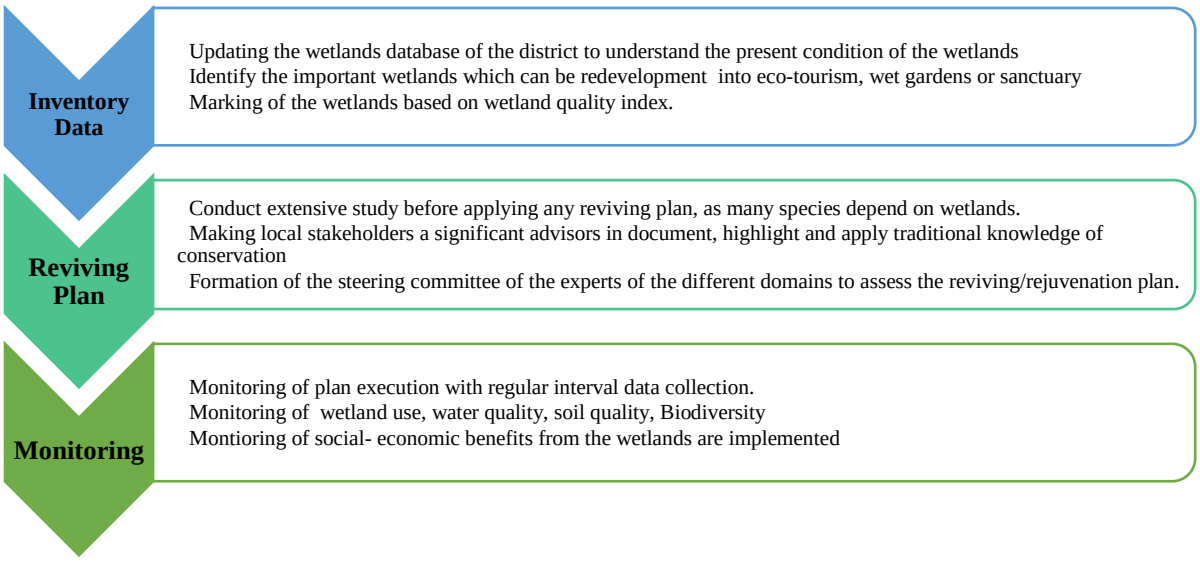
- ★ Potential for Religiously inclined tourist, interested in history and culture seeing knowledge enhancement.
- ★ Reuse of vacant lands into economically productive use.
- ★ Obtaining grants for provision of best infrastructure and housing.
- ★ Encourage Public – Private partnership for provision of 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.
  « Arsenic Prone Area.
- ★ Illegal Migration.
- ★ 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.

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 overall net sown area in the district is 322136 hectares, out of this, 183900 hectares is irrigated net sown area, which is around 57.08% of the net sown area and the rest 138236 hectares is unirrigated net sown area, which is around 42.91% of the net sown area.

Long-term bank credit should be encouraged so that farmers can purchase solar pumps and indulge in capital-intensive techniques of farming, which are cost-effective and environment friendly.

Solarization of feeders is not feasible in this district, as there is a high concentration of electric pumps and the cost of power supply from the DISCOMs is low. The price of solar pumps or water as a service model should be competitive, so that farmers should exploit the solar energy.

Moreover, 1 HP or sub-HP solar pumps should be encouraged for the marginal farmers, which would help in doubling the farmer's income. The region is also vulnerable to climate change, so solar pumps would help in achieving agricultural output through low-cost carbon (CEEW, 2020). Furthermore, solar drip and sprinkler technique could be used to aid efficient irrigation through Per Drop More Crop.

PROJECTION AND MONITORING MATRIX

Firstly, rural population should be made aware about the solar energy.

Secondly, financial assistance and disbursement of credit needs to be enhanced.

Thirdly, solar pumps at a competitive price needs to be available to the farmers.

Fourthly, solar drip irrigation technique needs to be enhanced.

Lastly, there is a need to encourage solar rooftop panels in the government and private firms, which would help in exploiting the unused solar energy to its maximum level.

By implementing these methods, district could help the state achieving its solar energy targets and would also lead to sustainable development of the district.

4.4.2. Biomass

There is a need for awareness in the district for biomass energy, as the district has a huge potential however, it has not yet been exploited. The government should promote and aid the Biomass, Biomass Co-generation firms to establish their units in the district, and install mechanism to deliver biomass raw materials from the farms to the biomass units. Moreover, the productivity of sugarcane is pretty impressive, implying that the Biomass Bagasse Co-generation projects would be suitable for the district, as the raw materials of sugarcane would be efficiently utilised for the energy generation. Moreover, since the households in the district are still using crop residue as a fuel for cooking, which is not good for the indoor people, that crop residue could be sell off to the biomass plant holders which would serve two benefits for the people, first they could be able to earn money and second crop residue would be used to generate energy. Further, the there is a need to shift households from the traditional biomass cooking method to better cooking methods like LPG.

PROJECTION AND MONITORING

Firstly, awareness is important in the district, as the district has not utilised the biomass energy.

Secondly, steps from government is required to support the firms to set up and help in establishing storage units for the management the biomass raw materials, by providing subsidies and financial assistance.

Thirdly, there is a need to spread awareness regarding the ill-effects of using crop residue for cooking.

Lastly, the government or NGO should also need to educate households to sell their crop residues to the storage units or to the biomass plants.

The advanced biomass energy could help in alleviating the life of the people in the district.

4.4.3. Biogas:

- WBREDA and M/s. Beltron planned an awareness campaign in selected districts.

- Wall painting, banners, awareness plays etc will happen in future for awareness program.

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

- Introducing high yielding varieties of crops
- Farmers should be encouraged for low-cost vermicompost production.
- Organic farming could be enhanced by providing government assistance certification among the farmers.
- Malda district is very rich in qualitative mango production. It can be supplied to other parts of the country.
- As one of the primary hubs for fruits and pulses, the district has a lot of scope for fruit processing infrastructure and pulse mill.
- The district has enormous scope for poultry farming.
- Resources conservation technologies like zero tillage, mulching, drum seeder for paddy need to be encouraged.
- Fish culture has a good scope in this district; training for the scientific method in fish culture needs to increase.
- Inter-culture in the existing mango orchards such as Chilli, turmeric, foot yam could be profitable, which should be encouraged among the farmers.
- Greenhouse and poly house are highly recommended for the high revenue crops like capsicum, strawberry, tomato, etc., and orchids like rose, Gerbera, etc.
- The farmers should adopt Micro-irrigation to increase the water use efficiency.
- Besides the mango orchards, the district has scope for other fruits cultivation like lemon, guava, and banana, which should be encouraged among the farmers.
- Farmers should follow the crop advisory and be sensitized over the overuse of fertilizer application.
- Medicinal crops like ekangi (***Kaempferia galanga L.***) cultivation should be promoted.
- The district has an arsenic contamination problem in a few areas; measures should be taken by replacing and relocating the old tube wells.
- The dairy-based processing unit has potential in the district, and it should be promoted.
- Farmers should be encouraged to benefit from schemes such as BFBY (Bangla Fasal Bima Yojana), Krishak Bandhu, Amar Fasal Amar Gola, PMKSY, and so on.

- The district is often affected by the flood, the preventive measure should be taken to overcome the problem or minimize the losses.
- Beekeeping practice should be promoted, which could provide an additional income to the farmers.

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 and improving the economy of the district.

5.2.1 Biodiversity

- 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.

5.4 ENERGY

5.4.1. Solar

- ❖ Awareness programs and campaigns need to be conducted in the district.
- ❖ Government needs to provide and implement substantial subsidy programs.
- ❖ Solar drip irrigation needs to be studied in-dept for future projects.
- ❖ Rooftop solar needs to be encouraged in the public buildings and all the new private projects in the urban areas of the district.

5.4.2. Biomass

- ❖ Awareness regarding biomass, ill-effects of using crop residue needs to be explained to the households.
- ❖ Storage units for biomass raw materials need to be formed.
- ❖ Financial assistance and aid is needed to set up the biomass plants in the district.
- ❖ Since the district has good productivity in sugarcane and other crops, Bagasse based Power Plants and Biomass based Gasifier Plants, Co-generation plants should be encouraged to be set up by small start-ups.

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

- It is recommended to investigate hydropower potential in Ganga, Mahananda, and Kalinadi.

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
- ❖ 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.
- 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.
- Local youth can also be trained in the games like Boating, Cycling, Heritage Walk and Marathon.
- 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. v 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 pilgrimage/ religious tourism, emphasis on other tourism places for promotion of more tourism activities like, Arts & Crafts, Rural Tourism, Fair & Festivals, 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

- Malda is the centre point and has good connectivity.
- It has opportunities for Tourism.
- Ghat Beautification works have been taken up and also the Arth Ganga Trails will be planned as suggested.
- Products like Mango and Sattu is famous hence, can be considered for the Jalaj model at Dili Haat, INA.
- 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.

7 REFERENCES

https://censusindia.gov.in/census.website/data/census-tables

https://agricoop.nic.in/sites/default/files/WestBengal%2010-Malda-31.12.2011.pdf

https://www.sciencedirect.com/science/article/pii/S0961953408001189?casa_token=5ELUJzrxE-oAAAAA:Il0pQ_R1yOq1nLf2sruJmz2nXf0IOLZOI0qQyu_sX1xpzlnMTJxElep_LRp9o2_kIQJJsGApo6Tv

https://wberc.gov.in/sites/default/files/policy-renewable-wb.pdf

http://www.wbreda.org/

https://www.malda.gov.in/index.php/node/27

https://censusindia.gov.in/census.website/data/census-tables

https://www.malda.gov.in/index.php/node/27

http://wbnorthbengaldev.gov.in/HtmlPage/about_malda.aspx

http://wbpspm.gov.in/publications/District%20Statistical%20Handbook

https://bengalchamber.com/downloads/report-north-bengal-jan2016.pdf

https://www.financialexpress.com/infrastructure/railways/for-first-time-indian-railways-eastern-zone-installs-solar-panels-embedded-roof-over-platform-shelters-details/2380675/

https://theprint.in/india/malda-town-railway-station-in-bengal-gets-green-building-certificate/836350/

https://www.sciencedirect.com/science/article/pii/S1364032112003632?casa_token=49VKdt9awgAAAAA:p-heblySMTInOex-37kRB2GoqXbYs7aKKooHRACtwA-wrwpmGJ4jlkKJWh2s50ePmkbP37tjPso#t0015

https://portal.ceew.in/datastory/maldah-west-bengal/

Heritage Place of Malda. (n.d.). Retrieved September 12, 2022, from https://wbhc.in/home/place_list/

Malda: ASI. (n.d.). Retrieved September 11, 2022, from http://www.asikolkata.in/maldah.aspx#Firoz

Malda: West Bengal Heritage Commission. (n.d.). Retrieved September 12, 2022,

https://wbhc.in/home/place_list/

Malda District. (n.d.). Retrieved September 13, 2022,

http://wbnorthbengaldev.gov.in/HtmlPage/about_malda.aspx

Places to Visit in Malda. (n.d.). Retrieved September 14, 2022, https://www.holidify.com/places/malda/sightseeing-and-things-to-do.html

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	1038763	10	3,79,14,84,950	284361371 3	568722742.5	25	22748909.7	62325.78	2E+06
Buffalo	Manure	38439	15	21,04,53,525	157840143.8	31568028.75	25	1262721.15	3459.51	86488
Sheep	Manure	32919	1	1,20,15,435	9011576.25	1802315.25	25	72092.61	197.514	4937.9
Goat	Manure	1376487	1	50,24,17,755	376813316.3	75362663.25	25	3014506.53	8258.922	206473

Pig	Manure	70969	2.5	6,47,59,213	48569409.38	9713881.875	25	388555.275	1064.535	26613
Total		**25,57,577**						**27486785.27**		

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	17399	1.5	26098.5	18268.95	15	15528.6075	800	12422886
Rice	husk	457341	0.28	128055.48	89638.836	30	62747.1852	800	50197748.16
sugarcane	bagasse	208143	0.33	68687.19	48081.033	80	9616.2066	750	7212154.95
Total		**682883**							**69832789.11**