Arth Ganga Project: District Nadia

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EXECUTIVE SUMMARY

The district Nadia is located in the heart of the Bengal delta bound by Ganga. On the west and the east by Padma running into the Meghna estuary, the entire district lies in the alluvial plain of the Ganga and its tributaries.

The total geographical area of the district is around 3927 km^2. The primary sector contributes, on average, 25.53% to the district GDP with the average annual growth rate from 2007-08 to 2013-14 to be 2.73% only. Its share decreased from 27.18% in 2007-08 to 22.09% in 2013-14. The share of the secondary sector slightly decreased from 16.95% in 2007-08 to 16.25% in 2013-14, with an average annual growth rate of 4.90%. The tertiary sector grew with a annual growth rate of 7.26%, and its share increased from 55.86% in 2007-08 to 61.67% in 2013-14. Overall, the district economy grew by 5.60% annually during the study period.

The cropping intensity of the district is 234.79 %. Major crop types are rice, cereals, pulses, jute, along with oilseeds, etc. The livestock consists of cattle (indigenous and crossbred), buffalos (indigenous and crossbred), pigs (indigenous and crossbred), sheep, goats, pigs and fisheries. The total number of cattle decreased in the district from 1013 thousand in 2003 to 817 thousand in 2019, but the cattle's share in large ruminants went up from 93.88% in 2003 to 97.94% in 2019. Total buffaloes significantly decreased from 66 thousand in 2003 to 17 thousand in 2019. Total sheep decreased from 71.56 thousand in 2003 to 24.67 thousand in 2019, a net decrease of 65.52%. Total goats and pigs decelerated from 1519 and 91 thousand in 2003 to 924 and 5 thousand in 2019, respectively. The total livestock population significantly decreased in the district from 2764 thousand in 2003 to 1788 thousand in 2019, a net decrease of 35.31%.

The share of cultivable wasteland decreased from 0.15% in 2011-12 to 0.03% in 2019-20. The share of barren and uncultivable land went up from 0.00% in 2011-12 to 0.08% in 2019-20. The fallow land decelerated from 1.23% in 2011-12 to 0.36% in 2019-20. The net sown area (NSA) has increased over the years, from 74.97% in 2011-12 to 75.20% in 2019-20. The non-agricultural use area went up from 22.65% in 2011-12 to 23.14% in 2019-20. In 2019-20, the nitrogen share decreased to 55.51%, while the phosphorus and potassium share has increased to 27.96% and 16.52%. The overall use of chemical fertilizers went up from 127.39 kg/ ha of GSA in 2013-14 to 145.48 kg/ ha of GSA in 2019-20.

Forests cover of the district (2021) is 12.22% out of the total geographical area which is 3927 sq. km. The district has a total of 497.47 sq. km. under the forests out of which 1 sq. km. is under dense forest, 160.13 sq. km. is under moderately dense forests and 318.84 sq. km under the open forests. The area under forest is very low and remained almost constant (0.31%) over the years. The area under trees and gardens increased from 0.67% in 2011-12 to 0.90% in 2019-20. Forest data shows that forest cover was decreased by 3.29 % in 2019. There are 393 bird species and seventeen threatened/rare species and two introduced species of bird in the district.

Nadia is an important district in the tourism as ancient temples, mosques, historic forts and magnificent handicrafts make Nadia District a great tourist destination. Nadia district has some important centres of pilgrimage and ancient learning like Nabadwip, Santipur and Mayapur, places of historical interest like

Ballal Dhipi, Battle ground of Plassey, Krishnanagar Rajbari, Birthplace of Poet Krittibas at Fulia and tourist spots like Bethuadahari Forest and Ghurni. The district is well connected by railways and road.

There are a total of 4465 natural and man-made wetlands of mainly lakes/ponds, oxbow/meanders and tanks/ponds type. Electricity has been used by the half of the households, which is used by around 50.60% of the total households. Kerosene is being used by 47.80% of the households, which is the second most used sources in the district. Solar is used by 0.70% of the households in the district. The type of fuel used by households for cooking is 38.70% of the households use crop residue, 33.90% of the households use fire-wood, 13.70% of the households use LPG/PNG. Biogas potential from animal waste and agricultural waste was calculated approximately as two crore m^3/year and four crores m^3/year. No hydropower plant exists, nor the site has been identified in the district.

The active measures should be taken to support and promote sustainable economy and development. Creating awareness and strict implementation of laws, adapting various measures such as eco-tourism, reduction of over-exploitation of ground water and afforestation should be taken to improve tourism and forest cover of the district and enhance the use of renewable energy especially by creating awareness. Use of micro-irrigation, Vermicomposting, farm mechanization, adopting greenhouse farming with organic farming, and encouraging farmers for adapting different crop cultivation and various irrigation methods such as Micro-irrigation. Along with focusing on agriculture practices Bee culture, poultry, fisheries, etc. needs encouragement as they have high economic potential. Promoting high-quality gerbera flowers and capsicum production, commercial production of strawberry cultivation, and sorting, grading, and packaging units. Encouraging high-quality jute fiber production, grow off-season crops, sugarcane and jute cultivation, nursery raising, hardening of crops, etc.

1. DISTRICT OVERVIEW

1.1 INTRODUCTION

Nadia is a district in the state of West Bengal, India. It borders Bangladesh to the east, North 24 Parganas and Hooghly districts to the south, Purba Bardhaman to the west, and Murshidabad to the north. Geographically the district lies at 23º47’ N latitude , 88º56’ e longitude and 14 m Altitude. The distric occupies an area of 3927 sq. km. According to the 2011 census Nadia district has a population of 5,167,600. This gives it a ranking of 18th in India (out of a total of 640).

The District of Nadia has its headquarter at Krishnanagar town. Administration wise the district is divided in 4 sub-divisions namely Krishnanagar Sadar, Kalyani, Ranghat and Tehatta. There are 15 assembly constitencues in the district. Moreover the district comprises 65 towns and 1307 villages.

Agriculture is the main occupation of the district. The industries of the district are also contributing a share in its economy.

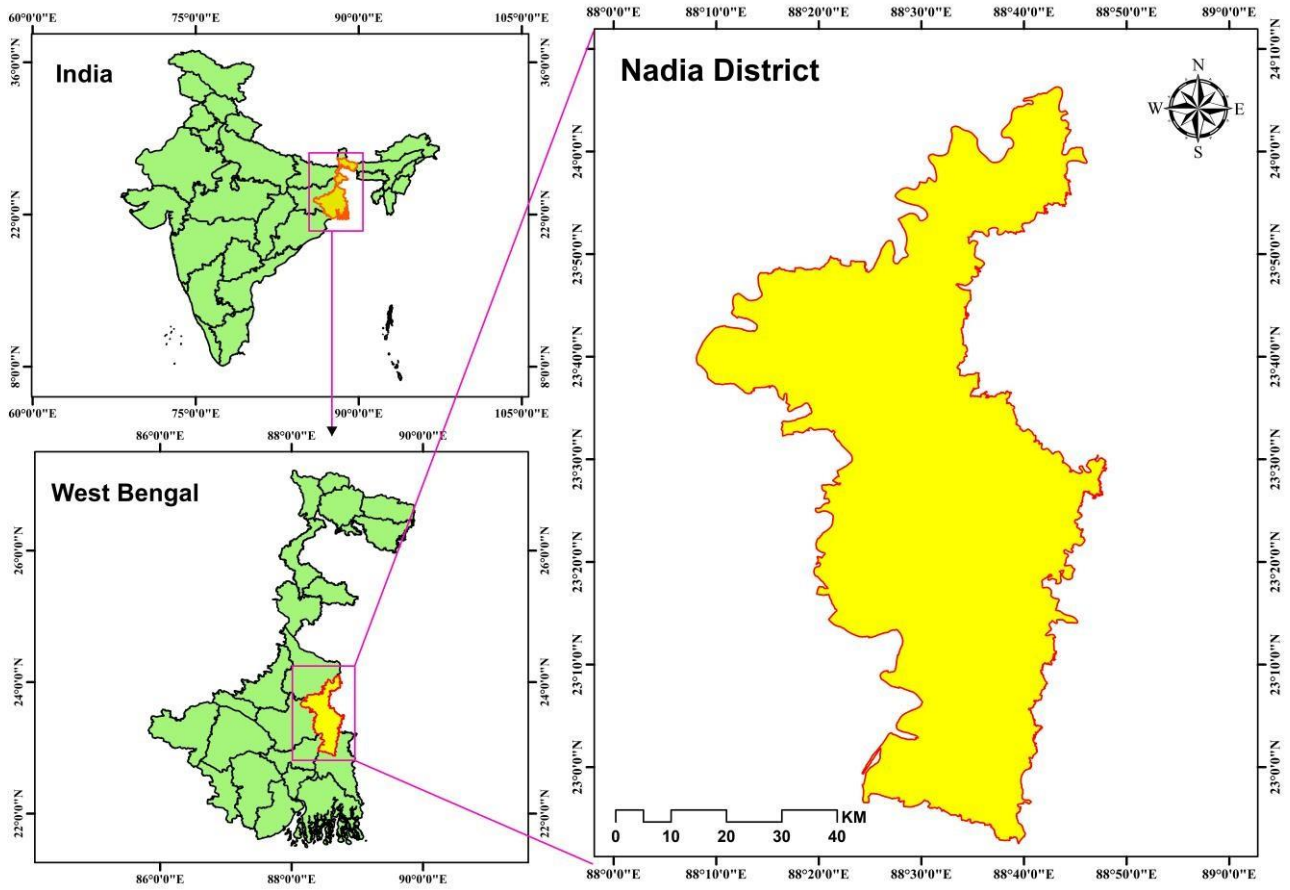


Figure 1 Map of the district

1.2 DEMOGRAPHIC PROFILE OF NADIA

In 1948, Nadia district was formed after independence, prior to that it was formed by Britishers in 1787. The district is situated at a latitude between 22° 53’ North and 24° 11’ North and at a longitude between 88° 09’ East and 88° 48’ East. The district is divided into two parts by Tropic of Cancer.

The district is surrounded by Murshidabad district in the North and North-West, by the Republic of Bangladesh in the South-East and East, by North 24-Parganas district in the South, by Bardhaman district in the West, and by Hugli in the South-West. The major rivers flowing in the district are Bhagirathi, Churni, Mathabhanga, Ichamati and Jalangi. There are four sub-divisions in the district which are Krishnagar Sadar, Ranaghat. Kalyani and Tehatta, and there are 17 C.D. blocks in the district. The district headquarters is located at Krishnagar town.

The district has an overall area of 3927 sq.km., and has a population of 5167600, as of Census 2011. Out of the overall population, 26,53,768 is male population, which is around 51.35% of the total population and the rest is 25,13,832 female population, which is around 48.64% of the total population. Moreover, 3728727 people reside in the rural areas, which is around 72.15% of the whole population, and the rest 1438873 people reside in the urban areas, which is around 27.84% of the total population. The sex ratio, as per Census 2011 is 947 females per thousand males. The average literacy rate in the district is 74.97%, males have a literacy rate of 78.755, while females have a literacy rate of 70.98%.

According to the Ministry of Environment, Forest and Climate Change Notification (2018), more than half of the area is covered by Tropical Evergreen forests which is 228511.52 hectares (around 58.30%), 8.91% of the area is covered with Tropical Semi-Evergreen forests, which is 34921.59 hectares, 1.51% is covered by crop land, which is 5920.81 hectares, and 1.66% of the area is barren land, which is around 6487.15 hectares of land. Tal, Fuel Wood, Gamar, and Sisu are the main forest products.

The primary occupation in the district is agriculture, as 70% of the district's rural population depends on it for their livelihood. The major crops grown in the district are Aus paddy, Arnan paddy, Boro paddy, wheat, maize, pulses, oilseeds, potato, vegetables, and jute.

1.3 ECONOMIC PROFILE OF NADIA

The primary sector contributes, on average, 25.53% to the district GDP. However, the average annual growth rate in this sector from 2007-08 to 2013-14 was 2.73% only. Its share decreased from 27.18% in 2007-08 to 22.09% in 2013-14 because the other sectors' growth was higher than the primary sector. The share of the secondary sector slightly decreased from 16.95% in 2007-08 to 16.25% in 2013-14, with an average annual growth rate of 4.90%. The tertiary sector grew with a remarkable annual growth rate of 7.26%, and its share increased from 55.86% in 2007-08 to 61.67% in 2013-14. Overall, the district economy grew by 5.60% annually during the study period. The growth in the primary sector was lower than in the other two sectors, which needs to be enhanced to improve farmers' income and livelihood.

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

Year	Sector-wise GDDP				Annual Growth Rates			
	PRIMARY SECTOR	SECONDARY SECTOR	TERTIARY SECTOR	TOTAL GDDP	PRIMARY SECTOR	SECONDARY SECTOR	TERTIARY SECTOR	TOTAL GDDP

2007	26577	16577	54618	97772	-	-	-	-
	(27.18)	(16.95)	(55.86)	(100)				
2008	24251	15964	58353	98568	-8.75	-3.70	6.84	0.81
	(24.60)	(16.20)	(59.20)	(100)				
2009	32086	17955	63795	113836	32.31	12.47	9.33	15.49
	(28.19)	(15.77)	(56.04)	(100)				
2010	32971	18659	67767	119397	2.76	3.92	6.23	4.89
	(27.61)	(15.63)	(56.76)	(100)				
2011	31114	18893	72149	122156	-5.63	1.25	6.47	2.31
	(25.47)	(15.47)	(59.06)	(100)				
2012	30250	19852	77925	128026	-2.78	5.08	8.01	4.81
	(23.63)	(15.51)	(60.87)	(100)				
2013	29781	21907	83152	134840	-1.55	10.35	6.71	5.32
	(22.09)	(16.25)	(61.67)	(100)				
Average Growth Rate					2.73	4.90	7.26	5.60

Source: http://data.icrisat.org/district-level-data/

Note: Figures in Parenthesis are percentage shares in 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 3907.30 sq. km The area under forest is very low and remained constant (0.31%) over the years, which should be increased. The share of cultivable wasteland decreased from 0.15% in 2011-12 to 0.03% in 2019-20. The share of barren and uncultivable land went up from 0.00% in 2011-12 to 0.08% in 2019-20. The fallow land decelerated from 1.23% in 2011-12 to 0.36% in 2019-20. Moreover, the net sown area (NSA) has increased over the years, from 74.97% in 2011-12 to 75.20% in 2019-20. The non-agricultural use area went up from 22.65% in 2011-12 to 23.14% in 2019-

20 (Table 2). The area under trees and gardens increased from 0.67% in 2011-12 to 0.90% in 2019-20, which should further be increased to achieve sustainable development goals. Overall, the land use pattern shows that the area under fallow land decreased while the NSA increased over the years.

Table 2: Trends in land use pattern in Nadia (as % of the total reported area)

Year	TOTAL REPORTED AREA (in 1000 Ha)	AREA UNDER FOREST	CULTIVABLE WASTELAND	TOTAL FALLOW	BARREN AND UNCULTIVABLE LAND	LAND OTHER THAN AGRICULTURE	AREA UNDER TREES AND GARDENS	NET SOWN AREA
1	2	3	4	5	6	7	8	9
2011	390.7	0.31	0.15	1.23	0.00	22.65	0.67	74.97
2012	390.7	0.31	0.10	1.02	0.00	22.78	0.64	75.15
2013	390.7	0.31	0.08	0.87	0.00	22.83	0.59	75.33
2014	390.7	0.31	0.08	0.77	0.05	22.91	0.64	75.22
2015	390.7	0.31	0.08	0.69	0.08	22.98	0.69	75.10
2016	390.7	0.31	0.10	0.64	0.08	23.04	0.72	75.09
2017	390.7	0.31	0.08	0.49	0.08	23.09	0.82	75.15
2018	390.7	0.31	0.05	0.38	0.08	23.11	0.87	75.17
2019	390.7	0.31	0.03	0.36	0.08	23.14	0.90	75.20

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

2.1.2 Trends in Operational Land Holdings

In Nadia district, the total number of operational farms increased from 424 thousand in 2010-11 to 429 thousand in 2015-16, a net increase of 1.18%. While in the state, their numbers increased from 7123 thousand in 2010-11 to 7242 thousand in 2015-16, a net increase of 1.67%. Most land positions in the district are marginal and small. These two size categories represented around 97.23% in the district in 2015-16, while the corresponding proportion in the state was 96.22% (Table 3). The two agricultural censuses of 2010-11 and 2015-16 show a decline in the percentage share across the small, semi-medium, and medium land holding and an increase in the share of the marginal land holdings, indicating to the marginalization of farm holdings.

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

	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.)
Nadia	2010-11	79.79	17.27	2.81	0.12	0	424
	2015-16	80.09	17.24	2.59	0.09	0	429
							[1.18]

West Bengal	2010-11	82.16	13.76	3.75	0.32	0.01	7123
	2015-16	82.81	13.41	3.53	0.24	0.01	7242 [1.67]
Source: Compiled from https://agcensus.nic.in/. Figures in [] are percentage increase/decrease in 2015-16 over 2010-11.							

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

2.1.3.1 The Trend in Cropping Patterns

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 (32.01%). The area shared by the total cereals slightly increased from 40.19% in 2013-14 to 40.31% in 2019-20. The main pulses produced are Masoor and black gram. The total pulses acreage went up significantly from 7.74% in 2013-14 to 10.08% in 2019-20. The total food grain acreage also increased from 47.93% in 2013-14 to 50.39% in 2019-20, mainly due rise in pluses acreage. Moreover, the food grains cover a majority (average, 49.48%) of the GCA. Mustard and Sesamum are the major oilseeds crop produced, and the total oilseed acreage increased from 16.03% in 2013-14 to 18.42% in 2019-20. Thus, both pulses and oilseeds show a rise in their cropped area. Jute is a major fibre crop of Nadia, however, area shared by Jute decreased from 16.86% in 2013-14 to 14.22% in 2019-20. In general, there was no significant change in the cultivation pattern during the study period. The average cropping intensity in the district is 234.79, which indicates to the intensive farm practices in the district.

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	33.52	33.82	33.47	33.34	36.18	34.67	32.01
Wheat	6.21	6.07	5.25	5.20	5.01	4.86	4.70
Other Cereals	0.46	0.72	0.59	0.69	0.89	0.89	3.59
Total Cereals	40.19	40.62	39.32	39.23	42.08	40.42	40.31
Masoor (Lentil)	3.59	3.36	4.56	4.02	5.13	5.46	5.16
Black gram (urad)	1.78	2.02	2.10	2.31	2.28	1.96	2.08
Gram	0.95	1.38	1.16	1.13	0.52	0.68	0.92
Other Pulses	1.42	1.62	1.47	1.49	1.77	1.92	1.92
Total Pulses	7.74	8.37	9.29	8.96	9.70	10.02	10.08
Total Food Grains	47.93	48.99	48.61	48.19	51.78	50.44	50.39
Mustard	10.83	10.99	10.87	10.49	13.10	13.24	13.09
Sesamum (Til)	4.09	3.41	3.61	3.88	4.40	4.47	4.88
Other Oilseeds	1.11	1.09	0.71	0.96	0.69	0.95	0.46
Total Oilseeds	16.03	15.49	15.19	15.33	18.18	18.65	18.42
Jute	16.86	16.28	16.86	15.77	13.95	14.53	14.22

Net Sown Area	41.27	40.94	41.42	43.24	43.76	44.33	43.44
Gross Sown Area (in 1000 Ha)	713.1	717.9	708.3	678.5	670.9	662.6	676.3
Cropping Intensity	242.30	244.27	241.41	231.26	228.51	225.60	230.19
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 across years. Rice is the main crop in the district, and its per hectare yield of 33.39 qtls, in 2019-20 is low. Moreover, the per hectare yield of total cereals increased from 31.11 qtls in 2013-14 to 33.00 qtls in 2019-20. On the other hand, the per hectare yield of total pulses decreased from 9.28 qtls in 2013-14 to 6.64 qtls in 2019-20. The yield of total oilseeds also decreased from 12.38 qtls in 2013-14 to 9.33 qtls in 2019-20. The yield of Jute went down from 31.26 qtls in 2013-14 to 27.91qtls in 2019-20. The yield of total food grains slightly increased from 27.59 qtls in 2013-14 to 27.72 qtls in 2019-20. In summary, all crop yields show yearly fluctuations. The lack of stability in crop yields makes farmers' income riskier, requiring a solid insurance protection measure.

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

Crop/Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Rice	30.73	32.16	31.34	32.45	33.14	33.08	33.39
Wheat	33.63	34.01	24.81	32.04	20.06	34.38	21.95
Total Cereals	31.11	32.39	30.37	32.28	31.69	33.46	33.00
Masoor (Lentil)	9.61	9.34	6.56	8.42	9.68	6.08	7.34
Black gram (urad)	7.80	7.79	8.12	7.96	7.45	7.31	6.52
Gram	10.74	10.71	6.59	8.70	12.00	6.89	3.87
Total Pulses	9.28	9.20	7.16	8.40	9.16	6.73	6.64
Total Food Grains	27.59	28.43	25.94	27.84	27.47	28.15	27.72
Mustard	11.76	12.17	12.05	11.98	10.74	11.35	10.14
Sesamum (Til)	11.85	12.08	12.30	10.30	9.97	11.25	6.18
Total Oilseeds	12.38	12.50	12.34	11.90	10.83	11.76	9.33
Jute	31.26	27.98	25.53	28.99	28.19	28.95	27.91
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 dominates the production. In 2019-20, Rice (723 thousand tonnes) and wheat (69.8 thousand tonnes) formed a major part of the total cereal production. Moreover, there has been an increase in total cereals production from 891.7 thousand tons in 2013-14 to 899.5 thousand tons in 2019-20. Coming to pulses, Masoor and black gram occupied the highest production, with their productions being 25.6 thousand tons and 9.2 thousand tons,

respectively, in 2019-20. Although these pulses show variation in the production across years, they still represent around 76.82% of the total pulse production. Mustard and Sesamum productions were 89.7 thousand tons and 20.4 thousand tons, respectively, which represented 94.75% of the total oilseed production in 2019-20. Jute production decreased from 375.8 thousand tons in 2013-14 to 268.5 thousand tons in 2019-20. Looking at the annual production data of various crops, we find that the production of all crops varied substantially across years. This calls for proper crop insurance arrangements so that farmers can take more risk and diversify their production.

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

Crop/Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Rice	734.4	780.9	743.1	734	804.3	759.9	723
Wheat	149	148.3	92.3	113.1	67.4	110.7	69.8
Other Cereals	8.3	15.4	10.5	12.3	23	25.4	106.7
Total Cereals	891.7	944.6	845.9	859.4	894.7	896	899.5
Masoor (Lentil)	24.6	22.5	21.2	23	33.3	22	25.6
Black gram (urad)	9.9	11.3	12.1	12.5	11.4	9.5	9.2
Gram	7.3	10.6	5.4	6.7	4.2	3.1	2.4
Other Pulses	9.4	10.9	8.4	8.9	10.7	10.1	8.1
Total Pulses	51.2	55.3	47.1	51.1	59.6	44.7	45.3
Total Food Grains	942.9	999.9	893	910.5	954.3	940.7	944.8
Mustard	90.8	96	92.8	85.3	94.4	99.5	89.7
Sesamum (Til)	34.6	29.6	31.5	27.1	29.4	33.3	20.4
Other Oilseeds	16.1	13.4	8.5	11.4	8.3	12.6	6.1
Total Oilseeds	141.5	139	132.8	123.8	132.1	145.4	116.2
Jute	375.8	327.1	304.8	310.2	263.8	278.8	268.5

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

2.1.3.4 Variability assessment in the area, production, and yield

To understand the variability across the years (Table 7), we calculated the mean, standard deviation (SD), and coefficient of variation (COV) of the area, production, and yield of the main crops. Among different crops, the lowest variability in the area is observed in Rice (4.18%), followed by Urad (7.89%) and Mustard (8.40%), and the highest in Gram (32.79%). The variability in the area under jute is 11.03%. The variability in the area under total pulses (7.23%) is much higher than in the area under total cereals (3.44%). Since Rice dominates the production, the variability in the area under total food grains is, therefore, influenced by the variability in Rice production. Variability in the area under total oilseeds is 7.12%.

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	233.43	9.76	4.18	754.23	29.30	3.89	32.33	1.00	3.08

Wheat	36.86	5.18	14.07	107.23	33.39	31.14	28.70	6.21	21.64
Total Cereals	277.94	9.57	3.44	890.26	31.66	3.56	32.04	1.07	3.34
Masoor (Lentil)	30.69	4.92	16.04	24.60	4.12	16.76	8.15	1.50	18.36
Black gram (urad)	14.31	1.13	7.89	10.84	1.31	12.05	7.56	0.54	7.10
Gram	6.69	2.19	32.79	5.67	2.82	49.64	8.50	2.88	33.92
Total Pulses	63.09	4.56	7.23	50.61	5.46	10.79	8.08	1.20	14.89
Total Food Grains	341.03	8.26	2.42	940.87	33.91	3.60	27.59	0.80	2.90
Mustard	81.20	6.82	8.40	92.64	4.61	4.97	11.45	0.76	6.67
Sesamum (Til)	28.24	2.94	10.40	29.41	4.71	16.01	10.56	2.12	20.11
Total Oilseeds	115.33	8.22	7.12	132.97	10.24	7.70	11.58	1.14	9.88
Jute	107.09	11.81	11.03	304.14	39.23	12.90	28.40	1.71	6.02
Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/									

The variability of production depends on the variability of the cultivated area and the variability of the yield. The highest variability in production is observed in Gram (49.64%), followed by Wheat (31.14%) and Masoor (16.76%). The variability in the production of total oilseeds is 7.70%. The variability in Jute production is 12.90%. Variability is lowest in Rice (3.89%), followed by Mustard (4.97%) and black gram (12.05%). Improvement in crop insurance conditions and better market accessibility can lower the variability.

In the case of yield, the highest variability is estimated in Urad (33.92%), followed by Wheat (21.64%), and Sesamum (20.11%). The variability in yield of Jute is 6.02%. Yield variability in total pulses (14.89%) is much higher than in total cereals (3.34%). Several factors, such as climate change, market prices, rainfall patterns, etc., influence the variability in agricultural production.

2.1.4 Consumption of Chemical Fertilizers

Table 8 shows the trends in the use of chemical fertilizers in agriculture. The recommended nitrogen to phosphorus and potassium ratio is 4:2:1, which is not maintained in the district. For example, in 2013-14, nitrogen represented 63.67% of the total fertilizers used, while the proportions of phosphorus and potassium were 20.07% and 16.26%, respectively. In 2019-20, however, the nitrogen share decreased to 55.51%, while the phosphorus and potassium share has increased to 27.96% and 16.52%, respectively. In 2019-20, usage of all fertilizers was around the recommended ratio, which is a good development in the district. The table also shows that fertilizer consumption varies across years, which can be due to several factors such as rainfall patterns, cultivation patterns, etc. The overall use of chemical fertilizers went up from 127.39 kg/ ha of GSA in 2013-14 to 145.48 kg/ ha of GSA in 2019-20. There is a need to incentivize the farmers to use organic and bio fertilizers to reduce the degradation of soils and water resources.

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	81.11	76.48	86.22	79.82	81.11	85.32	80.76

Phosphorous	25.57	27.91	37.19	38.81	37.05	39.62	40.68
Potassium	20.72	21.71	19.71	23.89	26.40	27.50	24.04
Total	127.39	126.11	143.11	142.53	144.55	152.44	145.48
GSA (1000 Ha)	713.1	717.9	708.3	678.5	670.9	662.6	676.3
Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/							

2.1.5 Status of Organic Farming

To promote sustainable agricultural practices and improve the farmers' livelihood, the Government of India launched PKVY and Namami Gange schemes. Under these schemes, farmers are incentivized to form groups to do organic farming and sell their products with PGS certification.

The transition period for the full conversion from conventional to organic is considered three years. During this period, crop yield, on average, is expected to decline by 10—15 percent. However, after three years, it may reach its original level. Financial assistance received by the beneficiary farmers seems to be adequate to compensate for the yield losses and motivate them to do organic farming. There is a need to set up an integrated processing unit for organic products. Monitoring of the project should be periodically done through MIS, Geo-tagging, and monthly physical and financial reports.

There may be a possibility that in the absence of the regulatory framework, the beneficiary farmers may revert to conventional farming. In this context, two things need to be thought of—a well-designed regulatory and monitoring framework and the introduction of payments for ecosystem services for the organic farmers after the transition period so that they may carry on the activity sustainably. Organic and zero-budget farming will provide ecological services in terms of soil health, human and animal health, water-saving, biodiversity protection, etc. A long-term system of payments for ecological services may be evolved to retain the existing farmers and motivate others to move towards this sustainable farming system. There is no assured market for these products, and farmers do not get premium prices. They sell their products at the same prices their conventional counterparts do. Certification and quality check and monitoring mechanisms are yet to be set up.

Table 9 shows the details of the establishment of organic clusters under the Paramparagat Krishi Vikas Yojana (PKVY) in the district. The district has two groups in two development blocks. The number of groups is equal in Hanskhali (1) and Karimpur-1 (1). It is reported that the maximum limit of land under a cluster per farmer is 2.00 hectares. Hence, the majority of the beneficiary farmers are small and marginal. Groups need to be added under the Namami Gange, and more groups should be further encouraged in other development blocks.

Table 9: Status of Organic Farming PGS Groups under PKVY and Namami Gange Schemes in Nadia (as on June 6, 2022)

S. No.	Block	Scheme	No. of groups	No. of farmers in groups			
				Total	Average	Median	SD
1	**Hanskhali**	PKVY	1	41	41	41	0
2	**Karimpur-1**	PKVY	1	50	50	50	0
3	**District Total (Nadia)**	PKVY	2	91	45.5	45.5	6.36

		Total	2	91	45.5	45.5	6.36
Source: Compiled from https://pgsindia-ncof.gov.in/								

A gradual shift of farmers from conventional to organic farming systems is likely to positively impact water quality, soil health, and farming sustainability. However, being a knowledge-intensive farming system, farmers need proper training to know the practical details of the integrated sustainable farming system. Since economies of scale in both production and marketing matter in organic farming, some institutional framework may be needed in the forms of SHGs/ farm cooperatives/PFOs/contract farming, etc. Organic farming could be an economically viable option in the district if the government builds strong marketing networks linking farmers, processors, and distributors with the easy certification process and minimizes farmers' risk by protecting their farm income through payments of ecosystem services. A long-term system of incentives and regulation needs to evolve to retain the existing farmers and motivate others to move toward a sustainable farming system in the district.

2.1.6 Trends in Livestock Sector

The total number of cattle decreased in the district from 1013 thousand in 2003 to 817 thousand in 2019, a net decrease of 19.40%. It is because of a decline in adult male cattle (from 307 thousand to 46 thousand) and adult female cattle (from 374 thousand to 331 thousand). Only young cattle increased from 333 thousand to 440 thousand in the same period. Cattle represent 96.74% of the total large ruminants. However, cattle's share in large ruminants went up from 93.88% in 2003 to 97.94% in 2019. Total buffaloes significantly decreased from 66 thousand in 2003 to 17 thousand in 2019, a net decrease of 74.03%. It is due to deceleration in adult female buffaloes from 21 thousand in 2003 to 4 thousand in 2019 and young buffaloes from 15 thousand in 2003 to 6 thousand in 2019. Buffaloes represent around 3.2% of the total large ruminants. Moreover, total sheep decreased from 71.56 thousand in 2003 to 24.67 thousand in 2019, a net decrease of 65.52%. Total goats decelerated from 1519 thousand in 2003 to 924 thousand in 2019, a net decrease of 39.14%. Total pigs also declined from 91 thousand in 2003 to 5 thousand in 2019, a net decrease of 94.56%. The total livestock population significantly decreased in the district from 2764 thousand in 2003 to 1788 thousand in 2019, a net decrease of 35.31%.

Notably, the number of female cattle and buffaloes substantially decreased over the period, indicating the decline in 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 10:Trends in Livestock population (in 1000 numbers) in Nadia

Category	2003	2007	2012	2019
CATTLE TOTAL	1013.41	871.02	748.99	816.78
CATTLE ADULT MALE	306.84	95.29	69.5	46.55
CATTLE ADULT FEMALE	374.05	345.93	312.08	330.68
CATTLE YOUNG TOTAL	332.52	429.79	367.42	439.55
CATTLE SHARE IN LARGE RUMINANT (Percent)	93.88	97.31	97.69	97.94
BUFFALO TOTAL	66.08	24.08	17.75	17.16

BUFFALO ADULT MALE	30.24	16.98	10.85	6.62
BUFFALO ADULT FEMALE	20.86	3.55	3.42	4.28
BUFFALO YOUNG TOTAL	14.98	3.55	3.49	6.25
BUFFALO SHARE IN LARGE RUMINANT (Percent)	6.12	2.69	2.31	2.06
SHEEP TOTAL	71.56	11.72	11.19	24.67
SHEEP SHARE IN SMALL RUMINANT (Percent)	4.5	1.2	1.61	2.6
GOATS TOTAL	1518.93	968.71	684.51	924.34
GOATS SHARE IN SMALL RUMINANT (Percent)	95.5	98.8	98.39	97.4
PIGS TOTAL	90.96	12.96	11.04	4.92
LIVESTOCK TOTAL	2763.78	1889.76	1474.9	1787.87
Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/				

2.1.7 Trends in Milk Production

Table 11 shows the trends in Milk Production in Nadia district over the years. Cow milk has the largest share in milk production. However, cow milk production significantly declined by 22.71% during 2011-12 to 2015-16. Buffalo milk production remained almost constant (5 thousand tons) over the years. Moreover, the total milk production reduced from 410 thousand tons in 2011-12 to 318 thousand tons in 2015-16, majorly due to a decrease in cow milk production. There is a need to incentivize dairy farming to improve cattle and buffaloes' milking capacity.

Table11: Trends in Milk Production (1000 tons)					
Source/Year	**2011**	**2012**	**2013**	**2014**	**2015**
TOTAL COW MILK PRODUCTION	405	455	496	394	313
TOTAL BUFFALO MILK PRODUCTION	5	6	6	5	5
TOTAL MILK PRODUCTION	410	461	502	399	318
Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/					

2.1.8 Trends in Fishery Production

Table 12 shows the trends in Fish Production in Nadia as compared to the total fish production in West Bengal. Fish Production was 59695 tons in 2011-12 in Nadia which increased to 98329 tons in 2014-15. Nadia represented 4.05% of the total fish production in West Bengal in 2011-12. However, its share increased to 6.07% in 2014-15.

Table12: Trends in fish production (in tons) in Nadia				
District/Year	**2011-12**	**2012-13**	**2013-14**	**2014-15**
Nadia	59695	88543	96505	98329
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.

According to the 2021 Forest survey, forests cover of the district is 12.22% out of the total geographical area which is 3927 sq. km. With respect to 2019 forest assessment there has been decrease in the forest area of the district by 0.03 sq. km.

The district has a total of 497.47 sq. km. under the forests out of which 1 sq. km. is under dense forest, 160.13 sq. km. is under moderately dense forests and 318.84 sq. km under the open forests. The district does not has any land area under scrubs as depicted in Fig. 1.

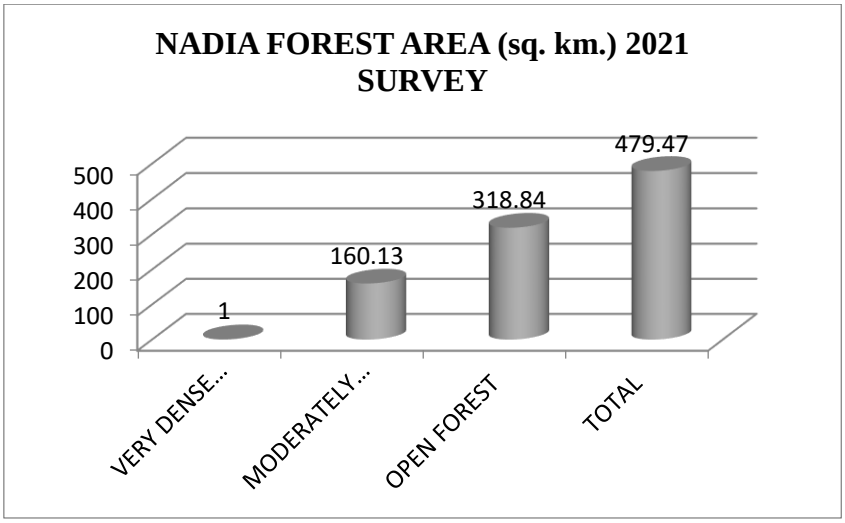


Fig. 1

2.2.1. Biodiversity

The district's biodiversity data includes various crop production, livestock population, bird species, and forest cover. The crop production trend shows an increase in crop production. Forest data shows that forest cover was decreased by 3.29 % in 2019. There are 393 bird species and seventeen threatened/rare species and two introduced species of bird in the district.

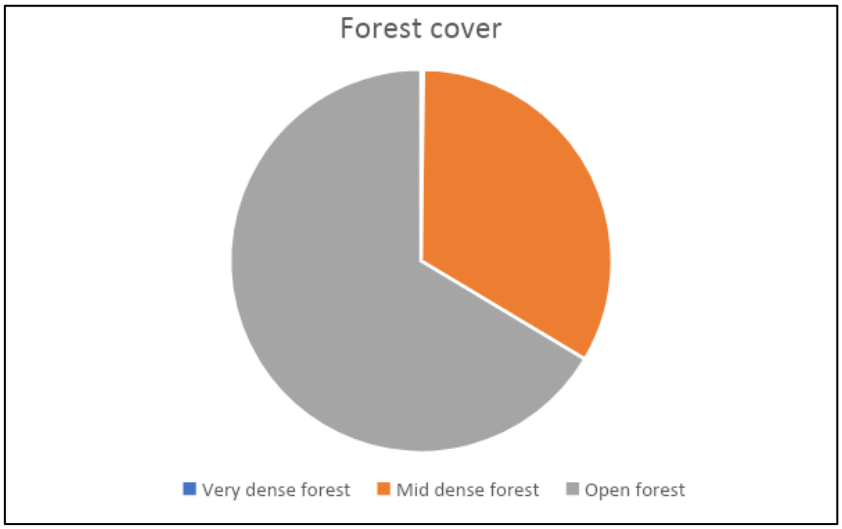
Table 1 Bird species recorded in the district.

Number of species	393
Number of rare/accidental species	17

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

3927	1	160.16	318.84	480	12.22	0	0



2.3 TOURISM

West Bengal: Year Wise Tourist Arrivals (2001 to 2020)

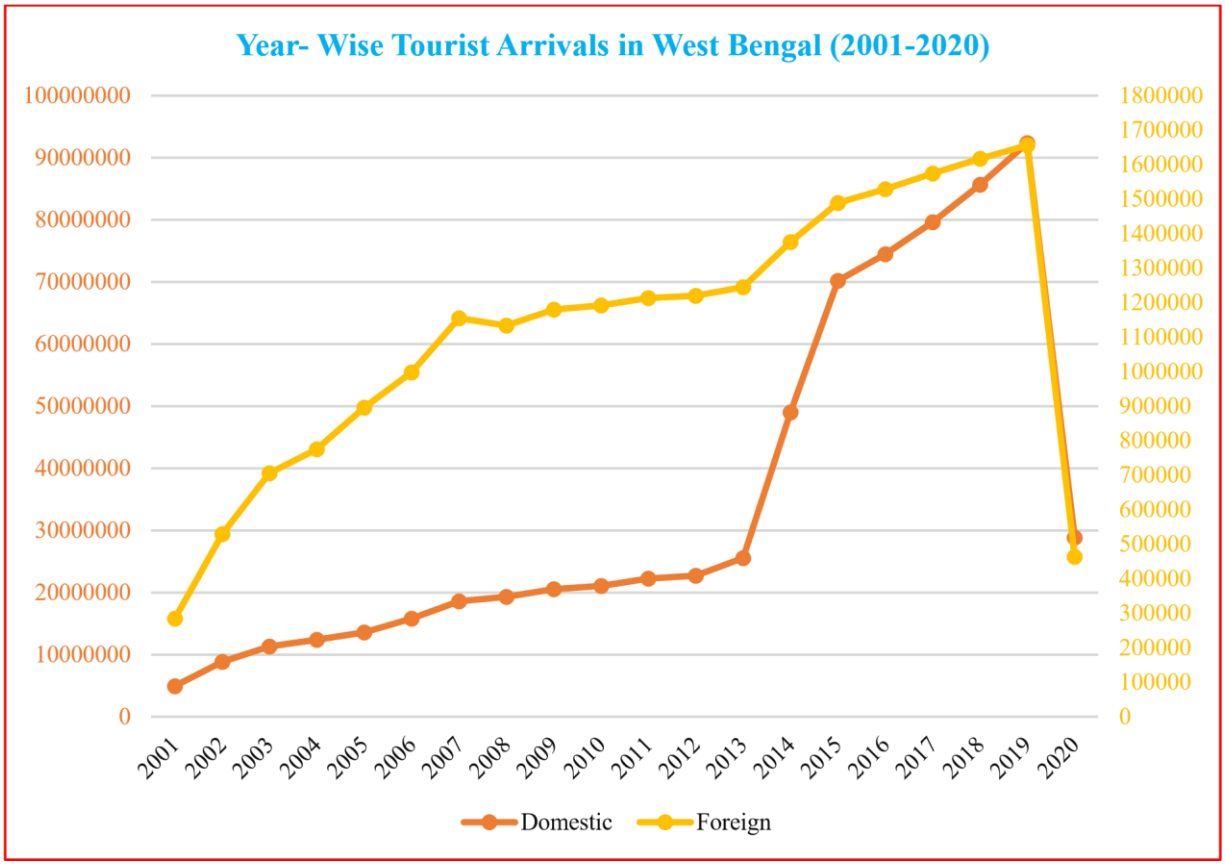
Table: 1 West Bengal Year Wise Tourists Arrivals (2001 to 2020)

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

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



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

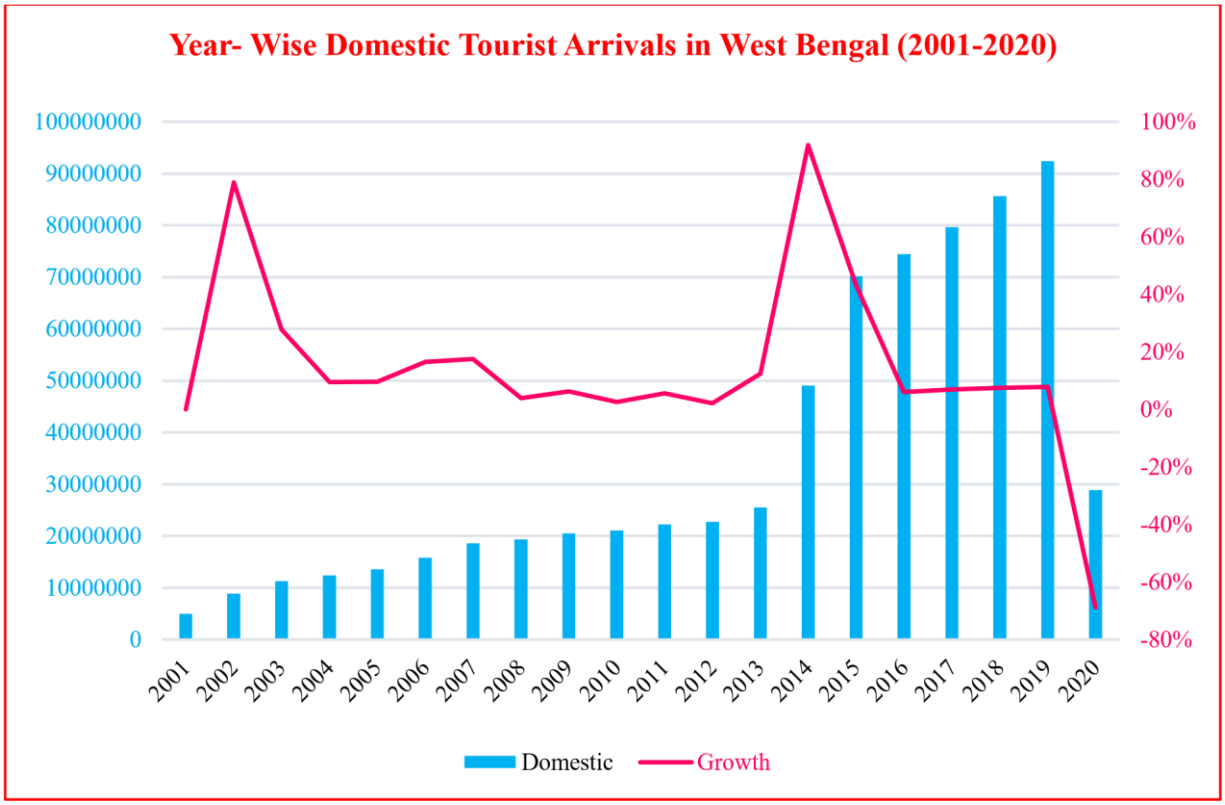


Figure: 3 West Bengal: Year Wise Foreign Tourists Arrivals (2001 to 2020)

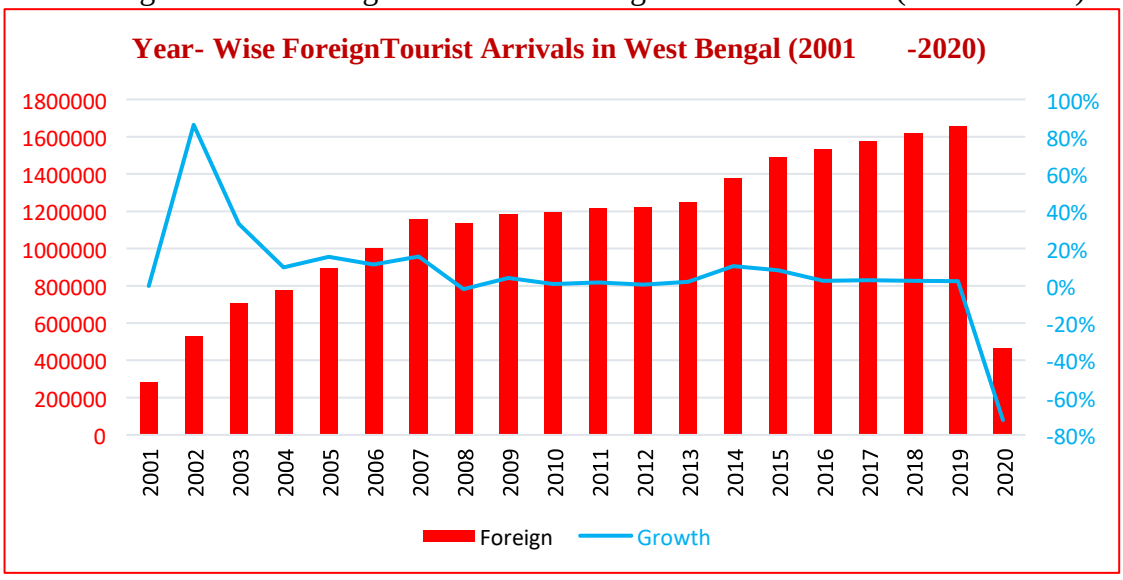


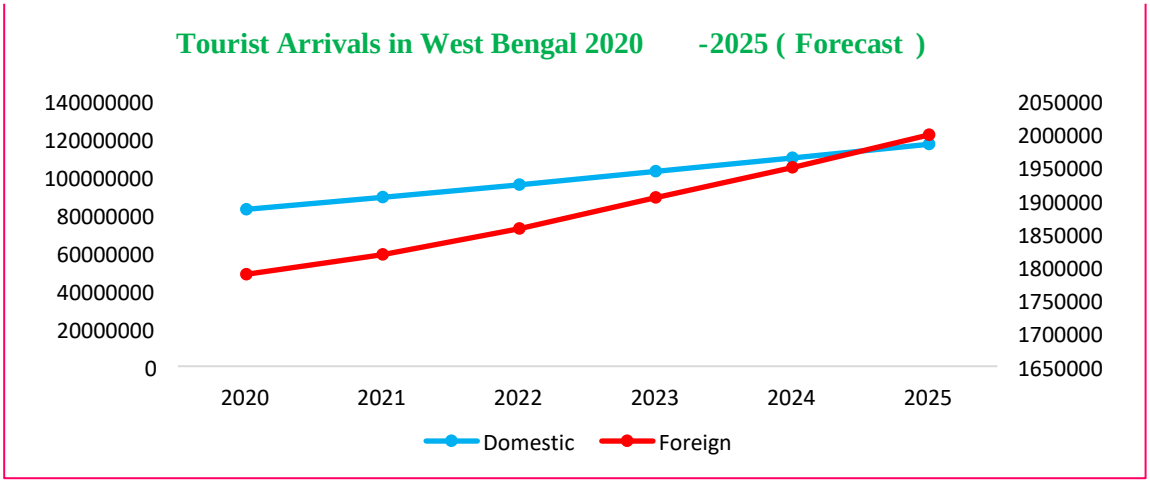
Table: 2 West Bengal: Year Wise Tourists Arrivals (2020 to 2025) Forecast

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

3.1.1.2.1 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)

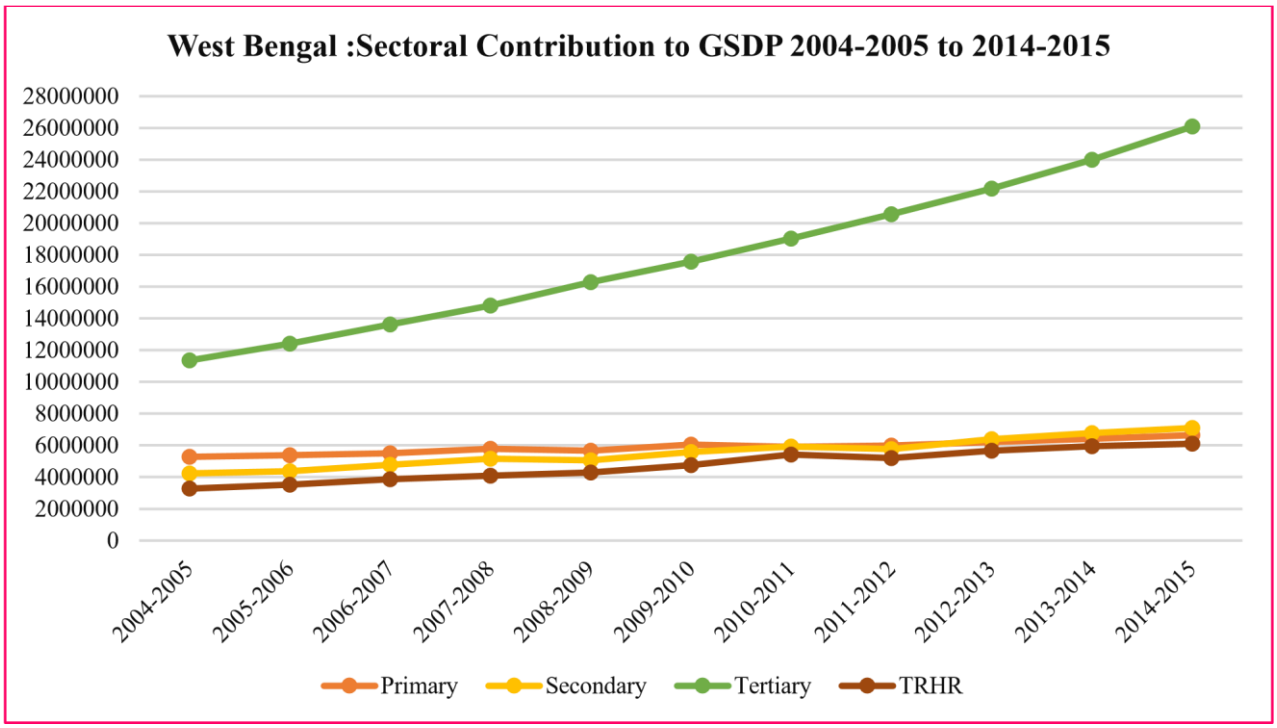
2.3.1.1.3 Table: 3 Sectoral Contribution to GSDP West Bengal 2004-2005 to 2014-2015

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

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



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

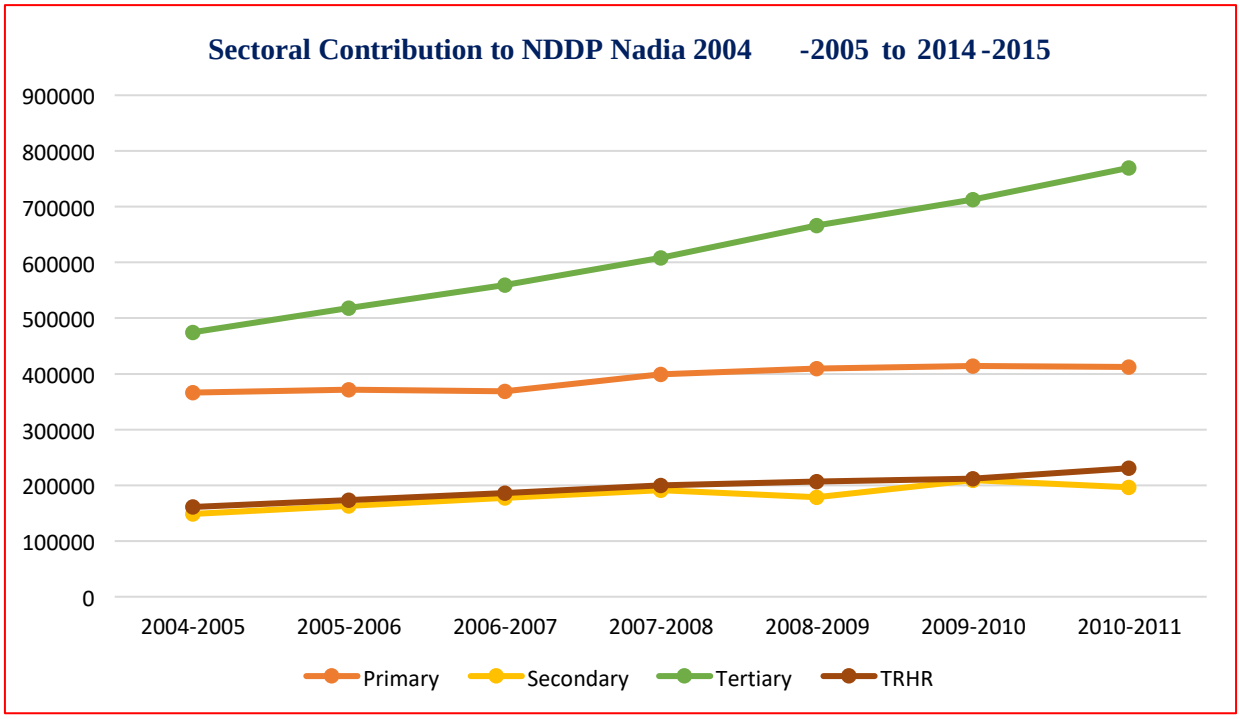
2.3.1.1.5 Table: 4 Sectoral Contribution to NDDP Nadia 2004-2005 to 2010-2011

Year	Primary	Secondary	Tertiary	TRHR as % of Tertiary
2004-2005	366419 (37.03%)	148606 (15.02%)	474580 (47.96%)	161108 (33.95%)
2005-2006	371780 (35.30%)	163354 (15.51%)	518072 (49.19%)	173286 (33.45%)
2006-2007	368576 (33.34%)	177455 (16.05%)	559558 (50.61%)	185806 (33.21%)
2007-2008	398970 (33.28%)	191176 (15.95%)	608540 (50.77%)	199709 (32.82%)

2008-2009	409390 (32.64%)	178515 (14.23%)	666357 (53.13%)	206564 (31.00%)
2009-2010	414162 (31.00%)	209230 (15.66%)	712769 (53.34%)	211959 (29.74%)
2010-2011	412400 (29.91%)	196662 (14.26%)	769605 (55.82%)	230609 (29.96%)

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

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



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

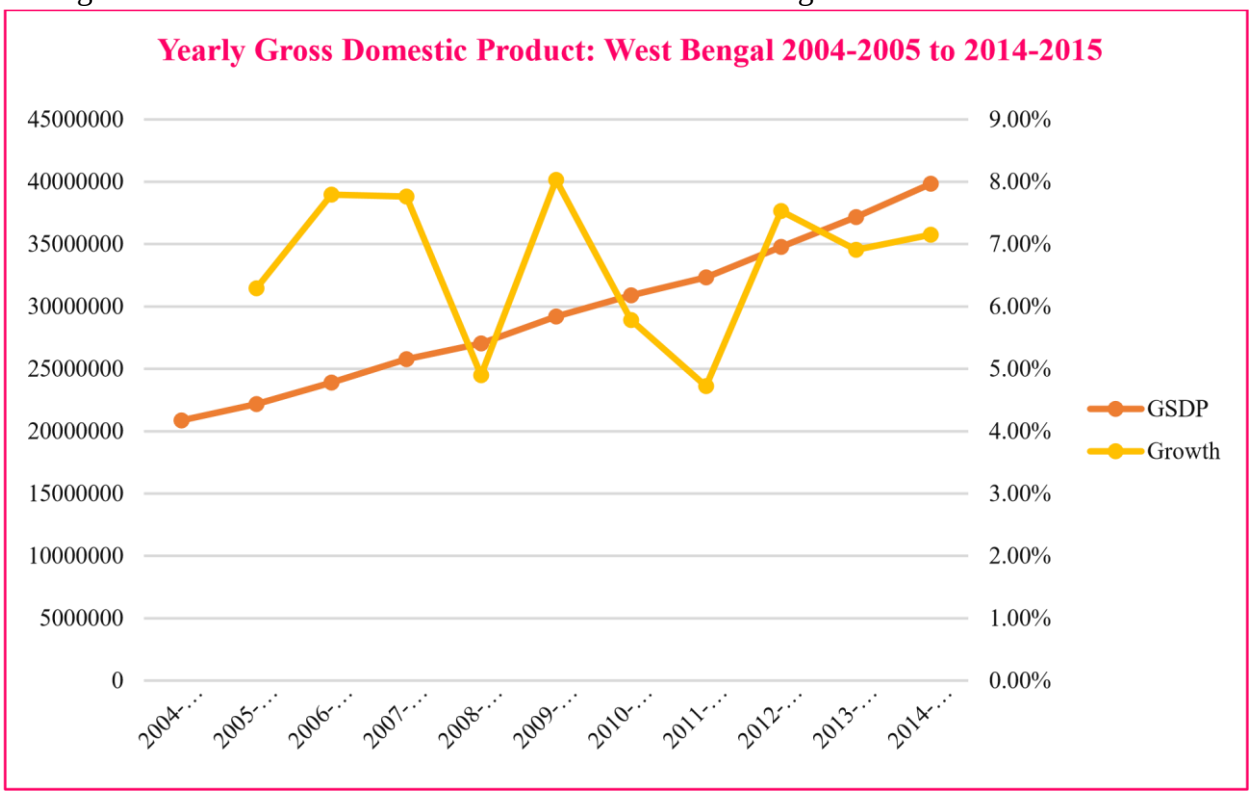
Table: 5 GSDP Growth Rate at Constant Price: West Bengal 2004-2005 to 2014-2015

Year	GDDP	Growth
2004-2005	20865636	-
2005-2006	22178946	6.29%
2006-2007	23907712	7.79%
2007-2008	25763218	7.76%
2008-2009	27024826	4.90%
2009-2010	29195496	8.03%

2010-2011	30883705	5.78%
2011-2012	32341698	4.72%
2012-2013	34777383	7.53%
2013-2014	37179504	6.91%
2014-2015	39838651	7.15%

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

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



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

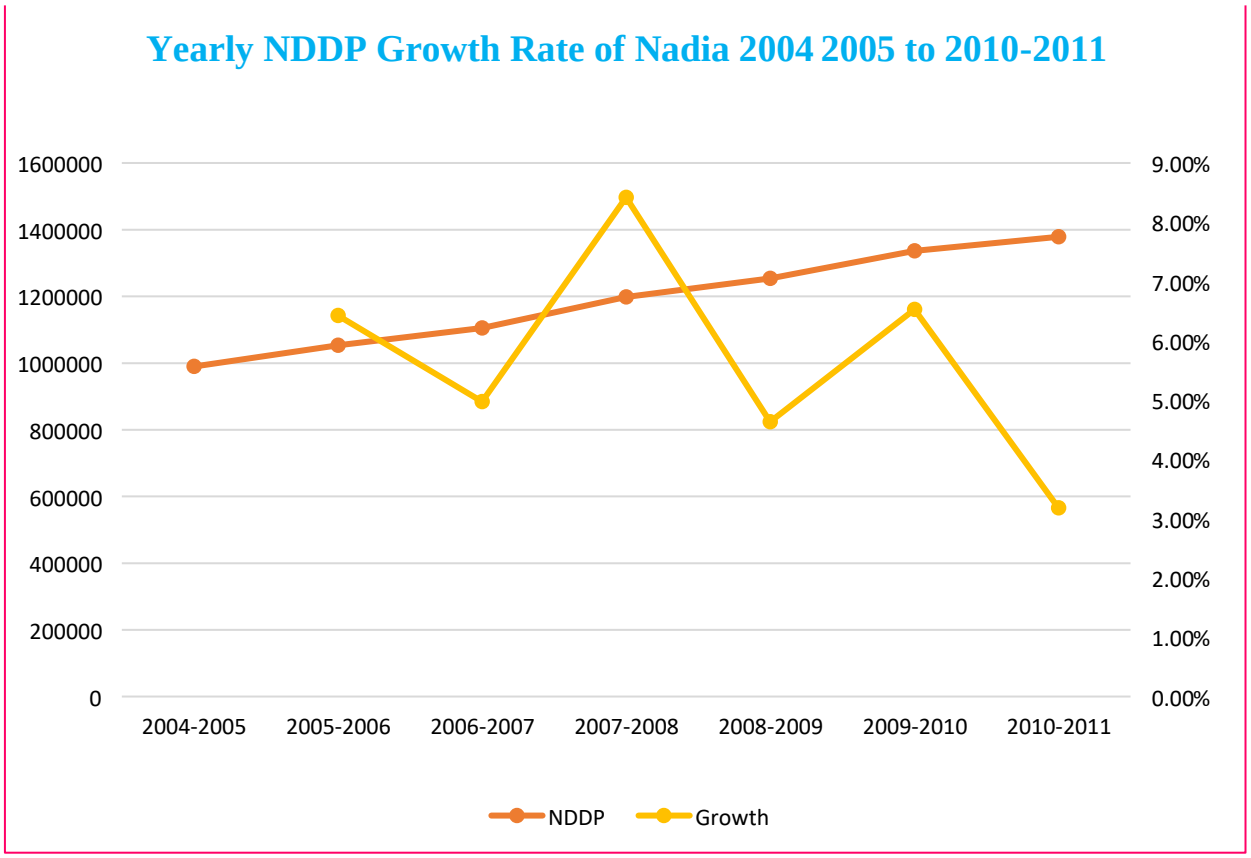
2.3.1.1.7 Table: 6 NDDP Growth Rate at Constant Price: Nadia 2004-2005 to 2010-2011

Year	NDDP	Growth
2004-2005	989605	-
2005-2006	1053206	6.43%
2006-2007	1105589	4.97%

2007-2008	1198686	8.42%
2008-2009	1254262	4.64%
2009-2010	1336161	6.53%
2010-2011	1378667	3.18%

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

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



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

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

Year	TRHR	Tertiary	TRHR as % of Tertiary	NDDP	% of TRHR to NDDP
2004	161108	474580	33.95%	989605	16.28%

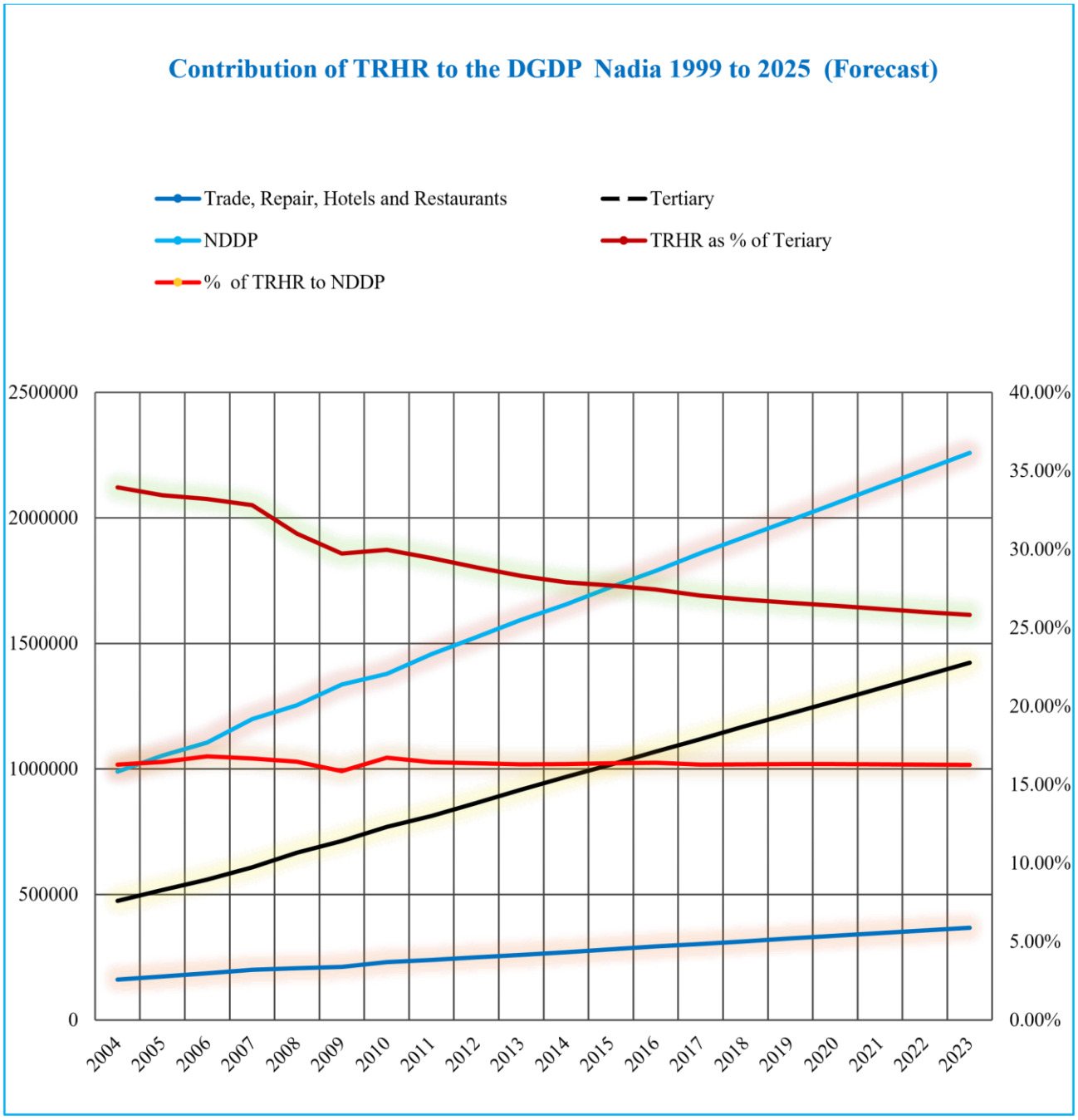
2005	173286	518072	33.45%	1053206	16.45%
2006	185806	559558	33.21%	1105589	16.81%
2007	199709	608540	32.82%	1198686	16.66%
2008	206564	666357	31.00%	1254262	16.47%
2009	211959	712769	29.74%	1336161	15.86%
2010	230609	769605	29.96%	1378667	16.73%
2011 F	239378	812964	29.45%	1456849	16.43%
2012 F	249635	865266	28.85%	1525426	16.36%
2013 F	259790	917754	28.31%	1593697	16.30%
2014 F	270207	968416	27.90%	1655971	16.32%
2015 F	281966	1017849	27.70%	1723999	16.36%
2016 F	293310	1068897	27.44%	1789392	16.39%
2017 F	302678	1118792	27.05%	1860146	16.27%
2018 F	313770	1170683	26.80%	1924801	16.30%
2019 F	324663	1220923	26.59%	1991125	16.31%
2020 F	335548	1271185	26.40%	2057888	16.31%
2021 F	346288	1321855	26.20%	2125533	16.29%
2022 F	356808	1372701	25.99%	2192208	16.28%
2023 F	367508	1423297	25.82%	2259058	16.27%

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

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

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

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



2.4 WETLANDS

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

Table 1: Wetland Data of Nadia 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	188	191	3	0	19	48	41	52	24	4	0	0	142
Ox-bow lakes/cut off meanders	238	249	11	0	52	45	61	46	31	3	0	0	153
High altitude Wetlands	0	0	0	0	0	0	0	0	0	0	0	0	0
Riverine Wetlands	21	21	0	0	5	4	3	4	3	2	0	0	16
Waterlogged	97	98	1	0	25	28	28	12	3	1	0	0	49
River/Stream	0	11	11	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	113	117	4	0	62	32	11	6	2	0	0	0	33
Waterlogged	15	15	0	0	6	8	1	0	0	0	0	0	8
Salt pans	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (4465)	**672**	**702**	**30**	**3763**	**169**	**165**	**145**	**120**	**63**	**10**	**0**	**0**	**401**

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 the prominent authority which is responsible to undertake and promote renewable energy in the state of West Bengal.

The data from Census of India 2011, has been used to make the graph below, to understand the proportion of households having various sources of lightning in the district. Electricity has been used by the half of the households, which is used by around 50.60% of the total households. Kerosene is being used by 47.80% of the households, which is the second most used sources in the district. Solar is used by 0.70% of the households in the district, other oil by 0.20% of the households, and other sources of lightning are being used by 0.10% of the households. 0.50% of the households do not have any sources of lightning.

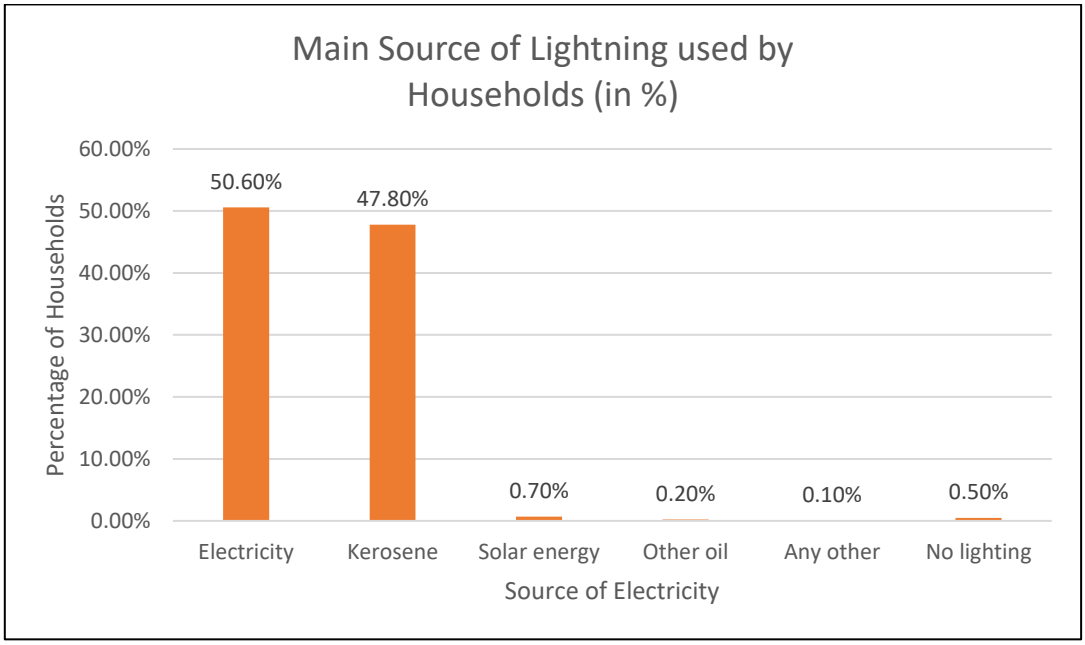


Fig 1

2.5.2. Biomass

WBREDA or West Bengal Renewable Energy Development Agency is responsible for promoting renewable energy in West Bengal.

The net sown area of the district is 280200 hectares, area sown more than once is 417500 hectares, gross cropped area is 697700 hectares. The cropping intensity is 249%. The total forest area is 1200 hectares.

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

Crop	**Productivity (kg/ha)**
Rice	2665
Wheat	2217
Pulses	782
Oilseeds	962
Jute	14.43
Potato	22860

Table 1

The data from Census 2011 has been collected for the type of fuel used by households for cooking in the district Nadia. From the pie-chart, it can be seen that 38.70% of the households use crop residue, 33.90% of the households use fire-wood, 13.70% of the households use LPG/PNG, 5.20% of the households use coal, lignite, charcoal, and 5.10% of the households use cow dung cake as a fuel for cooking.

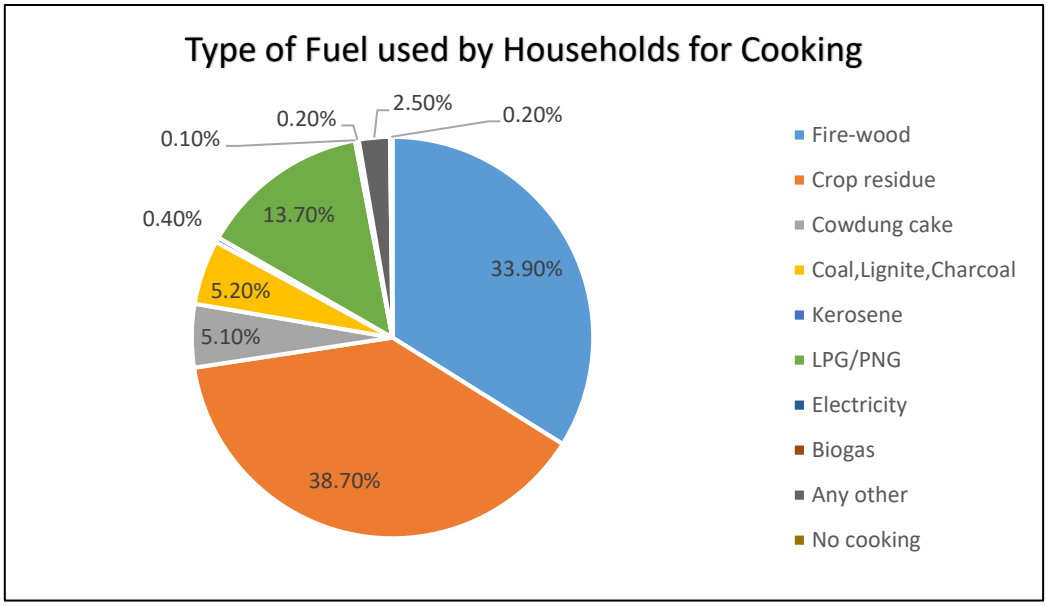


Fig. 1

2.5.3. Biogas

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

2.5.4. Hydro Power

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

3 QUALITATIVE DATA ANALYSIS

3.1FORESTRY

According to the report of FSI, 2021 there has been decrease in the forest cover in the district. The decrease is although only 0.03 sq. km. but still is alarming. The first thing that needs to be done is to make people aware of the requirement of forests in the district and to educate them on how can they increase the forest cover. The district can also take up Sub-Mission on Agroforestry (SMAF) Scheme. Agroforestry should be encouraged in the district and eventually agroforestry can create opportunities for setting up agri-based small enterprises such as pickle production, and juice/pulp extraction of these fruits. The district also has cultivable wasteland, which should be brought under plantation drive under the National Afforestation Mission. There is also a need to include technology like geo-tagging. GPS etc. to monitor the plants which have been planted and the already planted trees. Along with the technology, the local governments should appoint agents who would look after and monitor the plants. The NTFP collection in the district should be made comfortable for the people related to it. They should be given easy access to the resources keeping in track the conservation of forests.

3.1.1 Biodivesity

Nadia lost 20 ha of tree cover between 2010 and 2021, equating to a 2.5 percent drop in tree cover from 2010, and 6.49kt of CO_2e emissions. The peak fire season in Nadia usually starts in early March and lasts for around 11 weeks. There were no VIIRS fire alarms recorded between June 14th and June 6th, 2022, when only high confidence alerts were considered. When compared to recent years, dating back to 2012, this is typical. Nadia received a total of 156 VIIRS Alarms fire alerts between June 10th and June 6th, 2022. The Bethuadahari Wildlife Sanctuary, located near NH-34 (22 km north of Krishnanagar) in the Nadia district of West Bengal, is home to a huge population of Spotted Deer, Jackal, Bengal Fox, Porcupine, and Common Langur. Parakeets, Indian Cuckoos, Barbets, and other smaller birds, as well as Pythons, are among the other species. Gharials are miniature crocodiles that live in a variety of trees. It's in the Nakashipara neighborhood. It has a total area of 67 hectares. It was founded in 1980.

3.2. ENERGY:

3.2.1. Solar

According to the West Bengal State Electricity Distribution Company Limited (WBSEDCL), off-grid solar PV plants with battery back-up have been decided to use to electrify the ‘Nadir Char’ area in 6 districts and one of the districts is Nadir, where WBSEDCL has decided to install off-grid solar power plants having a capacity of 160 KW and it has achieved the target, where it has been able to benefit 391 households.

West Bengal Green Energy Development Corporation Limited (WBGEDCL) has completed various solar energy projects in the district of Nadia. In 2013-14, in the Nadia District Library, WBGEDCL had installed one high-capacity solar street lightning system. Further, in 2015-16, at National Institute of Biomedical Genomics in the Kalyani region of Nadia district, WBGEDCL had installed a grid connected solar PV rooftop plant having a capcity of 20 kWp. Moreover, in 2016-17, at the Nadia District Library, at Ghurni, Krishnagar, a 2.5 kW of solar PV power plant with battery back-up had been installed. Furthermore, in 2018-19, in the Maheshtala Municipality and Nadia District library WBGEDCL had installed 43 solar street lights.

The government in the Nadia district has set to provide power to the 2000 ICDS centres, which are functioning from their buildings, in a phased manner in which 105 centres will be taken up in Phase 1 and 100 centres would be taken in Phase 2. The funding has been provided by the Zila Parishad, which was around Rs. 19000.

3.2.2. Biomass

The total agricultural residue for biomass energy generation in Nadia district is 1748.14 (10^3 ta^{-1}31). Moreover, the biomass residues from rice husk from rice mills/ hullers in the district is 264.86 (10^3 ta^{-1}), residues from saw mills is 20.83 (10^3 ta^{-1}), and residues from non-forest land is 361.85 (10^3 ta^{-1}). The net surplus biomass in the district is 696.79 (10^3 ta^{-1}). Furthermore, the net surplus biomass power generation potential in the district is 88.48 MW (Das & Jash, 2009).

According to the Census 2011, more than half of the households in district are using crop residue and fire-wood as a fuel for cooking. This causes indoor pollution and lung problems among the people living in that environment (Diette, et al., 2012). It is necessary to reduce the usage of crop residue and firewood for cooking and instead shift to the LPG for cooking.

3.2.3 Biogas:

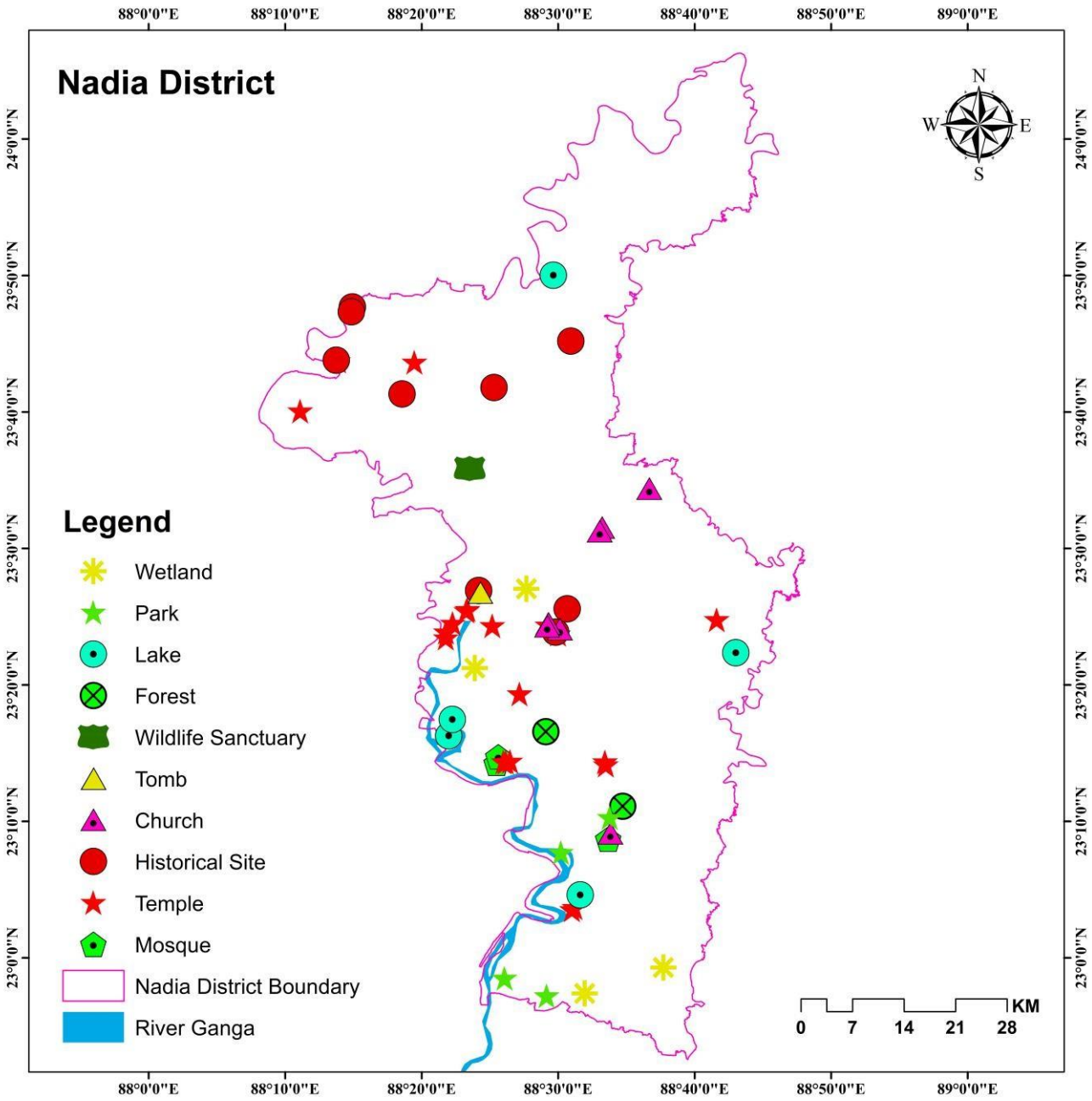
Livestock and agricultural data show a great potential of biogas in the district. Around 320 household biogas plant of capacity 2 cummec was installed in year 2010-11 in the district. Up until December 2011, roughly 11,000 household biogas plant installations had been completed in West Bengal.

3.2.4. Hydropower:

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

3.3 TOURISM

2.3.1.1.10 Map: 2 Tourism Sites of Nadia District



Source: Prepared by Author

ARCHAEOLOGICAL & HISTORICAL TOURISM

★ **Nabadwip:** Nabadwip lies on the western side of the river Bhagirathi at a distance of about 20 K.M. from Krishnagar and it is associated with birth of Lord Sri. Chaitanya and the advent of the Vaishnab religion in Bengal. Sri. Chaitanya was not only a religious leader preaching Vaishnab ideas and Bhakti cult but also a social reformer in the 16th Century. Nabadwip was the capital of Lakshman Sena, the famous ruler of Sena dynasty, who ruled from 1179 to 1203. There are a number of temples and pilgrimage centres. Dwadas Shib Mandir built in 1835 with the exquisite floral designs attracts a large number of pilgrims. The images and idols of Lord Sri. Chaitanaya in a few other places are also regarded with reverence.

★ **Krishnanagar:** Krishnanagar is named after Raja Krishna Chandra Rai (1728 – 1782). The Rajbari built here during the reign of Raja Krishna Chandra Rai is a prominent place of tourist attraction though the remnants of the past glory have been eroded and only a dilapidated structure of the exquisite places with carving on its inner walls exists today. Krishnanagar is the district headquarters situated on the bank of river Jalangi. Krishnanagar was the birthplace of the noted Poet, Composer and Playwright Shri. Dwijendra Lal Roy (1863 – 1913) whose contribution to Bengali Literature needs no mention. The Christian Missionaries attached much importance to Krishnanagar. The Protestant Church was built here during 1840s. The Roman Catholic Cathedral was built in 1898. The origin of famous clay models of Krishnanagar is Ghurni. The clay model artists of Ghurni have won international repute and fame for their excellence in clay modelling.

★ **Shantipur:** Shantipur had been a seat of Sanskrit learning and literature, Vedic texts and scriptures since ninth century. It is located in the Ranaghat Sub-division of the district and is about 18 K.M. away from Krishnagar. The Topkhana Mosque was built by Fauzder Gazi Mohammad Yaar Khan in 1703 – 1704 during the reign of Mughal Emperor Aurangzeb. This mosque consists of a big dome and eight minars. The Shayam Chand Temple built in traditional "Aatchala" manner, the Jaleswar Temple with its exquisite terracotta designs and the Adwaita Prabhu Temple are the noteworthy temples of Shantipur. The weavers of Shantipur have made themselves famous throughout India by their professional aptitude in making "Tant Saree". Fulia a township very close to Shantipur, is the birthplace of Poet Krittibas, composer of Bangla Ramayan.

★ **Mayapur:** Mayapur is situated on the opposite of Nabadwip across the river Bhagirathi. Some Schools of thought claim this place to be the actual birthplace of Lord Sri Chaitanya. The ISKCON temple of A.C.Bhaktivedanta, the Saraswat Adwaita Math and the Chaitanya Gaudiya Math are the important temples at Mayapur. During Holi (DOL) festival Rashyatra Mayapur presents itself as a center of harmony, amity, fraternity and festivity.

★ **Shivaniwas:** Shivaniwas is located within Krishnaganj Block in the Sadar Sub-Division and is about 26 K.M. away from Krishnanagar. Predicting an attack from the Bargis and Marathi raiders, Raja Krishna Chandra Rai (1728 – 1782) temporarily shifted his capital

from Krishnanagar to this place. The Raj Rajeswar Temple, named after Lord Shiva, was built by him in 1754. The Shivalinga enshrined in this temple is said to be the largest in Asia.

★ **Ragniswar Temple:** The Ragniswar temple and the Ram-Sita temple built in 1762 form a composite structure alongside Raj Rajeswari Temple, locally known as BuroShib Mandir. The architecture of this temple bears Gothic influence.

★ **Ballal Dhipi:** Ballal Dhipi is located near Bamanpukur Bazar on way to Mayapur at a distance of about 25 K.M. from Krishnanagar. The excavation work was started here by the Archaeological Survey of India in the early 1980s, It revealed a unique structural complex covering nearly 13,000 Sq. meters. Centering around a mound (Dhipi) having a height of 9 metres. This complex identifies itself with the Vikramsila Vihar. Experts say that this side of Stupa (Vihar) of eighth / ninth century was perhaps a seat of learning and pilgrimage up to the eleventh century.

★ **Plassey:** The place where the Battle of Plassey was fought between Bengal ruler Nawab (king) Siraj-ud-Daullah and the British is in Nadia. A memorial stone was erected there.

★ **Kamdevpur in Kaliganj:** A stone axe and few articles belonging to the Stone age and Bronze age were found from Kamdevpur in Kaliganj.

★ **Jitpur and Tehatta:** Earthern pottery belonging to the period of 10th and 12th century A.D. were excavated from Jitpur and Tehatta.

★ **Debagram at Kaliganj:** Evidence of Buddhist influence in Nadia district was shown from the statue made of stones which were excavated from Debagram at Kaliganj. The Statue of Buddha belongs to 10th century A.D. made of black stone was found at Baneya village in Tehatta.

★ **Krishnanagar:** A black stone image of Sadasiva belongs to 12th century found at Krishnanagar.

★ **Sambhunagar:** The image of a Goddess resembling Manasa was found at Sambhunagar.

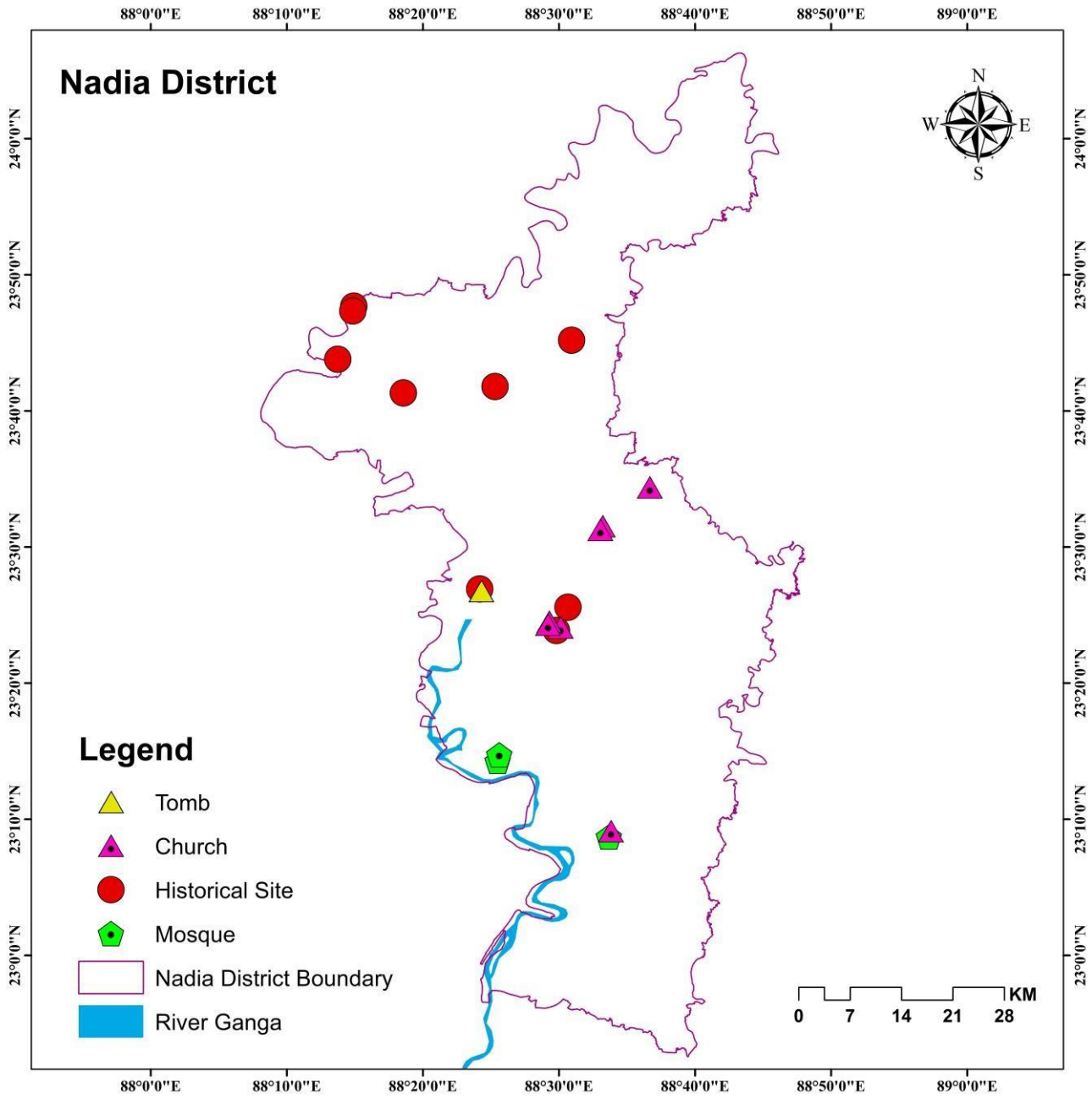
★ **Debagram in Ranaghat:** Ruins of fortress and temples prior to the period Muhammadan are found from Debagram in Ranaghat.

★ **Rajbari at Krishnanagar:** The Rajbari (palace) of Krishnagar was built during 17th century. Raja Rudra Roy ruled Krishnanagar which was previously known as Reui. He ruled Matiari (presently Krishnaganj) during 1683-1694 AD.

★ **Shibnibas Palace in Krishnaganj:** The Sivmibas Palace situated at Krishnaganj was built by Raja Krishna Chandra Das, one of the successors of Raja Rudra Roy, who ruled from 1728 AD to 1782 AD.

★ **Brahma Samaj Mandir:** ‘Brahma Samaj Mandir’ at Krishnanagar was established in 1847 under the patronage of Raja S. Chandra Roy of Krishnanagar. Another Brahma Samaj Mandir was established at Shantipur in 1898.

2.3.1.1.11 Map: 3 Archaeological & Historical Tourism Sites of Nadia District



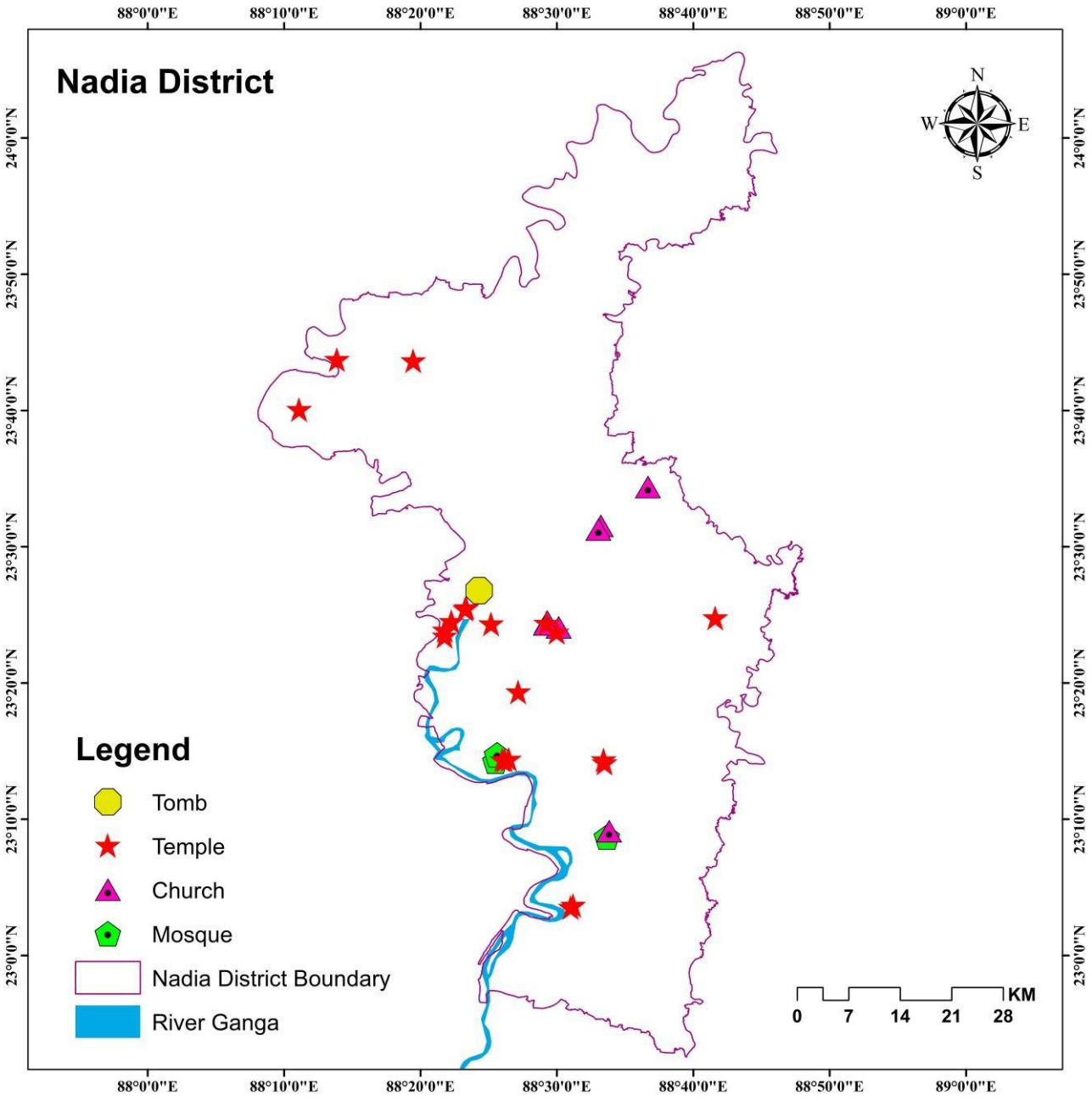
Source: Prepared by Author

RELIGIOUS & SPIRITUAL TOURISM

- ★ The Siva temple at Matiari (Krishnaganj) was built by Raja Raghab Roy in the year 1665.
- ★ The Siva temple at Dogachhi was established by Raja Raghab Roy in 1669.
- ★ The famous Jaleswar Siva temple at Santipur was built by Raja Raghab Roy.
- ★ The Siva temples at Srinagar (Chakdaha) were built by Raja Raghab Roy during 1671 to 1674.
- ★ The Siva temple at Itla, Birnagar was built by Kasiswar Mitra in the year 1669.
- ★ The Ghateswar Siva temple was built by Raja Raghab Roy of Krishnanagar.
- ★ The Raghabeswar temple at Dignagar was built by Raja Raghab Roy in the year 1669.
- ★ There is a temple at Akandaberia in Kaliganj. The temple was established by the Sinha family at Bhaluka.
- ★ The Siva temple at Baghanchra Santipur was built in 1665 by Chand Roy. Presently it is in a dilapidated condition, due to lack of maintenance.
- ★ The Gokulchand temple is situated at Santipur.
- ★ The terracotta temple situated at Belpukur is famous for its architecture.
- ★ The Advaitaprabhu temple situated at Santipur.
- ★ The Rajrajeswar temple at Sivnibas Krishnaganj built by Raja Krishna Chandra Roy of Krishnanagar in the year 1754. This site is a composite structure of five temples and Lord Siva is named as Rajrajeswara (The Lord of King of Kings). The Ragnishwar Siva temple built in the year 1762 and the Ram-Sita temple form part of this composite structure. The entrance gates bear Gothic influence.
- ★ The Shyamchand temple situated at Santipur built in the year 1726.
- ★ In the year 1767 Rani Bhabani established a temple at Mrigi, Tehatta of Krishnanagar.
- ★ The Krishnaraj temple situated at Kanchanpalli built in 1786.
- ★ The Anandamayee Kali temple at Krishnanagar built by Raja Girish Chandra Roy (1802-1841) of Krishnanagar the significance of this temple is here the image of Kali is seated upon Mahakal.
- ★ The Bhabatarini Kali temple situated at Nabadwip, established by Raja Girish Chandra Roy.
- ★ The Jagattarini temple built by Iswarchandra Mitra at Itla, Birnagar in the year 1817.
- ★ The Deen Dayamoyee temple at Itla, Birnagar established by Iswarchandra Mitra in the year 1818.

- ★ The Jugalkishore temple situated at Aranghata built during the reign of Raja Krishna Chardra Roy in 1728, by Ganaram Das and Ramprasad Pande.
- ★ The Radhakrishna temple situated at Kuli, Kalyani bears the memory of Sree Chaitanya.
- ★ The Harihar Mandir at Aamghata established by Raja Krishnachandra Roy in 1776. Temple architecture of Bengal is categorized into three categories viz. Chala Mandir, Ratna Mandir and Dalan Madir. Most of the temple in Nadia district belongs to Chala type. The important and ancient mosques found in Nadia district are built during the regime of Bakhtiar Khalji in 1202 AD. These mosques are built using lime and terracotta mixture.
- ★ The Siva temple at Palpara (Chakdaha) was built during the 17th century by Raja Raghab Roy of Krishnanagar. The trident of this Siva temple is considered very significant in the light of religious interpretations. Tales from the Ramayana, the great Hindu mythology book, have been inscribed on its terracotta walls.
- ★ The Kechuadanga mosque situated at Karimpur.
- ★ The Topkhana mosque at Santipur built by Fauzdar Gaji Mohammad Yaar Khan in during 1703 and 1704.
- ★ The mosque situated at Shantipur market.
- ★ The dargah at Matiary Banpur in Krishnaganj, popularly known as ‘Buro Sahaber Dargah’, was built in 17th century. □
  Tomb of the Gazi at Gazitala.
- ★ Ancient mosque situated at Palpara.
- ★ Roman Cathedral Church in Krishnanagar established in 1898.
- ★ The Protestant Church at Krishnanagar established during 1840 to 1843, enshrined by Captain Smith.
- ★ The Protestant Church at Chapra

2.3.1.1.12 Map: 4 Religious Tourism Sites of Nadia District



Source: Prepared by Author

ADVENTURE, NATURE & ECO TOURISM

★ **Bahadurpur Forest:** Bahadurpur forest situated by the side of N.H.-34 in Krishnanagar-II Block has been chosen as a prospective spot for Jungle Safari

★ **Hasadanga Beel:** Hasadanga Beel adjacent to Bahadurpur Forest is a vast waterbody which can be transformed into a Water Sports Complex. This Beel has the potential to be developed as a safe haven for the seasonal migratory birds

★ **Mangaldwip Char:** Mangaldwip Char which has emerged at the confluence of the Bhagirathi and the Churni in Ranaghat-I Block is another spot likely to be developed as a Tourist Transit Point-Cum-Resort along the river cruise to Murshidabad

★ **Bethuadahari Wildlife Sanctuary:** A forest covering about 67 Hectares is located at Bethuadahari which is situated at a distance of about 22 K.M. from Krishnanagar. This forest is actually an extended Deer Park. The forest was established in 1980 to preserve the biodiversity of the central Gangetic alluvial zone. A census of 1998 reveals a population of 295 deer in this forest and other wildlife includes Python, Jungle Cat, Porcupine, Monitor Lizard, Snake and a variety of birds (around 50 species)

★ **Hijuli Forest Ranaghat**

★ **Mangaldeep Eco Tourism Park**

★ **Jubilee Park**

★ **Central Park**

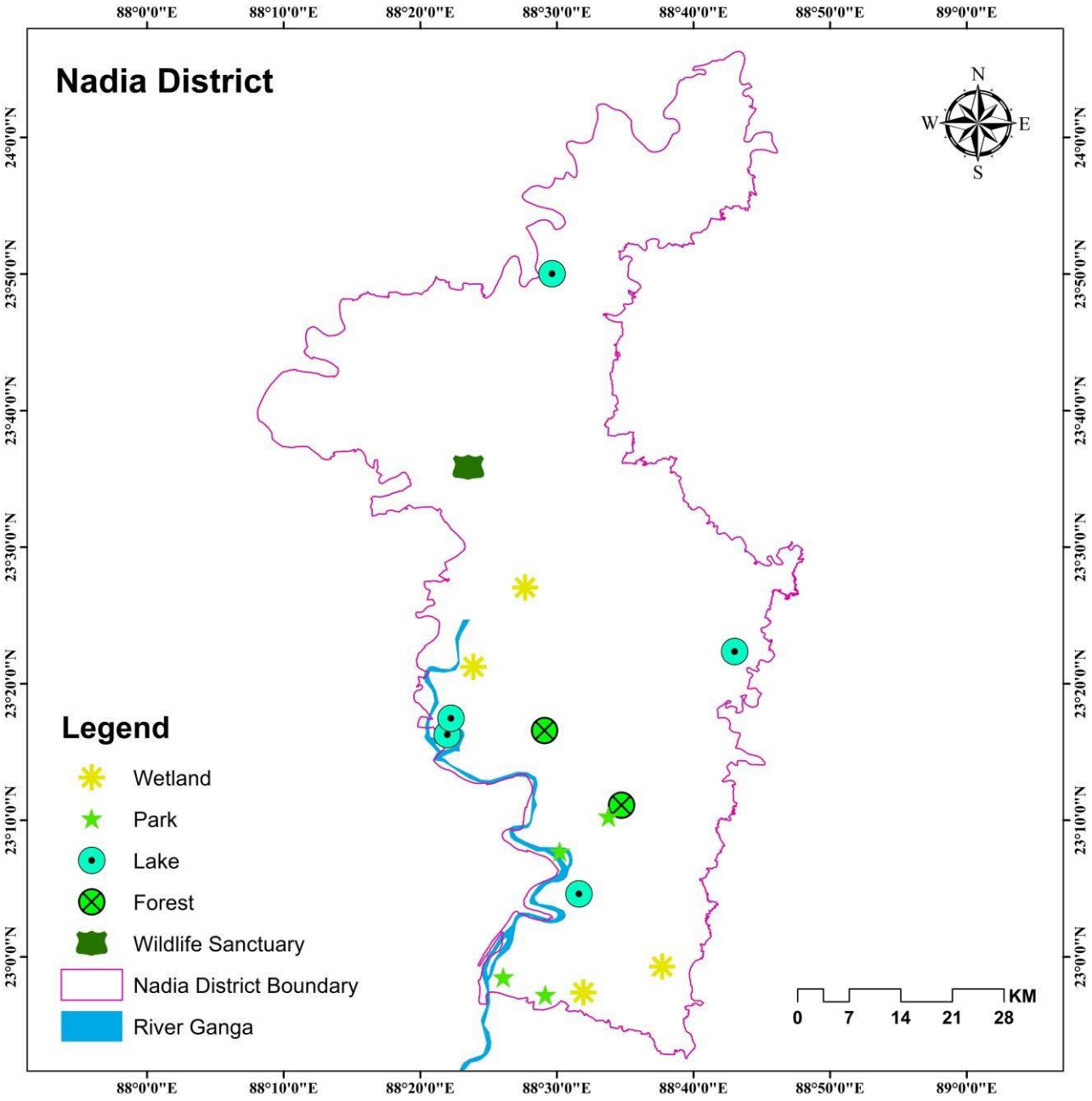
★ **Obosor Park**

★ **Haringhata Bird Zone**

★ **Bhomra Wetland**

★ **Bhaluka Beel**

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

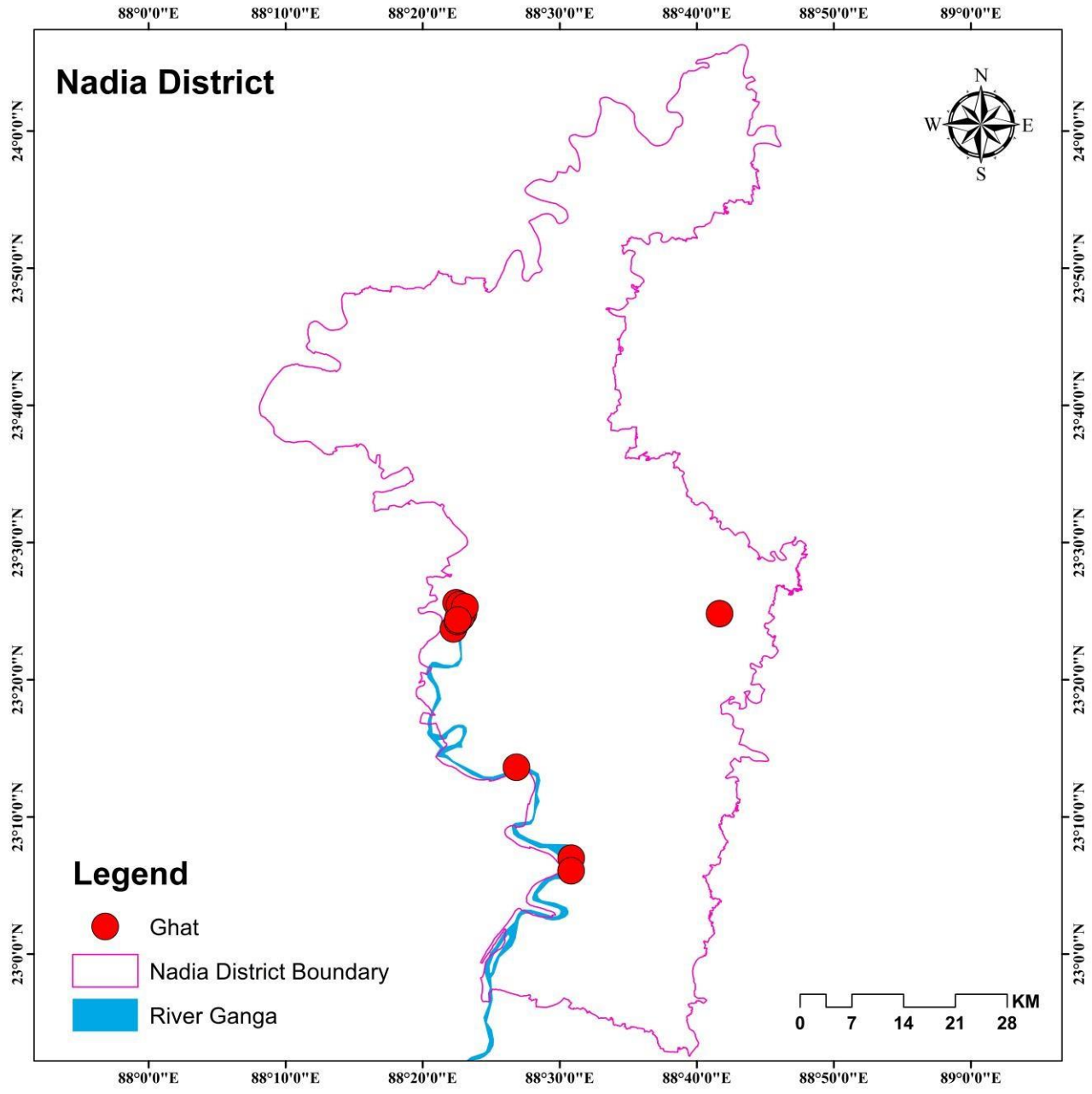


Source: Prepared by Author

GHAT TOURISM

- ★ **Nabadwip Ferry Ghat Shivnibas Manji Ghat**
- ★ **Mayapur Nabadwip Ferry Ghat**
- ★ **Hular Ghat**
- ★ **Char Swarup Ganj Ghat**
- ★ **Pora Ghat**
- ★ **Manipur Ghat**
- ★ **Gandhi Ghat**
- ★ **Mukundanagar Ghat**
- ★ **Gaour Nagar Ghat**
- ★ **Nidaya Ghat**
- ★ **Jal Prakalp Ghat**
- ★ **Mayapur Ganga Ghat**
- ★ **Fasitala Ghat**
- ★ **Sribas Angan Ghat**

2.3.1.1.14 Map: 6 Ghat Tourism Sites of Nadia District



Source: Prepared by Auth

CULTURE & ARTS TOURISM

There is a vibrant culture of literary exchange among small groups of writers and poets, and there is a strong tradition of stage acting. In a locality of Krishnagar called Ghurni, there is a colony of artists who work with clay. These artists produce images of Hindu gods and goddesses for traditional worship throughout the year, as well as clay models of human figures and real-life objects. It is said that initially

it was Raja Krishnachandra who settled a few families of talented clay artists in the area. Since then the colony has grown and flourished. Jagaddhatri Puja is celebrated with great grandeur at Krishnagar, when lightings from the town of Chandannagar are brought. A lot many expertised gems are to be found here in this heritage city.

- **Festivals of District Nadia:**

Durga Puja: Durga puja is the most famous Hindu religious festival in the district. It is being celebrated during the month of September-October or Bengali calendar month Ashwin. Durga is considered as the mother God, as per Hindu religious belief. Four days celebrations are being organized at district level for worshiping the mother God i.e.

'Durga,' which symbolizes the victory of good over evil. It is also believed to be the homecoming of Mother Durga (Parbati), wife of Lord Shiva, along with her two sons and two daughters; visiting her parental home from the Himalaya. Commemorating this belief every member of the family in district joins together during the puja which is celebrated for four days. (Culture and Heritage, n.d.)

Vaishnavism: Vaishnavism or following the paths of Lord Vishnu in district Nadia goes back five hundred years ago during the time of Shri Chaitanya Dev. One of the most important social and cultural event in the district is Samkirtan or communal singing in the name of God. This was introduced by Sri Chaitanya himself, one of the greatest 'Vaishnavite' saint ever born to the nation. He developed it in a complete revolutionized form and preached it. 'Vaishnavism' of 'Bhakticult' introduced by him reached in the heart of all the people irrespective of rich or poor, caste or creed. Sri Chaitanya was born in Nadia, in AD 1486. Vaishnavism or Lord Krishna Cult is all about profound love and kindness for mankind, tolerance and restraints in personal life and respect for others. Worship of Lord Krishna, which was inspired by Sri Chaitanya, resulted in many celebrations in the district. It includes Rath Yatra, Dol Yatra, Jhulan Yatra, Ras Yatra, Goshthashtami and Janmashtami.

Barodol: 'Barodol' of Krishnagar is one of the most important events in Nadia district. The deity of Krishnagar Raj is Baro Narayan. The main festival is of three days and the festival is more than 200 years old.

Raas Yatra: Raas Yatra of Nabadwip and Shantipur are famous all over West Bengal. The Shantipur Ras is of influence of Vaishnavism predominates whereas in Nabadwip Ras is influenced of Saktaism.

Sakta Festival: Sakta festival is associated with the name of Krishnananda Agambagi of Nabadwip. Different forms of Goddess Kali such as Bhadrakali, Sabsiva, Ranakali and Krishnakali was believed to be delineated by Krishnananda Agambagis. During Siva festival, Siva is taken on an elevated seat by night in Nabadwip and the devotees dance with much

enthusiasm. The bathing ceremony of seven images of Siva takes place under the name of Satgajan, Phal, Phul, Nil and Chadak.

- **Folk Tradition of District Nadia:**

Lalanshahi: 'Lalanshahi' Sect was founded by the most famous Baul Fakir of nineteenth Century Bengal Lalan Sainji. He is also known as Lalon Sain, Lalon Shah, Lalon Fakir or Mahatma Lalon. Lalan Fakir `rejected all distinctions of caste and creed' and people from both Hindu and Muslim communities followed his path. His 'Akhra' which is situated in present day Chheuria village near the Sub-divisional headquarters of

Kusthia (part of undivided Nadia district now in Bangladesh). They used to arrange

'Bhandara' (mahotsab or grand festival) and great number of disciples will take part in discourse and community song.

Matua Sect: Matua Sect is founded by Hari Thakur. Namasudras, a Scheduled Castes community of West Bengal, who have migrated from Bangladesh are the main followers of this Sect. A festival in memory of Hari Thakur is held in the Bengali calendar month of Chaitra (mid-March to mid-April) every year in Chandghar village under Kaliganj Police Station.

Sahebdhani Sect: The 'Sahebdhani' sect was founded by Dhani, a Muslim woman born in Murshidabad. All Sahebdhani, irrespective of Hindu or Muslim will worship their Guru Dindayal. Their Mahotsav (greatest festival) will be celebrated on Ekadashi, the eleventh day of the lunar fortnight in the Bengali calendar month of Chaitra (midMarch to mid-April) every year.

- **The Fairs of District Nadia:**

Satimar Mela: Satimar Mela is another important event organized in Ghoshpara near Kalyani. This was introduced by Saraswati Debi alias 'Satima,' wife of Ram Saran Pal of Sadgop caste. Ram Saran was disciple of Aulechand, who is the founder of

'Kartabhaja' Sect. This sect is numerically the second biggest after the Vaishnavist in West Bengal. No deity is worshiped by the Kartabhaja, it is the Guru (religious head) who is worshiped. The fair is scheduled for three days during Dol Yatra or Holi festival. However, it may continue for a month. The people follow the practice of confession before the Guru which is similar to Christianity and Islam. Satima Festival and Mela is held at Ghoshpara near Kalyani during Holi. Satima the Founder of Kartabpuja Sect is worshiped during the festival.

The **Jugalkishore Festival** is held at Aranghata during the Bengali calendar month of Jaishtha (mid-May to mid-June) every year. It is month long festival. The Ras Utsav at Santipur is a three day festival of Vaishnav and it is not free from Sakta influence and as a result, Goddess Kali is also being worshiped.

Brahma Puja Mela: The Brahma Puja Mela at Arbandi in Badkulla is a weeklong festival during the Bengali calendar month of Falgun (mid-February to mid-March).

The weeklong **Baruni and Ganga Puja festival** at Phulkhali on way to Krishnanagar to Shikarpur is held during the Bengali calendar month of Chaitra (mid-March to midApril).

The **Kali Puja Mela** at Patuli, near Badkulla is being held during the new moon day of the Bengali calendar month of Agrahayan (mid-November to mid-December).

The two-century old **festival and Mela of Fatima Bibiis** held at Uttar Rajpur on the way to Haringhata in the Bengali calendar month of Baisakh (mid-April to mid-May). This festival lasts for three days.

The **Agmeshwari festival** at Nabadwip is held at Agmeshwaritala, the birthplace of Krishnananda Agambagis, who wrote 'Tantrasar'.

The **Madan Mohan fair** at Birohi, near Kalyani is held during Bhatradwitiya in the Bengali calendar month of Kartik (mid-October to mid-November).

The **Ganesh Jamai Puja** and mela at Chakdah is held during Makar Sankranti (the last day of Bengali calendar month of Pous (January).

The **Sanajatra festival** at Jasra is held to celebrate the worship of Jagannath and coincides with the chariot festival of Puri, Odisha.

The **Nrisingha mela** at Deypara, near Krishnanagar is held on the fourteenth day in the Bengali calendar month of Baisakh (mid-April to mid-May) every year.

The **Jagadhatri Puja** at Krishnanagar was started by Raja Krishna Chandra Roy during the 18th Century.

The **Panchannanda and Raksha Kali festival** at Harishpur near Krishnanagar is held during the Bengali calendar month of Magh (mid-January to mid-February).

The two hundred years old **Muharram festival** at Dhananjoypur near Bethuadahari is held in the Islamic calendar month of Muharram (April-May).

The **Mahishmardini and Vindhyabasini festival** at Birnagar is held during Baishakhi

Purnima – full moon night in the month of Bengali calendar month of Baisakh (midApril to mid-May).

The **Lalen Mela and Hari Thakur Mela** are being held at Asannagar and Bara Chandghar respectively.

The **Jaleshwar Siva Mela** at Ghurni is held during Sivaratri (in the Bengali calendar month of Falgun (mid-February to mid-March).

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. The data collected and analyzed shows the region's production and possible product that can be derived from the raw product. The list of sources and the possible products are mentioned below:

- The district is known for autumn rice/Aus/bhadoi rice.
- The district consists of large number of bil.
- The district has a steady production of jute, it occupies 14 per cent of net cropped area.
- The district has rich horticulture with the production of fruits like bananas and mango.
- The district has diversity in their farming culture like bee keeping and fishing

4 ACTION PLAN DEVELOPMENT

4.1 FORESTRY

According to the report of FSI, 2021 there has been decrease in the forest cover in the district. The decrease is although only 0.03 sq. km. but still is alarming. The first thing that needs to be done is to make people aware of the requirement of forests in the district and to educate them on how can they increase the forest cover. The district can also take up Sub-Mission on Agroforestry (SMAF) Scheme. Agroforestry should be encouraged in the district and eventually agroforestry can create opportunities for setting up agri-based small enterprises such as pickle production, and juice/pulp extraction of these fruits. The district also has cultivable wasteland, which should be brought under plantation drive under the National Afforestation Mission. There is also a need to include technology like geo-tagging. GPS etc. to monitor the plants which have been planted and the already planted trees. Along with the technology, the local governments should appoint agents who would look after and monitor the plants. The NTFP collection in the district should be made comfortable for the people related to it. They should be given easy access to the resources keeping in track the conservation of forests.

4.1.1 Biodiversity –

Action plan was prepared for rejuvenation of river Chumi which includes mainly covering aspects such as appropriate management of sewage water, rainwater harvesting, protection and management of flood and plain zones, and setting up biodiversity park.

4.2 TOURISM

SWOT ANALYSIS

STRENGTHS

★ Outstanding scenic places, picnic spots, beautiful Churches, temples with marvellous architecture lakes and gardens.

★ Rich Bengali culture and Bengali cuisines of Nadia.

★ 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, Wildlife 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.

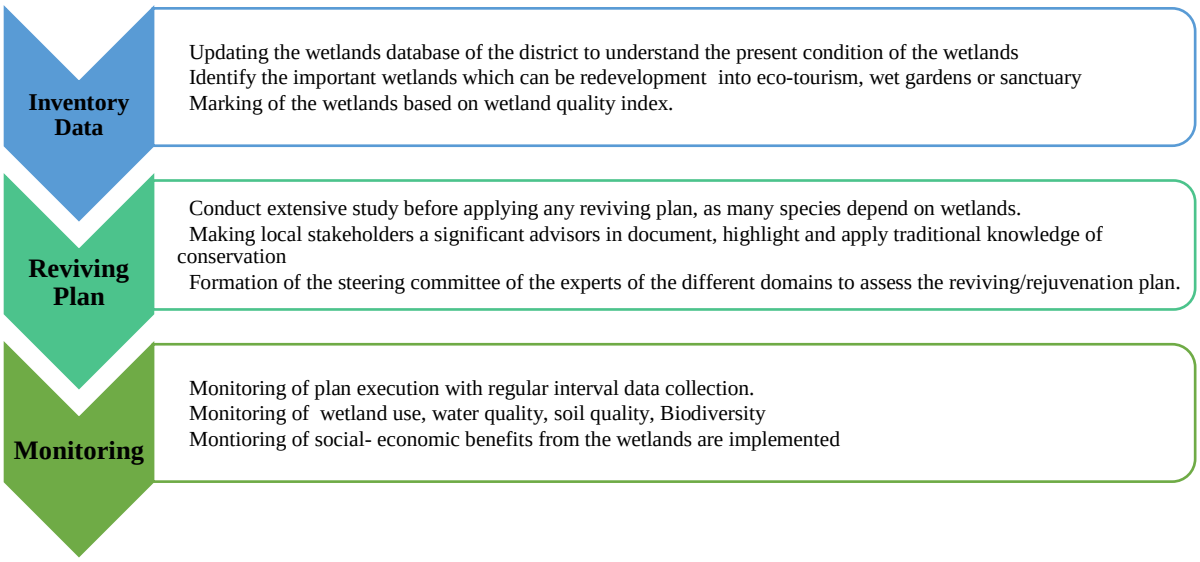
★ Illegal Migration.

★ 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

Only 0.70% of the households use solar energy as a main source of lightning, which could be due to lower levels of awareness. So, in the district solar promotion needs to be increased.

According to the Agriculture Contingency Plan for Nadia District report, the district has 100 hectares of barren and uncultivable land. This could be used to implement component A of PM-KUSUM scheme, where ground mounted solar panels or other renewable sources of energy could be installed.

According to Input Survey 2016-17, the total net sown area is 300130 hectares, out of this, 293077 hectares is irrigated net sown area, which is 97.65% of the net sown area, and the rest 7053 hectares of land is unirrigated net sown area, which is 2.34% of the total net sown area. This implies that the demand of irrigation in the district is insignificant (CEEW, 2020). This leads to non-requirement of solar based water as a service. Moreover, limited feeder segregation also leads to unfeasibility of solar feeder segregation. Moreover, the ground water level is below the safe level, so grid-connected individual solar pumps are not suitable.

On the other hand, private ownership of off-grid solar pumps could be feasible as the district has greater crop revenue per holding and it would require accessibility and proper disbursement of credit, which is weak in the district, which is also a part of component B of PM-KUSUM scheme.

Due to low ground water levels, solar drip irrigation could be a solution and would work on the scheme of ‘Per Drop More Crop’.

PROJECTION AND MONITORING MATRIX

Firstly, solar promotion needs to be increased.

Secondly, solar rooftop should be implemented on the government buildings and institutions.

Thirdly, component A of PM-KUSUM scheme needs to be planned in a phased manner.

Fourthly, component B of KUSUM scheme needs support from the government in terms of financial aid.

Through the implementation of solar energy schemes in the district would lead to overall sustainable development of the district.

4.4.2. Biomass

The people of the district need to be made aware about the ill-effects of burning crop residue and fire-wood for cooking, both for their health and for environment, and they would be provided with alternative sources of clean fuel like LPG and PM Ujjwala Yojana needs to be strengthened. Moreover, the storage facilities can be developed near the farm lands where those can be transported to the biomass plants. There is a need for providing encouragement to the entrepreneurs to set up the biomass gasifier systems and biomass cogeneration in the district, to be able to fully utilise the bioenergy. Moreover, training and skills need to be developed among the youth in the district. It would also generate employment opportunities in the district, which would lower migration also.`

PROJECTION AND MONITORING

Firstly, it is essential that the farmers and households should be aware about the bioenergy, so that they can give the excess crop residue for bioenergy.

Secondly, funding to government need to be made available to the people for setting up biomass gasifier and biomass co-generation plants in the district.

Thirdly, the rural people need to be skilled and trained according to the working of the biomass technology.

Lastly, storage and logistics facilities should be provided by the government.

The biomass energy generated would help the district achieve sustainable development.

4.4.3. Biogas:

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

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

- The district has ample scope for high-quality gerbera flowers and capsicum production in shed-net houses and poly-houses, which needs to be prompted.
- There is a scope for off-season cultivation, nursery raising, and hardening of crops in the shed-net house and poly-houses.
- Commercial production of strawberry cultivation should be encouraged.
- Sorting, grading, and packaging units can be set up in small and micro-level numbers for both table and processing purposes for vegetables and fruits.
- Preventive measures should be taken to minimize the impact of floods in many blocks of the district.
- Organic farming should be encouraged by implementing the government's scheme like PKVY (Paramparagat Krishi Vikas Yojana).
- Vermicompost production and application should be increased to boost soil health.
- Micro-irrigation should be promoted for horticultural crops under the National Mission for Sustainable Agriculture (NMSA)
- Farmers should be sensitized over the application of fertilizer and pesticides.
- Over-exploitation of groundwater should be reduced mainly for the boro rice cultivation. Rainwater harvesting structures like ponds should be constructed under the MGRNGA scheme to facilitate irrigation and groundwater recharge.
- The cultivation of oilseeds such as til (Sesamum), rapeseed, mustard, sunflower, and linseed should be encouraged to boost productivity and improve quality.
- Infrastructure and markets should be developed to promote sugarcane and jute cultivation in the district.
- Farmers should follow the crop advisory.
- Beekeeping has an enormous scope in the district, which should be encouraged.
- Farmers should be encouraged for farm mechanization.
- Proper market and export facilities should be provided for potato farmers, as well as storage facilities.

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. Those dependent on NTFPs should be provided with assured economic benefits keeping in mind the conservation of the mangroves. 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 of water scarcity and water quality in the region. The government needs to take steps like water quality testing and quantification of water bodies at regular intervals and promote MNREGA schemes to rejuvenate extinct water bodies and promote rainwater harvesting.
- 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.
- Small-scale industries like beekeeping, boat making and net making should be promoted 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)

5.4.1. Solar

- ❖ Awareness needs to be generated, especially among the rural areas.
- ❖ Component A and Component B of PM-KUSUM scheme needs to be researched for the district's growth.
- ❖ Financial assistance is required from the government.
- ❖ Disbursement of credit needs to be there from the financial institutions.

5.4.2. Biomass

- ❖ The people in the district should be made aware about the demerits of using crop residue and fire-wood as a fuel for cooking.
- ❖ Storage facility for biomass raw materials should be made available.

- ❖ Provision for establishing biomass gasifier and biomass cogeneration need to be made in the district.
- ❖ Funding and technical support from the government is required in the district for advancement of biomass units in the district.

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 chumi, Hooghly, Jalangi and Bidydhari river.

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.

❖ 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, Eco Tourism and Waterfront development etc.

❖ Development of combined projects involving Tourism department/ Ministry, Disaster management department and Environment, forest, and climate change section/Ministry. Stakeholder consultation & Participatory management and involvement of Municipality, and local communities and tour operators to build ecotourism options and choosing adventure and religious tourism sites.

6. Discussion during the Report Presentation

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

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5 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**
Cattle	Manure	816780	10	2,98,12,47,000	223593525	447187050	25	1788748	49006.8
Buffalo	Manure	17157	15	9,39,34,575	70450931.25	14090186.25	25	563607.45	1544.13
Sheep	Manure	24669	1	90,04,185	6753138.75	1350627.75	25	54025.11	148.014
Goat	Manure	924339	1	33,73,83,735	253037801.3	50607560.25	25	2024302.41	5546.034
Pig	Manure	4923	2.5	44,92,238	3369178.125	673835.625	25	26953.425	73.845
Total		**17,87,868**						**20556370.4**	

Table 2 Biogas potential from agricultural waste.

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

		(2017-18)					moisture (tons)	matter)]	
Maize	straw	3776	1.5	5664	3964.8	15	3370.08	800	2696064
Rice	husk	273137	0.28	76478.36	53534.852	30	37474.3964	800	29979517.12
sugarcane	bagasse	248215	0.33	81910.95	57337.665	80	11467.533	750	8600649.75
Total		**525128**							**41276230.87**