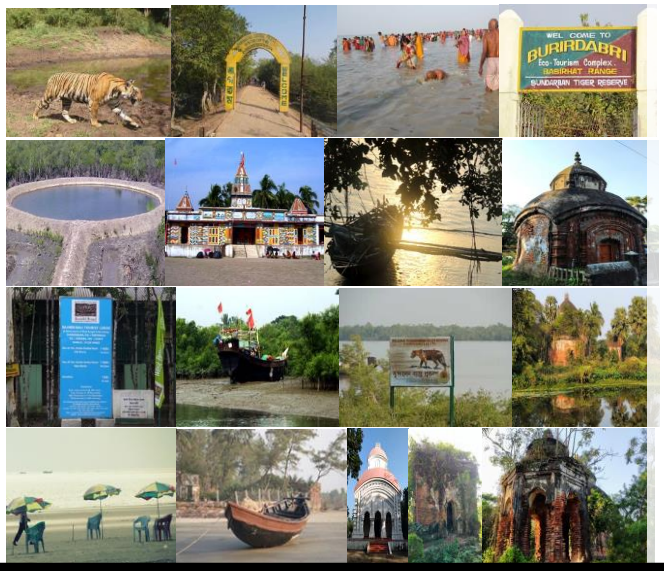

Arth Ganga Project: District South 24 Paraganas

Submitted to:

National Mission for Clean Ganga (NMCG)

Submitted by:

IIM Lucknow

IIT Roorkee

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EXECUTIVE SUMMARY

South 24 Paraganas district, a fertile land with Sunderban delta, is located in the Indian state of West Bengal. The important rivers flowing in the district are Bidhadhari, Herobhang, Matla, Thaneram, Mridhangabhang and Saptamukhi.

The total geographical area of the district is around 8165 km^2. The primary sector contributes, on average, 22.06% to the district GDP with its share in GDP declined from 28.84% in 2007-08 to 17.41% in 2013-14. The secondary sector's share in GDP also decreased marginally from 16.72% in 2007-08 to 16.59% in 2013-14, though it grew by 6.29% annually during the period. The tertiary sector grew with a remarkable average annual growth rate of 9.73%, and its share rose from 54.45% in 2007-08 to 65.99% in 2013-14. Overall, the district economy grew by 6.26% annually during the study period.

The cropping intensity of the district is 158.11 %. Major crop types are rice, cereals, pulses, jute, along with oilseeds, etc. The livestock consists of cattle, buffalos, pigs, sheep goats, and fisheries. The total number of cattle decreased from 1271 thousand in 2003 to 1019 thousand in 2019, with a net decrease of 19.81%. Total buffaloes significantly decreased from 27 thousand in 2003 to 12 thousand in 2019, a net decrease of 56.53%. Total sheep decreased from 221 thousand in 2003 to 82 thousand in 2019, with a net decrease of 62.72%. The goats' population also decelerated from 1598 thousand in 2003 to 791 thousand in 2019, a net decrease of 50.47%. Total pigs went down from 63 thousand in 2003 to 7.35 thousand in 2019, a net decrease of 88.33%. The total livestock population in the district significantly declined from 3180 thousand in 2003 to 1912 thousand in 2019, a net decrease of 39.87%. In 2011-12, South 24 Parganas represented around 15.28% of the total fish production in West Bengal with its share decreased to 14.33% in 2014-15.

The share of cultivable wasteland is reported to be 0% of the total declared area. The share of barren and uncultivable land decreased from 0.03% in 2011-12 to 0.02% in 2019-20. The fallow land significantly decreased over the years, from 1.59% in 2011-12 to 0.81% in 2019-20. The net sown area has decreased from 37.87% in 2011-12 to 37.78% in 2019-20. The non-agricultural use area increased from 15.16% to 16.05% in 2019-20. In 2019-20, the nitrogen and potassium share decreased to 53.72% and 14.98%, respectively, while the phosphorus share has increased to 31.30%Although the overall use of chemical fertilizers has decreased in the district from 83.75 kg/ ha GSA in 2013-14 to 78.69 kg/ ha GSA in 2019-20.

The district has a total of 2790.71 sq. km under the forests out of which 981.97 sq. km. is under very dense forests, 744.77 sq. km. is under moderately dense forests and 2790.71 sq. km under the open forests. According to the 2021 Forest survey, forests cover of the district is 28.02% out of the total geographical area which is 9960 sq. km. With respect to 2019 forest assessment there has been increase in the forest area of the district by 2 sq. km. The area under trees and gardens rose slightly from 0.37% in 2011-12 to 0.40% in 2019-20. . There are 393 bird species and seventeen threatened/rare species and two introduced species of bird in the district.

South 24 Parganas is an important district in the tourism map of West Bengal. Clock Tower, Temples, Wildlife Sanctuaries, National Park, Island, Ghat, Natural Landscape and Historical Sites make South 24

Parganas District a great tourist destination. There are various tourist places in South 24 Parganas. The visitors visit the well-known places like the Sundarbans National Park, Gurusaday Museum, Chintamoni Kar Bird Sanctuary, Metiabruz Church, and much more.

There are a total of 4465 natural and man-made wetlands of mainly lakes/ponds, oxbow/meanders and tanks/ponds type. Kerosene has been used by 48.70% of the households, which is dominating in the district. Electricity is second important source which is used by 47.30% of the households. Solar is being used by 3.30% of the households. the type of fuel used by households for cooking in the South 24 Parganas district. 33% of the households use fire-wood, and 25% of the households use crop residue. 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. The district has a very high potential for tourism thus eco-tourism should be promoted. There is a necessity for conservation / preservation of many historic exhibits, utilization of natural and anthropic resources, exploring of new destination, tagging of potential household industries and organized institutional initiatives, reduction of over-exploitation of groundwater. Various measures such as afforestation should be taken to improve tourism and forest cover of the district and enhance the use of renewable energy especially by creating awareness. Use of micro-irrigation, technology, Vermicomposting, adopting greenhouse farming with organic farming, off-season cultivation, nursery raising, hardening of crops, and encouraging farmers for adapting different crop cultivation and various irrigation methods. Along with focusing on agriculture practices Bee culture, poultry, fisheries, etc. needs encouragement as they have high economic potential. Promoting micro and small units for horticulture products processing, new technologies, strawberry cultivation, proper market and export facilities etc.

1. DISTRICT OVERVIEW

1.1 INTRODUCTION

South 24 Parganas or sometimes South Twenty Four Parganas and Dakshin 24 Parganas, is a district in the Indian state of West Bengal, headquartered in Alipore. It is the largest district of West Bengal by area and second largest by population. It is the sixth most populous district in India (out of 640). On one side of the district there is the urban fringe of Kolkata, and on the other the remote riverine villages in the Sundarbans. The district comprises five subdivisions: Alipore Sadar, Baruipur, Diamond Harbour, Canning and Kakdwip.

Spreading over an area of 8165 sq. km the district of South 24 Parganas covers almost 9 per cent of the total landmass of the state of West Bengal. Located between latitudes 20°20´ N and 20°06´ N and

longitudes 88°20´ E and 88°60´ E, the district is bounded to its due south by the Bay of Bengal, by Bangladesh across the Raimangal and Kalindi rivers to its east, by Kolkata and North 24 Parganas districts to its north-west and north-east respectively and by the districts of Howrah and East Medinipur across the Bhagirathi river to its west. Two distinct physiographic zones are discernible in the terrain presently known as South 24 Parganas. The northern part of the district bordering Kolkata and North 24 Parganas belongs to what is known as the Marine-riverine Delta.

Alipore is the district headquarters. There are 33 police stations, 29 community development blocks, 7 municipalities and 312 gram panchayats in the district. Other than the municipality areas, each subdivision contains community development blocks which in turn are divided into rural areas and census towns. In total there are 118 urban units: 7 municipalities and 111 census towns.

Agriculture, industry and Pisciculture are the backbones of the economy of the district. The prime agricultural crops of the district are rice, sugarcane, timber and betel nuts.

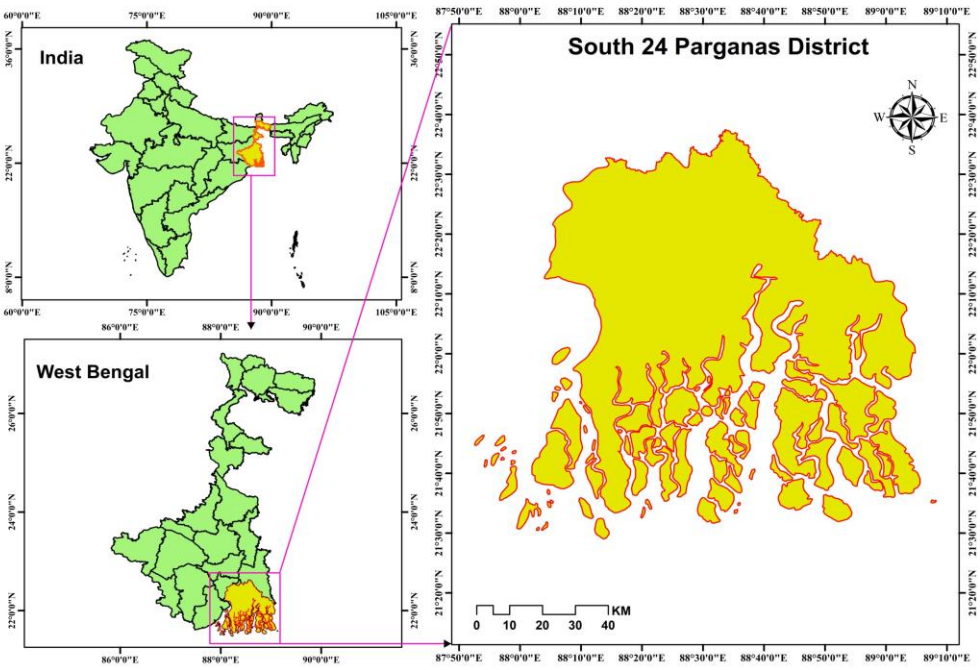


Figure 1 Map of the district

1.2 DEMOGRAPHIC PROFILE OF SOUTH 24 PARAGANAS

In 1986, South 24 Pargana district came into existence in West Bengal. Earlier it consisted of 2 subdivisions, namely; Alipore and Diamond Harbour and 30 blocks and currently there are 5 subdivisions which are Alipore, Baruipur, Canning, Diamond Harbour, and Kakdwip, 29 blocks, and 7 Municipalities. The district is situated at a latitude between 20°20´ N and 20°06´ N and at a longitude between 88°20´ E and 88°60´ E. The district is surrounded by Bay of Bengal in the South, in the East by Bangladesh, in the North-West by Kolkata, in the North-East by North 24 Parganas district, and in the West by Howrah district and East Medinipur. The headquarter of the district is situated at Alipore.

The district has also the presence of The Sundarbans, which are scattered to over 13 development blocks in the district. Moreover, due to this, the infrastructure of roads and communication is not developed. Additionally, irrigation is also limited in the district, so mono-crop agriculture technique is adopted here. As of 2013-14, according to the Directorate of Agriculture Evaluation Wing, Government of West Bengal, the total forest area in the district is 426300 hectares, barren and unculturable land is 200 hectares, and the net sown area is 361550 hectares. The important rivers flowing in the district are Bidhadhari, Herobhang, Matla, Thaneram, Mridhangabhang and Saptamukhi.

The total area of the district is 8165 sq. km., and is around 9% of the total area of West Bengal. According to the Census of India 2011, the total population of the district is 81,61,961. Out of this, 41,73,778 is male population, which is around 51.13% of the total population, and the rest 39,88,183 is female population, which is around 48.86% of the total population. Moreover, 60,74,188 of the population, which is around 74.42% of the aggregate population resides in the rural areas, while the rest 20,87,773 of the population, which is 25.57% of the population resides in the urban area. The literacy rate in the district is 77.51%. The sex ratio of the district is 96 females for every 100 males.

The main source of income and employment in the district is agriculture, though there has been fall in the share of agricultural workforce, and hence in the share of income generation (Bagchi, 2017). The major crops produced in the district are rice (also the dominant crop), wheat, maize, barley, and pulses (Bagchi, 2017). The non-food crop include ginger, oilseeds, chillies (dry), jute, potato, and sugarcane (Bagchi, 2017). As of 2010-11, even though the total cultivated area with the irrigation facility has improved over the years, but the net sown area has only led to less than one-third of the irrigated land. Due to inadequate irrigation facility in the district, the cropping intensity and crop diversification has been low in the district (Bagchi, 2017).

1.3 ECONOMIC PROFILE OF SOUTH 24 PARAGANAS

The primary sector contributes, on average, 22.06% to the district GDP. The sector experienced negative growth of 2.18% per annum during 2007-08 to 2013-14. Resultantly, its share in GDP declined from 28.84% in 2007-08 to 17.41% in 2013-14. The secondary sector's share in GDP also decreased marginally from 16.72% in 2007-08 to 16.59% in 2013-14, though it grew by 6.29% annually during the period. The tertiary sector grew with a remarkable average annual growth rate of 9.73%, and its share rose from 54.45% in 2007-08 to 65.99% in 2013-14. Overall, the district economy grew by 6.26% annually during the study period. Steps should be taken to increase the productivity of the primary sector so that it can grow at a higher rate.

Table 1: Trends in Gross District Domestic product in South 24 Parganas at Constant (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	47556	27572	89794	164922	-	-	-	-
	(28.84)	(16.72)	(54.45)	(100)				
2008	46979	27019	97828	171826	-1.21	-2.01	8.95	4.19
	(27.34)	(15.72)	(56.93)	(100)				
2009	41685	29872	111835	183392	-11.27	10.56	14.32	6.73
	(22.73)	(16.29)	(60.98)	(100)				
2010	38981	32675	120283	191939	-6.49	9.38	7.55	4.66
	(20.31)	(17.02)	(62.67)	(100)				

	39502	32075	131558	203135	1.34	-1.84	9.37	5.83
2011	(19.45)	(15.79)	(64.76)	(100)				
	40103	34725	143544	218372	1.52	8.26	9.11	7.50
2012	(18.36)	(15.90)	(65.73)	(100)				
	41322	39367	156596	237286	3.04	13.37	9.09	8.66
2013	(17.41)	(16.59)	(65.99)	(100)				
Average Growth Rate					-2.18	6.29	9.73	6.26

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

Note: Figures in Parenthesis are percentage share of total GDDP

2. Quantitative Data Analysis

2.1 Agriculture and Allied Activities

2.3.1 Trend in Land Use Pattern

The total declared area of the district is 9487.2 sq. km². The area under forest has remained constant (44.94%) over the years. The share of cultivable wasteland is reported to be 0% of the total declared area. The share of barren and uncultivable land decreased from 0.03% in 2011-12 to 0.02% in 2019-20. The fallow land significantly decreased over the years, from 1.59% in 2011-12 to 0.81% in 2019-20. Moreover, the net sown area (NSA) has decreased slightly over the years, from 37.87% in 2011-12 to 37.78% in 2019-20. The non-agricultural use area increased from 15.16% to 16.05% in 2019-20 (Table 2). The area under trees and gardens rose slightly from 0.37% in 2011-12 to 0.40% in 2019-20. Overall, the land use pattern shows no significant change over the period.

Table2: Trends in land use pattern in South 24 Parganas (as % of the total reported area)							
Year	TOTAL REPORTED AREA (in 1000 H.)	AREA UNDER FOREST	TOTAL FALLOW	BARREN AND UNCULTIVABLE LAND	OTHER LAND THAN AGRICULTURE	AREA UNDER TREES AND GARDENS	NET SOWN AREA
1	2	3	4	5	6	7	8
2011	948.7	44.94	1.59	0.03	15.16	0.37	37.87
2012	948.7	44.94	1.41	0.02	15.23	0.35	38.01
2013	948.7	44.94	1.26	0.02	15.26	0.36	38.10
2014	948.7	44.94	1.16	0.02	15.29	0.43	38.15
2015	948.7	44.94	1.02	0.04	15.33	0.50	38.17
2016	948.7	44.94	0.99	0.04	15.53	0.52	37.98
2017	948.7	44.94	1.00	0.03	15.77	0.47	37.78
2018	948.7	44.94	1.00	0.02	15.84	0.42	37.77
2019	948.7	44.94	0.81	0.02	16.05	0.40	37.78
Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/							

2.3.2 Trends in Operational Land Holdings

In South 24 Parganas district, the total number of operational farms increased from 615 thousand in 2010-11 to 618 thousand in 2015-16, a net increase of 0.49%. 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 98.72% 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 and semi-medium land holding and an increase in the share of the marginal land holdings.

Table3: Distribution of Operational Holdings by Size-categories of farms (in %) in South 24 Parganas							
	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.)

South 24 Parganas	2010-11	87.54	10.94	1.48	0.03	0	615
	2015-16	88.09	10.63	1.24	0.03	0	618
							[0.49]
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.

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

2.3.3.1 The Trend in Cropping Patterns

Rice dominates the agriculture of the district. Table 4 shows the area devoted to various crops over the last seven years. In 2019-20, Rice made up the highest share of GCA (67.22%). The area shared by the total cereals decreased from 72.67% in 2013-14 to 67.44% in 2019-20. The main pulses produced are Moong and Khesari. The total pulses acreage rose from 4.41% in 2013-14 to 11.67% in 2019-20. The total food grain acreage also went up from 77.07% in 2013-14 to 79.12% in 2019-20. Moreover, the food grains cover a majority of the GCA (average, 77.50%). Sunflower seeds, Mustard, and Sesamum are the major oilseeds crops produced, and the total oilseed acreage increased marginally from 2.16% in 2013-14 to 2.24% in 2019-20. Jute is a major fibre crop of South 24 Parganas. However, area shared by jute decelerated from 1.5% in 2013-14 to 0.7% in 2019-20. In general, there was no significant change in the cultivation pattern reported in the district during the study period. The average cropping intensity in the district is 158.11.

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	71.99	70.93	69.45	67.40	67.57	66.96	67.22
Other Cereals	0.68	0.76	0.05	0.06	0.28	0.23	0.23

Total Cereals	72.67	71.69	69.51	67.46	67.85	67.20	67.44
Green gram (Moong)	2.63	3.51	5.94	5.31	5.90	6.61	7.16
Khesari (Lathyrus)	1.12	1.21	1.26	1.77	3.68	3.74	3.98
Other Pulses	0.66	0.83	0.83	0.94	0.32	0.78	0.53
Total Pulses	4.41	5.55	8.03	8.03	9.89	11.13	11.67
Total Foodgrains	77.07	77.24	77.53	75.49	77.74	78.33	79.12
Mustard	0.84	1.12	0.83	1.21	0.41	0.53	0.74
Sunflower seeds	0.80	0.85	0.85	0.92	0.89	1.08	1.03
Sesamum (Til)	0.49	0.54	0.39	0.55	0.53	0.45	0.43
Other Oilseeds	0.02	0.04	0.05	0.06	0.04	0.03	0.03
Total Oilseeds	2.16	2.54	2.13	2.73	1.87	2.09	2.24
Jute	1.5	0.5	0.6	0.5	0.3	0.3	0.7
Net Sown Area	66.09	65.17	64.16	67.89	63.66	59.36	57.70
Gross Sown Area (in 1000 Ha)	547.0	555.3	564.4	530.7	563.0	603.6	621.1
Cropping Intensity	151.31	153.44	155.87	147.29	157.09	168.46	173.30
Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/							

2.3.3.2 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 24.37 qtls, in 2019-20 is quite low. The per hectare yield of total cereals decreased from 25.18 qtls in 2013-14 to 24.37 qtls in 2019-20. Similarly, the yield of total pulses went down from 8.22 qtls in 2013-14 to 3.77 qtls in 2019-20. Total oilseeds' yiled evinced a decrease from 13.56 qtls in 2013-14 to 9.64 qtls in 2019-20. The yield of Jute increased from 37.92 qtls in 2013-14 to 47.06 qtls in 2019-20. The yield of total food grains dropped from 24.21 qtls in 2013-14 to 21.33 qtls in 2019-20. In summary, all crop yields show year-over-year 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 South 24 Parganas District (in Qtl per Ha)

Crop/Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Rice	25.15	25.86	23.54	24.84	26.31	26.81	24.37

Total Cereals	25.18	25.89	23.54	24.84	26.28	26.78	24.37
Green gram (Moong)	5.90	5.85	5.82	6.67	5.90	2.83	2.94
Khesari (Lathyrus)	11.48	11.64	7.89	10.21	8.74	6.42	4.53
Total Pulses	8.22	7.76	6.31	7.82	7.06	4.60	3.77
Total Food Grains	24.21	24.59	21.76	23.03	23.84	23.63	21.33
Mustard	14.13	12.58	7.87	7.81	9.13	6.88	9.35
Sunflower seeds	13.41	12.55	12.50	12.24	11.80	8.62	12.03
Sesamum (Til)	12.59	11.33	8.64	8.28	14.33	9.26	4.81
Total Oilseeds	13.56	12.20	9.75	9.52	11.90	8.33	9.64
Jute	37.92	39.60	28.20	30.60	37.80	37.20	47.06
Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/							

2.3.3.3 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 (1017.60 thousand tonnes) formed a major part of the total cereal production (1020.90 thousand tonnes). Moreover, there is an increase in the production of total cereals from 1000.8 thousand tons in 2013-14 to 1020.90 thousand tons in 2019-20. Among pulses, Moong and Khesari occupied the highest production, with 13.1 thousand tons and 11.2 thousand tons, respectively, in 2019-20. Although these pulses show variation in the production across years, they still represent around 89% of the total pulse production. Sunflower seeds, Mustard, and Sesamum productions were 7.7 thousand tons, 4.3 thousand tons, and 1.3 thousand tons, respectively, representing 99.25% of the total oilseed production in 2019-20. Jute production dropped from 5.7 thousand tons in 2011-12 to 3.3 thousand tons in 2-19-20. Looking at the annual production data of various crops, we find that the production of almost all crops show high level of variation across years. This calls for proper insurance arrangements so that farmers may take more risks and diversify their production.

Table 6: Trends in Production of Principal Crops in South 24 Parganas District (in 1000 Tons)

Crop/Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Rice	990.4	1,018.70	922.8	888.4	1,000.80	1,083.80	1,017.60
Other Cereals	10.4	12	0.7	0.9	3.2	2.3	3.3
Total Cereals	1000.8	1,030.70	923.5	889.3	1,004.00	1,086.10	1,020.90

Green gram (Moong)	8.5	11.4	19.5	18.8	19.6	11.3	13.1
Khesari (Lathyrus)	7	7.8	5.6	9.6	18.1	14.5	11.2
Other Pulses	4.3	4.7	3.5	4.9	1.6	5.1	3
Total Pulses	19.8	23.9	28.6	33.3	39.3	30.9	27.3
Total Food Grains	1020.6	1054.6	952.1	922.6	1043.3	1117	1048.2
Mustard	6.5	7.8	3.7	5	2.1	2.2	4.3
Sunflower seeds	5.9	5.9	6	6	5.9	5.6	7.7
Sesamum (Til)	3.4	3.4	1.9	2.4	4.3	2.5	1.3
Other Oilseeds	0.2	0.1	0.1	0.4	0.2	0.2	0.1
Total Oilseeds	16	17.2	11.7	13.8	12.5	10.5	13.4
Jute	5.7	2.0	1.7	1.5	1.1	1.1	3.3
Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/							

2.3.3.4 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 (4.80%), followed by Sesamum (10.06%) and sunflower seeds (16.14%), and the highest in Khesari (60.03%). The variability in the area under Jute is 65.41%. The variability in the area under total pulses (37.13%) is much higher than in the area under total cereals (4.89%). Since Rice dominates the production, the variability in the area under total food grains is affected by the variability in rice acreage. Variability in the area under total oilseeds is 11.42%.

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	391.36	18.77	4.80	988.93	64.98	6.57	25.27	1.14	4.51
Total Cereals	393.20	19.24	4.89	993.61	66.62	6.70	25.27	1.13	4.48
Green gram (Moong)	30.46	10.69	35.11	14.60	4.61	31.54	5.13	1.56	30.41
Khesari (Lathyrus)	13.90	8.34	60.03	10.54	4.45	42.17	8.70	2.64	30.36
Total Pulses	48.31	17.94	37.13	29.01	6.35	21.88	6.50	1.72	26.41
Total Food Grains	441.51	30.89	7.00	1,022.63	65.82	6.44	23.20	1.23	5.32
Mustard	4.57	1.48	32.27	4.51	2.12	46.88	9.68	2.69	27.74
Sunflower seeds	5.24	0.85	16.14	6.14	0.70	11.39	11.88	1.53	12.86

Sesamum (Til)	2.74	0.28	10.06	2.74	1.02	37.23	9.89	3.15	31.82
Total Oilseeds	12.77	1.46	11.42	13.59	2.35	17.32	10.70	1.87	17.44
Jute	0.63	0.41	65.41	2.35	1.65	70.16	36.91	6.16	16.69
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 Mustard (46.88%), followed by Khesari (42.17%) and Sesamum (37.23%). The variability in the production of total oilseeds is 17.32%. The variability in Jute production is 70.16%, which is quite high. Variability is lowest in Rice (6.57%), followed by sunflower seeds (11.39%) and Moong (31.54%). Improvement in crop insurance conditions and better market accessibility can lower this variation.

In the case of yield, the highest variability is estimated in Sesamum (31.82%), followed by Moong (30.31%), and Khesari (30.36%). The variability in yield of jute is 16.69%. Yield variability in total pulses (26.41%) is much higher than in total cereals (4.48%). Several factors, such as climate change, market prices, rainfall patterns, etc., influence the variability in agricultural production.

2.3.4 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 54.80% of the total fertilizers used, while the proportions of phosphorus and potassium were 24.81% and 20.39%, respectively. In 2019-20, however, the nitrogen and potassium share decreased to 53.72% and 14.98%, respectively, while the phosphorus share has increased to 31.30%. In 2019-20, all fertilizers were used around the recommended ratio. The table also shows that fertilizer consumption varies yearly, which can be due to several factors such as rainfall patterns, cultivation patterns, etc. Although the overall use of chemical fertilizers has decreased in the district from 83.75 kg/ ha GSA in 2013-14 to 78.69 kg/ ha GSA in 2019-20, the government can incentivize the farmers to use organic and bio fertilizers to improve soils and water resources and sustain farm productivity and income.

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	45.90	50.46	53.62	49.39	45.34	44.16	42.27
Phosphorous	20.78	31.73	35.15	34.54	24.47	26.44	24.63

Potassium	17.08	18.44	19.12	17.18	14.45	13.03	11.79
Total	83.75	100.63	107.89	101.10	84.26	83.63	78.69
GSA (1000 Ha)	547	555.3	564.4	530.7	563	603.6	621.1
Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/							

2.3.5 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, saving of water, protecting biodiversity, 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 in the district. The district has ten groups in seven development blocks. The highest number of groups are in Magra Hat-1 (2), Pathar Pratima (2), and Sonar Pur (2). Significantly high variation can be seen in the number of farmers per group. 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 scheme, 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 South 24 Parganas (as on June 6, 2022)

S. No.	Block	Scheme	No. of groups	No. of farmers in groups			
				Total	Average	Median	SD
1	Baruipur	PKVY	1	50	50	50	0
2	Bhangar-2	PKVY	1	50	50	50	0
3	Gosaba	PKVY	1	63	63	63	0
4	Kultali	PKVY	1	50	50	50	0
5	Magra Hat-1	PKVY	2	100	50	50	0
6	Pathar Pratima	PKVY	2	100	50	50	0
7	Sonar Pur	PKVY	2	192	96	96	22.62
8	District Total	PKVY	10	605	60.5	50	20.57
		Total	10	605	60.5	50	20.57

Source: Compiled from https://pgsindia-ncof.gov.in/

Agradual 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 towards a sustainable farming system in the district.

2.3.7 Trends in Livestock Sector

The total number of cattle decreased from 1271 thousand in 2003 to 1019 thousand in 2019, with a net decrease of 19.81%. The decrease in total cattle is due to a decrease in adult male cattle from 469 thousand in 2003 to 61 thousand in 2019. However, adult female cattle rose from 352 thousand to 380 thousand, and young cattle from 450 thousand to 579 thousand during the same period. Cattle represent 98.74% of the total large ruminants. Moreover, cattle's share in large ruminants went up from 97.93% in

2003 to 98.86% in 2019. Total buffaloes significantly decreased from 27 thousand in 2003 to 12 thousand in 2019, a net decrease of 56.53%. The decrease is due to a decrease in adult male buffaloes from 10 thousand in 2003 to 1 thousand in 2019, adult female buffaloes from 9 thousand in 2003 to 8 thousand in 2019, and young buffaloes from 8 thousand in 2003 to 2 thousand in 2019. Buffaloes represent only1.25% of the total large ruminants. Total sheep decreased from 221 thousand in 2003 to 82 thousand in 2019, with a net decrease of 62.72%. The goats' population also decelerated from 1598 thousand in 2003 to 791 thousand in 2019, a net decrease of 50.47%. Total pigs went down from 63 thousand in 2003 to 7.35 thousand in 2019, a net decrease of 88.33%. The total livestock population in the district significantly declined from 3180 thousand in 2003 to 1912 thousand in 2019, a net decrease of 39.87%.

Notably, the number of female cattle substantially increased over the period by 8.04%, indicating the growth of livestock products, including milk. The substantial decline in the number of male cattle and male buffaloes also shows the rising farm mechanization and declining relevance of animal power, mainly because of the high maintenance cost of livestock.

Table 10: Trends in Livestock population (in 1000 numbers) in South 24 Parganas

Category	2003	2007	2012	2019
Cattle Total	1271.44	1103.26	787.24	1019.5
Cattle Adult Male	469.41	127.16	84.17	60.77
Cattle Adult Female	351.83	433.62	340.19	380.1
Cattle Young Total	450.2	542.48	362.89	578.63
Cattle Share in Large Ruminant (Percent)	97.93	98.93	99.27	98.86
Buffalo Total	26.94	11.94	5.8	11.71
Buffalo Adult Male	9.91	3.2	1.09	0.97
Buffalo Adult Female	9.31	5.25	3.39	8.33
Buffalo Young Total	7.73	3.48	1.32	2.42
Buffalo Share in Large Ruminant (Percent)	2.07	1.07	0.73	1.14
Sheep Total	220.69	226.69	96.13	82.26
Sheep Share in Small Ruminant (Percent)	12.13	20.09	13.57	9.41
Goats Total	1598.29	901.87	612.16	791.59
Goats Share in Small Ruminant (Percent)	87.87	79.91	86.43	90.59
Pigs Total	63.01	25.23	16.39	7.35
Livestock Total	3180.59	2269.07	1517.97	1912.4

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

2.3.8 Trends in Milk Production

Table 11 shows the trends in Milk Production in South 24 Parganas over the years. Cow milk has the largest share in milk production. Moreover, cow milk production significantly increased by 12.87% from 2011-12 to 2015-16. Buffalo milk production decreased from 7 thousand tons in 2011-12 to 5 thousand tons in 2015-16. The reason for decline in Buffaloes' milk production is the decline in their population. Moreover, the total milk production increased from 178 thousand tons in 2011-12 to 198 thousand tons in 2015-16, majorly due to the increase in cow milk production. Milk production can be increased further by providing incentives for dairy farming to improve the cattle and buffaloes' milking capacity.

Table11: Trends in Milk Production (1000 tons)

Source/Year	2011	2012	2013	2014	2015
Total Cow Milk Production	171	175	171	153	193
Total Buffalo Milk Production	7	7	7	5	5
Total Milk Production	178	182	178	158	198

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

2.3.8 Trends in Fishery Production

Table 12 shows the trends in Fish Production in South 24 Parganas as compared to the total fish production in West Bengal. Fish Production was 225050 tons in 2011-12 in South 24 Parganas which increased to 231860 tons in 2014-15. South 24 Parganas represented around 15.28% of the total fish production in West Bengal in 2011-12. However, its share decreased to 14.33% in 2014-15.

Table12: Trends in fish production (in million tons) in South 24 Parganas

District/Year	2011-12	2012-13	2013-14	2014-15
South 24 Parganas	225050	208879	220888	231860
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 28.02% out of the total geographical area which is 9960 sq. km. With respect to 2019 forest assessment there has been increase in the forest area of the district by 2 sq. km.

The district has a total of 2790.71 sq. km. under the forests out of which 981.97 sq. km. is under very dense forests, 744.77 sq. km. is under moderately dense forests and 2790.71 sq. km under the open forests. The district has 1 sq. km. of land area under scrubs as depicted in Fig. 1.

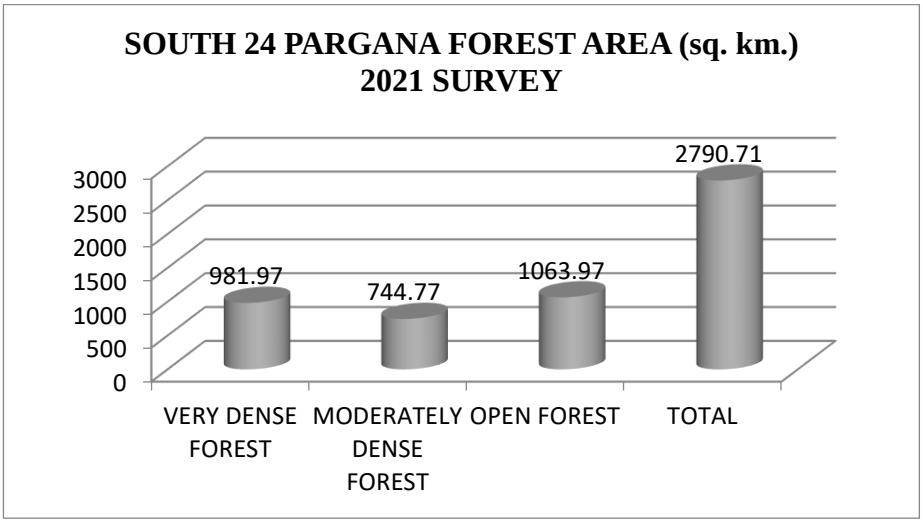


Fig. 1

The district has 40 ha of cultivable wasteland and 8170 ha of land as current fallow.

2.2.1. Biodiversity

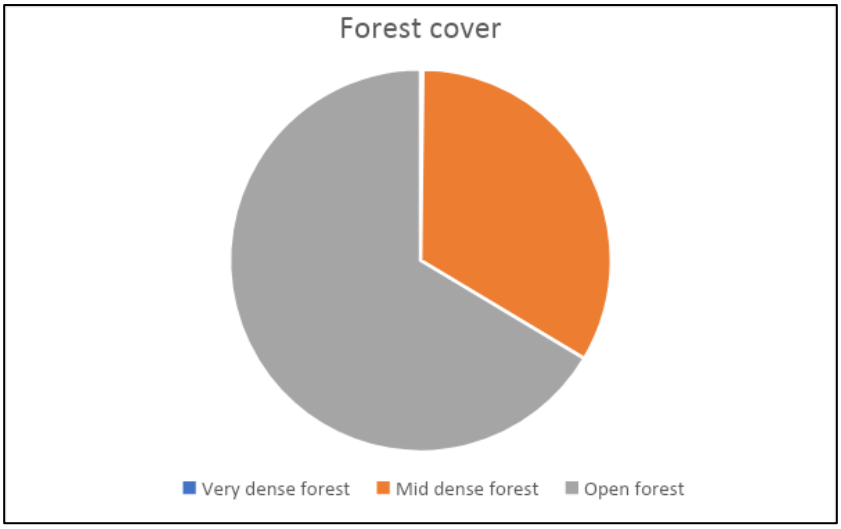
The district's biodiversity data includes various crop production, livestock population, bird species, and forest cover. The crop production trend shows an increase in crop production. Forest data shows that forest cover was decreased by 3.29 % in 2019. There are 393 bird species and seventeen threatened/rare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

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**

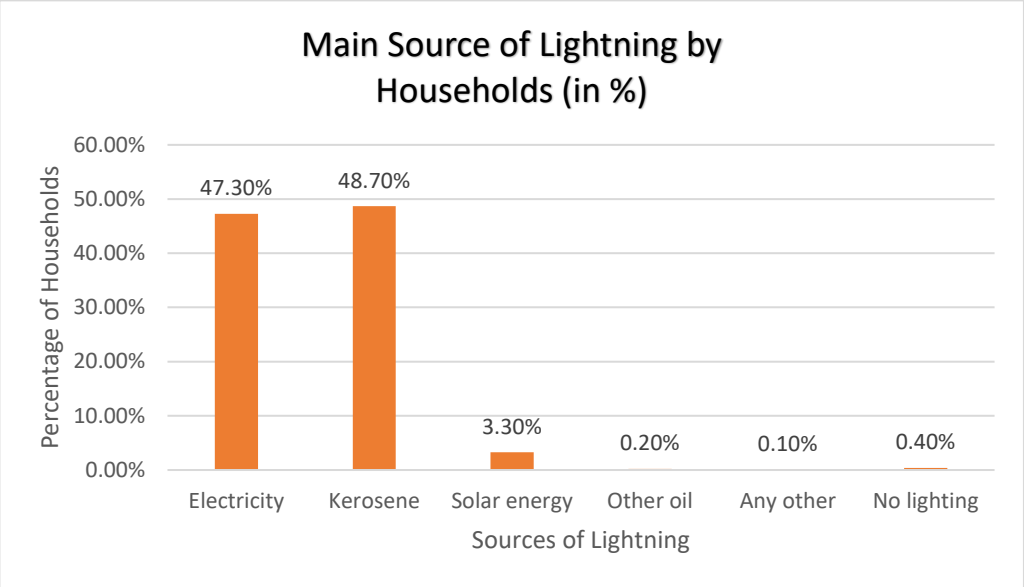
Source: National River Conservation Directorate (NRCD), National Wetland Inventory and Assessment (NWIA) Atlas

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.

According to the Census of India 2011, the data of main sources of lightning used by the total percentage of the households has been analysed through a graph below. Kerosene has been used by 48.70% of the households, which is dominating in the district. Electricity is second important source which is used by 47.30% of the households. Solar is being used by 3.30% of the households, other oil by 0.20% of the households, other sources of lightning by 0.10% of the households. 0.40% of the households do not have any source of lightning.



2.5.2. Biomass

West Bengal Renewable Energy Development Agency (WBREDA) is the chief authority to promote renewable or non-conventional sources of energy in West Bengal.

The net sown area of the district is 372290 hectares, area sown more than once is 158970 hectares, gross cropped area is 531260 hectares. The cropping intensity of the district is 143%. The total forest cover in the district is 426300 hectares.

The major crops grown in the district are rice, wheat, pulses, oilseeds, jute, and potato. Potato has the highest productivity of 17885 kg/ha.

Crop	**Productivity (kg/ha)**
Rice	2512
Wheat	1886
Pulses	652
Oilseeds	1205
Jute	2364
Potato	17885

Table 1

The pie-chart uses Census 2011 data of the type of fuel used by households for cooking in the South 24 Parganas district. 33% of the households use fire-wood, 25% of the households use crop residue, 17% of the households use no cooking, 11% of the households use LPG/PNG, 7% of the households use cow dung cake, and 3% of the households use coal, lignite, charcoal as a fuel for cooking.

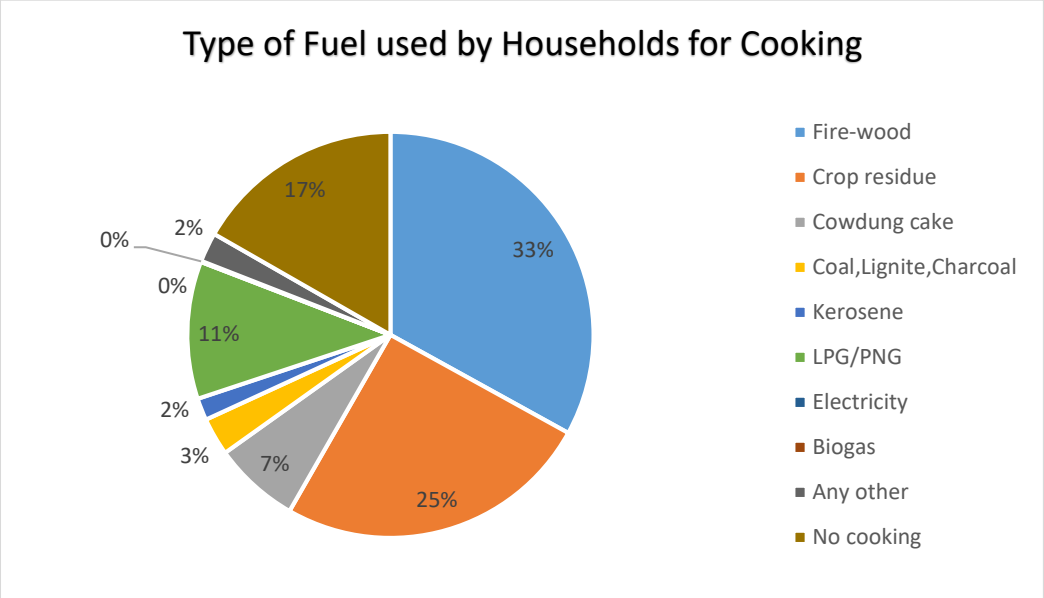


Fig. 1

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

3.1 FORESTRY

The Sunderbans of Indian part is covering most of the southeastern region of the district of South 24 Parganas, the southernmost district of West Bengal. Sunderbans is a biogenous coast of numerous flora and fauna where the biological factors play significant roles in coastal evolution. There are 64 species of mangroves and its associated species and 1586 species of fauna are identified in Sunderbans.

This eco-region on the coast forms the seaward fringe of the delta and is the world's largest mangrove ecosystem, with 20,400 sq. km. (7,900 sq. mi.) of area covered. The dominant mangrove species Heritiera fomes is locally known as sundri or sundari from which the name of the forest had probably been derived. Twenty six of the fifty broad mangrove types found in the world grow well in the Sundarbans. Amongst them Avicennia spp., Xylocarpus mekongensis, Xylocarpus Granatum, Sonneratia apetala, Bruguiera gymnorrhiza, Ceriops decandra, Aegiceras corniculatum, Rhizophora mucronata are worth mentioning. The commonly identifiable vegetation that grow in the dense mangrove forests at the Sundarbans are salt water mixed forest, mangrove scrub, brackish water mixed forest, littoral forest, wet forest and wet alluvial grass forests. Mangrove forests of the Sunderbans provide a lot of protection from natural calamities. Acts as a carbon sink as mangrove ecosystem absorb more carbon than the other land-based forests. This provides breeding grounds for fisheries and preserving biodiversity. Around 20,000 kg of honey is collected every year from forests of Sundarbans. Mostly people from the Kultali, Joynagar, Basanti, Gosaba and Canning areas are engaged in honey collections.

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

3.1.1 Biodivesity

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

West Bengal Renewable Energy Development Agency (WBREDA) had selected 18 villages in the 3 blocks of South 24 Parganas district. The three blocks are Gosaba, Pathar Pratima, and Namkhana, where the preliminary work has completed, under the implementation of RVE program. Currently, tender process is taking place and the project will work on providing 23745 Solar Photovoltaic Home Lightning Systems to individual households, and providing 742 Solar Photovoltaic Street Lightning System for the community.

Moreover, WBREDA has proposed that 6 different schools in Gosaba block would install 6 number of stand-alone solar PV power systems and funding has been sanctioned by Hon’ble MLA of Gosaba Assembly Constituency (AC), amounting Rs. 2.50 lakh for each school. Furthermore, 100 schools have been identified in South 24 Parganas district, North 24 Parganas district, and Murshidabad district to install solar PV and improved Chulhas, which would help in reduction of the conventional fuel consumption.

In November 2018, WBREDA implemented ground mounted Solar PV power system at Ganga Sagar, South 24 Parganas district, having a capacity of 1 MW, with a cost of Rs. 5.62 crores. It has been estimated that the project would be completed in 6 months.

Microgrid with floating solar and Battery Energy Storage System (BESS) has been put on trial in the South 24 Parganas district, having a capacity of 100 kW and the Battery storage of 218 kWh, which would be helpful in providing uninterrupted power supply even in case of natural disasters.

According to the Hindustan Times, the first region in the Sundarbans lightened by grid connected Solar power was Rudranagar on Sagar Island in South 24 Parganas district. Gosaba, a block in the district of South 24 Parganas received solar energy in the year 1997.

3.2.2. Biomass

The total agricultural residue for biomass energy generation in South 24 Parganas district is 2081.489 (10^3 ta^{-1}26). Moreover, the biomass residues from rice husk from rice mills/ hullers in the district is 248.338 (10^3 ta^{-1}), residues from saw mills is 5.292 (10^3 ta^{-1}), and residues from non-forest land is 180.98 (10^3 ta^{-1}). The net surplus biomass in the district is 844.399 (10^3 ta^{-1}). Furthermore, the net surplus biomass power generation potential in the district is 107.22 MW (Das & Jash, 2009).

West Bengal Renewable Energy Development Agency (WBREDA) has installed Biomass Gasifier Power Plants in 3 villages of South 24 Parganas district. In the Gosaba village, 1200 Biomass Gasifier units, having a capacity of 500 kW, installed in 1997, which is giving a revenue of Rs. 3.50 lakhs per month and is incurring an expenditure of Rs. 7.50 lakhs per month. Additionally, in the Chhoto Mollakhali village, 375 Biomass Gasifier units, having a capacity of 500 kW, installed in 2001, which is giving a revenue of Rs. 0.70 lakhs per month and is incurring an expenditure of Rs. 2.50 lakhs. Moreover, in the Herembo Gopalpur village, 50 Biomass Gasifier units, having a capacity of 400 kW, out of this 200 kW shifted to Gosaba village, installed in 2006, which is giving a revenue of Rs. 0.06 lakhs per month and is incurring an expenditure of Rs. 0.50 lakhs. These plants are out of date and they are not incurring profits. These plants need either shut down or renovation work.

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:

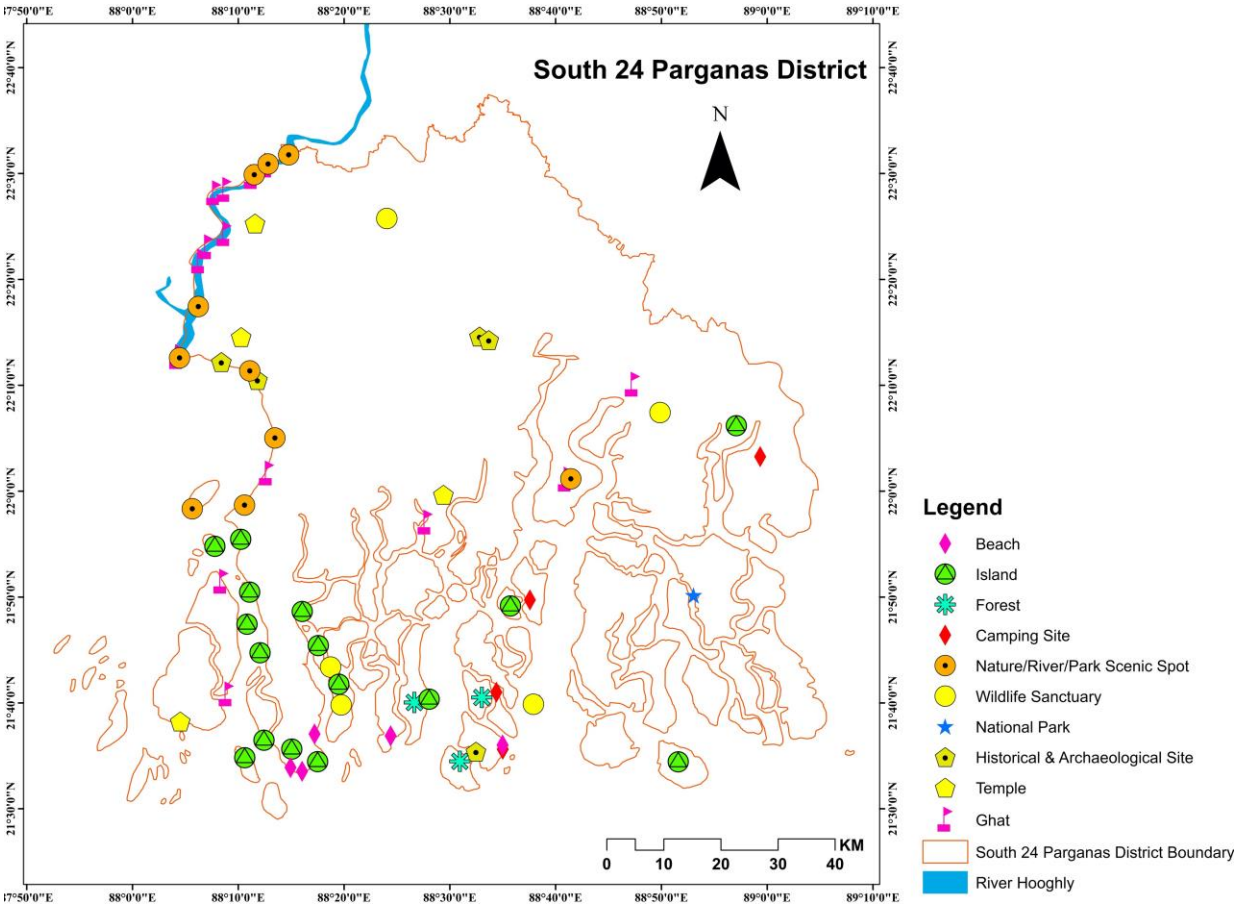
In hilly locations, WBREDA has taken the lead in harnessing small and micro hydel energy in partnership with WBSEDCL.

3.3TOURISM

Tourism is one of the fastest growing industries of the world in the 21st century. It has emerged as one of the major sources of employment and foreign exchange earnings for many developing countries, including India. South 24 Parganas is an important district in the tourism map of West Bengal. Clock Tower, Temples, Wildlife Sanctuaries, National Park, Island, Ghat, Natural Landscape and Historical Sites make South 24 Parganas District a great tourist destination.

South 24 Parganas is a district in the Indian state of West Bengal. It is the sixth most populous district of the country. South 24 Parganas has served as the capital of the kingdom of Raja Bikramaditya and later on, Pratapaditya. There are various tourist places in South 24 Parganas. The visitors visit the well-known places like the Sundarbans National Park, Gurusaday Museum, Chintamoni Kar Bird Sanctuary, Metiabruz Church, and much more. (*South 24 Parganas Overview*, n.d.)

Map: 2 Tourism Sites of South 24 Parganas District



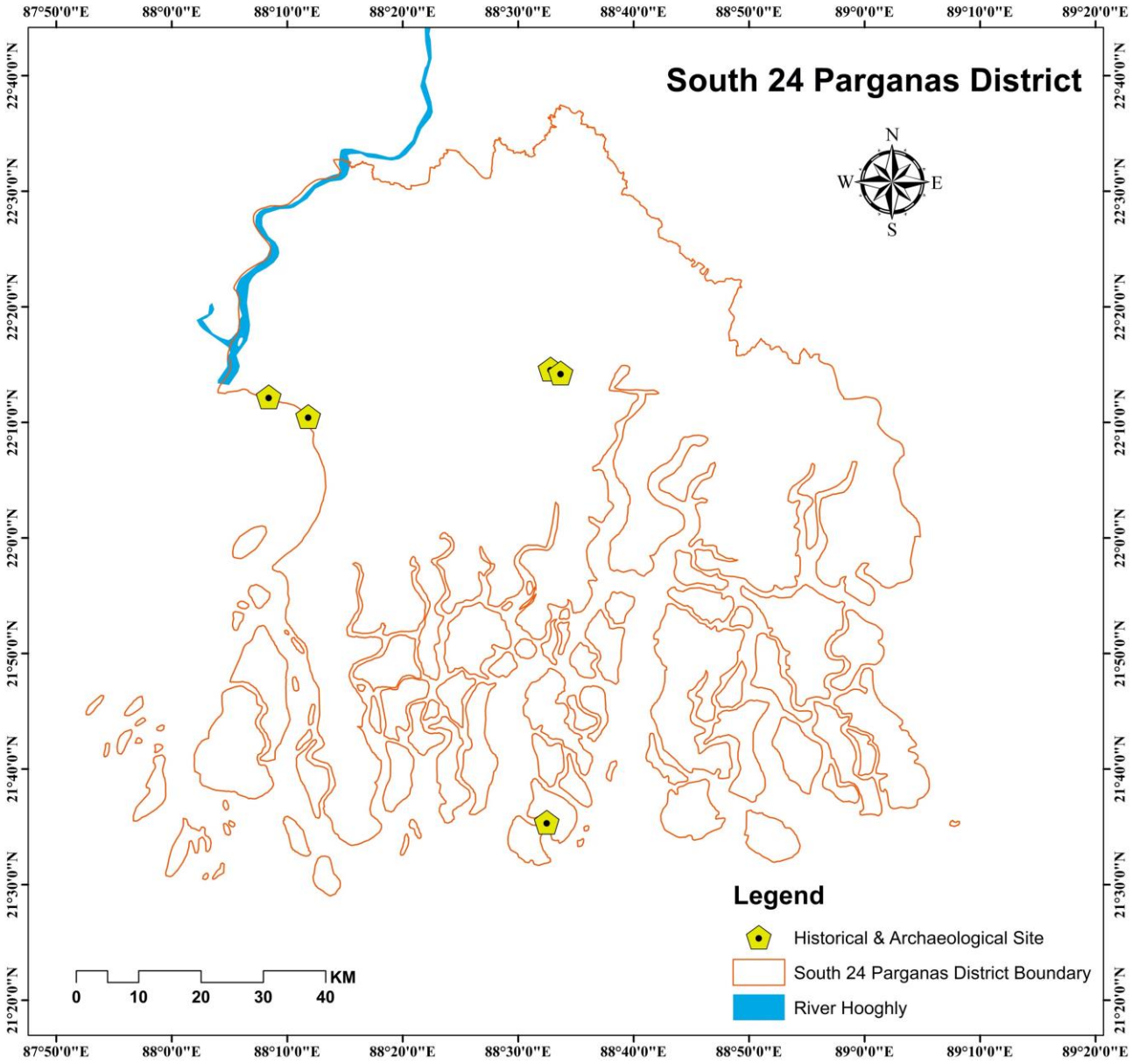
Source: Prepared by Author

3.ARCHAEOLOGICAL & HISTORICAL TOURISM

- ★ **Deulpota:** Deulpota is an archaeological site located beside the Hooghly river, in the Diamond Harbour II CD block in the Diamond Harbour subdivision of the South 24 Parganas district.
- ★ **Tilpi Village:** Tilpi is a village and an archaeological site in Jaynagar of Baruipur subdivision, South 24 Parganas district. This site is located beside a river named Piyali. Several artefacts and remains of ancient structures have been discovered from Tilpi. Sunga style Terracotta artefacts, earthen wares with ornate design, toy carts with animals like elephant, ram, god-like figurines etc. have been excavated.
- ★ **Dhosa**
- ★ **Chingrikhali Fort**
- ★ **Chulkati Lotus Pond**

- ★ **Frazerganj:** Just 2 km north of Bakkhali is the twin town Frazerganj, which is named after Andrew Fraser. Fraser, in early 1900s, tried to build the area into a resort, which he couldn't as the waves frequently washed the constructions. His office ruins can still be seen here.
- ★ **Sajnekhali Watch Tower:** Sajnekhali Watch Tower is counted among the most renowned watch towers in the park.
- ★ **Burirdabri Watch Tower:** This watch Tower in the Burirdabri camp is famous for its watchtower, a mud walk and mangrove cage trail leading to a view point known as Raimongal View Point.

Map: 3 Archaeological & Historical Tourism Sites of South 24 Parganas District



Source: Prepared by Author

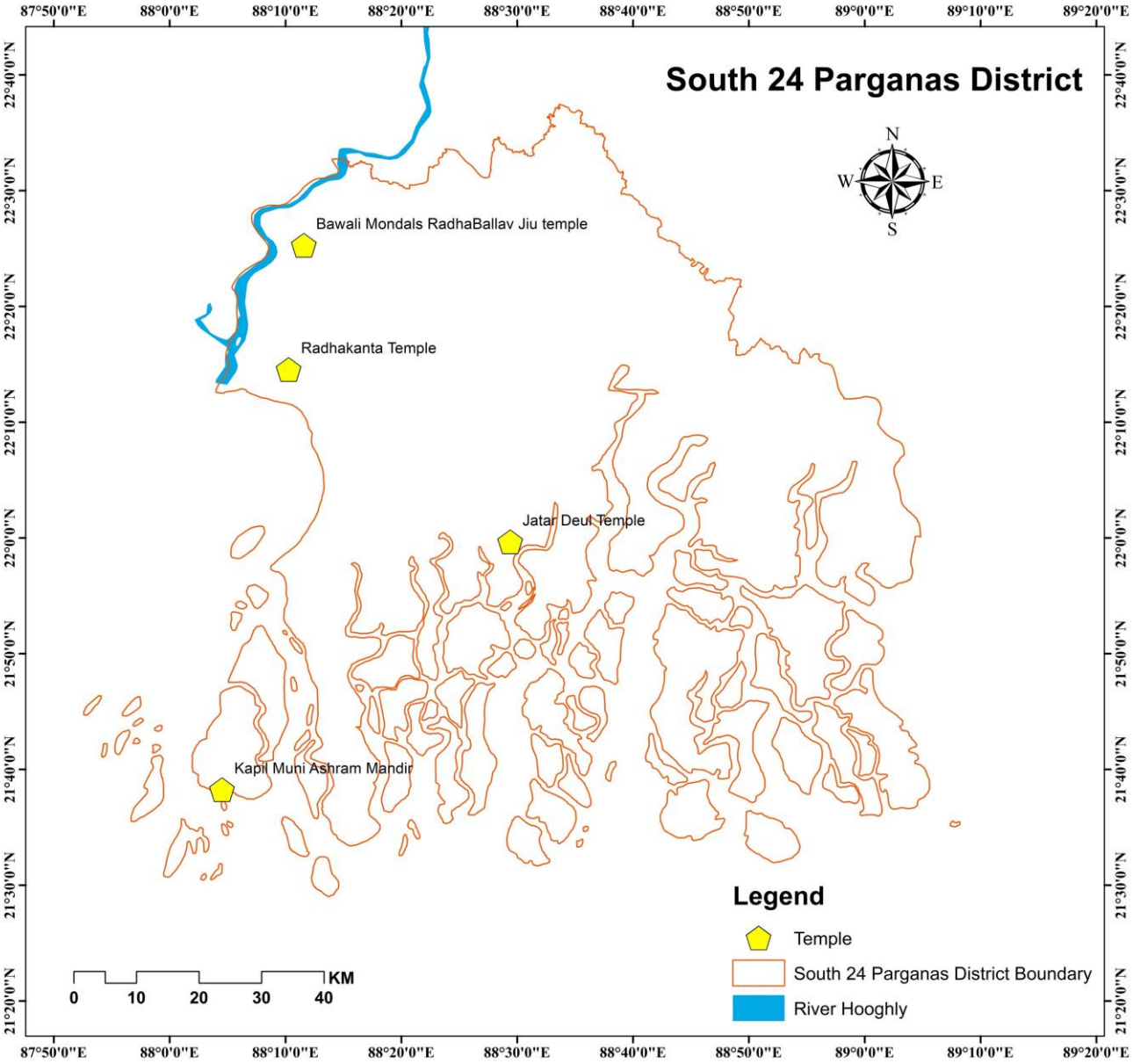
4. RELIGIOUS & SPIRITUAL TOURISM

★ **Kapil Muni Temple:** Kapil Muni Temple is situated at Sagar Island in West Bengal. It is believed that the deity was installed in 1437 by Swami Ramanand. The current structure

is a recent one and it has a stone block, considered to be the representation of Sage Kapil. The annual Ganga Sagar Mela is celebrated on Makar Sankranti Day here.

- ★ **Radhakanta Temple:** The west facing brick temple of Radhakanta looks beautiful after restoration. The temple follows the aatchala style of Bengal temple architecture and is about sixty feet in height. The temple was built by Dewan Darpanarayan Arnab Sarkar in 1176 Bangabda, which, after converting to Gregorian calendar comes to 1769 A.D.
- ★ **Lakshmi Narayan Mandir:** A little distance from Radhakanta Temple will take you to another big south-facing aatchala temple (now abandoned) dedicated to Lakshmi Narayan. The temple, like other aatchala temples has a triple arched entrance and is placed on a higher pedastal. According to the foundation stone the temple was built in 1704 Sakabda (1782 A.D) by Sree Jagmohan and he further extended it 17 years later in 1206 Bangabda (1799 A.D).
- ★ **Shiv Mandir:** Just about 50 meters south-west of Radhakanta Temple there is an aatchala east-facing Shiv Mandir made of brick. Like the other temples, this mandir has some floral designs. A new stone plaque is placed by the side of the temple. From it, it is clear that this temple has undergone renovation from 2011. A little away from this temple there is a pond locally known as Dewandighi.
- ★ **Jatar Deul Temple:** Jatar Deul also called tower temple (rekha-deul), is located in the numerous rivers criss-crossed by stone-free alluvial and bush landscape of the southern Sundarbans settlements in the Indian state of West Bengal.
- ★ **Ambulinga Ghat:** Ambulinga Ghat is located in the Indian state of West Bengal. "Ambu" means "water" in the Bengali language, and "linga" depicts the Hindu Lord Shiva. In the 16th century, the delta-shaped island was found in Chhatrabhog, where the Ganges River flowed in many separate streams. By the 18th century, its tributaries had dried up. The bathing place, or "ghat," is now found in Barashi Village, located in South 24 Parganas district in Mathurapur I, Diamond Harbour subdivision. (*Tourist Attractions in South 24 Parganas District*, n.d.)
- ★ **Bawali Mondals Radha Ballav Jiu Temple**
- ★ **Bono Bini Temple**

Map: 4 Religious Tourism Sites of South 24 Parganas District



Source: Prepared by Author

5.ADVENTURE, NATURE & ECO TOURISM

- ★ **Sundarban Tiger Reserve:** Sundarban Tiger Reserve was created in 1973 and constituted as a Reserve Forest in 1978. The current core area was established as a National Park in 1984. Recognising the region and its unique biodiversity, the National Park was listed as a World Heritage Site in 1985. The entire Sundarban area was declared a Biosphere Reserve four years later. Tiger, fishing cat, spotted Deer, wild boar, gangetic dolphin, water monitor, estuarian crocodile, river terrapin, olive ridley turtle, ground turtle, hawks bill turtle, king crab, etc.
- ★ **Bhagabatpur Crocodile Sanctuary:** The Bhagabatpur Crocodile Project in the Sundarban has, of late, emerged as an important tourist destination of the Sundarbans. This is the only crocodile project in West Bengal and is located adjacent to the Lothian Island and on the bank of the Saptamukhi Estuary. The dense mangrove forest at the confluence of Saptamukhi river system has immense natural beauty to attract tourist all throughout the year. This hatchery of estuarine crocodile and Batagur Baska species of tortoise in the project has crocodiles of varying ages.Though this place is easily accessible through Namkhana, one can also visit it from Sajnekhali.
- ★ **The Sundarbans National Park**: Sundarbans is a national park, tiger reserve and biosphere reserve in West Bengal, India. It is part of the Sundarbans on the Ganges Delta and adjacent to the Sundarban Reserve Forest in Bangladesh. It is located to south-west of Bangladesh. The delta is densely covered by mangrove forests and is one of the largest reserves for the Bengal tiger. It is also home to a variety of bird, reptile and invertebrate species, including the salt-water crocodile. The present Sundarban National Park was declared as the core area of Sundarban Tiger Reserve in 1973 and a wildlife sanctuary in 1977.
- ★ **Sajnekhali Wildlife Sanctuary:** Sajnekhali Wildlife Sanctuary is a 362 km2 area in the northern part of the Sundarbans delta in South 24 Parganas district, West Bengal, India. It is located at the confluence of the Matla and Gumdi river. The area is mainly mangrove scrub, forest and swamp. It was set up as a sanctuary in 1976. It is home to a rich population of different species of wildlife, such as waterfowl, heron, pelican, spotted deer, rhesus macaques, wild boar, tigers, water monitor lizards, fishing cats, otters, Olive ridley turtle, crocodiles, Batagur terrapins, and migratory birds. The ideal place for nature lovers to observe wild animals from a height is the Sajnekhali Watchtower.
- ★ **Chintamoni Kar Bird Sanctuary:** Chintamoni Kar Bird Sanctuary (CKBS), also known as Kayal-r Bagan, is a bird sanctuary located in West Bengal, India, south of Kolkata. This garden is famous for its wide variety of birds, butterflies, ferns and orchids.

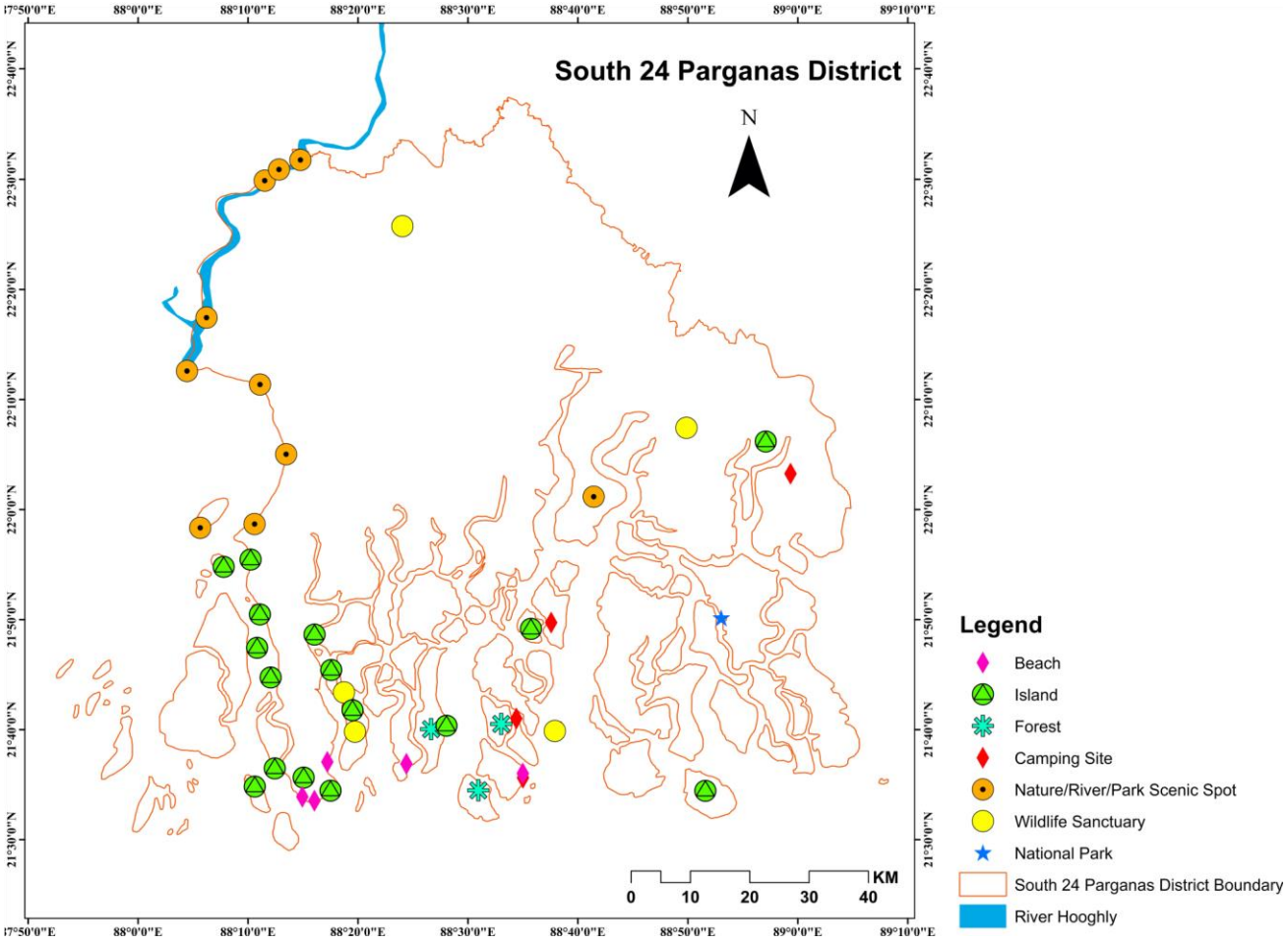
- ★ **The Haliday Island Wildlife Sanctuary:** The Haliday Island Wildlife Sanctuary (also just known as the Haliday Wildlife Sanctuary) is one of several wildlife sanctuaries in the nation of India. Located in the state of West Bengal, the area is approximately six square kilometers in size. It is a part of the 'Sundarbans Biosphere Reserve', with the Sundarbans region as a whole becoming a 'Biosphere Reserve' officially in 1989. The wildlife-heavy areas there are regarded as an environmentally minded tourist destination. Situated on the river Matla, many different types of flora and fauna exist within the wildlife sanctuary. Examples include spotted deer and wild boar. Bengal tigers have occasionally visited the area as well.
- ★ **Lothian Island Wildlife Sanctuary:** Lothian Island Wildlife Sanctuaries is one of the wildlife sanctuary of Sunderban. Lothian Island was declared as Wildlife Sanctuary in June 1976. The sanctuary is rich with Estuarine Crocodile, Olive Ridley Sea Turtle, Spotted Deer, Jungle feline, Rhesus macaque. The sanctuary is located at the section of Saptamukhi and Bay of Bengal. The vegetation of this area is flourished with 15 types of Mangrove plants. The wildlife here includes Estuarine Crocodile, Olive Ridley Sea Turtle, Spotted Deer, Jungle feline, Rhesus macaque. This sanctuary is accumulated with different types of Birds which include Black-Capped Kingfisher, Curlew, White-Bellied Sea-Eagle, Tern and Whimbrel.
- ★ **Bakkhali Sea Beach:** Bakkhali is a quiet sea beach only 132 km from Kolkata. From Namkhana by bus (105 km), then across the Hatania Doania river, by ferry and then another hour and a half bus journey will take one to Bakkhali. En-route, there is Diamond Harbour (48 km from Kolkata) where there is a comfortable Tourist Lodge for staying.
- ★ **Gobardhanpur Beach**
- ★ **Kalas Beach**
- ★ **Bakkhali Sea Beach**
- ★ **Fraserganj Sea Beach**
- ★ **Haripur Sea Beach**
- ★ **Kalashdeep:** Kalash Island, in South 24 Parganas, is a part of the Sundarbans National Park that lies at the estuary of the river Matla. Being outside the core area of Sundarbans, visitors with armed guards are permitted to get down on the beach.During winters, it is the breeding ground of the Olive Ridley Turtles that arrive in great numbers on this beach

for nesting. Kalash Island is also the home to many varieties of coastal birds and is specially a good place to spot uncommon waders. The Great Stone-curlew or Great Thickknee (Esacus recurvirostris) is sighted on the beach.

- ★ **Jambudeep Island:** Jambudwip is the name of an isolated island situated in the Bay of Bengal about 8 km to the southwest of Fraserganj/Bakkhali in the South 24 Parganas district. It remains uninhabited except in the fishing season, i.e. between the months of October and February.
- ★ **Henry's Island:** Henry's Island is an island near Bakkhali in South 24 Parganas of West Bengal, India. It is around 130 km (81 mi) from Kolkata. The island is home to millions of red crabs.
- ★ **Pikki Island**
- ★ **Ghoramara Island**
- ★ **Hamilton Island**
- ★ **Pecha Island**
- ★ **Bhaangaduni Deep**
- ★ **Susni Island**
- ★ **Pushpa/ Sikarpur Island**
- ★ **Mousuni Island**
- ★ **Basit Island**
- ★ **Green Island**
- ★ **Jameson Island**
- ★ **Sunderban Island**
- ★ **Lothian Island**
- ★ **Half Fish Island**
- ★ **Gangasagar:** Gangasagar or Sagar Island is an island in the Ganges delta, lying on the continental shelf of Bay of Bengal about 100 kms (54 nautical miles) south of Kolkata. The island is large - with an area of 224.3 kms. Gangasagar is a charming tourist destination, which attracts both pilgrims and adventure lovers.

- ★ **Kalas Forest**
- ★ **Mirs Forest**
- ★ **Sunderband Dhanchi Forest**
- ★ **Diamond Harbour Riverside**
- ★ **Akra Riverside**
- ★ **Noorpur Riverview**
- ★ **Falta Riverside**
- ★ **Budge Budge Riverside** ★ **Batanagar Ganga View**
- ★ **Golden Plover Point**
- ★ **Ramtanunagar Viewpoint**
- ★ **Kulpi Riverside**
- ★ **Jharkhali Park**
- ★ **Bonnie Camp**
- ★ **Kalashdeep Camp**
- ★ **Panna Camp**
- ★ **Dobanki Camp**

Map: 5 Adventure, Nature & Eco Tourism Sites of South 24 Parganas District



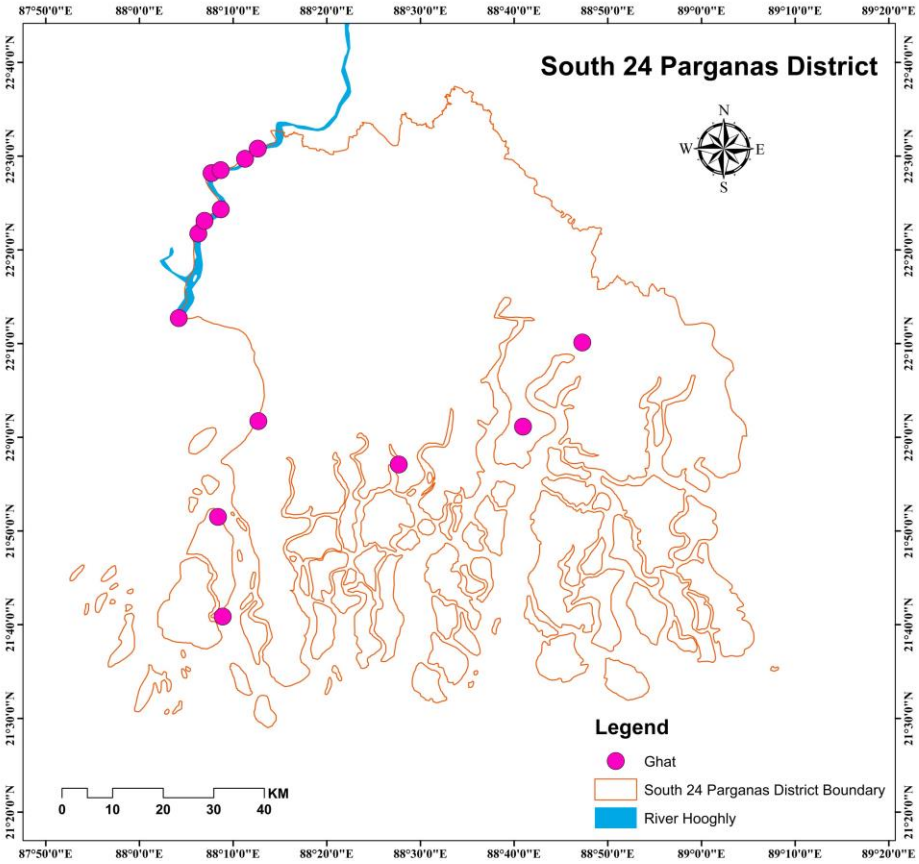
Source: Prepared by Author

6. GHAT TOURISM

- ★ Raipur Ghat
- ★ Achipur Ghat
- ★ Nagni Ghat
- ★ Pujali Ghat
- ★ Tyangra Char Ghat

- ★ Kachuberia Ghat
- ★ Maityrgheri Ghat
- ★ Jharkhali Ferry Ghat
- ★ Benuban Ferry Ghat
- ★ Noorpur Ferry Ghat
- ★ Burul Ferry Ghat
- ★ Budge Budge Ferry Ghat
- ★ Naldari Ferry Ghat
- ★ Gadkhali Ferry Ghat

Map: 6 Ghat Tourism Sites of South 24 Parganas District



Source: Prepared by Author

7. CULTURE & ARTS TOURISM

South 24 Parganas is an important district of West Bengal. It is the largest district in West Bengal in terms of area. As per the Census 2011 report, the district of South 24 Parganas is regarded as the second most populous district in the state after North 24 Parganas. The South 24 Parganas came into existence on 1st of March 1986 after the bifurcation of the erstwhile 24 Parganas district. The erstwhile 24 Parganas district was divided into South 24 Parganas district and North 24 Parganas district. The South 24 Parganas district is

bounded by North 24 Parganas to the north and north-east, Howrah to the Northwest, Purba Medinipur to the west, the Bay of Bengal to the south, and to the east is Bangladesh. The district headquarter is situated in Alipore.

The district is famous for the delta region called the Sundarbans, which is a tourist spot that witnesses people from all over the world. The land of South 24 Parganas is very fertile and comprises of dense forest area that is home to a large number of birds, animals and tropical trees including the Royal Bengal Tiger. The tiger sanctuary is popular all over the world. The district is recognized as an abode of heritage places.

The Indian part of the world's largest mangrove ecosystem of Sundarban is mostly spread over the district South Twenty-Four Parganas and Royal Bengal Tiger marks the symbol of this large forest. Shady trees of lush green forests of Sundarban, paddy fields adjacent to interlacing network of rivers, remnants of ancient monuments, temples, masjids and churches create the diversified heritage and culture of district South Twenty-Four Parganas. Innumerable fairs, festivals and socio-cultural events are held throughout the year in the district having an amalgamation of religion, community and culture. The followers of the main faiths and some tribal groups observe their own religious festivals whereas they intermingle in certain melas (fairs) and ceremonies. The Santals, Oraons, Mundas, Kurmis and other tribal people immigrated to this district along with KurmiMahatos and Mahisyas. As the district is unique in comparison with other districts of West Bengal for the presence of dense jungle of Sundarbans, wild animals, the Bay of Bengal and numerous rivers, creeks, khals and bils.

★ The district of South 24 Parganas is rich in its art and crafts. Clay dolls, Manasa Ghat, Kantha-patched cloth embroidery, Jute handicraft are some of its famous crafts. (West Bengal Heritage Commission, n.d.). Apart from the common State festivals like Durga Puja, Kali Puja, Muharram, Christmas etc. the District of South Twenty Four Parganas celebrates other festivals also which can be referred as district specific festival. Annual

festival of Baba Thakur (Lord Shiva). Gajan, Puja of Bonbibi, Shitala Puja and Manasa Puja

★ **Sagar Mela:** Millions of pilgrims and devotees from all over india come to take a dip in the freezing waters here to cleanse all sins away and offer worship at the temple of Kapil Muni. A huge and colourful fair takes place on this occasion- aptly names Sagar Mela - which is held once a year during Makar Sankranti.

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

The district South 24 Pargana has the famous Sunderbans forests which should be maintained and taken care of. Frequent Cyclones and Climate change , Sea level rise, reducing salinity are some of the major threats to mangroves. Recently there has been huge damage of the mangrove forests by Amphan Super Cyclone. Human activities resulting into pollution and plastic menace is also one aspect putting mangroves

in danger. The first thing required is to make the people of the district aware of the importance of forests and to educate them about how can their efforts be fruitful for the environment as well as for themselves. The district can also take up Sub-Mission on Agroforestry (SMAF) Scheme. SMAF aims to encourage farmers to plant multi-purpose trees together with the agriculture crops for climate resilience and an additional source of income to the farmers, as well as enhanced feedstock to inter alia wood-based and herbal industry. Hence there is a concerted effort to include medicinal, fruits, fodder, tree-borne oilseeds, lac host etc. in addition to the longer rotation timber species.

Conservation of existing mangrove forests and restoration of mangrove ecosystem has become important. The aim should be to support livelihood without destroying the mangrove forest. Restricted number of tourists in peak seasons will reduce pressure on ecosystem. Illegal activities like fisheries and others causing damage to mangroves need to be strictly stopped. Moreover it should be allowed in a regulated manner and the administration should look after the interests of those dependent on it. Even honey collection is an important economic activity which should be supported by the government and the administration so that the related people get the satisfactory benefit.

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: SOUTH 24 PARGANAS DISTRICT TOURISM

STRENGTHS

- ★ Outstanding scenic places, picnic spots, beautiful temples, Ashrams with marvellous natural beauty of lakes, Wildlife sanctuary, Forest and Parks.

- ★ Being near Kolkata, it is well connected by surface and local trains with Kolkata.
- ★ Rich Bengali culture and Bengali cuisines.
- ★ 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 natural heritage scenario of the destination.
- ★ Inadequate infrastructure facilities for tourists.
- ★ Congestion and Traffic problems.
- ★ Riverside is filled with dumped garbage, waste material, Plastics and polythene.
- ★ 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.
- ★ High opportunity for Religious, Adventure and eco-Tourism development.

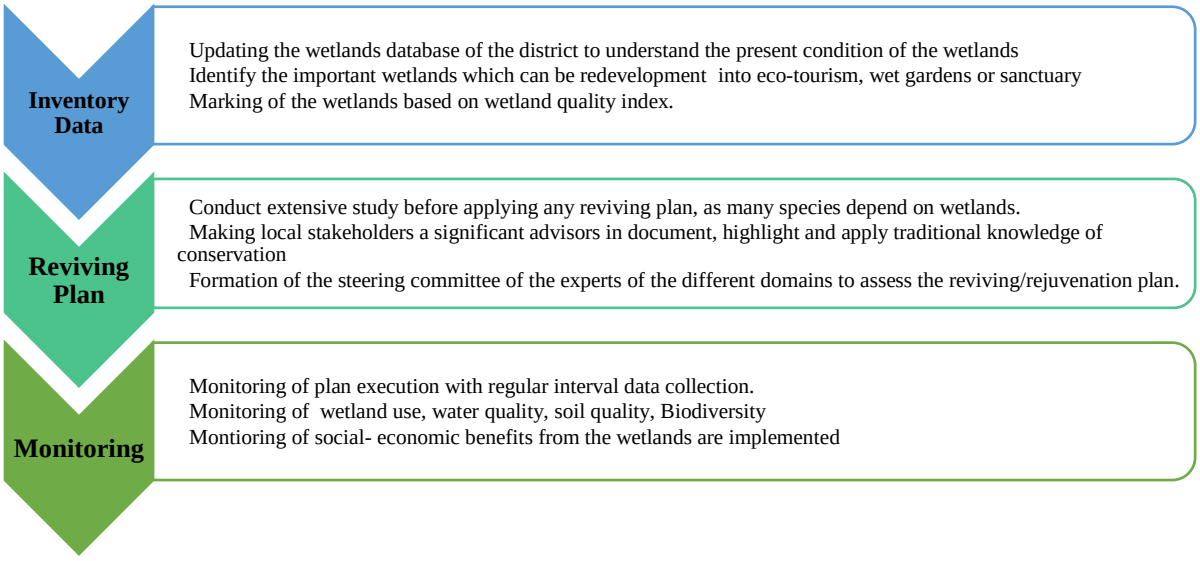
- ★ Reuse of vacant lands into economically productive use.
- ★ Obtaining grants for provision of best infrastructure and housing.
- ★ Encourage Public – Private partnership for provision of infrastructure services.

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.
- ★ Degradation of Natural Environment (Island, Wetland and Wildlife etc.) and Encroachment of River ecosystems.
- ★ Lack of governmental response towards tourism infrastructure such as tourism centre, tourism promotion and tourism accommodation.
- ★ There are areas in some parts of the district which remain vulnerable to inundation during rainy season largely due to over silting of rivers, canals, baors and beels.
- ★ The district faces a major challenge in providing proper conditions of living for its residents.
- ★ Threats for the Mangroves Forest, Delta, Beaches and Island.
- ★ Arsenic Prone Area.
- ★ Illegal Migration.

4.3 WETLANDS

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



4.4. ENERGY

4.4.1. Solar

According to the Input Survey 2016-17, the total net sown area is 357919 hectares, out of this, 179785 hectares is irrigated net sown area, which is 50.23% of the net sown area, and the rest 178134 hectares is unirrigated net sown area, which is 49.76% of the net sown area. Moreover, the availability of ground water is under safe levels, the district has a comparatively greater disbursement of credit, however, the crop revenue per holding is less, so to employ solar pumps, it is necessary to get financial support from the government.

Moreover, horticulture crops are dominantly grown in the gross cropped region, there is also a high proportion of marginal farmers, and the disbursement of institutional credit is also greater among marginal farmers in the district, so small-sized solar pumps like 1 HP and sub-HP pumps could be utilised for lift irrigation, as the ground water level is also under safe levels (CEEW, 2020).

The solar pumps could help in promoting NMOOP (National Mission for Oilseeds and Oil Palm), through better irrigation facilities.

As per the Agriculture Contingency Plan for South 24 Parganas district (2011), the barren and uncultivated land is 440 hectares. The land could be used for implementing ground-mounted solar panels or other renewable energy projects under component A of PM-KUSUM scheme.

There have been various programs related to solar PV plants in South 24 Parganas district, which are limited to few blocks, and more implementation and installation is needed in the other blocks as well for the overall development of the district through solar energy.

PROJECTION AND MONITORING MATRIX

Firstly, there is a need to recognise which blocks are backward in adoption of solar energy and which are good, and then steps need to be taken to improve the condition of those blocks.

Secondly, installation of rooftop solar in the government buildings and institutions are needed to increase.

Thirdly, solar pumps for agriculture could be efficient only if, the government provides substantial financial assistance.

Fourthly, small-sized solar pumps also need to be encouraged in the district.

Through these solar initiatives, the district's contribution would improve West Bengal's renewable energy targets, and also help in the development of district.

4.4.2. Biomass

There is a need to install new biomass plants in the district or to revamp the old ones at a faster rate, so that the biomass energy can be generated in the district. Also, there is a need to close down the ones which are producing more expenditure than the revenues and are not in the condition to be restored.

Further, more than half of the households use crop residue and fire-wood as a fuel for cooking, which are traditional and obsolete methods of cooking, which also leads to indoor pollution. These biomass residues could be traded to the biomass plant holders and energy could be generated by them.

There is also a need to provide subsidies to the biomass plant holders and maintenance should be done regularly. And small-scale biomass cogeneration plants should be encouraged in the district.

PROJECTION AND MONITORING

Firstly, biomass plants condition needs to be checked and maintained regularly.

Secondly, subsidies should be provided to the biomass plant holders.

Thirdly, mechanism of collection of biomass raw materials should be there.

Through the increase in biomass energy, the sustainable development of the district could happen.

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

Firstly the people of the district should be made aware of the importance of forests and what role can they play. Agroforestry should be promoted in the district to increase the tree cover in the district. Mangroves should be conserved and the areas which have lost the natural vegetation should be restored. Those dependent on NTFPs should be provided with assured economic benefits keeping in mind the conservation of the mangroves.

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

❖ Financial assistance needs to be strengthened in the district.

- ❖ Solar rooftop systems need to be installed at the government buildings.
- ❖ Component A of PM-KUSUM scheme needs a careful inspection in the district.
- ❖ Solar pumps or small-sized solar pumps like 1 Hp or sub-HP need a strong push in the district.

5.4.2. Biomass

- ❖ Subsidies should be regularly monitored.
- ❖ Proper biomass collection mechanism should be in place.
- ❖ Skills of rural adults need to be developed, so that they could help in maintenance of the plants.
- ❖ Biomass project needs timely monitoring from the government.

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.

- Purano Kella), Lighthouse, South Bengal Museum (Noongola), Famous Fish Market (Nagendra Bazar), Naval Camp, Sluice Gate can be arranged by the Tourism Department, Government of West Bengal. Tour Package may also include Ganga Sagar, Bakkhali, Raichak, Haldia, Bhagabatpur Crocodile Project etc. may be implemented and Ganga Sagar, Haldia, Kolkata can also be connected through waterways from Diamond Harbour.
- Tourism Department, Government of West Bengal can train through special course on Tour Guide in different languages. In this activity local people and youngsters may participate who have the primary and detailed knowledge about the surrounding areas.
- Riverside road should be renovated. Sitting arrangement facility should be of modern style. In several places we can arrange parks and gardens.
- Publicity is necessary for this unique tourist spot.
- People visiting Diamond Harbour should be aware of not polluting the physical environment by plastics 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.
- High opportunity for religious and eco-tourism development. v 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

- The suggestions had been noted by the officials, and further discussions will be done with SPMG, specially for interventions on Agriculture and Biodiversity.
- For tourism, opportunities such as promoting home stays and local artisans will be explored.
- 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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7 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/m^3)	Biogas potential (m^3/yr)	m3/day
Cattle	Manure	816780	10	2,98,12,47,000	22359350	44718700	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	25303781.3	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) (2017-18)**	**Residue production ratio**	**Residue amount (tons)**	**Average collection (70%)**	**Moisture content**	**Residue amount after removing moisture (tons)**	**Biogas potential [m3/(tons of dry matter)]**	**Overall biogas potential (m3)**
Maize	straw	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**