Arth Ganga Project: District Hooghly

Submitted to:

National Mission for Clean Ganga (NMCG)

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EXECUTIVE SUMMARY

Hooghly, a city laden by rich history and culture is situated in the state of West Bengal and is traversed by the River Hooghly to the east. Another major river is the Damodar. The district can broadly have divided into two divisions i.e., Old alluvial plains to the west of river Dwarakeswar and the monotonous level alluvial plain.

The total geographical area of the district is 3149 km^2. The primary sector contributes, on average, 21.52% to the district GDP with an average annual growth rate being decreased from 2007-08 to 2013-14 was negative (-2.31%) and its share decreased from 27.92% in 2007-08 to 17.36% in 2013-14. The secondary sector's share in the total GDDP decreased from 17.04% in 2007-08 to 15.03% in 2013-14 because it grew at a low rate of 3.49% per annum. The tertiary sector grew with a remarkable average annual growth rate of 9.21%, and its share increased from 55.04% in 2007-08 to 67.61% in 2013-14. Overall, the district economy grew with an average annual growth rate of 5.54% during the study period.

Major crop types are rice, cereal, pulses like a variety of gram, lentil, etc. along with oilseeds, mustard, etc. The livestock consists of cattle (indigenous and crossbred), buffalos (indigenous and crossbred), pigs (indigenous and crossbred), goats; poultry, and fisheries. The total number of cattle decreased from 1038 thousand in 2003 to 913 thousand in 2019, a net decrease of 12.02%. Cattle represent around 96.88% of the total large ruminant total buffaloes have increased from 34 thousand in 2003 to 35 thousand in 2019, a net increase of 4.26%; total sheep decreased from 2.67 thousand in 2003 to 1.66 thousand in 2019, a net decrease of 37.82%. Total goats also decreased from 1146 thousand in 2003 to 886 thousand in 2019, a net decrease of 22.67%. Total pigs have also decreased from 56.68 thousand in 2003 to 16.67 thousand in 2019, a net decrease of 70.58%. The total livestock population has decreased in the district from 2277 thousand in 2003 to 1853 thousand in 2019, a net decrease of 18.63%.

The share of cultivable wasteland and share of barren and uncultivable land decreased from 0.48% and 0.06% in 2011-12 to 0.10% and 0% in 2019-20, respectively. The fallow land has significantly decreased over the years, from 0.38% in 2011-12 to 0.13% in 2019-20. The net sown area has decreased slightly over the years, from 67.42% in 2011-12 to 67.29% in 2019-20. The area under non-agricultural uses went up from 30.82% to 31.78% in 2019-20. In 2019-20, the nitrogen and potassium share decreased from previous years to 41.10% and 27.56%, respectively, while the phosphorus share has increased to 31.34%. The use of potassium is more than the recommended ratio, while nitrogen and phosphorous usage are less than the recommended ratio. The overall use of chemical fertilizers has increased in the district from 199.90 kg/ ha GSA in 2013-14 to 265.52 kg/ ha GSA in 2019-20. The cropping intensity of Hooghly district is 249.45%

According to the 2021 Forest survey, forests cover of the district is 5.07% out of the total geographical area which is 3149 sq. km. With respect to 2019 forest assessment there has been decrease in the forest area of the district by 0.20 sq. km. The district has a total of 159.80 sq. km. under the forests out of which 14 sq. km. is under moderately dense forests and 145.80 sq. km under the open forests. The area under trees and gardens decreased from 0.67% in 2011-12 to 0.57% in 2019-20.

Historical monuments, sacred places, temples, spiritual centres of the district attract tourists from various parts of the country and abroad. The important tourist destinations of the district are: Muslim Imam-Bara ("meeting place"), Bandel (Portuguese) church, Hansweswari temple at Bansberia, Nandadulal Mondir, Tarakeshwar Temple, Radhanagar, Devanandapur, Birthplace of Sarat Ch. Chattopadhyay etc. Cultural Tourism has an important bearing on the economic and social lives of the people and hence on human development of the district.

The district has 414 bird species and twenty threatened/rare species and a total of 13706 natural and man-made wetlands outa of which they are mainly in form of oxbow/meanders and tanks/ponds. Electricity is the main source of lightning used by the households in the district, as 76% of the households are dependent upon it. 21.90% of the households are dependent upon Kerosene for lightning purposes. 1% of the households are dependent upon solar energy. The fuel used by households for cooking has been constructed into a pie-chart. 31.40% of the households use fire-wood, 25.20% of the households use LPG/PNG. Biogas potential from animal waste and agricultural waste was calculated approximately as two crore m3/year and thirty-four crores m3/year. The normalised value of the total available biomass in Hooghly district is 0.1808. No hydropower plant exists, nor the site has been identified in the district

To promote sustainable development creating awareness, educating people about renewable energies, sanitation, maintaining decorum of the properties by not destroying or keeping them clean, Adopting Public-Private partnerships, upgrading staff and facilities, etc. Drip and Sprinkler irrigation, Integrated farming structures, adopting greenhouse farming with organic farming, and encouraging farmers for adapting different crop cultivation and various irrigation methods, adopt resources conservation technologies, Various measures such as eco-tourism should be taken to improve tourism and enhance the use of renewable energy especially by creating awareness. Along with focusing on agriculture practices Bee culture, jute manufacturing facilities, off-season vegetables such as cauliflower, cabbage, promoting medicinal crops such as ekangi, fruits, dragon fruit and strawberry cultivation, adapting methods to lessen losses due to seasonal variations in rainfall. Monitoring and training programs and awareness and introducing KVKs instruction, etc.

1. DISTRICT OVERVIEW

1.1 INTRODUCTION

Hooghly district is one of the districts of the Indian state of West Bengal. The district is named after the Hooghly River. Geographical location of the district is between 23º 01'20" N to 22º 39'32"N latitude and 88º 30'15"E to 87º 39'32" E longitude. The headquarters of the district are at Hooghly-Chinsura (*Chuchura*). There are four subdivisions: Chinsurah Sadar, Srirampore, Chandannagore, and Arambagh. There are 18 development blocks, 12 municipalities and 210 gram panchayats in this district. According to the 2011 census Hooghly district has a population of 5,519,145.

The district is flat, with no place having an elevation of more than 200 meters. The River Hooghly borders it to the east. Another major river is the Damodar. According to genesis and evolution of landforms, the district can broadly have divided into two divisions i.e.; i. Old alluvial plains to the west of river Dwarakeswar ii. The monotonous level alluvial plains in the east which can be further divided into a. Natural levee b. Meander floor plain c. Alluvial plain. Along the bank of river Hooghly, the district is economically better-off both in terms of agriculture and industry. It is among the very few districts in West Bengal which successfully adopted the strategy of green revolution especially with respect to rice and potato cultivation. The river belt of Hooghly is heavily industrialized. The district has the experience of first wave of industrialization with the setting up of jute mills along the Hooghly river bed during the British era.

Hooghly is one of the most economically developed districts in West Bengal. It is the main jute cultivation, jute industry, and jute trade hub in the state. The jute mills are along the banks of the river Hooghly in Tribeni, Bhadreswar, Champdani and Sreerampur. There are a number of industrial complexes including one of the largest car manufacturing plants in India, the Hindustan Motors plant in Uttarpara.

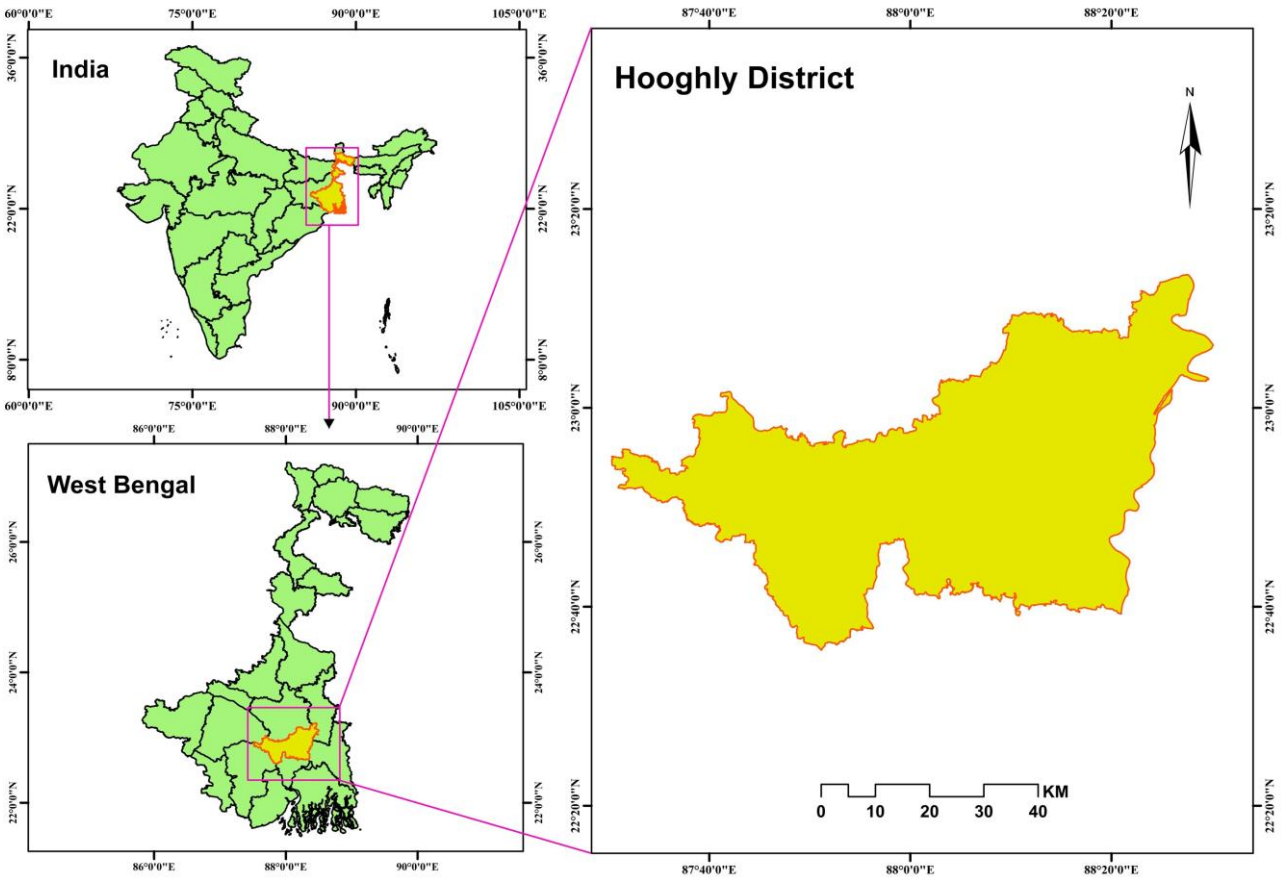


Figure 1 Map of the district

1.2 DEMOGRAPHIC PROFILE OF HOOGLY

The district has an aggregate area of 3149 sq.km. The headquarters of the district is situated at Chinsurah town. The district is situated towards the North-West of Kolkata and on the river Bhagirathi towards the Western region. Hoogly is adjoining to Bankura and Burdwan in the north, Nadia and North 24-Parganas in the south and Paschim Medinipare in the West. The district lies at a latitude between 23°01'2 0''N and 22°39'3 2''N, and at a longitude of 88°30'1 5''E and 87°30'2 0''E. The important rivers of Hooghly are the Hooghly, the Damodar, and the Rupnarayan. The district has 4 sub-divisions, 8 blocks, and 2585 villages. The four sub-divisions are Dhaniakhali, Pandua, Balagarh, and Hooghly-Chinsurah(M).

The district has a population of 5519145 out of this, 2814653 are male and the rest 2704492 are female. The urban population in the district is 38.56%, which is around 2128499, and the rural population is 61.43%, which is around 3390646. According to the Census 2011, the literacy rate in the district is 81.80%, the male literacy in the district is 67.03%, while the literacy rate for females is 76.36% in the district. According to the Census 2011, the sex ratio has improved from 947 females per thousand males in the year 2001 to 958 females per thousand males in the year 2011.

About 70% of the population of the district is dependent upon agricultural activities, because the soil is fertile. Rice is the major crop of the region. other important crops of the district are jute, vegetables, potato and orchid farming. According to Census 2001, one-third of the income in the Hooghly district comes from agricultural activities. There is a transition observed in the Hooghly district from agricultural activities to non-agricultural activities. Furthermore, the economy is also impacted by Micro and Small-Scale Enterprises (MSSEs).

1.3 ECONOMIC PROFILE OF HOOGLY

The primary sector contributes, on average, 21.52% to the district GDP. However, this sector's average annual growth rate from 2007-08 to 2013-14 was negative (-2.31%). Resultantly, its share decreased from 27.92% in 2007-08 to 17.36% in 2013-14. The secondary sector's share in the total GDDP decreased from 17.04% in 2007-08 to 15.03% in 2013-14 because it grew at a low rate of 3.49% per annum. The tertiary sector grew with a remarkable average annual growth rate of 9.21%, and its share increased from 55.04% in 2007-08 to 67.61% in 2013-14. Overall, the district economy grew with an average annual growth rate of 5.54% during the study period. Steps need to be taken to increase the growth of primary and secondary sectors. The tertiary sector performed relatively well during the study period.

Table 1: Trends in Gross District Domestic product in Hooghly 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
2007-08	43993	26842	86724	157559	-	-	-	-
	(27.92)	(17.04)	(55.04)	(100)				
2008 -09	42448	26056	94114	162618	-3.51	-2.93	8.52	3.21
	(26.10)	(16.02)	(57.87)	(100)				
2009-10	40496	28721	104937	174153	-4.60	10.23	11.50	7.09
	(23.25)	(16.49)	(60.26)	(100)				
2010 -11	34679	29634	112532	176845	-14.36	3.18	7.24	1.55
	(19.61)	(16.76)	(63.63)	(100)				
2011-12	34826	28314	123717	186856	0.42	-4.45	9.94	5.66
	(18.64)	(15.15)	(66.21)	(100)				
2012 -13	36050	29704	137204	202958	3.51	4.91	10.90	8.62
	(17.76)	(14.64)	(67.60)	(100)				
2013-14	37744	32676	147012	217432	4.70	10.01	7.15	7.13
	(17.36)	(15.03)	(67.61)	(100)				
Average Growth Rate					-2.31	3.49	9.21	5.54

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

The total declared area of the district is 3134.2 sq. km². The share of forest area decreased from 0.16% in 2011-12 to 0.10% in 2019-20. The share of cultivable wasteland decreased from 0.48% in 2011-12 to 0.10% in 2019-20. The share of barren and uncultivable land also decelerated from 0.06% in 2011-12 to 0% in 2019-20. The fallow land has significantly decreased over the years, from 0.38% in 2011-12 to 0.13% in 2019-20. Moreover, the net sown area (NSA) has decreased slightly over the years, from 67.42% in 2011-12 to 67.29% in 2019-20. The area under non-agricultural uses went up from 30.82% to 31.78% in 2019-20 (Table 2). The area under trees and gardens decreased from 0.67% in 2011-12 to 0.57% in 2019-20, which should be increased to achieve sustainable development goals. Overall, the land use

pattern shows that the area under fallow land and the NSA decreased, while the land usage for non-agricultural purposes increased over the years.

Table2: Trends in land use pattern in Hooghly (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	PASTURE LAND	AREA UNDER TREES AND GARDENS	NET SOWN AREA
1	2	3	4	5	6	7	8	9	10
2011-12	313.4	0.16	0.48	0.38	0.06	30.82	0.00	0.67	67.42
2012-13	313.4	0.16	0.29	0.35	0.03	30.95	0.00	0.51	67.68
2013-14	313.4	0.16	0.26	0.32	0.03	30.98	0.00	0.41	67.84
2014-15	313.4	0.16	0.22	0.29	0.03	31.21	0.00	0.41	67.65
2015-16	313.4	0.16	0.19	0.26	0.00	31.46	0.03	0.45	67.49
2016-17	313.4	0.10	0.16	0.22	0.00	31.68	0.03	0.51	67.28
2017-18	313.4	0.10	0.13	0.16	0.00	31.72	0.03	0.57	67.29
2018-19	313.4	0.10	0.13	0.16	0.00	31.75	0.00	0.54	67.29
2019-20	313.4	0.10	0.10	0.13	0.00	31.78	0.00	0.57	67.29

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

2.1.2 Trends in Operational Land Holdings

In Hooghly district, the total number of operational farms increased from 346 thousand in 2010-11 to 350 thousand in 2015-16, a net increase of 1.16%. 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 98.14% 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 marginal land holdings.

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

	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.)

Hooghly	2010-11	86.14	11.7	1.82	0.34	0	346
	2015-16	87	11.14	1.66	0.2	0	350
							[1.16]
West Bengal	2010-11	82.16	13.76	3.75	0.32	0.01	7123
	2015-16	82.81	13.41	3.53	0.24	0.01	7242
							[1.67]
Source: Compiled from https://agcensus.nic.in/. Figures in [] are percentage increase/decrease in 2015-16 over 2010-11.							

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

2.1.3.1 The Trend in Cropping Patterns

Rice dominates the agriculture of the district. Table 4 shows the area devoted to various crops over the last seven years. In 2019-20, Rice made up the highest share of GCA (50.90%). The area shared by the total cereals decreased from 53.08% in 2013-14 to 50.98% in 2019-20. The main pulses produced are Moong, Peas, and Masoor. The total pulses acreage went up from 0.07% in 2013-14 to 0.93% in 2019-20. However, the total food grain acreage decreased slightly from 53.15% in 2013-14 to 51.91% in 2019-20, mainly due to deceleration in area under cereal crops. Groundnut, mustard, and sesamum are the major oilseeds, and the total oilseed acreage rose from 11.23% in 2013-14 to 12.82% in 2019-20. Jute is a major fibre crop of West Bengal, and Hooghly is one of the prime district that grows Jute. However, area shared by Jute decreased in the district from 3.71% in 2013-14 to 2.36% in 2019-20. Potato is another important crop in the district. Its area decreased slightly from 18.50% in 2013-14 to 18.20% 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 251.23, which indicates to the intensive cultivation 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	53.02	50.81	50.77	52.09	49.86	51.25	50.90
Other Cereals	0.06	0.09	0.05	0.06	0.19	0.09	0.08
Total Cereals	53.08	50.90	50.82	52.15	50.05	51.35	50.98
Green gram (Moong)	0.02	0.02	0.02	0.21	0.23	0.15	0.13
Peas	0.04	0.04	0.02	0.04	0.13	0.08	0.11
Masoor (Lentil)	0.02	0.06	0.05	0.06	0.61	0.34	0.57
Other Pulses	0.00	0.00	0.04	0.02	0.11	0.06	0.11
Total Pulses	0.07	0.11	0.13	0.33	1.09	0.63	0.93
Total Foodgrains	53.15	51.01	50.95	52.48	51.14	51.97	51.91
Groundnuts	2.56	2.54	3.62	2.58	2.74	2.86	3.54
Mustard	2.47	2.60	1.43	1.60	1.86	2.05	2.13
Sesamum (Til)	6.03	7.51	7.70	7.14	7.64	7.59	7.13
Other Oilseeds	0.19	0.00	0.00	0.00	0.00	0.00	0.02

Total Oilseeds	11.23	12.65	12.75	11.31	12.23	12.50	12.82
Jute	3.71	4.22	2.43	2.22	2.43	3.03	2.36
Potato	18.50	18.54	20.41	19.53	19.89	18.06	18.20
Net Sown Area	39.41	39.03	38.68	41.13	40.38	40.00	40.10
Gross Sown Area (in 1000 Ha)	539.4	543.2	546.8	512.6	522.3	527.2	525.9
Cropping Intensity	253.72	256.23	258.53	243.13	247.65	249.98	249.36
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 per hectare yields of most crops vary from year to year. Rice is the main crop in the district, and its per hectare yield of 33.31 qtls in 2019-20 was low. The yield of total cereals increased from 28.24 qtls/ha in 2013-14 to 33.29 qtls/ha in 2019-20. The increase was mainly due to an increase in the yield of Rice. On the other hand, the per hectare yield of total pulses decreased from 12.50 qtls in 2013-14 to 7.55 qtls in 2019-20. The yield of total oilseeds has also decreased from 12.21 qtls in 2013-14 to 9.29 qtls in 2019-20. However, the yield of total food grains has increased from 28.21 qtls in 2013-14 to 32.83 qtls in 2019-20. The yield of jute has increased from 37.97 qtls in 2013-14 to 38.40 qtls in 2019-20, due to favourable weather conditions. The yield of potatoes has increased significantly from 208.17 qtls in 2013-14 to 330.32 qtls in 2019-20, which is a good sign for the district economy as potato is a high-value cash crop and can help in increasing the income of the farmers. In summary, all crop yields show year-over-year fluctuations, with a significant fall observed in the yield of pulses and oilseeds in the later years of the study. The lack of stability in yields makes farmers' income riskier and more unstable, requiring a solid insurance protection measure.

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

Crop/Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Rice	28.24	31.16	31.39	31.35	32.25	32.76	33.31
Total Cereals	28.24	31.14	31.37	31.35	32.21	32.74	33.29
Green gram (Moong)	10.00	10.00	10.00	9.09	15.00	13.75	17.14
Peas	15.00	10.00	10.00	15.00	12.86	15.00	15.00
Masoor (Lentil)	10.00	6.67	6.67	6.67	10.00	3.33	3.33
Total Pulses	12.50	8.33	7.14	10.00	11.40	7.88	7.55
Total Foodgrains	28.21	31.09	31.31	31.21	31.77	32.45	32.83
Groundnuts	21.38	21.59	22.37	22.12	25.59	24.37	17.04
Mustard	9.02	8.72	7.95	8.66	9.69	9.54	9.91
Sesamum (Til)	10.00	10.10	10.29	10.30	11.43	11.43	5.25
Total Oilseeds	12.21	12.14	13.47	12.76	14.33	14.08	9.29
Jute	37.97	41.03	34.43	34.25	33.04	18.46	38.40
Potato	208.17	348.17	126.64	366.04	349.31	99.10	330.32
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 (891.6 thousand tonnes) formed a major part of the total cereal production (892.6 thousand tonnes). Moreover, the production of total cereals increased from 808.4 thousand tons in 2013-14 to 892.6 thousand tons in 2019-20. Coming to pulses, Moong, Peas, and Masoor occupied the highest production, with their production being 1.2 thousand tons, 0.9 thousand tons, and 1 thousand tons, respectively, in 2019-20. Although these pulses show variation in production across years, they still represent around 83.78% of the total pulse production. Groundnut, Sesamum and Mustard production was 31.7 thousand tons, 19.7 thousand tons, and 11.1 thousand tons, respectively, representing around 99.84% of the total oilseed production in 2019-20. In fibre crops, Jute has the highest production, however its production has decreased from 75.9 thousand tons to 47.6 thousand tons, over the years. Potato is a major crop in the district and its production also significantly increased from 2077.5 thousand tons in 2013-14 to 3161.20 thousand tons in 2019-20. Looking at the annual production data of various crops, we find that the production of total cereals, pulses, and oilseeds has significantly increased, which can be further increased by providing proper insurance arrangements so that farmers may take more risks and diversify their production.

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

Crop/Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Rice	807.7	860	871.3	837.1	839.7	885.1	891.6
Other Cereals	0.7	1	0.5	0.8	2.4	1.3	1
Total Cereals	808.4	861	871.8	837.9	842.1	886.4	892.6
Green gram (Moong)	0.1	0.1	0.1	1	1.8	1.1	1.2
Peas	0.3	0.2	0.1	0.3	0.9	0.6	0.9
Masoor (Lentil)	0.1	0.2	0.2	0.2	3.2	0.6	1
Other Pulses	0	0	0.1	0.2	0.6	0.3	0.6
Total Pulses	0.5	0.5	0.5	1.7	6.5	2.6	3.7
Total Foodgrains	808.9	861.5	872.3	839.6	848.6	889	896.3
Groundnuts	29.5	29.8	44.3	29.2	36.6	36.8	31.7
Mustard	12	12.3	6.2	7.1	9.4	10.3	11.1
Sesamum (Til)	32.5	41.2	43.3	37.7	45.6	45.7	19.7
Other Oilseeds	0	0.1	0.1	0	0	0	0.1
Total Oilseeds	74	83.4	93.9	74	91.6	92.8	62.6
Jute	75.9	94.0	45.8	39.0	42.0	29.5	47.6
Potato	2,077.50	3,506.10	1,413.30	3,664.10	3,629.30	943.4	3,161.20

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 (3.09%), followed by potato (5.50%) and sesamum (8.42%), and the highest in Masoor (106.21%). The variability in the area under jute is 28.11%. The variability in the area under total pulses (88.24%) is much higher than in the area under total cereals (3.03%). Since Rice dominates the production, the variability in the area under total food grains is, therefore, relatively low (2.38%). Variability in the area under total oilseeds is 6.65%.

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	272.13	8.41	3.09	856.07	29.78	3.48	31.49	1.64	5.21
Total Cereals	272.60	8.25	3.03	857.17	29.76	3.47	31.48	1.64	5.20
Green gram (Moong)	0.59	0.48	82.72	0.77	0.68	87.83	12.14	3.13	25.79
Peas	0.34	0.23	67.06	0.47	0.33	70.05	13.27	2.36	17.82
Masoor (Lentil)	1.29	1.37	106.21	0.79	1.11	141.43	6.67	2.72	40.82
Total Pulses	2.47	2.18	88.24	2.29	2.23	97.45	9.26	2.07	22.40
Total Foodgrains	275.07	6.55	2.38	859.46	30.19	3.51	31.27	1.50	4.79
Groundnuts	15.51	2.61	16.80	33.99	5.58	16.42	22.07	2.70	12.24
Mustard	10.73	2.39	22.26	9.77	2.36	24.16	9.07	0.69	7.61
Sesamum (Til)	38.49	3.24	8.42	37.96	9.31	24.54	9.83	2.10	21.42
Total Oilseeds	64.89	4.32	6.65	81.76	11.95	14.61	12.61	1.70	13.47
Jute	15.53	4.37	28.11	53.41	22.92	42.91	33.94	7.38	21.76
Potato	101.00	5.55	5.50	2627.84	1136.36	43.24	261.11	114.23	43.75

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

The variability of production depends on the variability of the cultivated area and the variability of the yield. The highest variability in production is observed in Masoor (141.43%), followed by green gram (87.83%) and peas (70.05%). The variability in jute production is 42.91%, that is quite high. The variability in the production of total oilseeds is 14.61%. Improvement in crop insurance conditions and better market accessibility can lower this variation. Variability is lowest in Rice (3.48%), followed by groundnuts (16.42%) and mustard (24.16%).

In the case of yield, the highest variability is estimated in potato (43.75%), followed by Masoor (40.82%), and Moong (25.79%). The variability in yield of jute is 21.76%. Yield variability in total pulses (22.40%) is much higher than in total cereals (5.20%). Several factors, such as climate change, market prices, rainfall patterns, etc., influence the variability in agricultural production.

2.1.6 Consumption of Chemical Fertilizers

Table 8 shows the trends in the use of chemical fertilizers in agriculture. The recommended nitrogen to phosphorus and potassium ratio is 4:2:1, which is not maintained in the district. For example, in 2013-14, nitrogen represented 43.93% of the total fertilizers used, while the proportions of phosphorus and potassium were 26.46% and 29.61%, respectively. In 2019-20, however, the nitrogen and potassium share decreased to 41.10% and 27.56%, respectively, while the phosphorus share has increased to 31.34%. The use of potassium is more than the recommended ratio, while nitrogen and phosphorous usage are less than the recommended ratio. The table also shows that fertilizer consumption varies yearly, which can be due to several factors such as rainfall patterns, cultivation patterns, etc. As the overall use of chemical fertilizers has increased in the district from 199.90 kg/ ha GSA in 2013-14 to 265.52 kg/ ha GSA in 2019-20, the authorities should take steps to reduce their consumption as the chemicalization of agriculture degrades soils and water resources. There is a need to incentivize the farmers to use organic and bio fertilizers.

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

Fertilizer/Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Nitrogen	87.81	100.98	110.13	105.55	98.29	104.29	109.13
Phosphorous	52.90	76.85	89.39	89.62	85.81	79.74	83.21
Potassium	59.19	70.50	77.17	74.80	74.99	67.52	73.18
Total	199.90	248.33	276.70	269.97	259.10	251.56	265.52
GSA (1000 Ha)	539.4	543.2	546.8	512.6	522.3	527.2	525.9

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

2.1.7 Trends in Livestock Sector

The total number of cattle decreased from 1038 thousand in 2003 to 913 thousand in 2019, a net decrease of 12.02%. The decrease in total cattle has been due to a significant decline in adult female cattle (from 403 thousand to 391 thousand) and adult male cattle (from 178 thousand to 73 thousand). Moreover, the number of young cattle decreased slightly from 456 thousand to 448 thousand in the same period. Cattle represent around 96.88% of the total large ruminants. On the other hand, total buffaloes have increased from 34 thousand in 2003 to 35 thousand in 2019, a net increase of 4.26%. The increase is due to an increase in adult female buffaloes from 16.26 thousand in 2003 to 18.89 thousand in 2019 and young buffaloes from 9.46 thousand in 2003 to 10.51 thousand in 2019. Buffaloes represent 3.11% of the total large ruminants. However, total sheep decreased from 2.67 thousand in 2003 to 1.66 thousand in 2019, a net decrease of 37.82%. Total goats also decreased from 1146 thousand in 2003 to 886 thousand in 2019, a net decrease of 22.67%. Total pigs have also decreased from 56.68 thousand in 2003 to 16.67 thousand in 2019, a net decrease of 70.58%. The total livestock population has decreased in the district from 2277 thousand in 2003 to 1853 thousand in 2019, a net decrease of 18.63%. Thus, comparing the size of livestock in 2003 to 2019, we observe a steep decline in it, mainly due to male ruminants.

Notably, the number of female buffaloes has increased over the period, indicating the growth of livestock products. The substantial decline in the number of male cattle and male buffaloes also shows the rising

farm mechanization and declining relevance of animal power, mainly because of the high maintenance cost of livestock.

Table 9:Trends in Livestock population (in 1000 numbers) in Hooghly				
Category	**2003**	**2007**	**2012**	**2019**
Cattle Total	1037.51	960.84	956.13	912.75
Cattle Adult Male	178.36	63.5	51.11	73.98
Cattle Adult Female	402.82	426.51	326.15	390.95
Cattle Young Total	456.33	470.83	578.87	447.82
Cattle Share in Large Ruminant (Percent)	96.85	96.85	97.56	96.28
Buffalo Total	33.79	31.3	23.92	35.23
Buffalo Adult Male	8.07	7.5	6.82	5.83
Buffalo Adult Female	16.26	17.97	12.79	18.89
Buffalo Young Total	9.46	5.83	4.32	10.51
Buffalo Share in Large Ruminant (Percent)	3.15	3.15	2.44	3.72
Sheep Total	2.67	5.5	0.62	1.66
Sheep Share in Small Ruminant (Percent)	0.23	0.72	0.11	0.19
Goats Total	1146.4	759.72	553.78	886.41
Goats Share in Small Ruminant (Percent)	99.77	99.28	99.89	99.81
Pigs Total	56.68	29.06	21.58	16.67
Livestock Total	2277.09	1786.44	1556.11	1852.71
Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/				

2.1.8 Trends in Milk Production

Table 10 shows the trends in Milk Production in Hooghly over the years. Cow milk has the largest share in milk production. However, cow milk production decreased by 34.36% during 2011-12 to 2015-16. Buffalo milk production also decreased from 31 thousand tons in 2011-12 to 20 thousand tons in 2015-16. Moreover, the total milk production reduced from 482 thousand tons in 2011-12 to 316 thousand tons in 2015-16, majorly due to a decrease in cow milk production. There is a need to incentivize dairy farming to improve the cattle and buffaloes' milking productivity.

Table10: Trends in Milk Production (1000 tons)					
Source/Year	**2011**	**2012**	**2013**	**2014**	**2015**
Total Cow Milk Production	451	470	474	359	296
Total Buffalo Milk Production	31	32	33	22	20
Total Milk Production	482	502	507	381	316
Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/					

2.1.9 Trends in Fishery Production

Table 11 shows the trends in Fish Production in Hooghly as compared to the total fish production in West Bengal. Fish Production was 93197 tons in 2011-12 in Hooghly which increased to 96180 million tons in

2014-15. Hooghly represented around 6.33% of the total fish production in West Bengal in 2011-12. However, its share decreased to 5.94% in 2014-15.

Table11: Trends in fish production (in tons) in Hooghly				
District/Year	2011-12	2012-13	2013-14	2014-15
Hooghly	93197	83337	96168	96180
West Bengal	1472069	1488811	1580647	1617319
Source: http://wbpspm.gov.in/ and http://data.icrisat.org/district-level-data/				

2.2 FORESTRY

Baseline Data

According to the Forest Survey 2021, the total Forest Cover in the State is 16831.87 sq. km which is 18.96 % of the State's geographical area. The state has 3036.51 sq. km. under very dense forests, 4208.37 sq. km. under moderately dense forests and 9586.99 sq. km. under open forests.

According to the 2021 Forest survey, forests cover of the district is 5.07% out of the total geographical area which is 3149 sq. km. With respect to 2019 forest assessment there has been decrease in the forest area of the district by 0.20 sq. km.

The district has a total of 159.80 sq. km. under the forests out of which 14 sq. km. is under moderately dense forests and 145.80 sq. km under the open forests. The district does not has any land area under very dense forests and scrubs as depicted in Fig. 1.

The district has 1330 ha of cultivable wasteland, 340 ha of land as current fallow and 100 ha under other fallow.

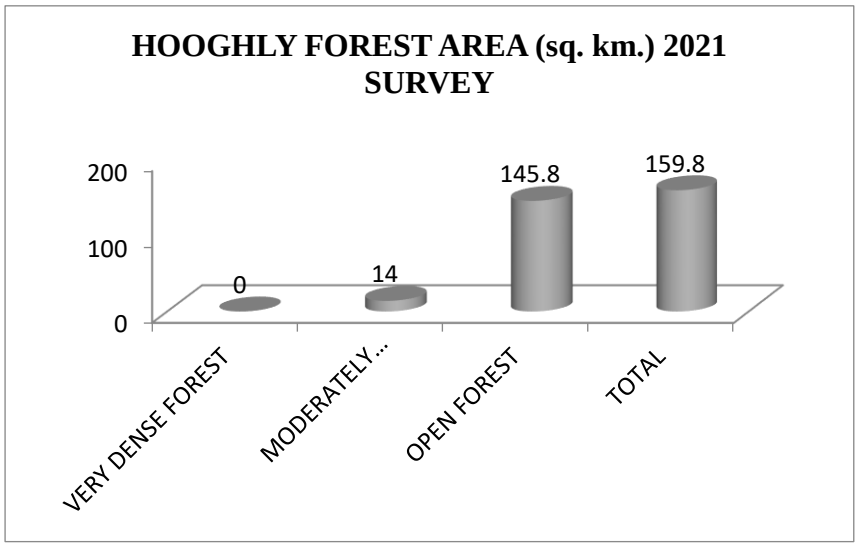


Fig. 1

2.2.1. Biodiversity

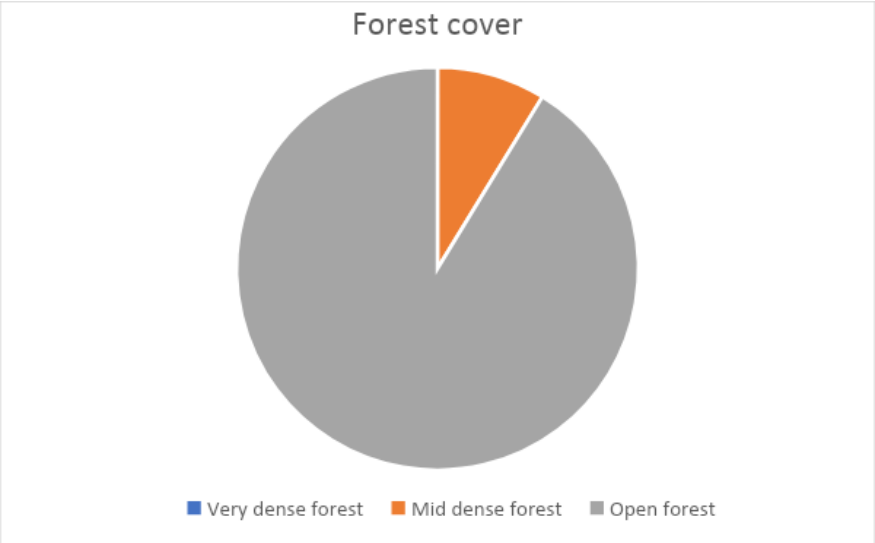
The district's biodiversity data includes various crop production, livestock population, bird species, and forest cover. The crop production trend shows an increase in crop production. Forest data shows that forest cover was increased by 5.08 % in 2019. There are 414 bird species and twenty threatened/rare species and two introduced species of bird in the district.

Table 1 Bird species recorded in the district.

Number of species	414
Number of rare/accidental species	20

Table 2 Forest cover in a square kilometer.

Geographical area	Very dense forest	Mid dense forest	Open forest	Total	% Of Geographical area	Change with respect to 2017 assessment	Scrub
3149	0	14	146	160	5.08	0	0



2.3 TOURISM

- **_WEST BENGAL: YEAR WISE TOURIST ARRIVALS (2001 TO 2020)**

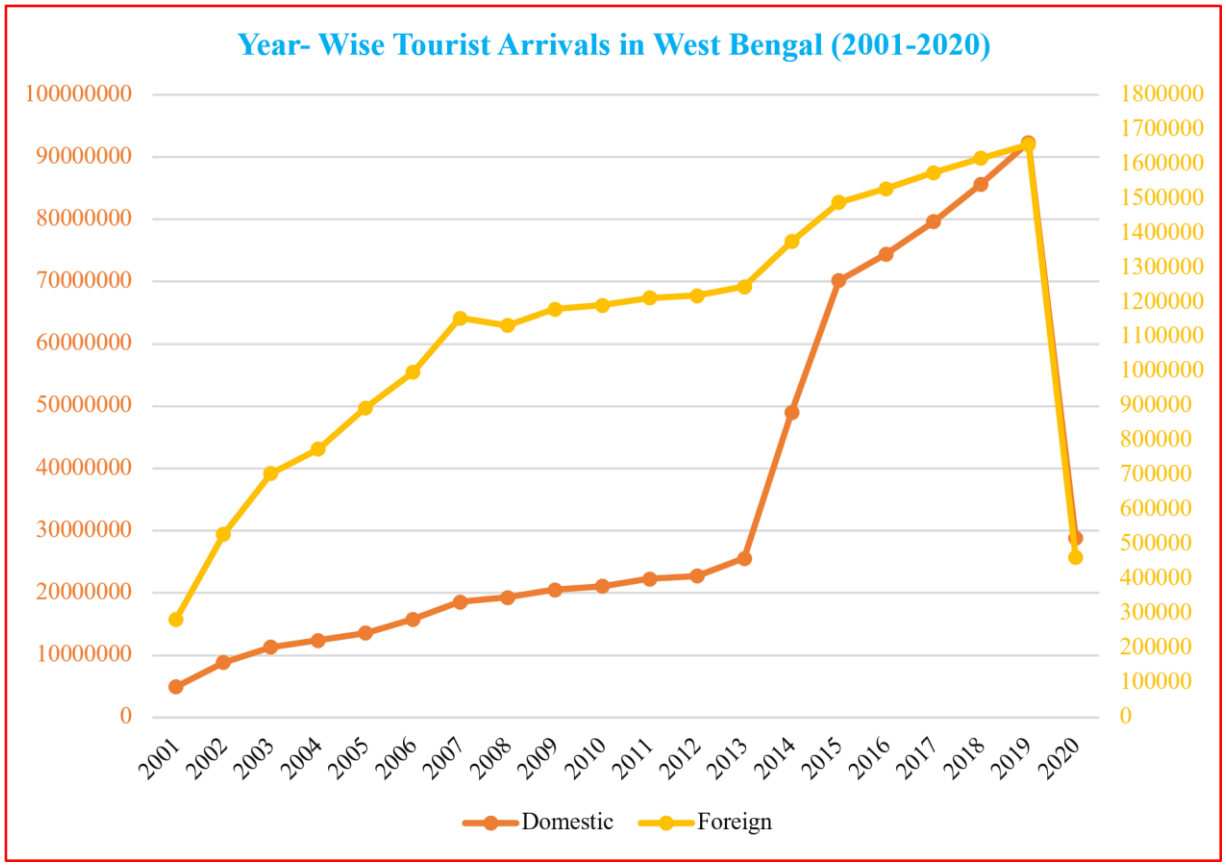
Table: 1 West Bengal Year Wise Tourists Arrivals (2001 to 2020)

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

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



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

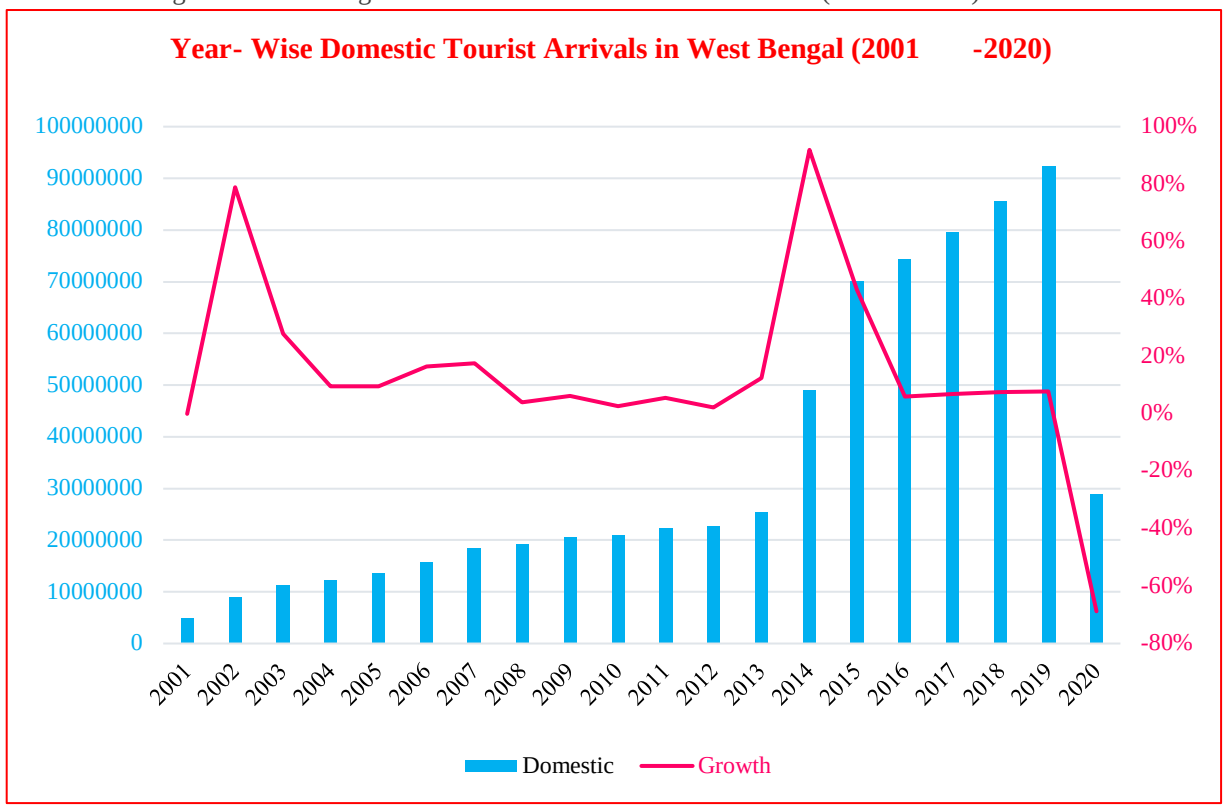


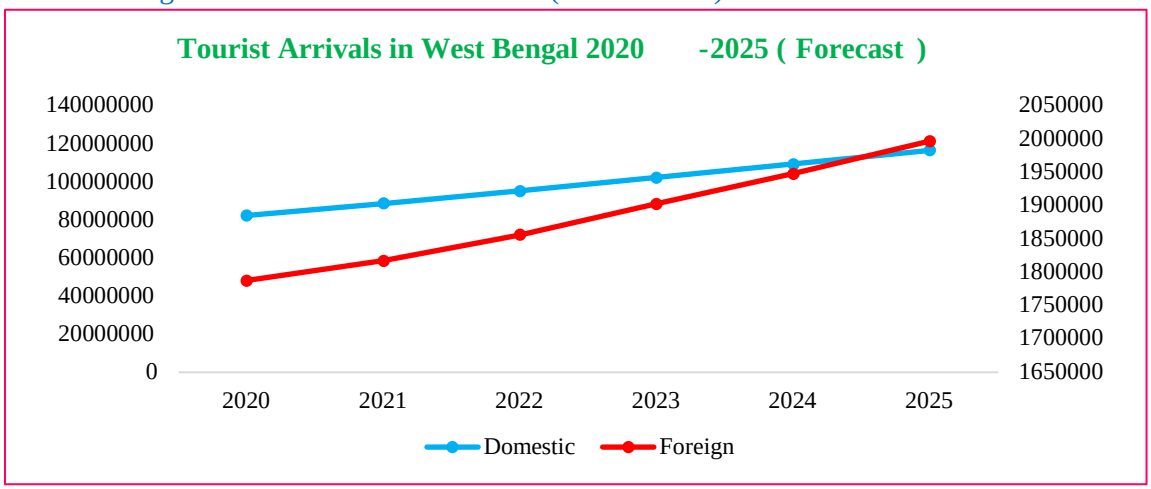
Figure: 3 West Bengal: Year Wise Foreign Tourists Arrivals (2001 to 2020)

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

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

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

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



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

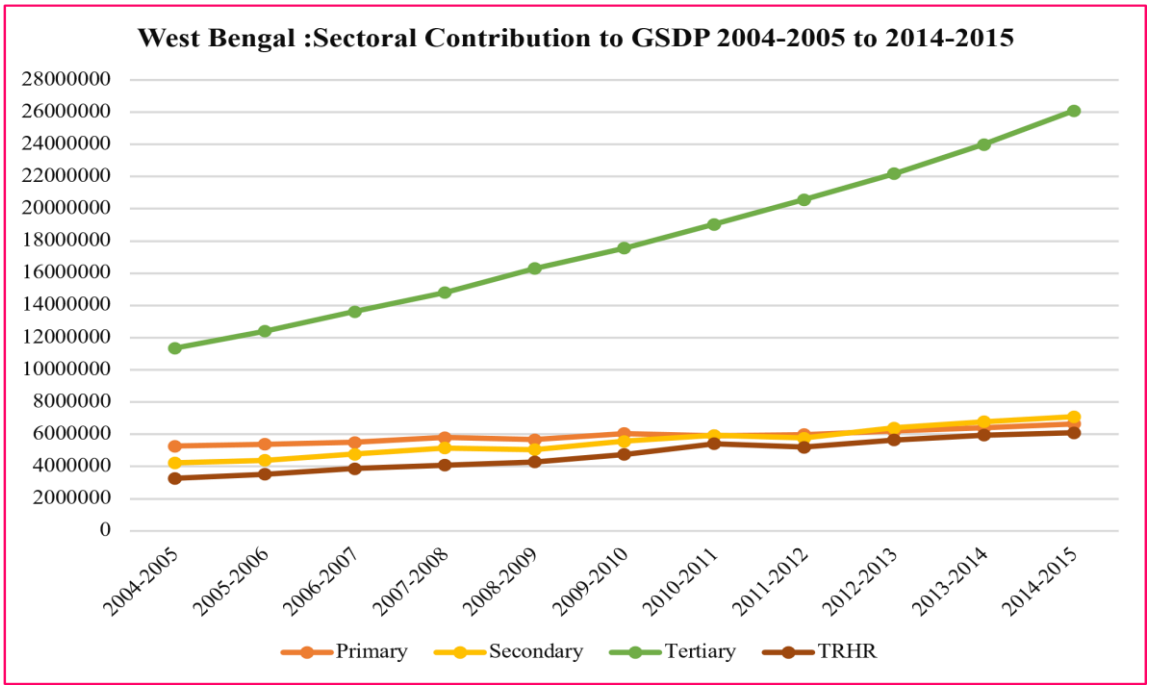
○ Table: 3 Sectoral Contribution to GSDP West Bengal 2004-2005 to 2014-2015

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

2014-2015	6645064 (16.68%)	7099285 (17.82%)	26094302 (65.50%)	6102731 (23.39%)

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

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



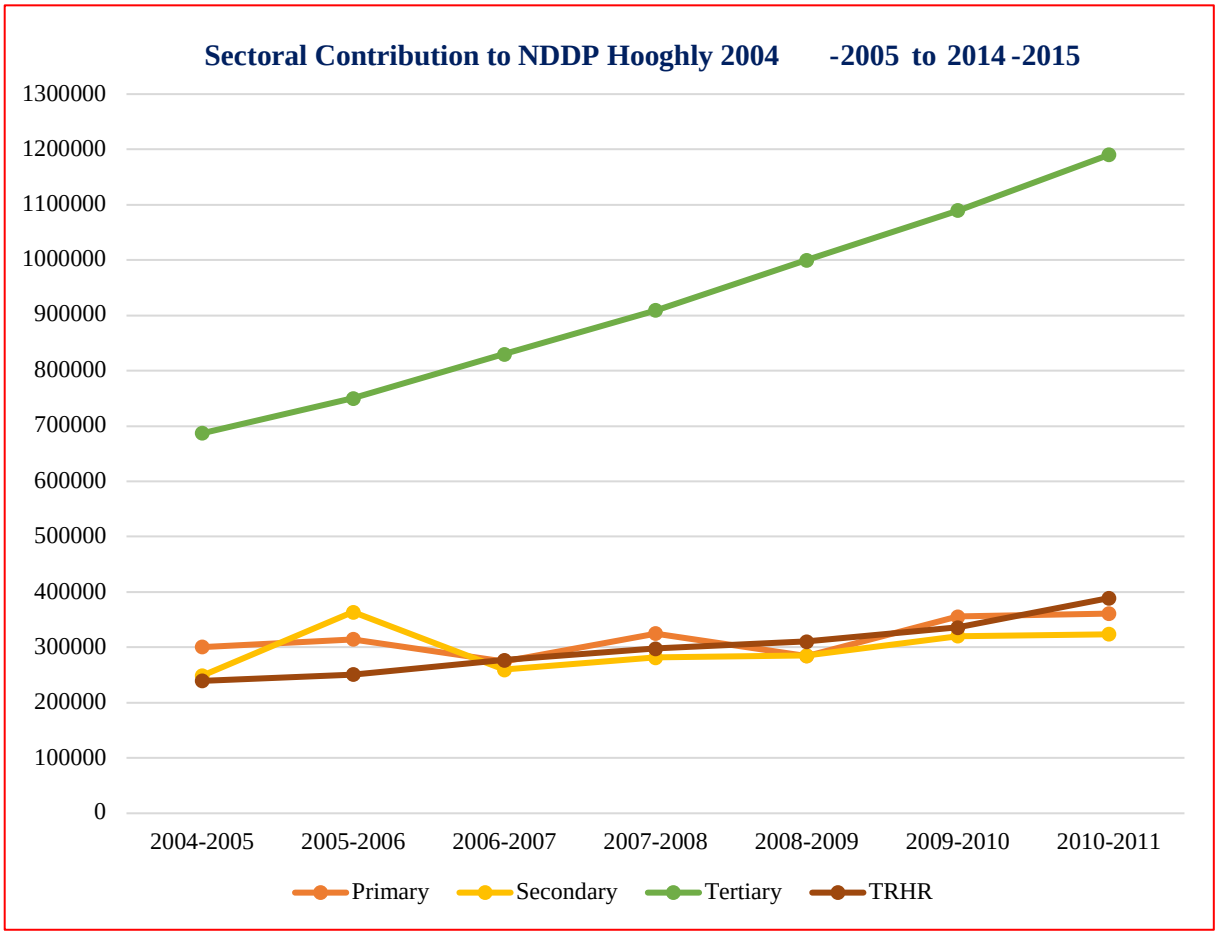
HOOGHLY: SECTORAL CONTRIBUTION TO NDDP (2004-2005 TO 2010-2011)

- *Table: 4 Sectoral Contribution to NDDP Hooghly2004-2005 to 2010-2011*

Year	Primary	Secondary	Tertiary	TRHR as % of Tertiary
2004-2005	300600 (24.32%)	248666 (20.12%)	686917 (55.57%)	2393553 (34.84%)

2005-2006	314268 (22.00%)	363911 (25.48%)	750289 (52.52%)	250977 (33.45%)
2006-2007	274365 (20.11%)	259792 (19.04%)	830073 (60.85%)	277095 (33.38%)
2007-2008	324682 (21.42%)	281652 (18.58%)	909396 (60.00%)	297996 (32.77%)
2008-2009	284737 (18.13%)	285174 (18.16%)	1000273 (63.70%)	310312 (31.02%)
2009-2010	355475 (20.13%)	320477 (18.15%)	10898873 (61.72%)	335933 (30.82%)
2010-2011	360949 (19.25%)	323602 (17.26%)	1190192 (63.49%)	388972 (32.68%)

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



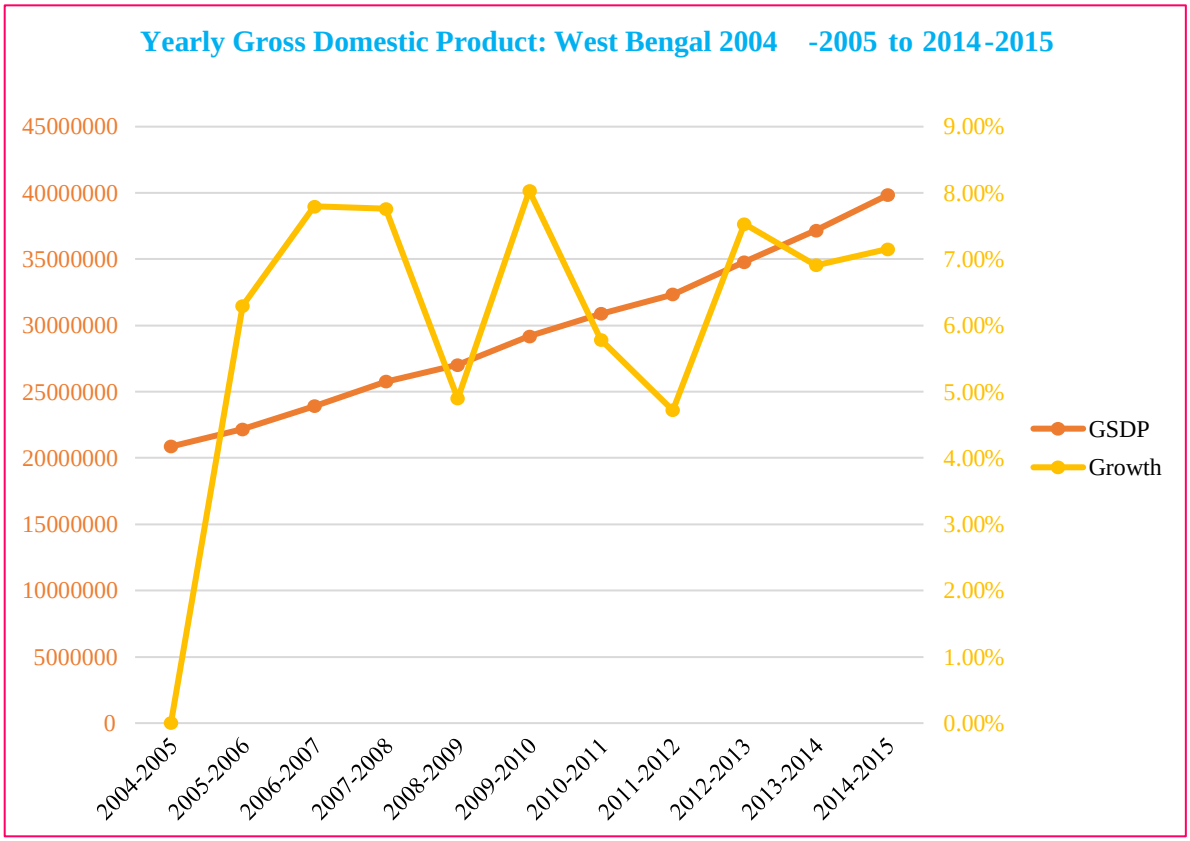
WEST BENGAL: GSDP GROWTH RATE AT CONSTANT PRICE (2004-2005 TO 2014-2015)

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

Year	GDDP	Growth

2004-2005	20865636	0
2005-2006	22178946	6.29%
2006-2007	23907712	7.79%
2007-2008	25763218	7.76%
2008-2009	27024826	4.90%
2009-2010	29195496	8.03%
2010-2011	30883705	5.78%
2011-2012	32341698	4.72%
2012-2013	34777383	7.53%
2013-2014	37179504	6.91%
2014-2015	39838651	7.15%

Source: Data Compiled from Department of Planning & Statistics, Govt. of West Bengal Figure: 7 GSDP Growth Rate at Constant Price: West Bengal 2004-2005 to 2014-2015



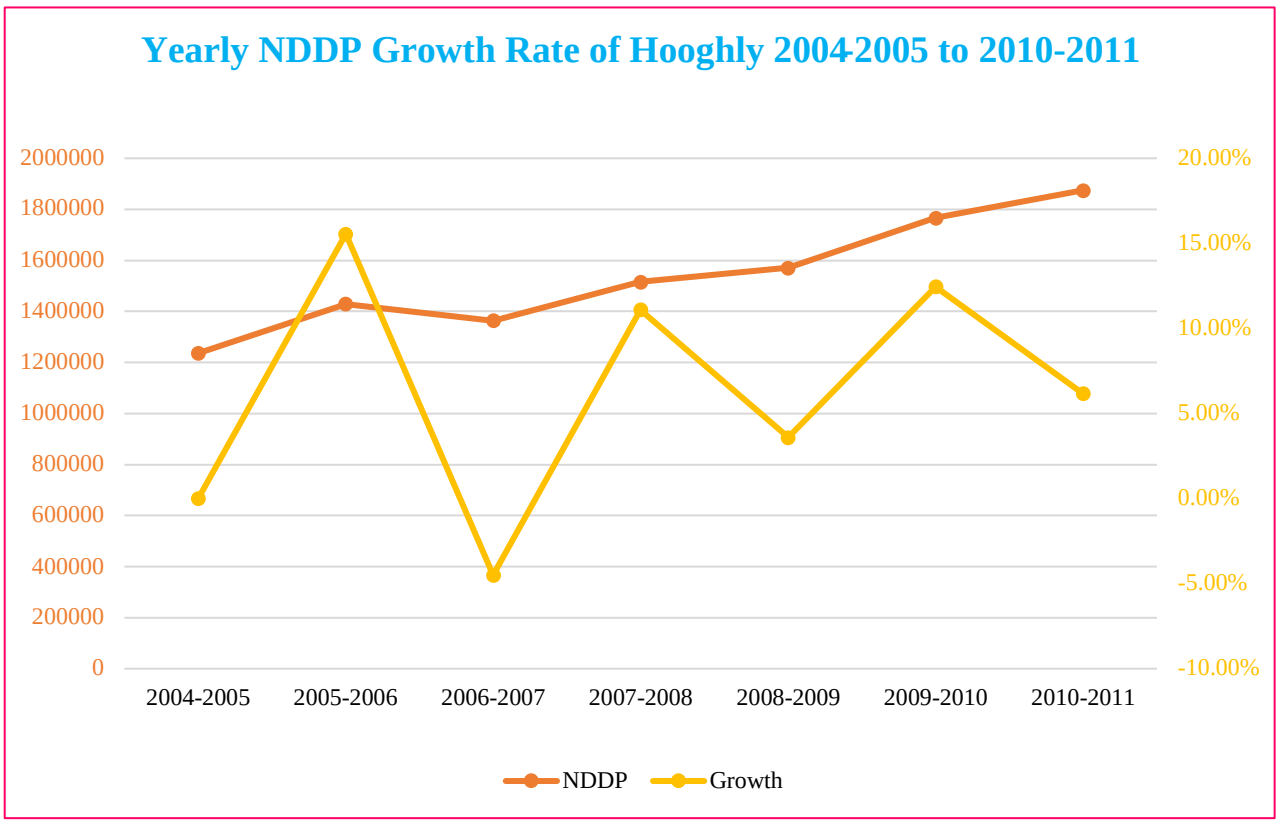
Hooghly: NDDP Growth Rate at Constant Price (2004-2005 to 2010-2011)

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

Year	GDDP	Growth
2004-2005	1236183	00
2005-2006	1428468	15.55%
2006-2007	1364230	-4.50%
2007-2008	1515730	11.11%

2008-2009	1570184	3.59%
2009-2010	1765825	12.46%
2010-2011	1874743	6.17%

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



(*Compiled from Department of Planning & Statistics, Govt. of West Bengal*)

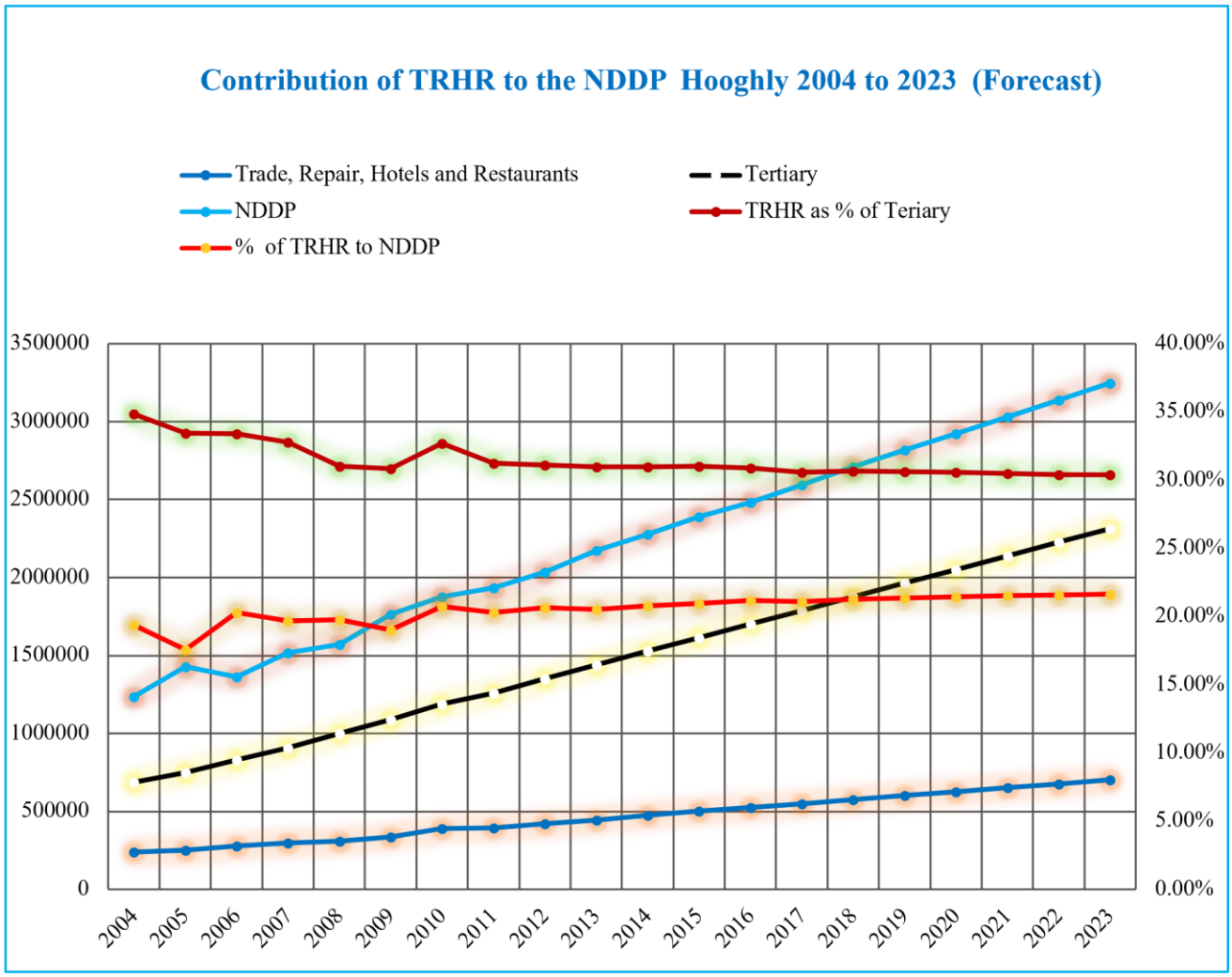
HOOGHLY: CONTRIBUTION OF TRHR TO THE NDDP AT CONSTANT PRICE (2004 TO 2023)

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

Year	Trade, Repair, Hotels and Restaurants	Tertiary	TRHR as % of Tertiary	NDDP	% of TRHR to NDDP
2004	239353	686917	34.84%	1236183	19.36%
2005	250977	750289	33.45%	1428468	17.57%

2006	277095	830073	33.38%	1364230	20.31%
2007	297996	909396	32.77%	1515730	19.66%
2008	310312	1000273	31.02%	1570184	19.76%
2009	335933	1089873	30.82%	1765825	19.02%
2010	388972	1190192	32.68%	1874743	20.75%
2011	393232	1259458	31.22%	1935959	20.31%
2012	420425	1351111	31.12%	2035533	20.65%
2013	446155	1440505	30.97%	2174447	20.52%
2014	473575	1529342	30.97%	2278486	20.78%
2015	501470	1615735	31.04%	2391160	20.97%
2016	525500	1701878	30.88%	2482590	21.17%
2017	546935	1787723	30.59%	2592831	21.09%
2018	576267	1878187	30.68%	2710350	21.26%
2019	601619	1964669	30.62%	2818674	21.34%
2020	626966	2051459	30.56%	2920945	21.46%
2021	651938	2138503	30.49%	3029315	21.52%
2022	677102	2226081	30.42%	3137555	21.58%
2023	703120	2313706	30.39%	3248674	21.64%

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



(Compiled from Department of Planning & Statistics, Govt. of West Bengal)

2.3 WETLANDS

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

Table 1: Wetland Data of Hugli 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	7	7	0	0	0	2	0	1	4	0	0	0	3
Ox-bow lakes/cut off meanders	17	17	0	0	3	8	5	1	0	0	0	0	3

High altitude Wetlands	0	0	0	0	0	0	0	0	0	0	0	0	0
Riverine Wetlands	1	1	0	0	0	0	0	1	0	0	0	0	1
Waterlogged	24	24	0	0	5	6	4	5	3	1	0	0	5
River/Stream	0	4	4	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	219	240	21	0	167	37	12	3	0	0	0	0	8
Waterlogged	5	5	0	0	2	2	0	1	0	0	0	0	0
Salt pans	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (13706)	273	298	25	13408	177	55	21	12	7	1	0	0	20

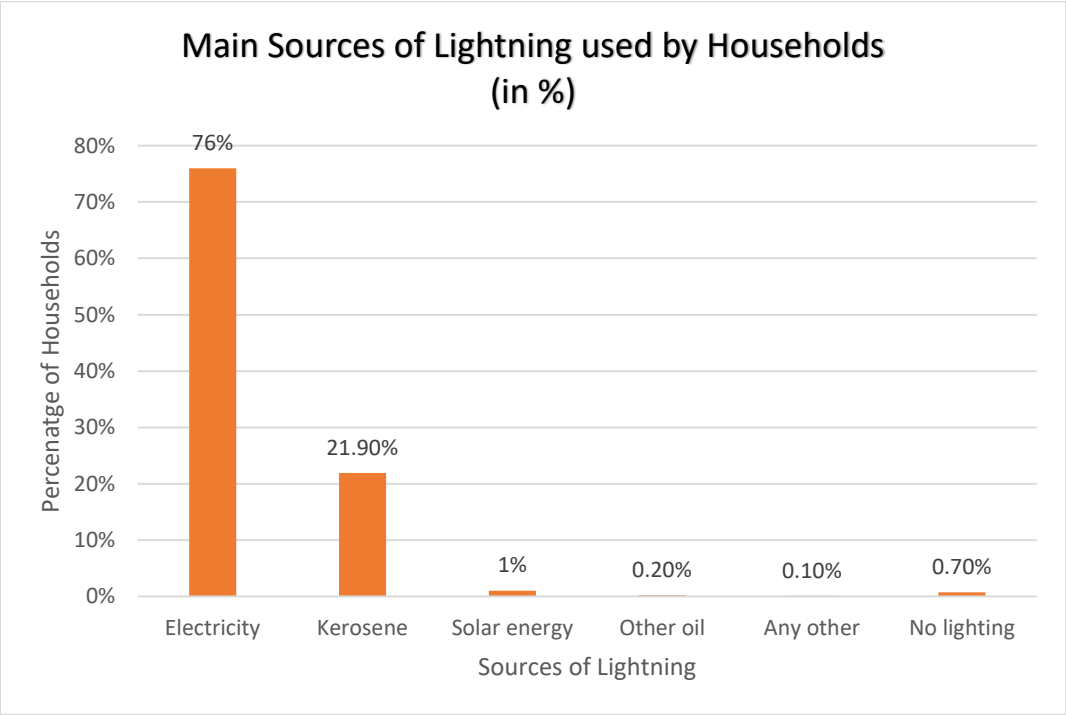
Source: National River Conservation Directorate (NRCD), National Wetland Inventory and Assessment (NWIA) Atlas

2.5. ENERGY

2.5.1. Solar

West Bengal Renewable Energy Development Agency (WBREDA) has mandated to implement renewable energy in West Bengal.

According to the Census 2011 data, main sources of lightning used by the households have been identified. Electricity is the main source of lightning used by the households in the district, as 76% of the households are dependent upon it. 21.90% of the households are dependent upon Kerosene for lightning purposes. 1% of the households are dependent upon solar energy, 0.20% of the households are dependent upon other oil, 0.10% of the households are dependent upon other sources of lightning. 0.70% of the households do not have any source of lightning.



2.5.2. Biomass

West Bengal Renewable Energy Development Agency (WBREDA) is the nodal agency of West Bengal to promote renewable energy in the district.

The total net sown area in the district is 219910 hectares, area grown more than once is 328670 hectares, and gross cropped area is 548580 hectares. The cropping intensity of Hooghly district is 249.45%. The total forest area is 530 hectares.

The important cultivated crops of the district are rice, potato, wheat, oilseeds, pulses, and maize. Potato has the highest productivity in the district.

Crop	**Productivity (kg/ha)**
Rice	8330
Potato	20889
Wheat	2110
Oilseeds	1127
Pulses	758
Maize	2531

Table 1

According to the Census 2011, the data for the type of fuel used by households for cooking has been constructed into a pie-chart. 31.40% of the households use fire-wood, 25.20% of the households use LPG/PNG, 18.90% of the households use crop residue, 13.90% of the households use coal, lignite, charcoal, and 6.60% of the households use cow dung cake for cooking purposes.

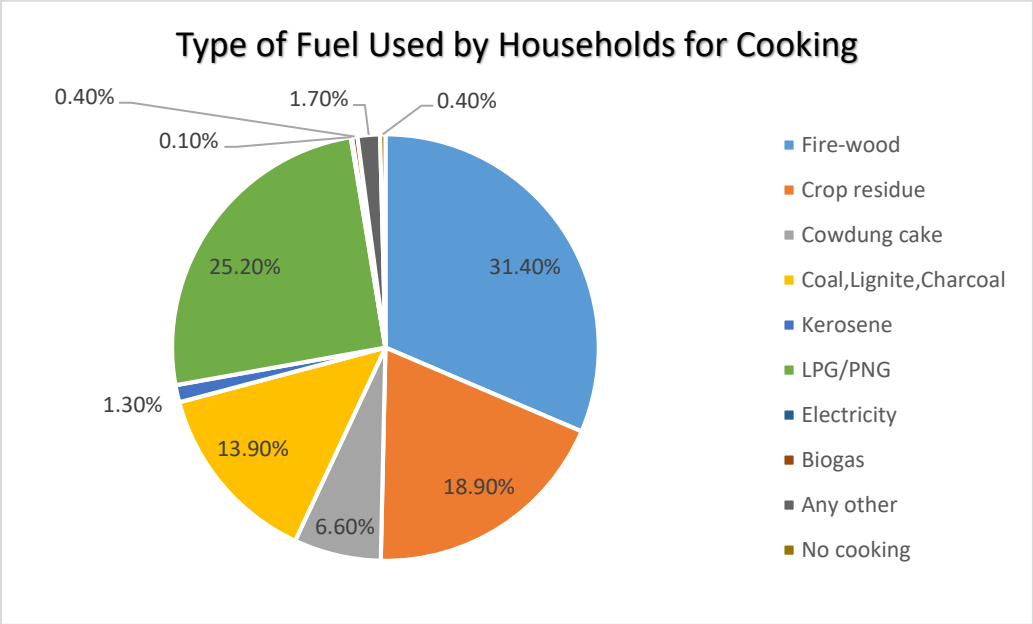


Fig. 1

The normalised value of the total available biomass in Hooghly district is 0.1808 (D, K, Mishra, & Bhattacharyya, 2016).

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 thirty-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

Forests are one of the renewable resources which may increase or decrease with time depending on natural conditions and the rate of exploitation. Tropical forests are found in the district. Apart from the social forestry, small patches of forest land are located at Arambag range (chandur forest) and Goghat -1 (Bhadur forest) in Hooghly district. This forest area is richly endowed with variety of teak species as well as Bamboo,Akashmoni,Arjun and Mennjiri, etc.

The Hugli District gains credit for an islandforest, namely SabujDwip. SabujDwip, created at the confluence of Behula and Hooghly rivers with the accumulation of sand silt and clay, spanning over an area of 180 bigha, is covered with the green canopy of Sonajhuri, Eucalyptus Mehagani Segun Kadam Chhatim Jarul Amaltas and other trees grown under the plantation programme of Social Forestry Scheme of the forest department. Sabuj Dwip is now a picnic spot and it hosts a watchtower, restaurant, children's park, flower garden including the arrangement of boat rides in its surrounding river waters. Likewise, SabujDwip, another well-known forest area in Hugli district is the Garh Mandaran. Hugli district is extremely poor in forest canopy having only deciduous trees generated through plantation. The forest cover of Hugli district in 2019, based on interpretation of IRS Resourcesat-2 LISS III satellite data of the period November 2017 to February 2018 is only 160 sq km which is 5.08% of the district's geographical area. In terms of forest canopy density classes, very dense forests area of the district is nil, 14 sq km area under moderately dense forests and 146 sq km area under open forests (Das G K, 2021)

A news article mentions that World Environment Day was celebrated in Hooghly district on Friday with mass tree plantation drives being conducted by several police stations, panchayats, NGOs and political parties. Super cyclone Amphan had caused large scale devastation in the district. So the

institutions seemed to take extra interest in tree plantation drives. However, it will be interesting to see what the Institutions do to protect the saplings planted on Friday.

3.1.1 Biodivesity

Hugli lost 2ha of tree cover between 2010 and 2021, equating to a 0.90 percent drop in tree cover since 2010, and 701t of CO_2e emissions. The peak fire season in Hugli usually starts in early January and lasts for around four 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. Hugli received a total of 176 VIIRS Alarms fire alerts between June 10th and June 6th, 2022.

3.2. ENERGY:

3.2.1. Solar

According to 'The Hindu', Eden Realty Group has launched a project of installing 4300 units of rooftop solar at Serampore in Hoogly district of West Bengal, the land which has been obtained from National Textile Corporation.

In Hooghly district of West Bengal, West Bengal Green Energy Development Corporation Limited (WBGEDCL) has announced as of 2021-22, to install and to maintain street lighting systems of 600 solar PV and 20 solar PV High Mast at four Gram Panchayat regions namely; Siakhala, Furfura, Jangipara, and Radhanagar, under Furfura Sharif Development Authority.

Moreover, in 2021, bids were invited to install and implement Component C of PM-KUSUM scheme to solarise 1.5 million grid connected agriculture pumps under the announcement by West Bengal State Electricity Distribution Company Limited (WBSEDCL) in various districts of West Bengal by 2022. In Arambagh town of Hooghly would solarise 100 agriculture pumps, each having a SPV capacity of 10 kWp. The total capacity of solarised grid connected agriculture pumps would have a capacity of 1000 kWp. Additionally, net metering under component C of PM-KUSUM scheme for agricultural consumers have been implemented by WBSEDCL in Arambagh town, having a capacity of 7.5 kWp, where 30% of the cost would be borne by the State government and 30% would be borne by the Central government.

The state Power Minister, Sovandeb Chattopadhyay proposed that big floating solar power projects could be installed at Bandel Thermal Power Unit in Hooghly district, which could have a capacity of 5 MW or greater.

3.2.2. Biomass

The total agricultural residue for biomass energy generation in Hooghly district is 1713.950 (10^3 ta^{-1}33). Moreover, the biomass residues from rice husk from rice mills/ hullers in the district is 233.66 (10^3 ta^{-1}), residues from saw mills is 1.765 (10^3 ta^{-1}), and residues from non-forest land is 140.50 (10^3 ta^{-1}). The net surplus biomass in the district is 348.017 (10^3 ta^{-1}). Furthermore, the net surplus biomass power generation potential in the district is 44.2 MW (Das & Jash, 2009).

In the Pursurah block of Hooghly district, 10 different plant species including 30 individual plants were studied to find out the biomass potential of those plants. It was estimated that the total biomass potential of those 30 individual plants in the Pursurah block is 1.892 kg (Maji, Das, & Mukherjee, 2017).

The majority of the rice mills are situated in Hooghly district and Burdwan district. There are 12 rice mills installed gasifier plants in the district of Hooghly, which comprises of 1 plant having a capacity of 120 kW and 350 kW, 2 plants having a capacity of 250 kW, and 4 plants having a capacity of 150 kW and 200 kW. The primary survey revealed that the gasifiers run for about 1 $^1/_2$ year to 2 years after starting its operations. This is due to the reason of unavailability of clean water for cooling and cleaning the system, which causes overheating and thus it reduces the lifespan of the system. Moreover, the working conditions of labourers in the factories is not good and the cost of maintenance of biomass gasifier is comparatively higher than fuel or diesel-based engines (Majhi & Jash, 2013).

3.2.3 Biogas:

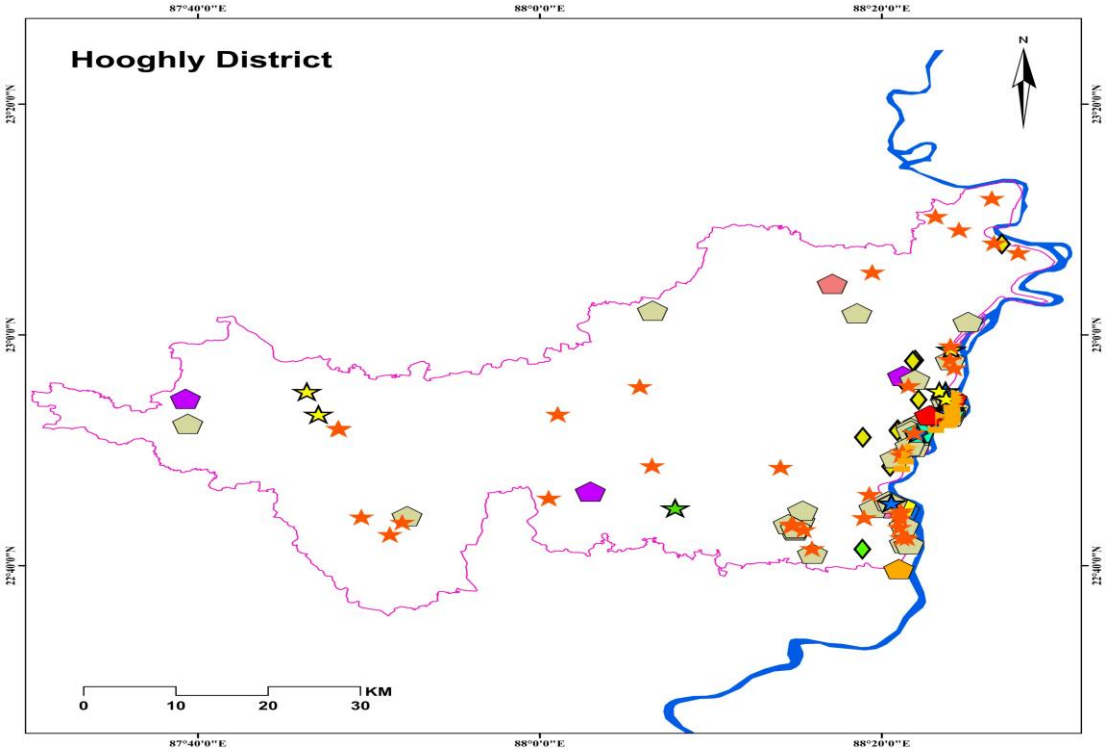
Livestock and agricultural data show a great potential of biogas in the district. Around 149 household biogas plant of capacity 2 cummec was installed in year 2010-11 in the district. Up until December 2011, roughly 11,000 household biogas plant installations had been completed in West Bengal. Thirteen sanitary landfills have been built using 25 ULBs, including a regional dump in Hooghly district established by the Kolkata Metropolitan Development Authority for six municipalities. Two of these landfills are currently active.

3.2.4. Hydropower:

In hilly locations, WBREDA has taken the lead in harnessing small and micro hydel energy in partnership with WBSEDCL. More than 50 nos. of canal crisscrossing in Hooghly district- which are mainly rainfed.

3.3 TOURISM

- *Map: 2 Tourism Sites of Hooghly District*



(Source: Nayak & Aiyazuddin, 2022)

ARCHAEOLOGICAL & HISTORICAL TOURISM

★ **Pandua:** Padua is best known for its minar and the ruins of Pandu Raja's Palace. The 13th century minar rises to a height of 125 feet. The history of Pandua traces back from the time of Chalcolithic age. It was discovered that in Pandua, there existed the archaeological site of King Pandua's palace. Pandua is best known for its minar of 13th century, which soars to a height of 125 feet. It resembles the victory pillar of the Bengal conquest. Later in Pandua, there erected a mosque called Bari Mosque. These draw a number of tourists of national and international levels.

★ **Hooghly Imambara:** The Imambara was built with money bequeathed to a trust by greatest philanthropists Hazi Muhammad Mohsin (1732-1812). It's an architectural splendour of the 19th Century, is a Holy shrine to the entire Muslim community in India. The massive Clock

Tower, a concrete Sun dial and many other interesting things are the special attraction of this spot.

★ **Chandannagar Strand:** It was built in the 1920s to honour Durgacharan Rakshit, the recipient of the French award, Legion d'honneur.it is beside the Hooghly River.

★ **Susana Anna Maria's Tomb:** Susanna Anna Maria was a Dutch lady married to an Englishman named Mr. Yeats. This Tomb is built in 1809, the octagonal structure is an ideal example of Indo–Dutch architecture. The two storied structure, with arched gateways and slender columns is crowned with a dome.

★ **Henry Martin's Pagoda:**

★ **Chandannagar Clock Tower:** The Chandannagar Clock Tower is quite famous at Strand Road. Built in 1880 and standing with pride the Clock Tower building withholds the glories of the French people. Clock towers reminds of serenity and tranquility.

★ **Chinsurah Tower Clock:** This clock tower was installed in 1914 to commemorate the life of Albert Edward (King Edward VII) who was the eldest son of Queen Victoria and Albert of Saxe-Coburg-Gotha.

★ **William Carry Museum:** The museum is about Dr. William Carey, the founder of the Serampore College. the building's name is Carey library and research centre. It has a library having the books mainly in theology. it's a three storied building.

★ **Chandannagar Museum and Indo-French Institute:** Chandannagar Museum and Indo-French Institute is an Indo-French cultural centre and museum. It was established in the 19th century by the then French Prime Minister Pompidre and Indian Prime Minister Lal Bahadur Shastri. The center features various galleries, dedicated to the French East India Company, French furniture, French periodic administration as well as Indian art and crafts.

★ **Duplex Palace Museum:** This heritage structure is situated in memory of the previous French Governor 'Duplex'.

★ **Radhanath Sikdar Himalayan Museum:** Located at strand road of Chandannagore Corporation. Museum with collection of different types gears for Himalaya excavation

★ **Chandannagar Library:** The Chandannagar Library is located at the Baghbazar of Chandannagar in Hooghly district. It is also known as the Nitya Gopal Smriti Mandir. Jadhunath Palit established the Chandannagar Library in the year of 1873. The building is built in neoclassical style influenced by European art.

★ **Uttarpara Jaykrishna Library:** Uttarpara Jaykrishna Public Library is a district library in Uttarpara municipality and is the first of its kind in Asia. Located in Uttarpara, a small town on the banks of the Hoogly river, this library was established by Babu Jaykrishna Mukherjee and opened to the public in 1859 Situated in Uttarpara-Kotrang municipality.

- ★ **Dutch Cemetery:** Dutch Cemetery is an ASI protected site. The cemetery contains an assortment of graves scattered under the shade of ancient trees. The oldest date back to 1743 while the newest one was laid in 1840. Built by Louis Taillefert.

- ★ **Danish Cemetery Serampore:** This cemetery is currently under the supervision of ASI and is a protected site.

- ★ **Crematory of William Carey Serampore:** The perimeter wall of the cemetery where 18th century British missionary and educator William Carey was interred in Serampore is intact.

- ★ **French Cemetery, Chandannagar:** It contains 150 tombs, there is also the tomb of Duplessis, the founding father of French.

- ★ **Sri Aurobindo Society:** The ancestral House of Rishi Aurobinda Ghosh is known as 'Shri Aurobindo Society', situated at the junction of Rishi Bankim Street & Aurobindo Road near Charaktala ground under Konnagar municipality.

- ★ **Abanindranath Tagore's Bagan Bari:** This place is located at 2, Mirapara Lane, PS – Konnagar, under Konnagar Municipality. This place was declared as a Heritage Place on 28th May 2007 by West Bengal Heritage Commission. This house is related with the history of Tagore Family.

- ★ **Kali Prasanna Singha's House:** Kali Prasanna Singha, well known by his pen name 'Hootum Pyancha', was a Bengali author, playwright, and philanthropist. His most famous work was the translation of the ancient Hindu epic Mahabharata into Bengali. Situated in Chandital-II block.

- ★ **Rashbehari Basu's Ancestral House:** Rash Behari Bose was born in Subaldaha village of Purba Bardhaman district of west Bengal, on 25 May 1886. In Chandernagar, Rashbehari Bose studied at Dupleix College with his cousin and friend Shrish Chandra Ghosh.

- ★ **Kanailal Vidyamandir (English and French Section):** The English section of Kanailal Vidyamandir is located on the North of the road near the Burrabazar of Chandannagar in Hooghly district. It was established by Father Barthet in 1862 at on the then Rue de Barrabazar before the Rue General Martin. The French section of Kanailal Vidyamandir is situated at the Laldighi in Chandannagar. Father Rev. Magloire Barthet founded this school.

- ★ **Keshab Chandra Nag's House:** House of Bengali mathematician, Sri Keshab Chandra Nag is situated at Gurap under Dhaniakhali Block.

- ★ **Janai Bazar Bari (Old Jamindar Bari):** About 200 years old & famous Jamindar Bari. Except this many 'Jamidar Bari' are located at Janai. Those are very old and have a historical significance.

- ★ **Registry Office Chandannagar:** It is situated at the junction of the famous Strand Road and Buddhadeb Mukhopadhyay Road in Chandannagar of Hooghly district. It was built in the

year of 1875. This nineteenth century structure is a mark of the French colonial architecture. It is considered to be the first court building in Chandannagar built by the French.

★ **Hazra Bari Rajyadharpur Ghoshpara:** Very old & famous house, about 200 years old has a historical significance.

★ **Garalgacha Jamindar Bari:** Popularly known as Babuder Bari was established in the year 1767 by 'Mukhopadhayay' family the Popular Jamindar of that time.

★ **House of Harihar:** The house of Harihar Sett is located at the Palpara of ward no. 8 of Chandannagar Municipal Corporation in Hooghly district. His two-storied mansion is the standing mark of history and heritage. In 218, the West Bengal Heritage Commission declared his house as a heritage site.

★ **Danish Governor's House:** The Danish Governor House one of the last testimonies of the Danish settlement in Bengal. It was established in early 18th Century.

★ **Sarat Chandra Birthplace:** This is a birthplace of Sahitya Samrat Sarat Chandra Chatyopadhayay. which is declared as Heritage Place.

★ **Kamarpukur:** Kamarpukur, renowned all over the world as the birthplace of the great.

Indian saint Sri Ramakrishna is frequented by lakhs of visitors every year.

★ **Lalkuthi:** Associated with Rabindranath, Situated at Telinipara, Bhadreswar. Rabindranath Tagore was visited here for few times.

★ **Raja Rammohan Roy's Birthplace:** Ram Mohan Roy was born here, May 22, 1772, at Radhanagar village, Khanakul-I Block.

★ **Debanandapur:** Debanandapur village is the birthplace of Katha Silpi Sarat Chandra Chattopadhyay, who was born on 15th September 1876. This village is one of the seven important villages, which formed the Sapta Gram during the Mughal era. The dwelling place of Sarat Chandra is still present there and is frequented by tourists year-round.

★ **Building of Champdani Municipality:** Colonial Architecture with prorch and Archaded building with corinthian columns.

★ **Victoria Hall:** It is situated within the Hugli-Chinsurah Municipality Office compound, old building of Municipal Office.

★ **Rakshit Bhavan:** The Rakshit Bhavan is located at Lalbagan in Chandannagar in

Hooghly district. It was built in the nineteenth century.

★ **Chandannagar Duplex College:** Chandernagore College is situated at Chandannagar in Hooghly district. It is the oldest college of the Hooghly district. The college was established in the year of 1862 near the Cultural Centre beside the famous strand bank of Hooghly River,

with multiple buildings. The college was founded by the French Catholic Missionary, Rev. Magloire Barthet.

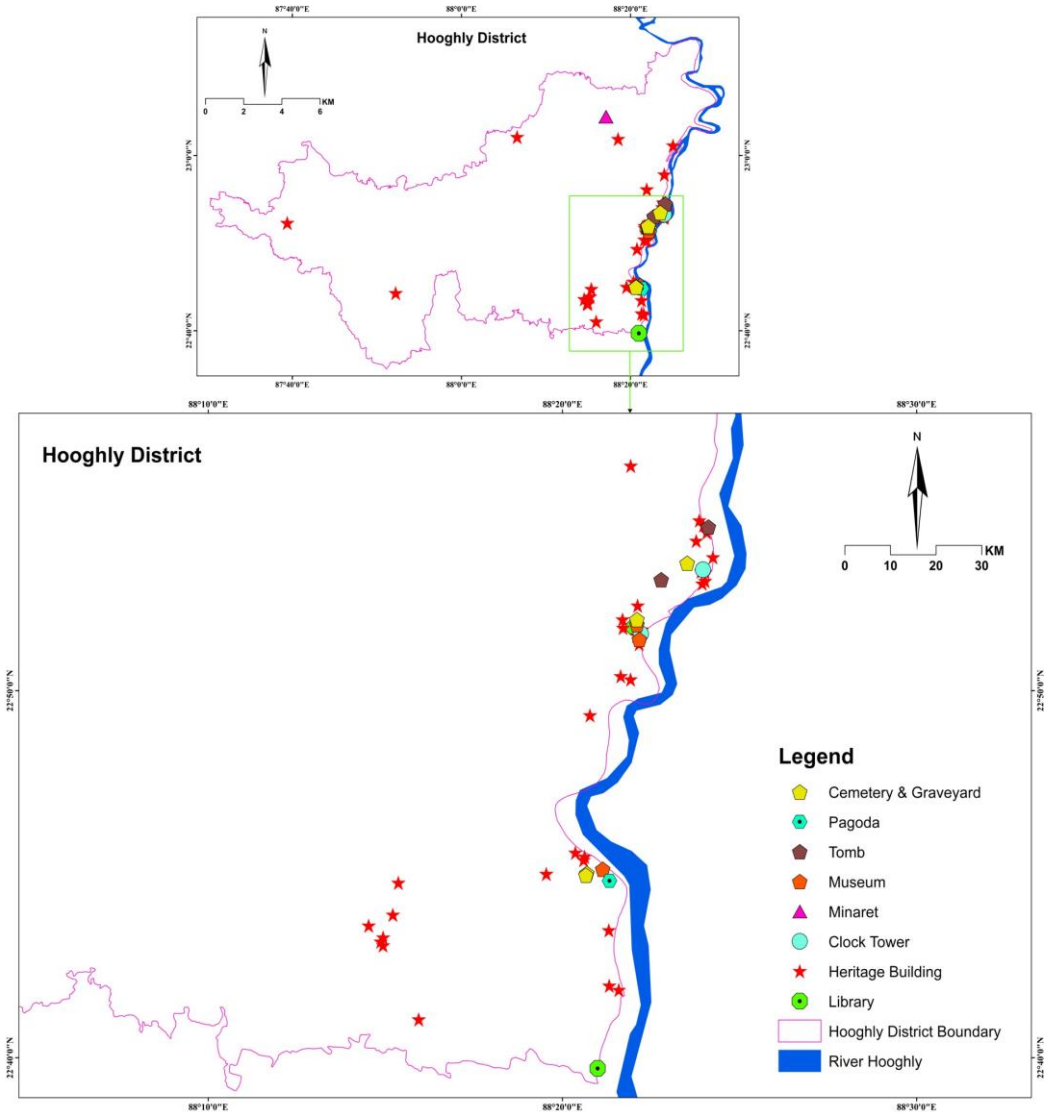
- ★ **Vidyamandir Bhawan:** Back site Mother Diary, Near DM office Hooghly, Ward no. 9. It was a shelter of freedom fighter on subjugated India.
- ★ **Hooghly Jail:** The great revolutionary poet of Bengal, Kazi Nazrul Islam was incarcerated in this solitary cell of Hooghly Jail as an ordinary prisoner from April 14, 1923, to June 17, 1923. It was here that he resorted to a prolonged hunger strike for 39 days demanding recognition as a political prisoner. He wrote a few of his famous poems during his stay at Hooghly Jail.
- ★ **Bande Mataram Bhawan (Bankim Bhawan):** Bande Mataram Bhwan (Bankim Bhwan). Joraghat West Bank of river Ganga, ward no.- 20 of Hugly- Chinsurah Municipality,
- ★ **Kalibabur Bari:** Very old and have a historical significance. Near about 300 years old & famous house.

Statue of Rashbihari Basu: Situated at Chandannagar College campus in memory of freedom fighter Rashbehari Basu.

★ **Liberty Gate:** The Liberty Gate is situated at Chandannagar on the way to Bhadreswar in Hooghly district. Initially, two gates were constructed that acted as the gateway to the French territory of Chandannagar when it was ruled by the French under British India.

★ **Itachuna Rajbari:** Itachuna Rajbari is a heritage home at Itachuna offering off-beat heritage homestay experience to the tourist in the town of Itachuna.

- *Map: 3 Archaeological & Historical Tourism Sites of Hooghly District*



(Source: Nayak & Aiyazuddin, 2022)

RELIGIOUS & SPIRITUAL TOURISM

★ **Hangseswari Temple:** Hangseswari Temple is located in Bansberia in Hooghly district. This 21 m high 19th century temple has 13 towers. The top of each tower is shaped as a lotus flower. The main deity is made up of blue-neem wood. The Temple is unique for its Terracotta work. It's repesents the yoga view of Human body.

★ **Anandamayee Temple:** Anandamayee Sakthi Pitha is also known as Ratnavali Sakthi Pitha is among the 51 Shakti Pithas of Sati.

★ **Shanderswartala Temple:** Shanderswartala Temple is the oldest temple in Chinsurah. It is about 5 km away from the Chinsurah railway station. The temple is situated on the bank of the river Ganges, north of the Dutta Ghat. The temple was established by Sidheswar Roychoudhury after the Lingam of Shiva was placed by Digambar Halder in the 16th century. There is also Durga Temple which was established in the year 1845.

★ **Nistarini Kali Bari Temple**: This is very old temple, situated beside River bank of Ganga, I was established on the year 1827 by Raja Harish Chandra Roy.

★ **Sandeswar Tala Temple:** It is located in Hugi-Chinsurah Municipality. It is situated at the banks of the River Ganges, it is very beautiful temple.

★ **Digambar Parswanath Jain Temple:** One of the oldest Jain temple in Chinsurah. The mulnayak Idol of Parshwanath is around 400 years old and the Temple was constructed in early 18th century. This temple is also known as 'Jogipada Digambar Jain Temple' of Parshwanath Lane.

★ **Tripur Sundari Temple:** The Tripur Sundari temple is located at konnagar Municipality. Lord shiva & sri Vishnu Maa Laxmi with Lord Brahma & Gomata idols are present.

★ **Mahesh Mashirbari:** It is located in Mahesh, Serampore Municipality Ward no, 25. It is a famous historical temple at Mahesh, at every year more than thousand people assemble here from different corners of West Bengal for this sacred religious occasion of Ratha yatra.

★ **Rajballav Temple:** The Rajballav temple or famously known as Terracotta temple of Jangipara is located at Jangipara in Serampore sub-division of Hooghly district. It was built in the 18th century by the Kings of Bhursut Kingdom in Rajbalhat.

★ **Nandadulal Temple:** It is located in the heart of Chandannagar in Hooghly District. Lord Krishna is the main diety. This beautiful temple was built in 1740 by Sri Indra Narayan Choudhury. It is a striking example of Bengali architecture.

Raghunath Temple: This temple is near about 400 years old under Chanditala-II block in the opposite side of the old Jamindar House i.e. ‘Baksha Mitra Bari’. This is an old Raghunath temple. It is said that Dakshineswar Temple has the architectural influence of this temple.

- ★ **Radha Krishna Temple** is Very old temple, situated at Sripur Rath tala, Balagar
- ★ **Annapurna Mandir:** Behind Bhadreswarnath Temple, A beautiful Navaratnam temple dedicated to Goddess Annapurna is one of the prime attraction of the town.
- ★ **Siddheswari Kali Mata Temple:** The Siddheswari Kali Mata Temple was established more than 800 years ago by Jatadhar Pakrashi.
- ★ **Ghanteswar Temple:** This is a famous old temple of Lord Shiva, situated in Khanakul-I. It is very old temple.
- ★ **Bishalaxmi Mandir:** The Atchala temple was built in 1859. Connected with this temple is the legend of Devi Bishalakhi and Ranjit Rai, the local Zamindar.
- ★ **Mahesh Jagannath Mandir:** It is the site of a 14th century temple of Sri Jagannath & the Rathayatra of Mahesh who is 1st took place in 1397 is the 2nd oldest in India. 2nd oldest Charriot festival of India after Rathayatra of Puri.
- ★ **Chanditala Chandi Mandir:** This old mandir is about 400 years old.
- ★ **Baro Mandir:** It is one of the oldest and famous place in Konnagar, Baro Mandir (Twelve Temples) ghat on the bank of Hugli River under Konnagar municipality. Baro Mandir alludes to the twelve Shiva Temples (six on each side) of the ghat.
- ★ **Panchabati Kali Mandir:** It is situated at Chanditala-II block. It's a locally well-known temple of the goddess Kali. Situated beside Saraswati river & near Janai High School.
- ★ **Baksha Baro Shiv Mandir:** It is located in Chanditala-II Block, It was said that in the sixteenth century when River Saraswati was navigable the Portuguese had built a small harbour here.
- ★ **Brahmadutta Mandir:** It is located in Banamalipur, Haripal Narayan Maharaj built "Char Datta Dhams" in four different directions in India.
- ★ **Baba Taraknath Temple:** The Takeshwarnath also known as Taraknath. The Taraknath temple, dedicated to the Hindu god Shiva worshiped as Taraknath, is a major pilgrimage spot in the town of Tarakeswar, West Bengal, India. Built in 1729.
- ★ **Baksha Baddima Mandir:** It is located in Chanditala-II Block near Janai Baksha PHC. It is about 350 years old.
- ★ **Baba Bhadreswarnath Shib Mandir:** Bhadreswar Nath Temple is a 500 years old Shiva temple.

Bikrampur Kalimandir: This is a famous old temple of Goddess Kali.

★ **Jhapan Temple:** Balagarh Block. It is Very old temple of Goddess Manasha

★ **Bameswari Mandir:** Bameswari Mandir is located in Dhaniakhali Block. This is a famous old temple of Goddess Kali.

★ **Gopinath Temple:** Krishnanagar, Khanakul-I, Hooghly. This is a famous old temple of Lord Krishna.

★ **Singur Dakat Kali Mandir:** It is constructed about 550-600 years ago. It was under the supervision of Raghu dakat & Pawan dakat. They started robbery after worshiping of Goddes Kali, so it's called as 'Dakat Kali'

★ **Dharmaraj Temple:** Near to Bhadreswarnath Temple this very old Temple of Dharmaraj (Yaamraj) is established around 1700 year by Chatterjee family. The Idol is made by 'touch stone'. This idol is actually worship of the cast 'bagdi'.

★ **Benimadhab Mandir:** At Bansberia Municipality. This is very old Radha-govinda temple at Bansberia Municipality,

★ **Chha Mandir:** Situated at the bank of River Hugli, ward No. 6 of Bansberia Municipality.

★ **Brindaban Chandra Jew Moth:** Nearly 600-year-old monuments of Lord Radha Krishna, the temple is ornamented with Terrakota sculpture & lot of paintings.

★ **Lahiri Baba Ashram:** The Temple is located above a small lake. The main structure of the temple is connected to the main ground via a bridge.

★ **Antpur Ramkrishna Math:** Antpur Ramkrishna Math is situated at the birthplace of Swami Premananda. A monastic disciple of Sri Ramkrishna. It was started in 1965.

★ **Furfura Sharif:** Furfura sarif is a great place of Muslim pilgrimages, especially during the Pir mela of the eastern India. Hazarat Moulana Pir Abu Bakkar Siddiqui a social and religious reformer and also spiritual guide was born there.

★ **Bari Mosque:** Pandua Bari Mosque is a long, low building established in 1300 AD. This masjid is a specimen of the typical brick style of Bengal. The building has dimension of 7041 m by 12.8 m. It has three aisles, with 21 door openings in front and three on the side.

★ **Ghazi Zafar Khan Dargah:** It is located on a small mount near Hanseswari Temple. This is an oldest mosque and oldest Islamic structure in the whole of undivided Bengal.

This darga was constructed in 1315.

★ **Dadapir Dargah**

★ **Dewan Shah Daulat Masjid**

Zafar Khan Gazi Mosque

★ **Miyapara Bada Masjid**

★ **Teen Gambuj Masjid** « **Balagarh Bon Masjid**

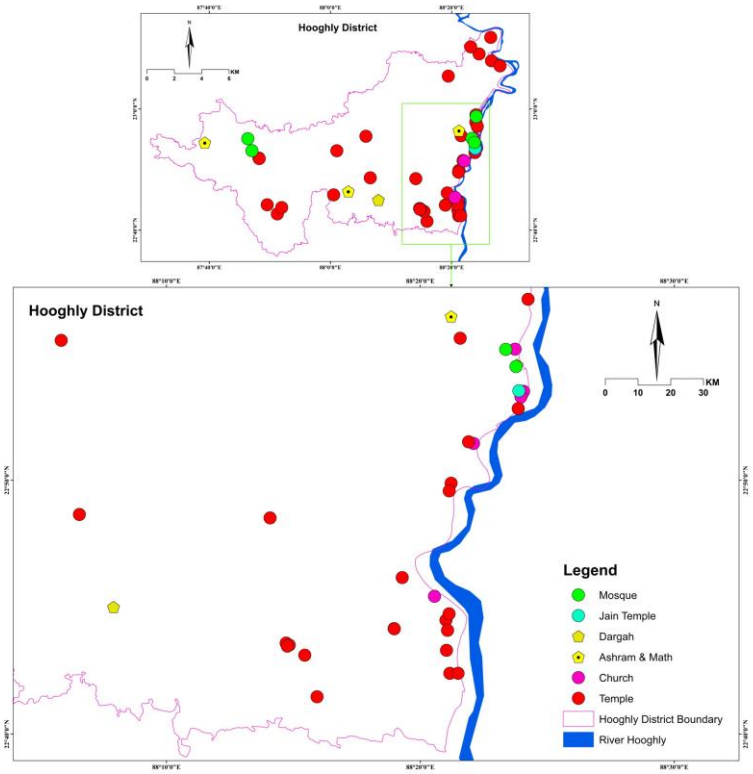
★ **St. Olav's Church, Srirampur:** St. Olav's Church from 1806 is one of Serampore's most important cultural monuments from the Danish era.

★ **Sacred Heart Church:** It is a catholic church in Chandannagar and constructed over 200 years ago. The church was designed by French architect Jacques Duchatz & inaugurated by Paul Goethals, it stands for over two centuries to mark the beauty of the architecture during the French period.

★ **Bandel Church (Basilica)** The Governor of Bengal confirms the grant of the land in 1646. Most historian agree in 1537 an admiral Sampayo entered the river hooghly with nine vessels to suport Muhammad sah, The Pathan Nawab of Gour.

★ **Armenian Church, Chinsurah:** The St. John, the baptist, Armenian Church in Chinsurah (Chuchura) was founded in 1695 and happens to be second oldest Christian Church, only next to the Bandel Churchin West Bengal.

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



Source: (Source: Nayak & Aiyazuddin, 2022)

ADVENTURE, NATURE & ECO TOURISM

- ★ **Dankuni Wetland:** Dankuni wetlands is perhaps the largest remaining contiguous marshland in the lower Gangetic floodplains. This is an almost 30 sq km wetland complex with a matrix of tall reed-beds, shallow water bodies interspersed with aquaculture ponds. The wetland is situated in the vicinity of Coca Cola factory in Hugli district beside the Durgapur Expressway.

- ★ **Suakhal Rajhat:** Suakhal Rajhat, a secluded picnic spot in the Hooghly district can offer a great weekend trip destination near Kolkata within 100 kilometres.

- ★ **New Digha:** New Digha is an ideal picnic place for those who reside in the Hooghly district or near Chandannagar. DVC canal flows through the picnic spots. Cooking utensils are also available here at a cheap rate. Nearest Chuti Park, Disneyland Park, Chandannagare, Chandannagar Strand, Bandel Church, KMDA Park.

- ★ **Wonder Land Park:** Wonder Land Park is a nice picnic spot situated at Chandannagar in the district of Hooghly. There are three small lakes surrounding the park.

- ★ **Mayur Mahal:** Mayur Mahal is one of the best picnic spots in Hooghly district with historical values. Mayur Mahal is located 4 km away from Rajhaat. Near Mayur Mahal, there is another park named Suwakhal Sanglagna Paryatan Kendra where visitors can see how water, wind and sun are tapped to produce energy.

- ★ **KMDA Park:** KMDA Park is another famous picnic spot at Chandannagar, situated very close to Chandannagar rail station. KMDA Park is also known as Wonderland Park. This park can accommodate nearly 120 picnic parties at a time.

- ★ **Matri Niwas:** Hooghly district has many beautiful picnic spots and Matri Niwas is one of those spots. Matri Niwas is located near Bandel in Hooghly. Rabbits, cranes, guinea pigs, turkeys, peacocks attract children here in this spot.

- ★ **Aqua Marina Water Park**

- ★ **Banabithi Park:** Banabithi Park is another picnic spot in Hooghly district. This park is situated at Bhadreswar which is near Kolkata. Main features of Banabithi Park are garden of fruits and flowers, Children Park, paddle boat and many more.

- ★ **Sabuj Dwip:** Sabuj Dwip is an attractive winter picnic spot in the Hooghly district of West Bengal. The place is near Bolagarh and Somrabazaar station at Hooghly. Sabuj

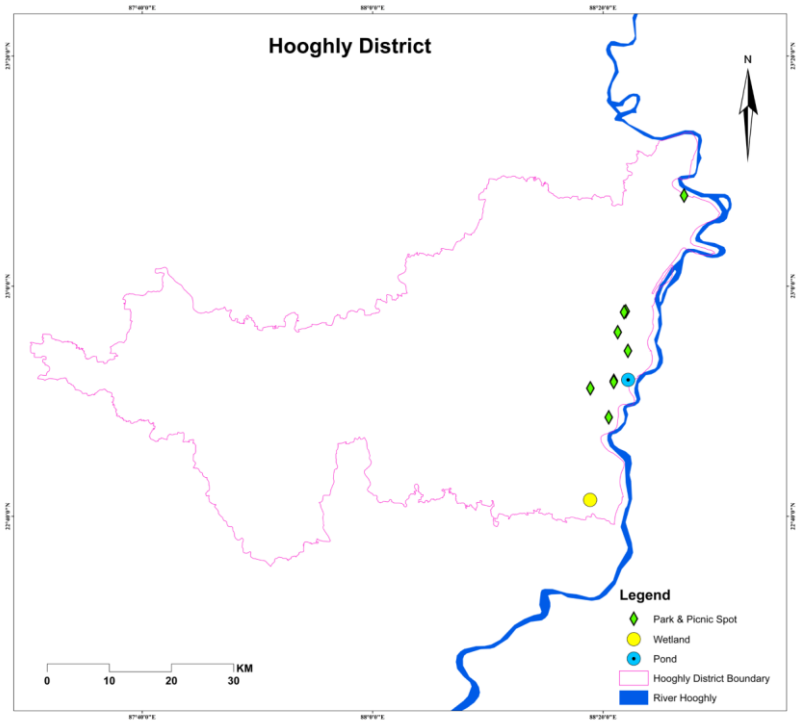
Dwip Picnic Spot is dotted with pine, palm, eucalyptus, teak, Mahogany and other trees.

Chandannagore Strand: Chandannagore Strand is a beautiful tourist spot along the banks of the river Ganges. It is about 1 km in length and 7 m in width, and many buildings with historical importance surround the spot.

- ★ **Triveni:** Once upon a time, Triveni used to be the confluence of three rivers, the Ganges (Hooghly), The Saraswati and the Kunti. About 500 years ago, Kunti dried up, and about 800 years ago Swaraswati dried up. It was known as the port city of Saptagram then.

Now, it is known as Bansberia.

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



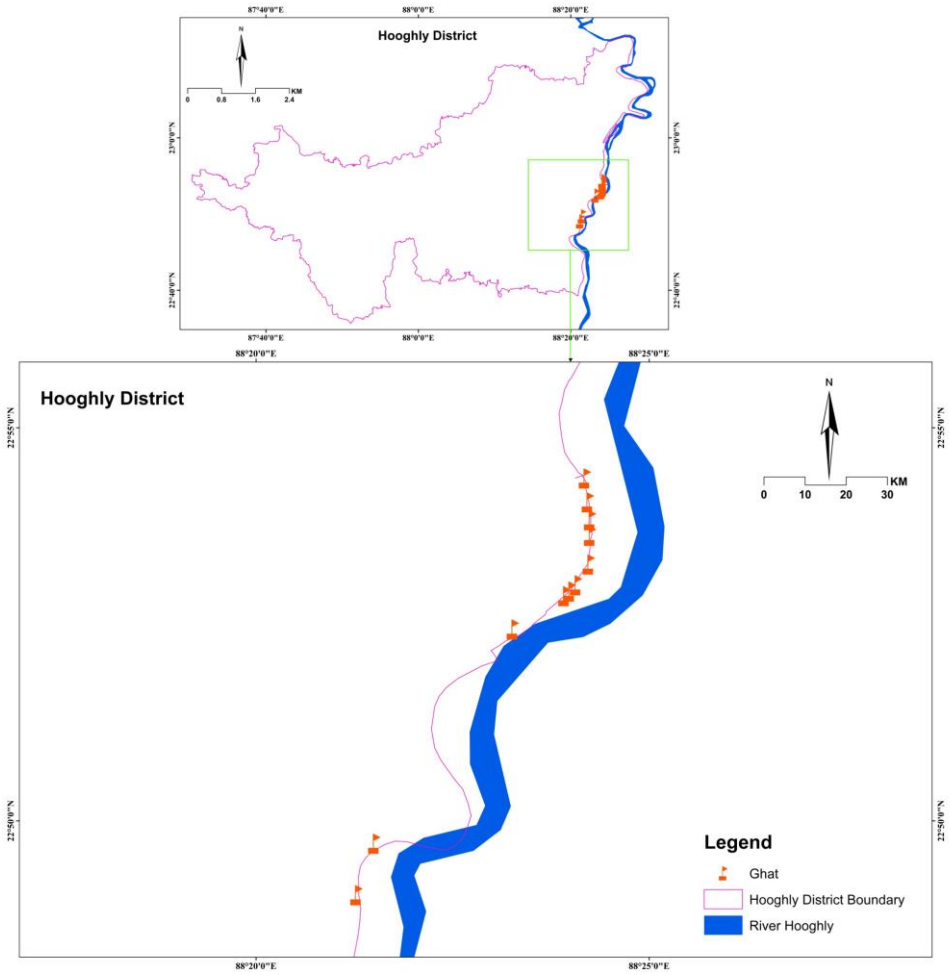
(Source: Nayak & Aiyazuddin, 2022)

GHAT TOURISM

- ★ Hooghly Ghat
- ★ Mayurpankhi Ghat
- ★ Jora Ghat
- ★ Ghanta Ghat
- ★ Chinsurah Ferry Ghat
- ★ Rani Rasmonir Ghat
- ★ Hooghly Nadia Ghat
- ★ Telopatti Ghat
- ★ Babu Ghat
- ★ Dutta Ghat

★ Dhala Ghat

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



(Source: Nayak & Aiyazuddin, 2022)

CULTURE & ARTS TOURISM

The Hooghly district is richly endowed with cultural heritage sites. Cultural Tourism has an important bearing on the economic and social lives of the people and hence on human development of the district. It is thus desirable to looks into the core cultural competency of the district for identifying the comparative and competitive advantages of the area in terms of tourism development vis-a- vis other places of the state.

- ★ **Cultural Tourism Sites in Chinsurah:** Hooghly Mohsin College, Watch Tower, Anandamath, Debanandapur, Shandeshwar Temple, Hooghly Imambara
- ★ **Cultural Tourism Sites in Bandel:** Bandel Church, Hangseshwari Temple, Temple in Balagarh, Tribeni
- ★ **Cultural Tourism Sites in Chandannagar:** Chandannagar Museum, Chandannagar Strand
- ★ **Cultural Tourism Sites in Serampur:** Fur Fura Sharif
- ★ **Cultural Tourism Sites in Hooghly:** Kamarpukur, Aantpur, Tarakeshwar
- ★ **Jagaddhatri Puja:** Jagaddhatri Puja is a major socio-cultural event in this region. This culture was even elevated to the status of Durga Puja in Kolkata, clearly represents the Hindu custom here. The uniqueness of this Puja is the height of the idol and intricate and attractive lightings.
- ★ **Makar Sankranti:** Makar Sankranti was another festival of equal importance. It was the traditional beliefs that the prayers of those are fulfilled who take dip in the Tribeni Sangam.
- ★ **Maha Shivratri**: Maha Shivratri is an important festival celebrated in this town during the month of February-March. It is celebrated at the time of Lord Shiva's birthday. During the celebration, fairs become a major attraction of this town. Other festivals that attract tourists here are Bengali New Year or the Chaitra Sankranti festival.
- ★ **Mahesh:** Mahesh is the principal fair held on the occasion of "Rathajatra". Printing Machine was first established in the district in the year of 1778 and the first Bengali book (Bengali version of A Grammar of the Bengali Language) was printed here. Thus the district is the onlooker of many first establishments, hence historically significant. Moreover, the buildings of Hooghly are the lively embodiments of the ancient culture and tradition.
- ★ **Rath Yatra**: Rath Yatra is a grand affair in Guptipara with thousands of devotees taking part in the procession. Other Celebrations Ras, Bhandarloot and Dol.
- ★ **Tant Shilpa:** It is located at Kharsarai hattala of Begampur. Begampuri cotton sharee which are high quality pure cotton by cotton with stitch weaving sharees. This smart traditional sharee is

done by our handloom craftsmen of West Bengal perfectly to look the sharee excellent and beautiful.

★ **Handicraft and Handlooms**: The handloom or 'Tant' saris of Aantpur and Dhaniakhali can be marketed extensively in India and abroad through cottage industries and big retailers.

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:

- Rice and jute are the most notable products of this district.
- Oilseeds (Sunflower, Safflower, Mustard, Linseed) are grown in a large scale in the district.
- Ginger and potato have notable production in this region

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 0.20 sq. km. but still is alarming. The district also has cultivable wastelands, fallow lands etc. which can be brought under plantations under the National Afforestation Programme. The other problem includes natural disasters like cyclones which affect the natural vegetation on a large scale. So the natural areas affected this way should be tracked and put under plantations.

The district is mainly agricultural and hence can take up agroforestry to preserve the forests as well as to increase the income of the farmers. The first thing that needs to be done is to make people aware of the requirement of forests in the district and to educate them on how can they increase the forest cover. The district can also take up Sub-Mission on Agroforestry (SMAF) Scheme. Agroforestry should be encouraged in the district and eventually agroforestry can create opportunities for setting up agri-based small enterprises such as pickle production, and juice/pulp extraction of these fruits. The district also has cultivable wasteland, which should be brought under plantation drive under the National Afforestation Mission. There is also a need to include technology like geo-tagging. GPS etc. to monitor the plants which have been planted and the already planted trees. Along with the technology, the local governments should appoint agents who would look after and monitor the plants. Most of forest in the district are open type, efforts should be made by the administration and the researchers in making these more denser to increase the carbon stock.

4.1.1 Biodiversity –

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

4.2 TOURISM

● SWOT ANALYSIS: HOOGHLY DISTRICT TOURISM

STRENGTHS

★ The district has fertile soil and diversified agriculture.

★ 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 and Wetlands 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.

★ 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, interested in painting visit to Handloom weavers of Aantpur & Dhaniakhali and interested in Eco tourism and Nature loving. Thus, huge potential in Archaeological, Religious, Eco Tourism, Heritage and Culture Tourism.

★ Reuse of vacant lands into economically productive use.

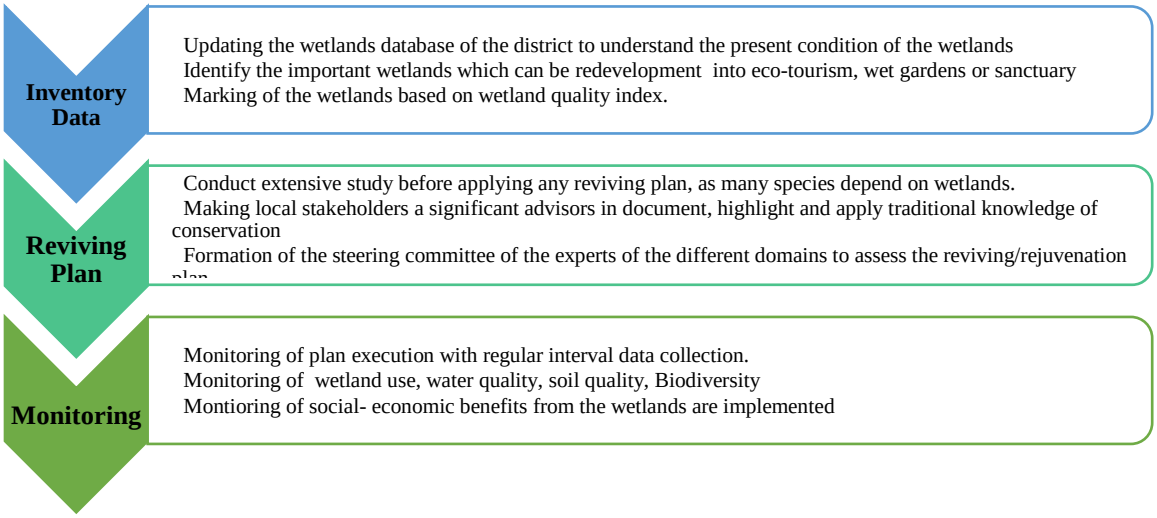
- ★ Obtaining grants for provision of best infrastructure and housing.
- ★ Encourage Public – Private partnership for provision of infrastructure services.

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.
- ★ Erosion of River Hooghly and Arsenic Prone Area.
- ★ Illegal Migration.
- ★ Degradation of Natural Environment.
- ★ Lack of governmental response towards tourism infrastructure such as tourism centre, tourism promotion and tourism accommodation.

4.3 WETLANDS

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



4.4. ENERGY

4.4.1. Solar

According to the Field Survey data of 2009, women in the Hooghly district are dependent upon coal and dung or on fuel wood for fuel sources, which takes a lot of time collecting it and it produces green house gases, so solar cookers could be a solution for this problem.

Area not under agriculture or cultivation and regarded as an area under barren land, non-agricultural uses, and unculturable land is estimated to be 97205 hectares. On this land, component A of PM-KUSUM scheme could be implemented to utilise the land and the solar energy.

According to the Input Survey 2016-17, the total net sown area of the district is 210212 hectares, out of this, 91.52% of the area is irrigated, meaning that 192404 hectares of net sown area, and the rest 8.47% is unirrigated, meaning that 17808 hectares of agricultural land is unirrigated. Due to this, there is less demand for irrigation (CEEW, 2020). Moreover, the ground water level in the district is very low, indicating that solar pumps would not be viable option here, but drip irrigation could be able to help in this situation (CEEW, 2020), or solar drip irrigation method could be stressed in those water deficient regions.

PROJECTION AND MONITORING MATRIX

Firstly, awareness regarding solar energy and the financial assistance should be give to the rural people, as only 1% of the total households are using solar energy for lightning purpose.

Secondly, solar drip irrigation method should be promoted in the district, as it would help in utilising the already limited groundwater to its maximum potential.

Thirdly, solar cookers should be developed and distributed to the women in the rural areas, as it would save a lot of their traveling time and also reduce carbon footprints.

Fourthly, to promote rural electrification through solar energy.

Through adoption of solar energy in these ways could help in the development of the district's economy.

4.4.2. Biomass

The biomass gasifier in the district revealed that the working conditions in them is not adequate, there is proper monitoring required. Technical assistance through short term courses could be made available to the people of the district, which would help in the reducing the cost maintenance of the plants, as those workers would be based out of the district. There also needs to be more biomass plants like Biomass Cogeneration plants which would utilise the excess biomass energy of the district. The storage facility is also needed in the villages and towns to store biomass raw materials.

PROJECTION AND MONITORING

Firstly, the biomass gasifiers should be regularly monitored for the working conditions.

Secondly, storage facility needs to be set up.

Thirdly, the rural people should be skilled to understand the biomass technology.

Lastly, new entrepreneurs from towns and villages should be encouraged to establish biomass plants in the district.

The provision of biomass plants in the district would help in the achievement of renewable energy goals of the state and help in the sustainable development of the state.

4.4.3. Biogas:

- WBREDA and M/s. Beltron planned an awareness campaign in selected districts.
- Wall painting, banners, awareness plays etc will happen in future for awareness program.

4.4.4. Hydropower:

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

5 RECOMMENDATIONS

5.1 AGRICULTURE AND ALLIED SECTORS

- Under the present jute manufacturing facilities, the district has a lot of scope for qualitative jute cultivation, which needs to be improved.
- Off-season vegetables such as cauliflower, cabbage, tomato, etc. cultivation could generate more income for the farmers.
- Farmers should be encouraged to grow medicinal crops such as ekangi (*Kaempferia galanga L.*), Aloe Vera, and ashwagandha. Infrastructures and marketing are also required to promote medicinal crops cultivation.
- Fruits such as banana, mango, and guava have a lot of scope in the district.
- Under the KVK's agricultural development initiative, more farmers should be trained in mushroom production.
- The district has ample scope for dragon fruit and strawberry cultivation, which need to be promoted.
- Need to encourage local farmers for vermicompost production.
- The Paramparagat Krishi Vikas Yojana (PKVY) should be induced to promote and encourage cluster-based organic farming with Participatory Guarantee Systems (PGS) certification.
- Construction of water harvesting structures like ponds should be developed to overcome the overexploitation of the groundwater.
- The district's groundwater is heavily contaminated with arsenic, particularly the Balgarh block.

- Drip and sprinkler irrigation should be promoted on a large scale to increase water use efficiency.
- Farm mechanization should be promoted among the farmer groups.
- Farmers should be sensitized over the fertilizer and pesticide application.
- Beekeeping should be encouraged among the farmers, and corresponding processing units must be facilitated.
- Integrated farming for the fishery, poultry, and vegetables should be promoted.
- Flowers like Chandra Mallika (Chrysanthemum), marigold, rose cultivation have a scope in the district, which should be encouraged.
- Farmers in the district suffer significant losses due to seasonal variations in rainfall; therefore, farmers should adhere to crop advice and suitable farming systems.

5.2 FORESTRY

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

5.2.1 Biodiversity

- Agricultural best practices (Bio-village program, IPM demonstration etc.) are recommended.
- Diversification of crops (Demonstration with low water requiring crops etc.) are recommended.
- Micro irrigation with supplemental water management activities are good irrigation strategies are recommended.
- Conservation of soil and water (water harvesting structure, excavated well, gully blocking, check dam, and so on.) are recommended.

5.3 WETLAND

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

- The district consists of many wetlands. It is recommended to rejuvenate and restore these water bodies, leading to the solution to water scarcity and water quality in the region.

- It is recommended to promote organic farming and a scientific approach near the wetlands to lower the pollution of the wetlands. Also, these practices help attract the market and increase the yield of rice and jute products.
- It is recommended to promote small-scale industries like beekeeping, boat making and net making under the schemes by the Ministry of Micro, Small & Medium Enterprises.
- Aquaculture needs to be promoted under the Fisheries and Aquaculture Infrastructure Development Fund (FIDF) scheme, and the fishing industry needs to be boosted under Pradhan Mantri Matsya Sampada Yojana (PMMSY)
- It is recommended to promote ginger production in the district

5.4 ENERGY

5.4.1. Solar

- ❖ Awareness with respect to renewable energy needs to be increased.
- ❖ Solar cookers need to be promoted.
- ❖ Solar drip irrigation could help in solving the irrigation issue in the scanty groundwater areas.
- ❖ Financial assistance needs to be developed in the district.

5.4.2. Biomass

- ❖ The working conditions in the biomass plants should be monitored and guidelines need to be set.
- ❖ The small biomass plants could be made in the villages.
- ❖ Provision of clean water is needed to cool down the biomass gasifier plants.
- ❖ Skills of rural people needs to be enhanced.

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 Damodar and Hooghly.

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. v 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. v 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.

- Tourism Information Centres are to be established at all the Gate Points like Bandel, Chinsurah, Chandannagar and Hooghly.
- To grab the attention of the tourists printed materials need to be prepared by considering the Unique Selling Proportion and basic rules of product mix and its promotion.
- An elaborate and effective distribution system should be implemented to ensure distribution of brochures through information centres and internet.
- As a new approach the Hooghly district administration can ensure a coordinated effort with the State and Central level tourism promotional agencies to promote the tourist sites of the district through their tourist offices, both in India and abroad. This will ensure the flow of both domestic and foreign tourists to Hooghly.

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

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6 APPENDICES

Table 1 Biogas potential from animal waste.

Livestock	**Residue type**	**Total population as of 2012**	**Manure yield * (kg/day)**	**Total manure generation annually (kg)**	**Average collection (75%)**	**Dry manure after removing Moisture content**	**Manure required for biogas* (kg/m^3)**	**Biogas potential (m^3/yr)**	**m3/day**	**Dry matter per day**
Cattle	Manure	912745	10	3,33,15,19,250	249863943 8	499727887.5	25	19989115.5	54764.7	1E+06
Buffalo	Manure	35229	15	19,28,78,775	144659081.3	289318 16.25	25	1157272.65	3170.61	79265

Sheep	Manure	1655	1	6,04,075	453056.25	90611.25	25	3624.45	9.93	248.25
Goat	Manure	886410	1	32,35,39,650	242654737.5	48530947.5	25	1941237.9	5318.46	132962
Pig	Manure	16671	2.5	1,52,12,288	11409215.63	2281843.125	25	91273.725	250.065	6251.6
Poultry	manure	0	0.1	0	0	0	25	0	0	0
Total		**18,52,710**						**23182524.23**		

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)**
Rice	husk	3053530	0.28	854988.4	598491.88	30	418944.316	800	335155452.8
sugarcane	bagasse	149289	0.33	49265.37	34485.759	80	6897.1518	750	5172863.85
Total		**3202819**							**340328316.7**