

Environmental Change and Population Settlement in the Bengal Delta, 1872-1941

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Abstract

In the contemporary context of global warming and climate change, historians have given much emphasis to planetary history writing, necessitating an in-depth study of ecological factors from a historical perspective. As the Bengal Delta is situated in a geographically vulnerable region, it stands out as an important area of investigation within the field of environmental history. From the second half of the nineteenth century, the colonial government conducted several scientific studies on the ecology of deltaic Bengal and found significant changes occurred in the regional distribution of rainfall. These changes not only affected the ecological pattern and agricultural productivity but also prompted migration, which reshaped the landscape and human-environment relationships of the region. The present article seeks to focus on how ecological variability played a vital role in shaping the population settlement pattern of the Bengal Delta from 1872 to 1941.

Keywords: Bengal Delta, Ecology, Rainfall, River, Population Density, Cultivation

Introduction

In the Bengal Delta, ecological shifts, agricultural production, habitation culture, and sustainability issues were intricately interconnected. This resource-rich region was transformed into a climatically vulnerable region in the colonial period.¹ According to Radhakamal Mukherjee, the geography and the history of the deltaic

¹ Nirmal Kumar Mahato has explored how climatic factors transformed Jungle Mahal, a resource-rich into a climate-sensitive region, decisively shaping settlement patterns during the colonial period. Nirmal Kumar Mahato, "Climate Migrants, Resource Scarcity, and Sustainability Issue: The Case of Jungle Mahal Region," *Refugee Watch* 63, Special Issue (December 2023): 121-139.

region were closely related to each other.² The Bengal Delta has a unique geophysical location and is vulnerable to various disasters, such as tropical storms, cyclones, floods, etc. These environmental phenomena have drastically changed mankind's socio-cultural and economic relations, posing a significant threat to human settlements. The inhabitants are obliged to abandon their original homeland and become 'environmental refugees'.³ The melting of ice in the Arctic has worsened the situation the most as it increases the water level, creating a severe possibility of the complete extinction of human civilization in the deltaic plain. In this context, the study of the impact of ecological patterns in the formation of demographic trends provides a breakthrough in understanding the contemporary crisis.

The unique topography and settlement patterns of the Bengal Delta have been a matter of core discussion among geologists and scientists, but have long been overlooked by historians. Richard Eaton was the first to explore the influence of geographical and ecological factors in the historical development of Islamic peasant settlements in the Ganges-Padma Delta. He attributed such development to the change of the course of the Ganges in the southeast direction.⁴ Ranjan Chakraborty has also traced the shifting nature of population, habitation, and market in the deltaic Bengal to the continual change in the course of rivers.⁵ Historians like Sukla Sen and Jyotirmoy Sen found a decline in the agricultural economy in the old Delta due to the deterioration of river channels and increasing human interference.⁶ However, Iftikhar Iqbal argued that the complex relationship between the colonial state policy, technological development, and nationalist politics on one hand and the region's fluid ecology⁷ on the other was mainly responsible for such rural impoverishment. Arabinda Samanta highlighted the malaria epidemic in central and western Bengal due to various ecological changes that developed from the colonial embankment policy.⁸ Moreover, some historians have conducted comprehensive studies on the population history of colonial India. Tim Dyson analysed India's population history for a long period from ancient to

² Radhakamal Mukherjee, *The Changing Face of Bengal: A Study in Riverine Economy*, (Calcutta: The University of Calcutta, 1938), 9.

³ Ranjan Chakraborti, *Climate, Calamity and the Wild: An Environmental History of the Bengal Delta, c.1737-1947*, (New Delhi: Primus, 2022), 85-86.

⁴ Richard Eaton, *The Rise of Islam and the Bengal Frontier, 1204-1760*, (New Delhi: Oxford University Press, 1994), 5.

⁵ Chakraborti, *Climate, Calamity and the Wild*, 85.

⁶ Sukla Sen and Jyotirmoy Sen, *Evolution of Rural Settlements in West Bengal, 1850-1985: A Case Study*, (Delhi: Daya Publishing House, 1989), 17-19.

⁷ Iftikhar Iqbal, *The Bengal Delta: Ecology, State and Social Change, 1840-1943*, (Hampshire: Palgrave Macmillan, 2010), 21.

⁸ Arabinda Samanta, "Crop, Climate and Malaria: Ecological Construction of an Epidemic in Colonial Bengal," *Economic and Political Weekly* 36, no. 36 (2001): 4887-4890. doi: 10.2307/4411544.

post-colonial times. He considered some social, political, environmental, and health issues in analysing the demographic trend of Bengal.⁹ There have been significant historical works focusing on the social, political, economic, and cultural factors that shaped the history of the Bengal Delta. The variations in population density, which were related to changing ecological conditions across different areas of the deltaic region, have not been discussed in detail. This study will address this aspect.

Physical Geography of Bengal Delta during the Colonial Times

The Delta region was situated between the Bay of Bengal to the south, the Bhagirathi-Hoogly channel to the west, and the Ganges-Padma-Meghna channel to the north and east. It was divided into two sections: the western inactive Delta and the eastern active Delta. The western inactive Delta was located west of the river Gorai-Madhumati, while the eastern active Delta was located east of the river. The western inactive Delta was further divided into three parts: moribund Delta, mature Delta, and partly inactive Delta.¹⁰ The moribund Delta region was a region where rivers were no longer active and land-building activities had been stopped. The districts of Murshidabad, Nadia, Jessore, the western part of Faridpur (Goalundo Subdivision), and the northern portion of Khulna and 24 Pargana fell in this geographical division. The mature Delta region was situated south of the moribund Delta and stretched up to the Sundarbans forests. The region chiefly comprised the districts of 24 Parganas and Khulna. The Faridpur region fell into the category of a partly active Delta and partly moribund Delta. On the other hand, the eastern active Delta covered an area of 15,000 sq. km, comprising the districts of Faridpur, Shariatpur, Madaripur, Gopalganj, Rajbari, Lakshmipur, Bhola, Barisal, Pirojpur, Barguna, etc.¹¹ The main topographical feature of the Delta region was the presence of numerous small rivers, canals, *bills*, and other water bodies.¹² According to Ranjan Chakrabarty, rivers constituted an important feature of eastern Bengal, similar to how feudalism formed a vital part of medieval Europe.¹³

The deltaic region in Bangladesh has a unique and diverse climate, primarily influenced by monsoon winds.¹⁴ The region experiences abundant rainfall, with the highest intensity from July to October. The average annual rainfall in Dhaka was 81 inches in the 20th century, while Chittagong City had 97 inches. Rainfall totals

⁹ Tim Dyson, *A Population History of India: From the First Modern People to the Present Day*, (Oxford: Oxford University Press, 2018), 7.

¹⁰ Kanagopal Bagchi, *The Ganges Delta*, (Calcutta: Calcutta University Press, 1944), 37.

¹¹ Bagchi, *The Ganges Delta*, 38.

¹² W. W. Hunter, *A Statistical Account of Bengal: The District of 24 Parganas and Sundarbans*, (London: Trubner and Co., 1875), 285-346.

¹³ Chakrabarti, *Climate, Calamity and the Wild*, 69.

¹⁴ Henry F. Blanford, *A Practical Guide to the Climates and Weather of India, Ceylon and Burma and the Storms of the Indian Seas*, (London: McMillan, 1889), 281.

ranged from 75 to 120 inches in the north, east, and southeast. Inland plains received less rainfall than areas near the coast and hills. The annual average rainfall decreased towards the western, southwestern, and central parts of the Delta. The districts of Murshidabad, Malda, and Bankura experienced the lowest rainfall with an annual average of less than 55 inches.¹⁵

Table 1: Comparison of Rainfall between Active and Inactive Delta during the Colonial Period

Inactive Delta Region	Summer Rainfall (Inches)	Average Annual Rainfall (Inches)	Active Delta Region	Summer Rainfall (Inches)	Average Annual Rainfall (Inches)
Rajshahi	8.35	56.80	Dacca	17.5	74.72
Bogra	12.01	66.29	Noakhali	19.06	113.80
Hoogly	9.88	57.42	Tippera	17.84	81.92
Nadia	11.37	55.11	Faridpur	14.64	72.19
Murshidabad	7.98	54.99	Bakarganj	13.45	89.29
Burdwan	9	56	Mymensingha	18.5	93
Jessore	14	66.3			
Khulna	12.28	71.83			

Source: Henry F. Blanford, *Report on the Meteorology of India in 1880*, (Calcutta: Office of the Superintendent of Government Printing, 1882), 125-26.

Western Delta: Ecological Degradation and Change in Population Settlement

Deterioration of Rivers

The western deltaic region has experienced significant alterations in its fluvial characteristics since the 19th century, primarily due to irregular and insufficient precipitation patterns. This led to the abandonment and rerouting of several tributaries and distributaries of major rivers like the Ganga, Padma, and Meghna. A notable event was the flood of 1770, which caused the Damodar River to change

¹⁵ Blanford, *A Practical Guide to the Climates and Weather of India*, 82.

its course from joining the Hooghly near Katwa to flowing through Kalna and meeting the Hooghly near Calcutta.¹⁶ This shift contributed to a decline in the Hooghly River and the drying up of various waterways in western and central Bengal. The Ganga's eastward migration further exacerbated the situation, as it left its historical channels and adopted a new course through the Padma in Bangladesh, ultimately merging with the Meghna before reaching the Bay of Bengal. While this new estuarine system enriched eastern Bengal, it also led to water scarcity, ecological changes, and shifts in agricultural practices in the western Delta.¹⁷

Increase in Uncultivated Area and Marshy Land

In central and western Bengal, significant changes in land use patterns occurred due to rainfall and weather variability. The conversion of cultivable land into fallow, marshy, and forested areas was prevalent, especially in higher elevations and upper river regions. C. A. Bentley's observations indicated a cyclical pattern of cultivation in Nadia, where land was tilled for a limited period before being left fallow due to declining soil fertility. However, there is little statistical data on changes in the proportion of cultivable and non-cultivable land. The proportion of cultivable and non-cultivable land in Burdwan had decreased significantly; only 47% of cultivable land was under cultivation in 1922.¹⁸ The central and western Bengal, especially in districts like Nadia, Faridpur, Hooghly, and Howrah, had seen declines in both land fertility and cultivation rates, with only 58% of land in central Bengal and 60% in western Bengal remaining under cultivation.¹⁹ This decline was exacerbated by landlords' difficulties in raising rents or evicting tenants due to poor soil quality, contributing to a population decrease in these areas.²⁰ In contrast, eastern Bengal, specifically Dhaka, had shown a more positive trend, with 92% of cultivable land actively being farmed, highlighting a regional disparity.

Shortage of Drinking Water

The environmental change in the moribund Delta caused a major change in the hydrological pattern of the region. According to the settlement report, due to the lack of rain in the north of the district of Murshidabad, there was a shortage of water for drinking and other purposes. The underground water level reacted directly with the siltation of the river beds and the reduction of their capacity to carry water. During the colonial period, several artificial embankments and levees

¹⁶ W. W. Hunter, *A Statistical Account of Bengal: Districts of Midnapore and Hooghly (Including Howrah)*, (London: Trubner & Co., 1876), 223-27.

¹⁷ C. A. Bentley, "Some Economic Aspects of Bengal Malaria," *Indian Medical Gazette* 57, no. 9 (September 1922): 321-326.

¹⁸ Bentley, "Some Economic Aspects of Bengal Malaria," 325.

¹⁹ J. C. Jack, *Final Report on the Survey and Settlement Operations in the Faridpur Districts, 1904-1914*, (Calcutta: The Bengal Secretariat Book Depot, 1916), 50.

²⁰ E. H. Pellow, *Report of R. C. Mukherjee*, (London: McMillan, 1878), 368.

were built where the water flowed above the level of the land on each side. The higher level of water inside the channel raised the overall water table. As a consequence, the underground water level increased and in some cases came near the surface. This prevented the main water from percolating below, forcing it to store in the natural levees or artificial embankments.²¹ It caused water scarcity, increased marshy land, and impacted cultivation.

Formation of Infertile Soil Structure

The nature of precipitation determines the composition, size, and formation of the chemical elements in the soil that subsequently control the character of crop production. As the environmental change of the entire Gangetic plain was not uniform, the composition of the soil in colonial Bengal was varied. The *Report on the Administration of Bengal 1921-22* identified two main classes of soil. One of these was the old alluvial soil, which was characterized by nodular deposits of lime or carbonate and the compaction of iron-hydrated peroxide. This type of soil was widely distributed in the western and central regions of Bengal. It was less fertile due to the lack of phosphoric acid, lime, nitrogen, and organic compounds.²² This type of soil was helpful in the production of *Aus* paddy and sugarcane in abundance. Due to less rain, this type of soil was devoid of farming in the winter.

Increase in *Aus* Cultivation

Variations in rainfall, determining the nature of soil formation and availability of water resources, affected the character of rice cultivation in colonial Bengal. There were mainly two types of paddy cultivated in Bengal: *aus* and *aman*. The *aus* was cultivated from March to May, and the *aman* from September to October. Thus, instead of the total rainfall in a year, the early or pre-monsoon rainfall (March, April, and May rainfall) and post-monsoon rainfall determined the fate of rice production in colonial Bengal, which in turn influenced the character of population density in the region. The *aman* cultivation was not very popular in the central and western parts of Bengal, where water supply was scarce and the rivers were in a state of decline. Instead, *aus* paddy was the main crop of this region. It was because *aus* was more dependent on seasonal rainfall or early rains, absorbed relatively less water, and grew on higher lands (above flood level). The gazetteer of Jessore district mentioned the shrinkage of the area under *aman* paddies due to less flooding. Comparing the agricultural statistics of 1920–21 with the agricultural statistics of 1906, it could be said that the normal area under *aus* has increased by 10% in Jessore and 50% in Nadia district.²³ The colonial statistical records in the

²¹ Rai Bijay Bihari Mukharji, *Final Report on the Survey and Settlement Operations in the District of Murshidabad, 1924-1932*, (Alipore, Bengal: Bengal Government Press, 1938), 70-76.

²² *Report on the Administration of Bengal 1921-22*, (Calcutta: Bengal Secretariat Book Depot, 1923), 6-7.

²³ Bentey, "Some Economic Aspects of Bengal Malaria," 325.

Faridpur district showed that water supply was closely linked to unusual variations in *aus* paddy production in individual police stations of the district.

Table No. 2: Early Rainfall and Its Relation with *Aus* Cultivation

Place	Early Rainfall in Inches (March, April and May)	Percentage of <i>Aus</i> -Cultivated Area (%)
Mymensingh	17.96	64
Noakhali	19.06	45
Tippera	17.84	44
Dacca	17.5	27
Faridpur	14.65	36
Bakerganj	13.45	12
Nadia	8.24	66
Medinipur	8.6	13.31
Jessore	13.96	32

Source: John Elliot, *Report on Indian Meteorology in 1890*, (Calcutta: Office of the Superintendent of Government Printing, 1892), 109.

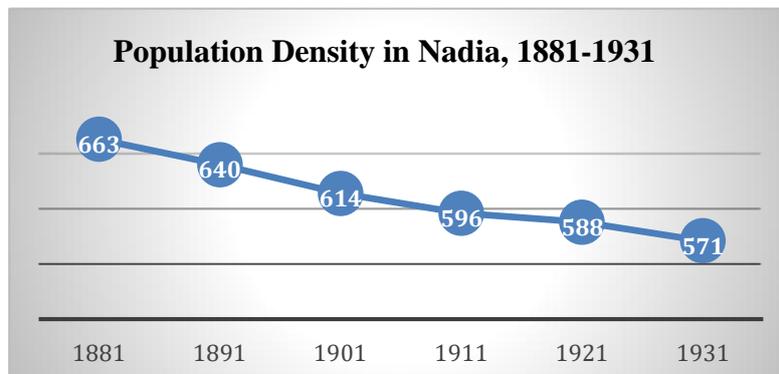
Nature of Population Density

There was a significant ecological change in the inactive western Delta, which created a hydrological crisis, an unhealthy environment, decreased soil fertility and crop production. The Delta region was divided into three parts, i.e. moribund Delta, mature Delta and partly inactive Delta.

The Moribund Delta

Most of the parts of the moribund Delta recorded a negative population growth. In Murshidabad, the population density was almost horizontal with little ascent and descent. There were only two police stations, Berhampur and Shamsherganj, which recorded a steady increase. The reason behind this was that Shamsherganj availed the benefit of inundation from the Bhagirathi and got fertile land for more crop production. On the other hand, Berhampur, owing to the healthy environment and

the status of the municipal area, has such an outstanding trend.²⁴ However, Hariharpara showed a steady decrease in its malarial nature.²⁵ The density of Murshidabad was nearly 600 in 1872 and 1881 and in 1931 it showed 664. The total population was 11,020,000 in 1881, and 13,70,677 in 1931. In the district, there was a drop in population from 1911 to 1921. However, the subsequent decade recovered such bars.²⁶ The graph of population variation in the districts of Nadia from 1881 to 1931 shows a gradual decay. The total population in that district was 16,62,795 in 1881 whereas it came to be 15,22,632 in 1931. Likewise, the population density decreased from 656 in 1881 to 571 in 1931.²⁷ According to Bagchi, the gradual decrease was due to inherent ecological causes and not to natural calamities.²⁸ However, from 1921-31, the region faced a slight increase due to its recovery from the epidemic situation.



Source: M. W. M. Yeatts, *Census of India 1941: Part II Table (Office Record File)*, (Delhi: Published by the Manager of Publication, 1943), 7.

In Jessore, there was a steady but gradual decline in population from 1939375 in 1881 to 1571164 in 1934.²⁹ The density curve also followed such a trend in the whole district. Except for the police stations Lohagara, Salkopa, Sripur and Alfadanga, located on the border of the river of Garai-Madhumati, the individual thanas showed a similar decreasing trend.³⁰

²⁴ A. E. Porter, *Census of India, 1931: Bengal & Sikkim, Part I*, (Calcutta: Central Publication Branch, 1933), 44.

²⁵ Porter, *The Census Report for 1931*, 45.

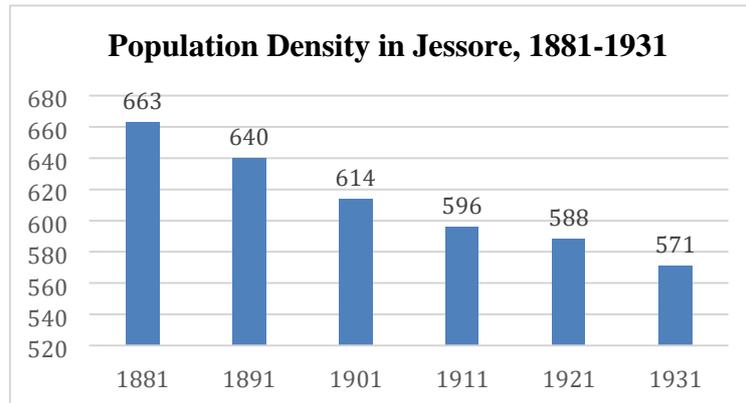
²⁶ W. H. Thompson, *The Census Report for 1921*, (Calcutta: The Bengal Secretariat Book Depot, 1923), 57.

²⁷ M. W. M. Yeatts, *Census of India 1941: Part II Table (Office Record File)*, (Delhi: Published by the Manager of Publication, 1943), 7.

²⁸ Bagchi, *The Ganges Delta*, 122.

²⁹ Thompson, *The Census Report for 1921*, 57.

³⁰ Yeatts, *Census of India 1941*, 7.



Source: M.W.M. Yeatts, *Census of India 1941: Part II Table (Office Record File)*, (Delhi: Published by the Manager of Publication, 1943), 7.

Mature Delta

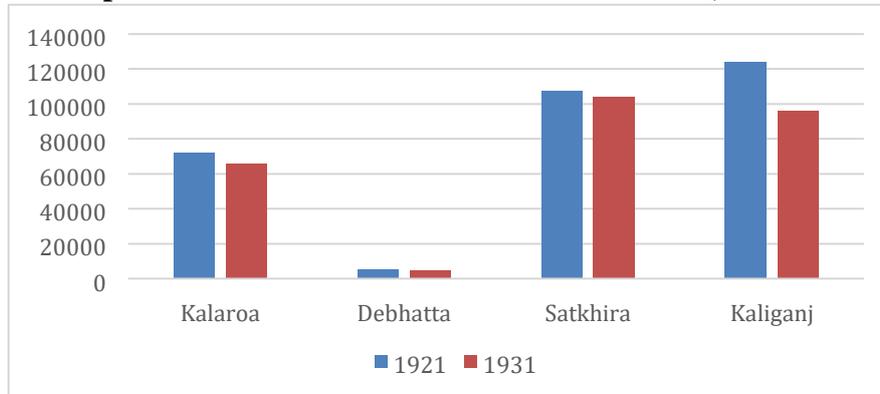
The northern and central portions of 24 Parganas suffered a shortage of drinking water, infertile soil, an increase in marshy land and an unhealthy environment. In this part, police stations like Habra, Deganga, Barasat, Dum-Dum and Tollygunge showed a decreasing or stagnant population density. On the other hand, the southern part and most of the areas lying near the Hooghly, such as Baranagar, Naihati, Budge-Budge, and Barrackpore, showed a steady rise in population. Indeed, due to the land reclamation and improvement of the Jamuna, there was a decent rise in population in the Sunderban region from 310 in 1880 to 516 in 1931. The overall population of the district showed a steep rise from 2303078 in 1881 to 4074578 in 1931.³¹ Apart from environmental factors, the development of industries and the immigration of labourers contributed significantly to such fluctuations in population density.

In the district of Khulna, the population density was diversified. In the northwestern police stations of the mature Delta, such as Kalaroa, Debhata, Satkhira, Kaliganj, etc., the population was either stagnant or declined due to the silting up and deterioration of the rivers. In the northeastern region, the situation was different. The river Madhumati was still active at that time, which made the region agriculturally productive through inundations and fertilizing the soil. Consequently, police stations like Mollahat, Kachua, Begerhat, Morelганj, etc., showed a rise in density. The central portion of the district, which was a low-lying area and consisted of *bils*, created insalubrious conditions and reared a steadily rising density. However, the population graph of the whole district showed a

³¹ L. S. S. O'Malley, *Bengal District Gazetteers: Faridpur*, (Calcutta: The Bengal Secretariat Book Depot, 1925), 7-9.

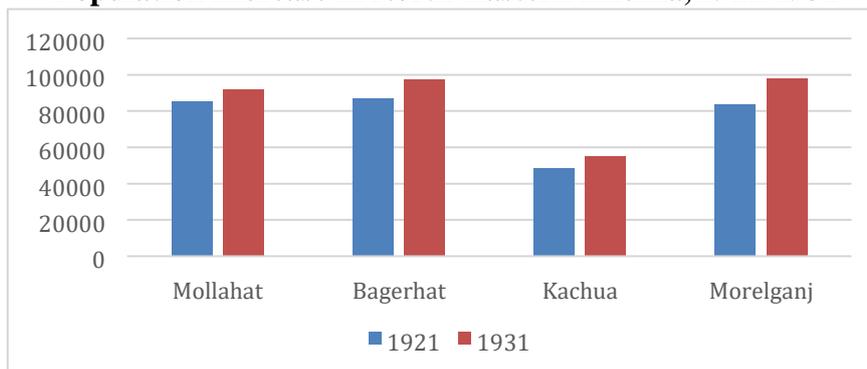
gradual rise from 1079948 in 1881 to 1626148 in 1931.³²

Population Decrease in North-Western Khulna, 1921-31



Source: M. W. M. Yeatts, *Census of India 1941: Part II Table (Office Record File)*, (Delhi: Published by the Manager of Publication, 1943), 7.

Population Increase in North-Eastern Khulna, 1921-1931



Source: M. W. M. Yeatts, *Census of India 1941: Part II Table (Office Record File)*, (Delhi: Published by the Manager of Publication, 1943), 7.

Partly Moribund and Partly Active Delta: Faridpur

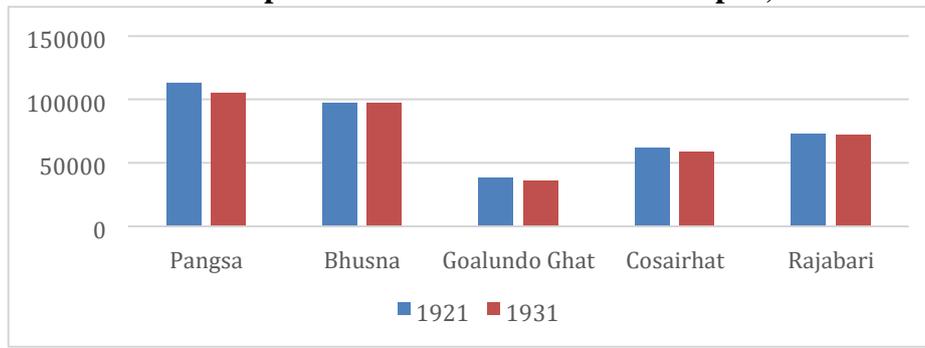
The ecological condition of Faridpur resembled both active and moribund Delta regions. The northern part of the district comprised relatively higher lands, made of the siltation of the rivers. It faced dry weather except during the monsoon. On the other hand, the Goalundo subdivision, situated in the extreme northwest, faced conditions like those of the moribund Delta. In this region, rivers such as Barasia, Kuman, and Chaidang, which were located between the Garai and Padma rivers, stopped their land-building activities. Thus, the northwestern portion faced a gradual decrease in fertility and an increase in insalubrious conditions. On the other hand, the Gopalganj sub-division, situated on the south-eastern side, consisted of

³² Yeatts, *Census of India 1941*, 7.

marshes (bills), low-lying areas and a strip of silt-deposited tract.³³ The active rivers, the Padma, the Aria Lakhan, and the Meghana, enriched the soil with silt and continuously built new chars or land. The land had a relatively better climate, which helped create healthy and agriculturally productive conditions.

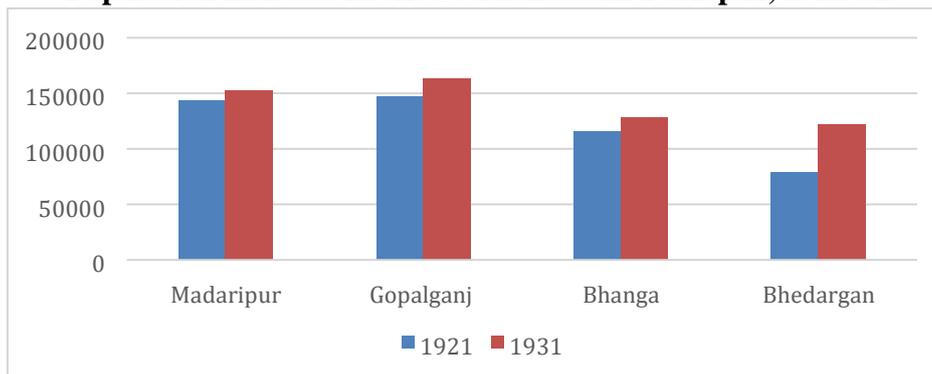
Regarding the variation of population density, the district showed an interesting feature. The north-western police stations like Pangsa, Goalundo, Balikandi, Madukhali, and Bhusna, where the Delta was becoming moribund, showed a stagnation in population distribution between 1931 and 1881. However, in the south-eastern police station, there was a slight increase in population density. Bhedargang, Pinjuri, Bhanga, Sibchar and Gopalganj police stations saw such an increase.

Decrease in Population in North-Western Faridpur, 1921-31



Source: M. W. M. Yeatts, *Census of India 1941*, Part II Table, Office Record File, (Delhi: Published by the Manager of Publication, 1943), 68-69.

Population Increase in the South-Eastern Faridpur, 1921-31



Source: M. W. M. Yeatts, *Census of India 1941*, Part II Table, Office Record File, (Delhi: Published by the Manager of Publication, 1943), 68-69.

³³ O'Malley, *Bengal District Gazetteers: Faridpur*, 8.

Eastern Delta: Increase in Rainfall, Rise in *Aman* Cultivation, and Diversity in the Population

There was an intimate connection between history and climate, as Emmanuel Bernard Le Roy Ladurie argues, until the eighteenth century, when societies were largely agrarian and affected by chronic food supply problems.³⁴ This was also applicable to the deltaic Bengal during the colonial period. The natural environment, i.e., the landscape, waterscape, or climate of deltaic Bengal, made people's lives and livelihoods much easier and more convenient in this region.

Water-Rich Region: The active delta region experienced heavy rainfall, with the rivers being active and young carrying out their function of depositing sediment and maintaining soil fertility. The region became one of the water-rich areas in the world. The Gangetic Delta is the only place in the world where rice cultivation solely relies on natural flood or flush irrigation. During the monsoon, the overflowing rivers' waters enter the inner lands through canals, which eventually re-enter the rivers after fertilizing and providing fertility to the soil. Apart from fertilising the lands, the rivers provided easy access to the market via the water. As a result, there prevailed an ecological condition favourable to a significant increase in cultivation and population density. The entire Bakarganj district generally remained below the high tide level, except for the island of Shahabazpur. The district was bordered by the river Madhumati to the west, the Tetulia and Shahabazpur to the east, and the river Meghna to the north, along with the cross-channels that connected them. During the flood season, the entire region was mostly underwater as the rivers had not yet built up any levees or embankments. The silt spread around, which improved the ecosystem as a whole.³⁵ As a result, the region remained free from unhealthy conditions and scarcity of drinking water.

Formation of New Alluvial Soil

The production of wetland crops was larger in the deltaic region than in the upper Gangetic valley. The active river basins of Meghna, Padma and Brahmaputra were responsible for creating such a condition. The rivers with heavy water velocity and changing course led to the deposition of sand, clay, and silt in the lower reaches, making this soil fertile. The newly formed alluvial soil made East Bengal's deltaic region a dynamic one. The new alluvial soil of the Meghna was full of nitrogen and other organic matter. This created a situation more favourable for *aman* paddy,

³⁴ Emmanuel Le Roy Ladurie, "History and Climate," in *Economy and Society in Early Modern Europe*, ed. Peter Burke, (London: Routledge, 1972), 134.

³⁵ J. C. Jack, *Bengal District Gazetteers: Bakarganj*, (Calcutta: The Bengal Secretariat Book Depot, 1925), 3-5.

which was much more dependent on water.³⁶

Increase in *Aman* Cultivation and Double Cropped Area

The *aman* cultivation depends on a substantial amount of water due to the necessity of fully submerging the roots. The plant requires a gradual flow of the upper water table, which replenishes old groundwater with oxygen-rich new water to fulfil oxygen demand. In the Ganges valley of Bengal, the heavy rainfall and the spread of water in the active and young rivers supplied oxygenated water for rice seedlings. The typical flood-controlled irrigation system led to the abundant growth of rice, especially *aman* rice, and jute, both heavily dependent on water. That is why the delta's tradition of double cropping was increasing remarkably.³⁷ In the districts of Mymensingh and Dhaka, there was a high percentage of double-crop areas. Apart from *aman*, the active Delta region also grew *boro*, or spring rice, on the edges of lakes, canals, or soft marshes. As a result, the region produced more than half of Bengal's rice production. Apart from rice, a large part of Bengal is under jute cultivation. Both the western and eastern parts of Bengal cultivate jute. However, significant rainfall and overall atmospheric humidity in areas like Dacca, Faridpur, Mymensingh, and Tipperah led to the production of large quantities of jute in the eastern Delta. Because of its fertile and new alluvial soil, the eastern Delta produced 64% of the total jute production in Bengal, compared to 26% in North Bengal, 8% in Central Bengal, and 2% in West Bengal.³⁸

Table No. 3: Relation between Rainfall Distribution and Jute Cultivation

Active Delta Region	Percentage of Cultivated Area under Jute in 1931	Early Rainfall in Inches (February to May)	Late Rainfall in Inches (June to August)
Dacca	22.4	18.7	39
Mymensingha	20.8	24	47
Tippera	23.8	20.7	45.8
Faridpur	20.9	17.6	37.8

Source: *Report on the Department of Agriculture, Bengal, 1927-28*, (Calcutta: Bengal Secretariat Book Depot, Instructed by the Department of Agriculture and

³⁶ *Report on the Administration of Bengal 1921-22*, (Calcutta: Bengal Secretariat Book Depot, 1923), 6-7.

³⁷ *Bengal District Gazetteer: Dacca District*, (Calcutta: Bengal Secretariat Book Depot, 1923), 10-13. A. Mitra, *Census 1951 West Bengal: District Handbook Nadia*, (Calcutta: Printed by S.N. Guha Ray, 1953), 121.

³⁸ *Report on the Department of Agriculture, Bengal, 1927-28*, (Calcutta: Bengal Secretariat Book Depot, Instructed by the Department of Agriculture and Industries, 1929), 5-8.

Industries, 1929), 5-8.

Increase in Population Density

In colonial Bengal, the population density corresponded to the production of *aman* paddy and twice-crop cultivation. As a result, eastern Bengal, a region with high rainfall where *aman* paddy was the main crop and much of the region fell under the two-crop zone, had a higher population density than any other region. This can be more clearly understood by comparing the meteorological data and agricultural data with that of the census data.

Table No. 4: Rainfall, Crop Production and Population Density

	Summer Rainfall (Inches)	Average Annual Rainfall (Inches)	Twice-cropped Area (%)	Amount of Aman Cultivation Land (%)	Population Density
Dacca	17.5	74.72	18.06	41	1265
Noakhali	19.06	113.80	57.5	90	1124
Tippera	17.84	81.92	28.2	74	1197
Faridpur	14.64	72.19	10.05	72	1003
Bakarganj	13.45	89.29	7.3	96	834

Source: A. E. Porter, *Census of India, 1931: Bengal & Sikkim, Part I*, (Calcutta: Central Publication Branch, 1933), 23-24. A. Mitra, *Census 1951 West Bengal: District Handbook Nadia*, (Calcutta: Printed by S.N. Guha Ray, 1953), xvii.

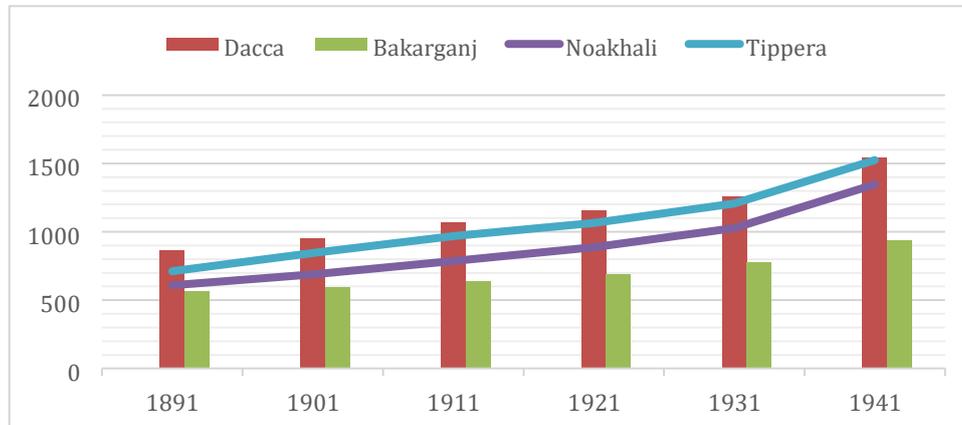
The population density of Bakarganj climbed from 19,00,889 in 1881 to 29,39,050 in 1931.³⁹

Immigration, fertile soil, and a healthy environment contributed to this population increase. The district's population density, which was 521 in 1881 and 776 in 1931, explains the significant spike in population fluctuation. In Noakhali, the Hatiya and Sandwip islands, located at the farthest end of the deltaic region, were experiencing a robust state of health, with a rapid increase in density. The population of the Sandwip islands increased from 281 in 1881 to 1106 in 1931, while Hatiya experienced a similar trend, with its population increasing from 218 in 1881 to 494 in 1931. In Dacca, the population density increased from 864 in 1891 to 1259 in

³⁹ L. S. S. O'Malley, *Census of India, 1911: Bengal, Bihar, Orissa and Sikkim*, (Calcutta: The Bengal Secretariat Book Depot, 1913), 60-100.

1931, and in the case of Tippera, it went up from 711 in 1891 to 1207 in 1931.⁴⁰

Increase in Population Density (per square mile) in Eastern Delta.



Source: M. W. M. Yeatts, *Census of India 1941: Part II Table (Office Record File)*, (Delhi: Published by the Manager of Publication, 1943), 9-10.

Conclusion

The environmental change occurred in the western inactive Delta, which affected the flora and fauna and severely damaged the food supply system of the region. There was a spatial and temporal disparity in rainfall distribution in the deltaic region from the 1870s. Meteorological statistics also supported the yearly fluctuations in precipitation. Due to the relatively low rainfall, the water-carrying capacity of the rivers gradually decreased, and their existing course began to change, passing through central and western Bengal. As a result, soil fertility deteriorated, water availability was reduced, and agricultural production decreased, except for the cultivation of *aus* paddy, which was mostly dependent on early monsoonal rainfall. As *aus* alone did not sustain a large number of people, the population density of the western inactive Delta was affected very badly. Most of the moribund Delta region, especially the districts of Nadia and Jessore, experienced a continuous decline in the decadal growth of population from 1872 to 1941. However, the condition of the whole inactive deltaic region was not uniform. There was a diversity in population density in the mature Delta and partly inactive Delta region, such as Faridpur. The northeastern part of Khulna, the northern and central parts of 24 Parganas, and the northwest police stations of Faridpur experienced situations like the moribund Delta and recorded either negative growth or stagnation in population density from 1881. The rest of the regions, on the other hand, experienced environmental conditions similar to those

⁴⁰ Yeatts, *Census of India 1941*, 9-10.

in the eastern active Delta. In the active Delta region, the increased rainfall enriched the course of rivers, which in turn facilitated irrigation and made the physicochemical composition of the soil more suitable for *aman* paddy, jute, and double cultivation. This change accelerated the population growth in most of the districts of eastern Bengal, like Dacca, Bakarganj, Noakhali, Tippera, etc. However, some portions of the western Delta, such as south-east Faridpur, the southern part of 24 Parganas, and north-east Khulna, had experienced a similar trend in human settlement.

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