



Research Article

# Asansol: Geographical Dimensions of a Growing Industrial and Urban Centre

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## Abstract

Asansol is one of the most important metropolitan areas in India, showing a rapid urbanisation rate, and it is one of the fastest-growing cities on earth, with a growth rate higher than that of Kolkata. Unlike most of the cities of the world, this particular city is not only famous for the services it provides, although it is the district headquarters, but moreover, it is famous for its mineral reserves. Situated on the edge of the Chotanagpur Plateau, it is the largest coal reserve in the state and a major industrial belt. This paper tries to find out the unique geographical conditions of the study area at a micro level using various secondary sources like Census data, AMC official site and other literature. Since the post-2011 census has not been conducted yet, the geometric population projection shows a significant increase in population, and it happens not only due to fertility but also due to migration. DEM has also been generated using ArcGIS. The paper found that it has a unique geography, for example, climate, elevation, etc., which is largely different from that of West Bengal. However, the study suggests that the rapid urbanisation and coal mines create environmental problems that need proper attention from urban planners.

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**KEYWORDS:** Asansol, AMC, Urbanisation, DEM.

## INTRODUCTION

Understanding the intricate relationships between the physical environment, human activity, and regional development within a specific area is largely dependent on micro-level geographic studies. Micro-level geographical study concentrates on specific spatial features of a specific locality, in contrast to macro or regional studies that highlight large-scale patterns. These studies offer a more in-depth understanding of the natural environment, economic activity, settlement patterns, demographic composition, and environmental factors that all work together to define a region's geographic character. Micro-level studies have grown in significance in modern geographical research because they assist in identifying minor variations that could go unreported in more comprehensive regional analysis. Cities in India are very good micro-level units that have great importance.

In India, we mainly have four megacities in four major geographical settings of the country. In the northern part of the country, the capital, Delhi, is located; in the western part, the gateway of western India, Mumbai; in the southern part of India, Chennai is a mighty city; and in the eastern part of India, we have the former capital of India, Calcutta. But besides these megacities, many more cities are growing and continuously evolving into bigger ones. In this way, India currently has 53 metropolitan cities, in which Asansol is ranked at number 33 (Census of India, 2011) [6]. It has become one of North-East India's most significant urban centres and one of the fastest-growing cities. The city in concern serves as both the division's and the tehsil's headquarters. After India was ruled by the British, the city gained prominence. The city served as a regional administrative hub when under British control.

Asansol has an assortment of human geographical attributes in addition to its physical attributes. Migration from nearby states and other parts of India has been stimulated by industrialisation and mining operations, creating a diverse population structure. The socioeconomic situation, occupational structure, and settlement patterns of various localities within the region, all reflect this diversity. In addition to coal mining (P. Ghosh, 2023; Dey *et al.*, 2024) [9, 7], industries that strengthen Asansol's economy include steel manufacturing, engineering, power generation, and transportation (Maji & Malik, 2021; Basu, 2021) [14, 3]. Its status as a major regional transportation and business nexus has been further reinforced by its excellent road and rail connections (Bhat & Thakur, 2025) [4]. The area's infrastructure and governance have also benefited from the work of administrative organisations like the Asansol Municipal Corporation.

Asansol is the district headquarters of Paschim Bardhaman district. According to a 2010 report released by the International Institute for Environment and Development, a UK-based policy research non-governmental body, Asansol was ranked 11th among Indian cities and 42nd in the world in its list of 100 fastest-growing cities (IIED Report, 2010; Saha & Malik, 2018; Paul *et al.*, 2020) [13, 21, 18]. Asansol is classed as a Y-category city for the calculation of HRA (House Rent Allowance) for public servants, which is rated 16%, making it a Tier-II city.

With a population of 1,243,414 persons and covering an area of 326 sq. km, Asansol is an industrial town also known as the 'city of brotherhood' (Census of India, 2011) [6]. This urban agglomeration is mainly governed by the Asansol Municipal Corporation, which has become an inseparable part of India.

Therefore, the goal of this research article is to investigate Asansol's micro-level geography by examining its physical location, demographics, economic activity, settlement patterns, and environmental conditions. The study aims to emphasise the region's spatial variety and developmental dynamics using a thorough geographical viewpoint. It is anticipated that the results of this study will advance both scholarly knowledge and the creation of well-informed planning strategies for the Asansol region's sustainable development. As it is one of the most important metropolitan areas in India, its geographical account becomes essential for its planning, and it will help further research.

## BACKGROUND:

On the banks of the Damodar River, you might come across "asan," a type of tree that typically reaches a height of thirty meters; "sol" means land. These two words have been combined to form the name "Asansol." The region surrounding Asansol, a city on the Damodar River, is abundant in resources, particularly coal. During British rule, the city's name was spelt Assensole, but following independence, it was changed back to Asansol (Rudra, 2022) [20].

Asansol's historical growth is the result of a lengthy process influenced by early human settlements, colonial commercial activity, physical terrain, and contemporary industrialisation. Important early centres of civilisation, such as Pandurajar Dhibi near the Ajoy River and Bivanpur near the Damodar River, were located on the eastern edge of the region, according to archaeological evidence. Many indigenous populations were forced from the fertile Rarh region into the wooded portions of the Chhotanagpur Plateau during the Chalcolithic and Iron Age periods due to the Aryan expansion into the Middle Gangetic Plain. The Sultanate and Mughal governments caused political strife in the Rarh region during the Middle Ages. Along the Ajoy–Nunia watershed, transportation routes and rich land had a significant impact on settlement patterns. While indigenous and underprivileged people continued to live in the inner regions, migratory groups like the Kanoujia Brahmins arrived in a number of villages and brought Vaishnava customs. Later, the area was included in administrative divisions under the Bardhaman Raj, and during the eighteenth-century Maratha incursions in Bengal, it was disturbed (McDermott, 2001) [15].

When the East Indian Railway arrived at Raniganj in 1855, it marked a significant turning point. Later, the railway junction was moved to Asansol. Asansol became a major transportation and industrial hub as a result of this expansion. The town's growth was prompted by the establishment of railway infrastructure, municipal administration, and manufacturing firms like the Indian Iron and Steel Company (1918) and Kulti Iron Works (1869). Asansol continued to grow after independence as a result of industrial growth and the inflow of

immigrants and refugees. The pinnacle of the region's industrial boom occurred between 1960 and 1980. However, economic difficulties were brought about in later decades by the demise of a number of enterprises, mine fires, and subsidence issues. Asansol has continued to be a significant urban and service hub in western West Bengal in spite of these challenges. The area nevertheless contributes significantly to industrial, commercial, and service operations today, thanks to organisations like the Asansol–Durgapur Development Authority (ADDA, 2010) [1], despite difficulties with population expansion, environmental concerns, and sustainable development.

## METHODOLOGY

The study primarily relies on secondary sources of data. Demographic data, such as population statistics, were collected from the Census of India reports, district statistical handbooks, and other published government records. Additional geographical and spatial information was obtained from

published books, research articles, government websites, and reports related to the region.

To analyse future population trends of Asansol, the Geometric Population Projection Method was used. This method assumes that the population grows at a constant percentage rate over time. The projected population was calculated using the standard geometric growth formula:

$$P_n = P_0 \left(1 + \frac{r}{100}\right)^n$$

This method helps estimate future demographic changes and provides insights into potential urban growth in Asansol.

To understand the topographical characteristics of the study area, a Digital Elevation Model (DEM) was prepared using ArcGIS. Elevation data were processed within the GIS environment to generate terrain visualisation and analyse elevation variation in and around Asansol. The DEM helped in identifying relief patterns, slope variations, and overall terrain structure of the region.

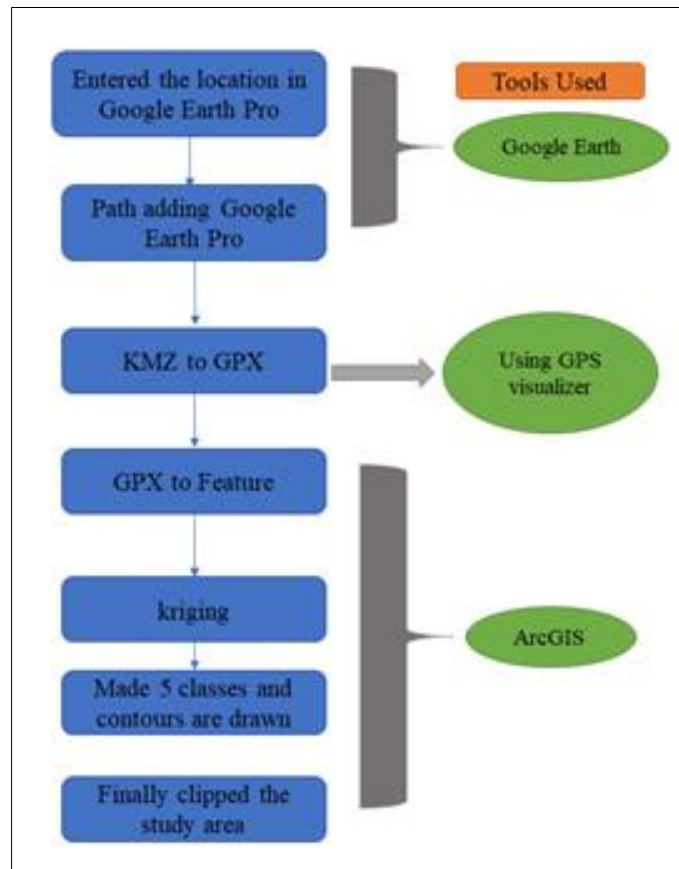


Fig 1: Methodological flow chart of DEM

All spatial data were processed and analysed using GIS techniques in ArcGIS. Analytical Approach

The collected data were analysed using descriptive and quantitative methods. All the diagrams are prepared using Excel.

## DISCUSSION

### Location

Primarily, we are taking the whole area under the Asansol Metropolitan Corporation (AMC), constituted of 106 wards, covering a 326.48 sq. km area. The geographical location of

any area is vital for any area. here are talking about the site and situation of the study area. Looking at the site of the city, this

city is located at a very strategic location, on the bank of the Damodar River.

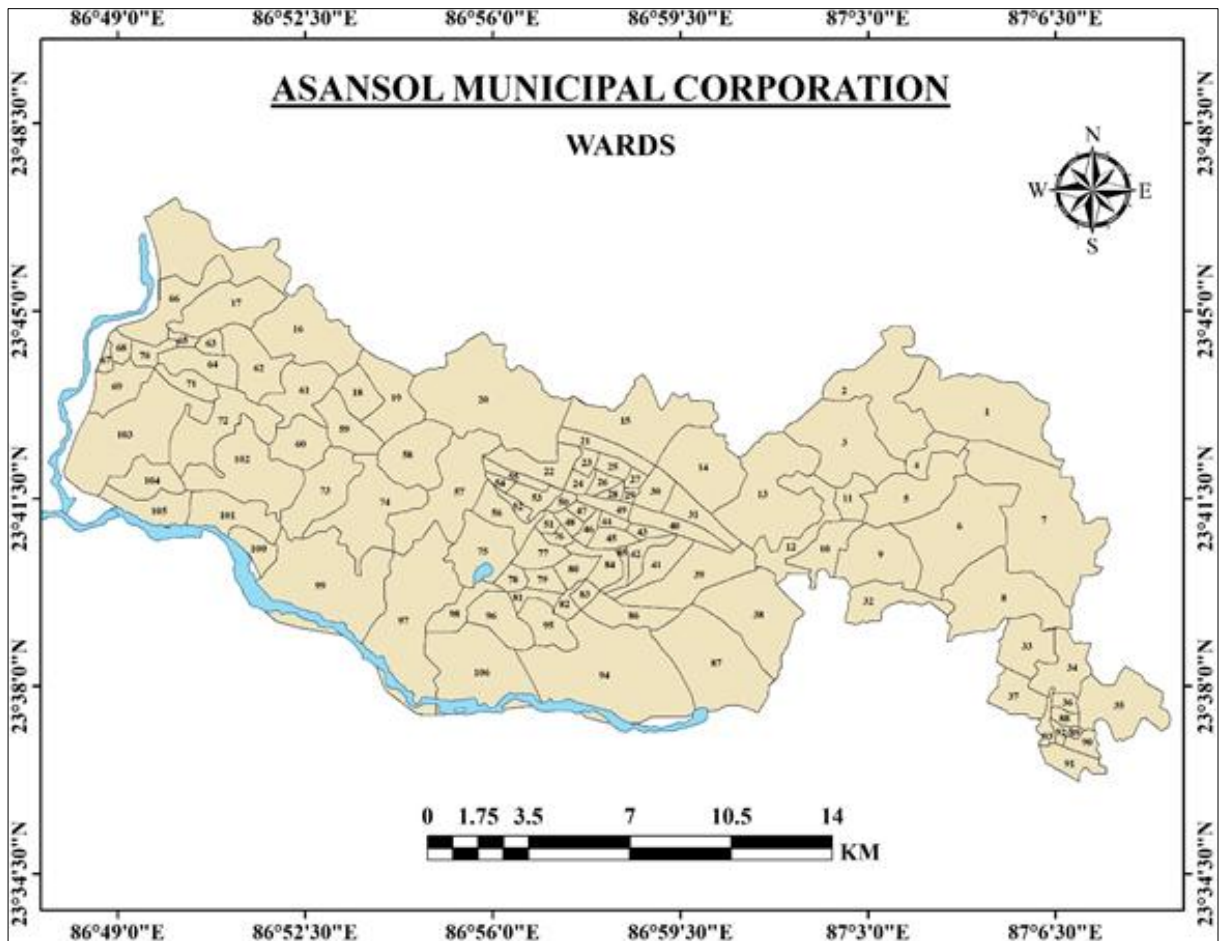


Fig 2: Asansol Municipal Corporation

**Administrative setup:**

The study area is surrounded on the east side by Andal Block, on the North-East side by Jamuria Block, on the north side by Barabani and Salanpur Block, on the west by the state of Jharkhand and on the south by Bankura district of West Bengal. While it is already mentioned that Asansol is the main city of the region, it works as the district headquarters of the Paschim Bardhaman district. Although the whole area comes under AMC, the main Asansol city maintains its law and order

through three police stations: namely, Asansol North, Hirapur and Asansol South police stations, combined to form the main city area of 127.87 sq.km. There are eighteen census towns in the Asansol metropolitan area. As per the notification published in the Kolkata Gazette on June 3, 2015, the Asansol Municipal Corporation now has jurisdiction over the municipal areas of Kulti, Raniganj, and Jamuria. Here, it is needed to be mentioned that the Asansol city is located within the territory of the Asansol municipality.

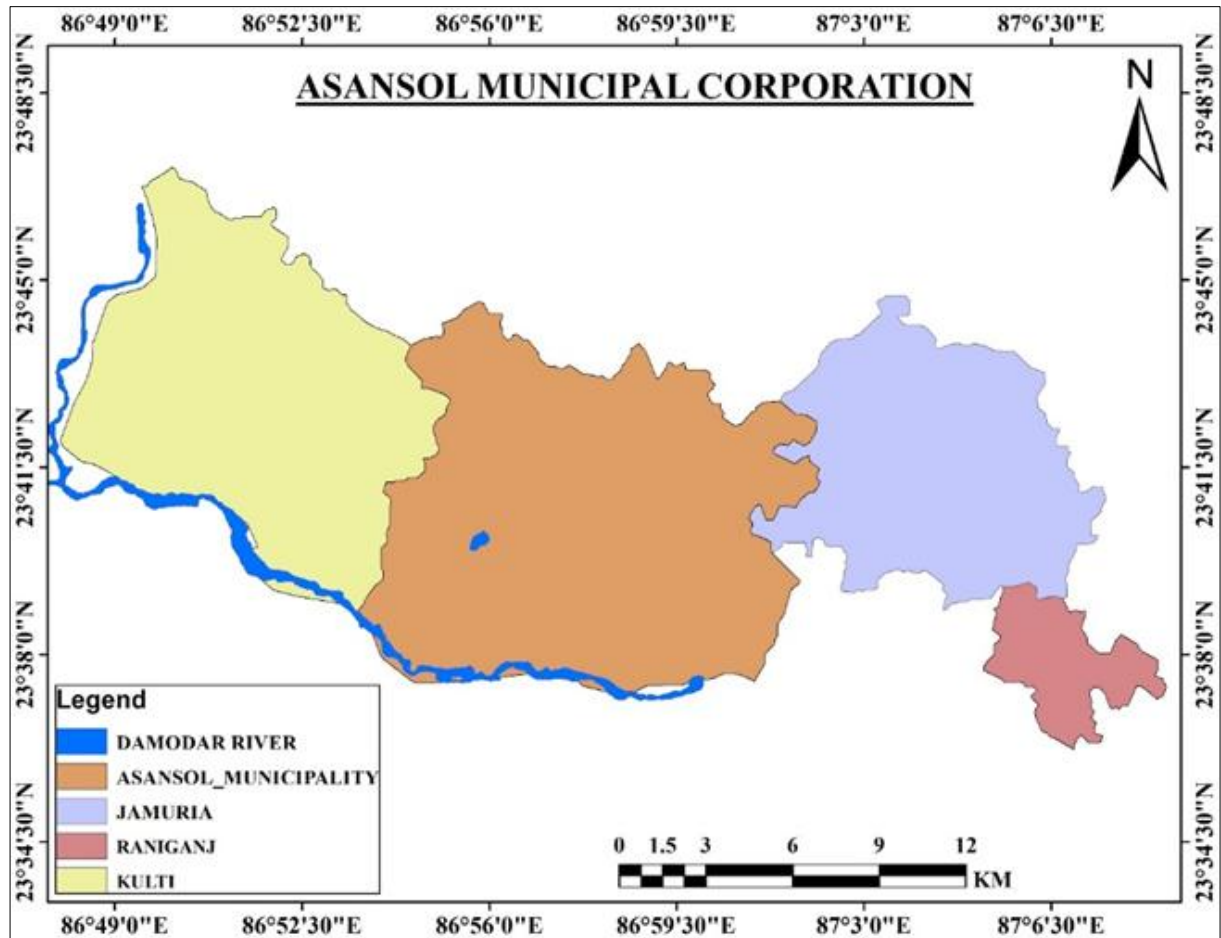


Fig 3: Municipalities that were merged in AMC

### Geology:

The region's geology comprises Upper Tertiary sediments, Gondwana sedimentary rocks, Rajmahal basalts, and Precambrian meta-sedimentary rocks (Ghosh, 2012). Both these older

rocks and the early Quaternary deposits have laterites. The existence of a number of coal measures that were essential to the development of mining operations and industries is the most pertinent fact in this context. To the north, west, and south of the coal layers are exposed Archaean-aged metamorphic rocks. The Damuda includes the Barakar ironstone and shales, the Raniganj measures, and the Panchet and Supta Panchet deposits. Talcher is exposed along the northern margin of the area under review (Krishnan, 1966).

### Physical Features:

Being a spatial science, Geography teaches us how the physical environment (topography, climate, etc.) controls human life. This urban agglomeration is shaped by the physical setting of the area. The eastern half of the Bardhaman district, which is made up of deltaic alluvium deposits, is entirely distinct from this undulating region that extends from the western plateau. The following pages provide descriptions of the region's

physical features, including its topography, geology, natural drainage, land, soil, and climate

### Topography

The region, which is part of the Damodar Valley, is distinguished for its wide, undulating landscape. The region gently dips down toward the south and southeast. The Damodar-Barakar basin's area is a naturally dissected plateau (Mukherjee, 1987) <sup>[17]</sup>. Although the plateau's sediments are unsuitable for farming, they make an excellent location for industries. This region's surface gradient is southerly toward the Damodar River, northerly near the Ajay River, and westerly toward the east (Peterson, 1910) <sup>[19]</sup>.

There are noticeable gullied and fragmented areas along the Ajay and Barakar tributaries, as well as along the Nunia Khal (creek), a tributary of the river Damodar. The most significant of them is the Nunia-Khal river, which becomes non-perennial in the middle and travels southeast after getting another non-perennial tributary that flows east, a mile northeast of Asansol. Although the geography of the Asansol Sub-division is primarily undulating and partially covered by the older floodplain alluvium of the Damodar, low gullied terraces encircle the interstream uplands. In addition, the Asansol

subdivision's terrain is distinguished by coal derricks and the spoil heaps they produce, the miners' haphazard and filthy habitation, a substantial rail and road system, and ropeways that transport sand from the Damodar (WB District Gazetteers, 1994) [10].

**Climate:**

We know the state of West Bengal mainly comes under the tropical type of climate in Koppen's classification of world climate. But here comes a little bit of variation in the climate. This particular study area of Paschim Bardhaman comes under

two types of climate according to Koppen's classification (IMD, 2008) [12]. These two types are-

- Aw
- Cwa

This particular area is relatively drier than the rest of the state, where the climatic type 'Aw' stands for Tropical Savanna. Which is usually hot and seasonally dry, like most parts of India, the winter season is very dry.

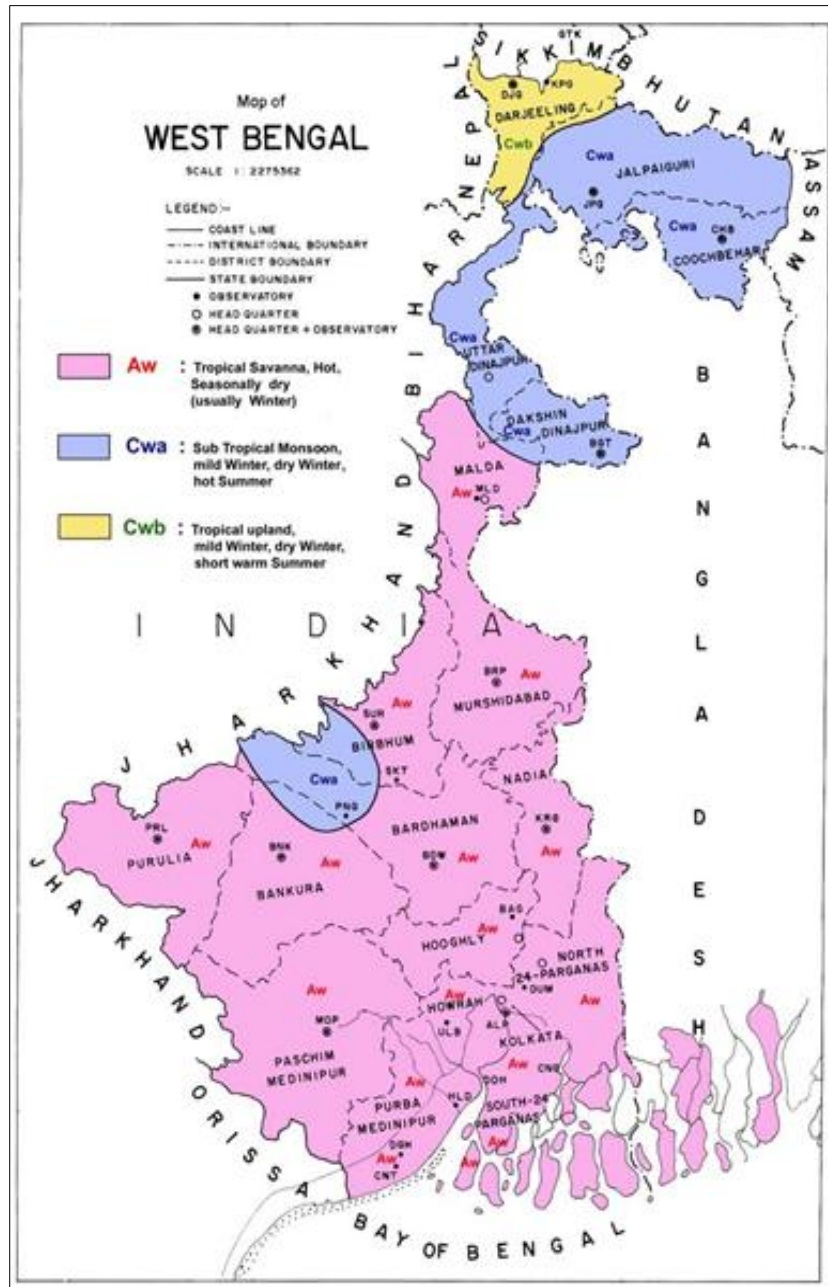


Fig 4: Climatic types of WB

The other type, 'Cwa', stands for sub-tropical monsoon climate with mild winter, dry winter and hot summer, as indicated in the map. So, in general, the whole study area is situated in a humid tropical monsoon regime. So, it has main characteristics like-

- i) Hot and dry summer season (Between March to May).
- ii) Rainy season or the time of monsoon rainfall (lies between June to September)
- iii) Very short Autumn season (during the months of October and November). And
- iv) A pleasant cold Winter season, which is also very short (December to February).

So the 'Cwa' climate is a little bit different from the 'Aw' climate. Although both of them are characterised by dry winter and hot summer, the temperature difference is the main actor here. In case of 'Aw' climate, the average temperature in the coldest month of the year is 18°C or above, whereas it can go below 18°C in 'Cwa' climate (Hamed *et al.*, 2022)<sup>[11]</sup>.

The Damodar River is the main river that collects rainwater in the region during the monsoon season, and later on, this water is used to irrigate the agricultural fields, for the purpose of industries and domestic uses, and also to generate hydroelectricity.

#### Temperature:

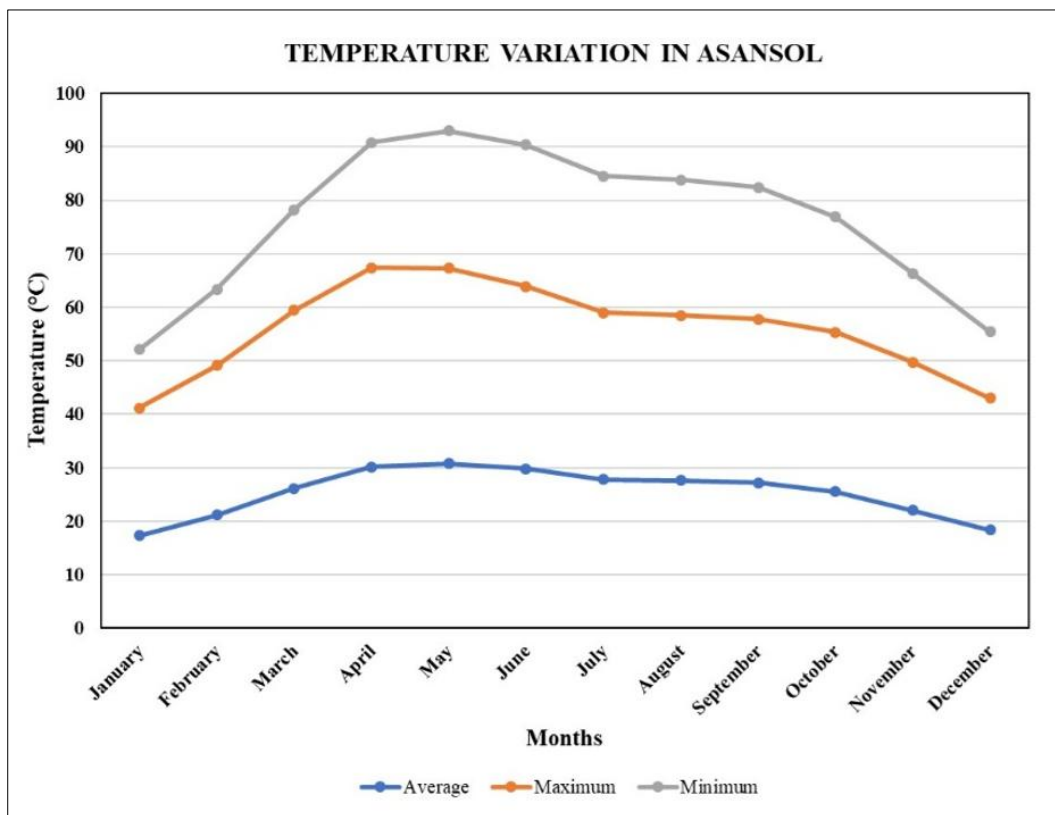


Fig 5: Temperature profile of Asansol.

Beginning in early March, the temperature climbs quickly and reaches its peak by the first week of June. However, by the first or second week of June, there is a noticeable dip in temperature due to the arrival of the south-west monsoon. However, from June through October, the temperature stays the same. In November, the temperature starts to drop. It should be mentioned that Asansol town has hotter summer temperatures than any other area in Paschim Bardhaman District (Gaz, Bur., 1994). In this area, the highest and lowest recorded temperatures in May and January are 48°C and 10°C,

respectively. Also, here we see the highest average temperature in the month of May, which is 30.8 °c, whereas the lowest average temperature is recorded in the month of January, 17.3°c.

#### Rainfall and Relative Humidity:

It is already mentioned in the aforementioned section of this chapter that this region comes under the Monsoon Climate, which produces a unique rainfall pattern.

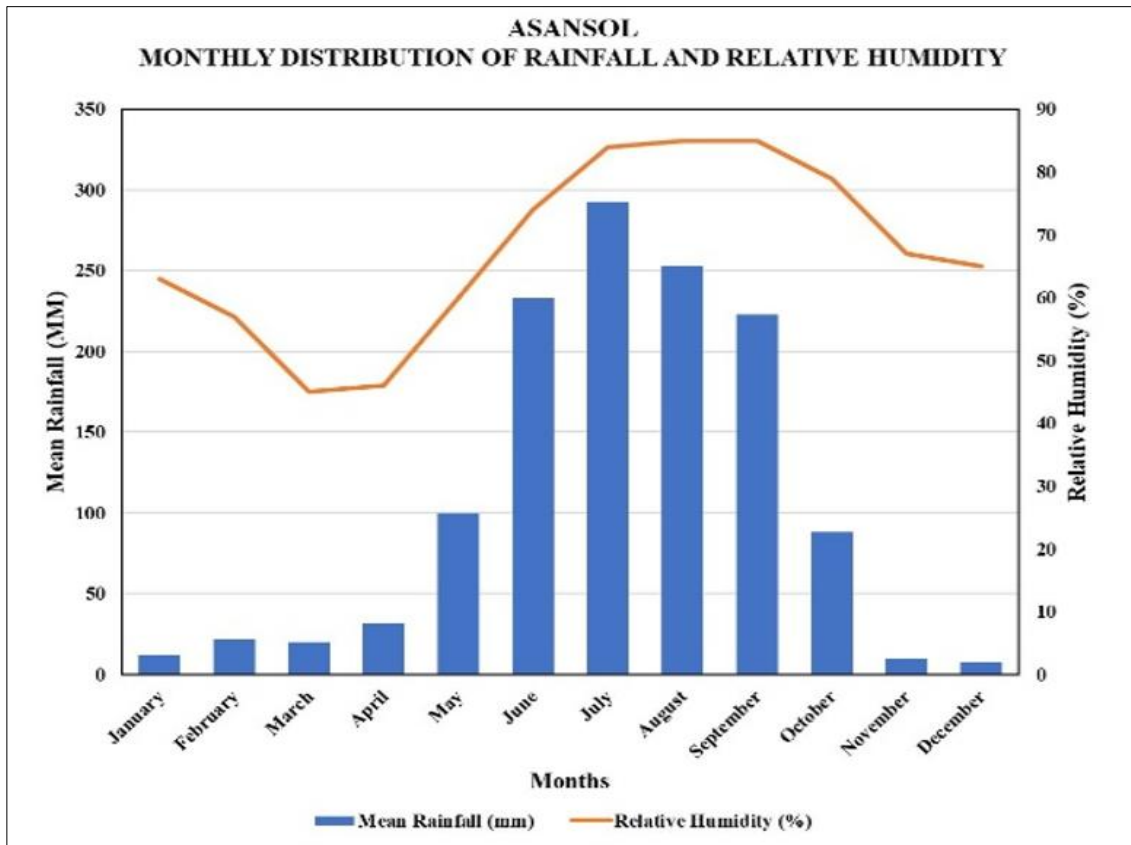


Fig 6: Rainfall and Relative Humidity of Asansol

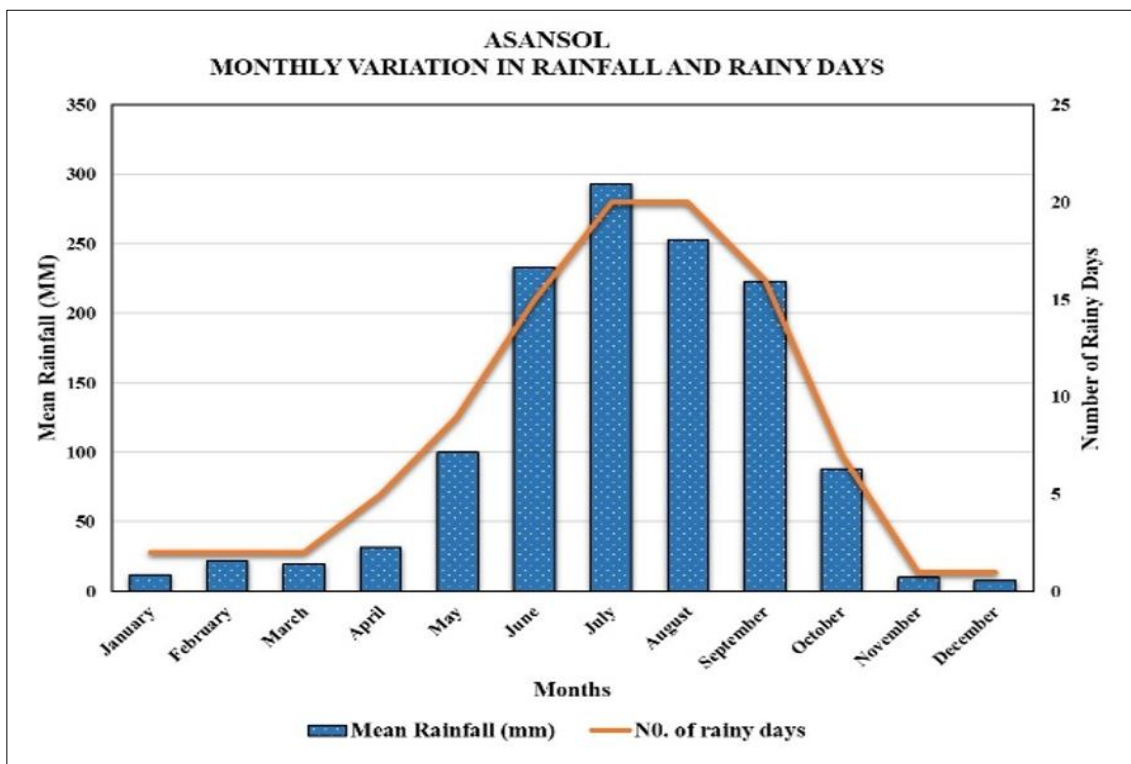


Fig 7: Monthly rainfall and number of rainy days in different months

We have already discussed that the monsoon is responsible for the largest amount of rainfall during the months of June to September. However, the data shows a considerable amount of rainfall also occurs in the month of May. So, if the Monsoon starts in the middle week of June, then what causes rainfall during May and the earlier half of June? This is due to the cyclonic conditions of the area. Cyclonic storms are primarily responsible for rainfall. The region experiences cyclonic storms, known locally as Kalbaisakhi, in May and June. The months of July and December get the most and least rainfall, respectively, at 350 mm and 3 mm. Overall, the Asansol region experiences medium (1330–1400 mm) rainfall in the northwest and heavy (>1400 mm) rainfall in the east. There is often little rainfall in the western and central regions of the flat plain, with 20% to 25% of rainfall fluctuating.

March has low relative humidity, while July and August have high relative humidity. Tropical cyclones and storms break up a dry summer that lasts from March to May. The monsoon season then explodes in June and retreats in September and October. Pre-monsoon seasons typically see three or four intense cyclones linked to norwesters, while post-monsoon periods typically see two or three (ADDA, 2010) [1]. Asansol experiences monsoon-season weather that is remarkably similar to that of other regions of southeast Bengal. Rainfall is not less in the Asansol district because it is closer to the monsoon's advance (Gaz., Bur., 1994).

Due to the Monsoon between the months of June and September, we see maximum days of rainfall.

#### Soil:

The soil in the majority of the region is made entirely from highly weathered rocks, which makes it very different from Central Bengal in many areas. These soils have a medium to coarse texture, are reddish in colour, react acidically, and have low levels of calcium, phosphate, nitrogen, and other plant nutrients. Rich agricultural grounds were encroached upon by mining regions. Loamy soils predominate in lowland regions, whereas sandy loam soils are found in uplands and along riverbanks.

If we generalise the soil type, this region is located near the river Damodar. As a result, it has a huge amount of Alluvial soil, especially concentrated in the plains and low-lying areas of Asansol, where the seasonal flow of the river leaves its impact (Ghosh *et al.*, 2025) [8]. This alluvial loamy soil can store moisture content, which makes it good land for cultivating crops like rice, Maize, and a wide variety of vegetables.

We know this region also comes under the eastern part of the Chotanagpur Plateau. As this region is largely composed of Laterite soil, so Asansol also has this soil, which is rich in iron and aluminium. This soil is not suitable for agriculture and is mostly used for mining and industrial purposes.

#### Elevation:

Elevation is very crucial for this region, because its drainage, mining etc. are very much influenced by it. That is why we have prepared a digital elevation map-

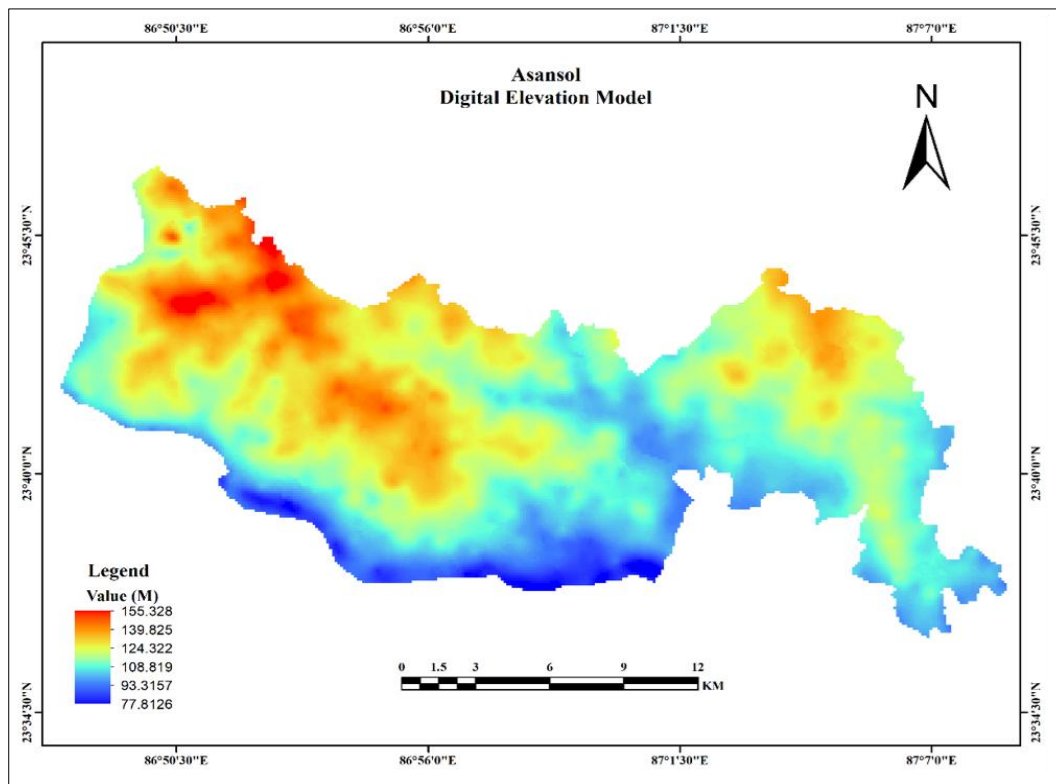
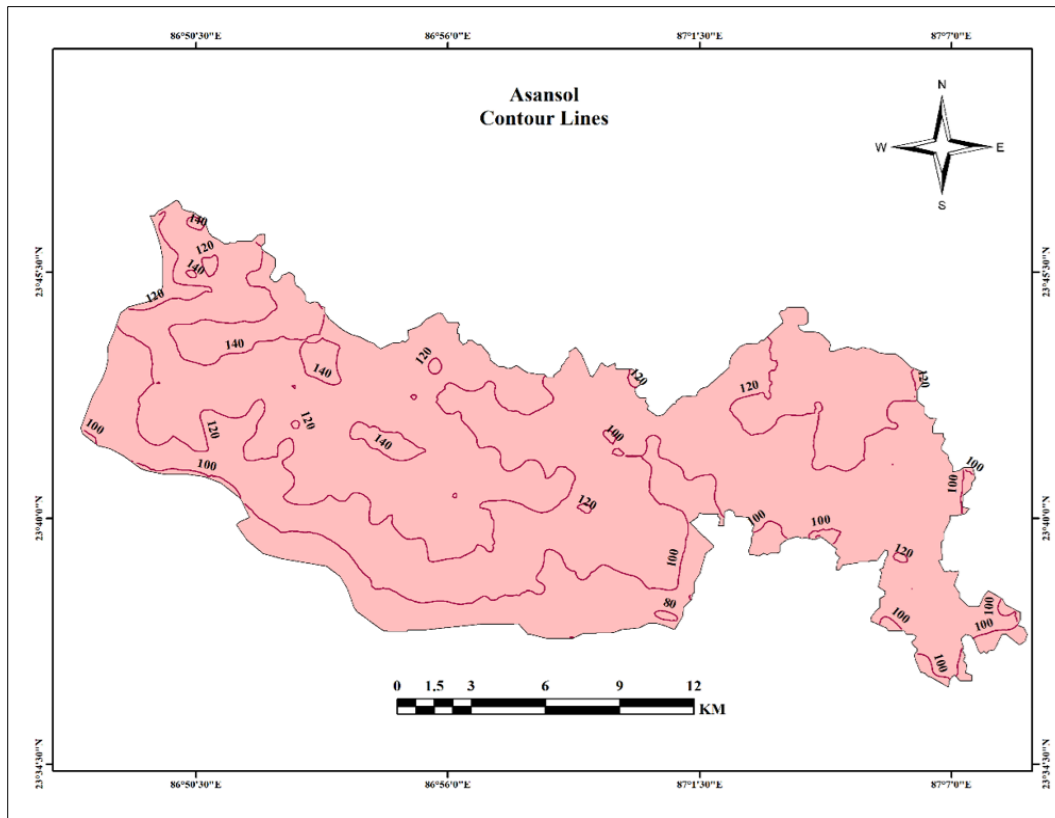


Fig 8: Digital Elevation Model of Asansol.



**Fig 9:** Contour lines showing elevation in the study area.

This map shows that the southern edge of the study area has an elevation of around 80 meters above sea level. This is the region where the mighty Damodar River flows. This map shows that the northwestern part has the maximum elevation of around 150 meters. So the relief gradient of the area is very high. So if we travel from east to west and south to north, the region acquires a high altitude, where we find isobars having 140 meters of elevation. This is the region which comes under the Chotanagpur Plateau, and famous coal fields like Raniganj are located in this area.

#### **Natural vegetation:**

Prior to the British Raj's occupation of the region, the area under study was a part of the enormous forest tract of the well-known Jangal Mahal, which was basically a tropical deciduous forest. As the predominant species, this forest had Sal, Mahua, Kendu, Bamboo, Teak, etc. After coal was discovered, mines were established, which contributed to the area's forests being rapidly destroyed. Here, the expansion of agricultural land also played a major role. Asan, the tree that produces tasar silkworms, is the source of the city of Asansol's name. Naturally, the locals are harvesting timber and non-timber forest products from an ill-defined history in the botanical endowment's abundance.

#### **Water resource:**

Considering the elevated position of the Ajoy River, it is plausible that in ancient times, an overwhelming surge of

floodwater cascaded into the Damodar Channel (Bhattacharyya, 2011) [5]. These phenomena, along with the complex interplay of geological, geomorphic, and climatic zones, are partially to blame for the prominence of two Damodar tributaries on the 'Gauri' and 'Nunia' terrain. These terrains, characterised by their striking east-west orientation, reflect a dynamic history shaped by nature's forces.

The Dabar Bandh, close to Chittaranjan Township, is where the Gauri River originated. It flows south up to Sitarampur before curving southeast in a trellis pattern over a number of faults. The Nunia, on the other hand, begins its journey close to Panifala and flows eastward before meeting the Gauri River, which is close to the well-known Ghagarburi temple in the area. All of these rivers get their water solely from rainfall.

#### **Demographic details:**

##### **Population growth:**

The population growth in the study area shows clear patterns. If we see the decadal growth rate of the population, we find this very interesting.

##### **Asansol urban agglomeration**

As of the 2011 census, the Asansol-centred urban agglomeration (UA) had a population of 1,243,414 people. This agglomeration included several census towns such as Amkula, Baktarnagar, Ballavpur, Bhanowara, Domohani, Egara, Majiara, Murgathaul, Raghunathchak, Sahebganj, and Topsi.

Additionally, it incorporated the former municipalities of Kulti, Jamuria, and Raniganj, which were merged into the Asansol

Municipal Corporation (AMC). The agglomeration also encompassed Charanpur, which is an outgrowth of Jamuria.

Table 1: Population and growth rate in AMC and City.

Years	AMC		ASANSOL CITY	
	Population (Numbers)	% (Decadal growth rate)	Population (Numbers)	% (Decadal growth rate)
1901	30747	-		
1911	37,416	21.70%	21919	+47.05
1921	41,035	9.70%	26499	+20.90
1931	64,973	58.30%	31286	+18.06
1941	1,21,508	87.00%	55797	+78.34
1951	1,82,104	49.90%	76277	+36.70
1961	2,86,539	57.30%	103405	+35.57
1971	3,70,800	29.40%	155968	+50.83
1981	6,28,991	69.60%	183375	+17.57
1991	9,38,067	49.10%	262188	+42.98
2001	10,67,369	13.80%	475439	+81.34
2011	12,43,414	16.50%	563917	+18.61

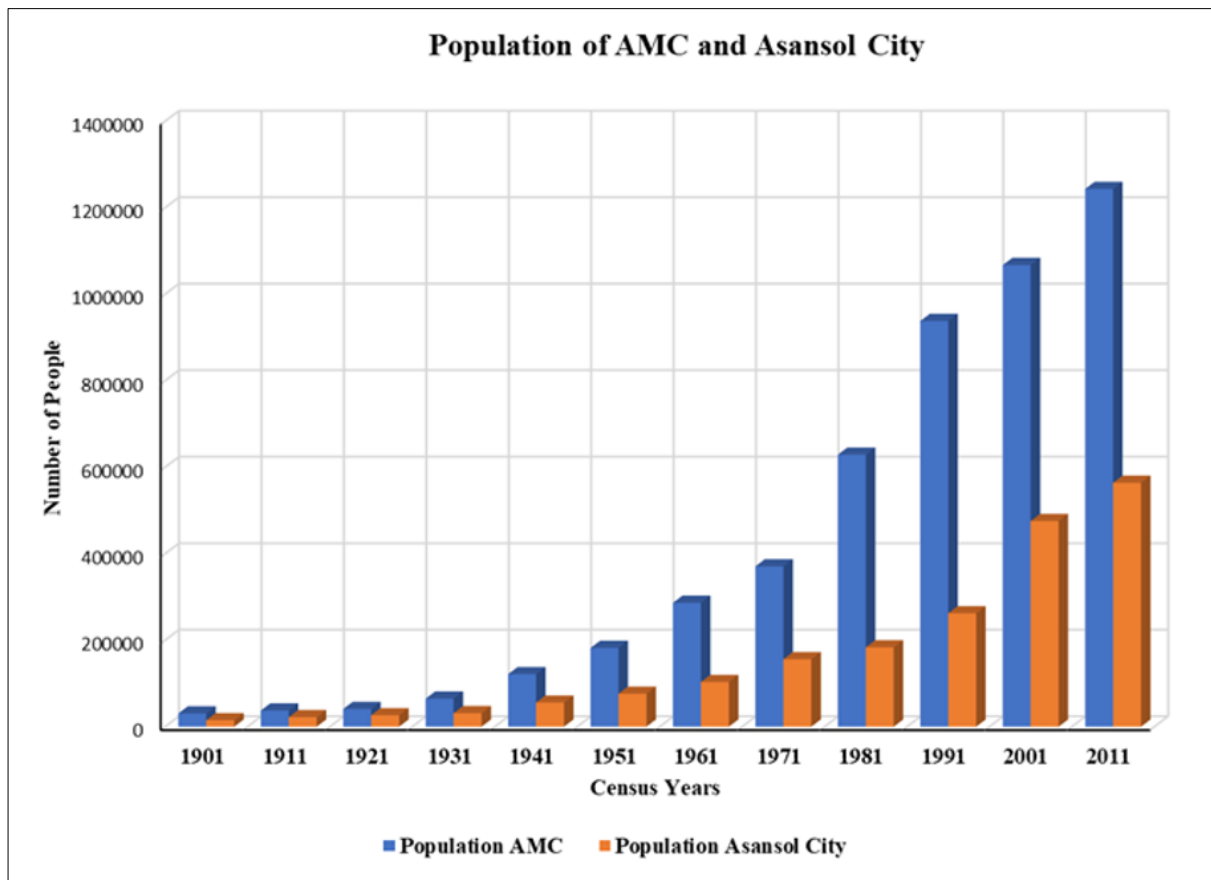


Fig 10: Comparison between the population of AMC and the city.

Here we find the population of the study area till 2011. Since no census has been conducted since 2011, it becomes very much essential to get some ideas about population projection. It will give us an idea of how much change has occurred in terms of population. For the projection, we have multiple methods, for example, Linear Projection, geometric projection, and

exponential projection. But here we have used the Geometric Projection (United Nations, 1974; United Nations, 2017) [23, 22]. This method is ideal for projecting the population of rapidly growing cities and urban planning. The mathematical expression is

$$P_n = P_0(1 + r)^n$$

But in case the growth rate is given in %, we need to use the modified version of the equation-

$$P_n = P_0 \left(1 + \frac{r}{100}\right)^n$$

As in the table, we have the growth rate of population in percentage (%), so we will use the second equation, where

$P_n$  = Population after n years,

$P_0$  = Base year (present year) Population

r = Growth rate

n = number of years between base year and projected year

So if we project the population for the year 2021-

$$\begin{aligned} P_n &= 1243414 \left(1 + \frac{2.7}{100}\right)^{10} \\ &= 1243414 (1.027)^{10} \\ &= 1623006 \end{aligned}$$

Here we have used 2.7 as the value of 'r' because the growth rate in 2001 was 13.80 and in 2011 it was 16.5. So the actual growth increase was (16.5 - 13.80 = 2.7). Now, in the same way, we will project the population for 2031, taking 2011 as the base year, which means the same growth rate of 2.7.

Population in 2031-

$$\begin{aligned} P_n &= 1243414 \left(1 + \frac{2.7}{100}\right)^{20} \\ &= 1243414 (1.027)^{20} \\ &= 2118481 \end{aligned}$$

Here, the population has increased because the value of 'n' becomes 20.

So the projection actually shows a very rapid increase. In 2011, it was 1243414 people, but in 2021, it should be somewhere around 1623006 people, and in 2031, it will be around 2118481. So in two decades, the population of AMC will almost double. This population increase is not only produced by a high fertility rate, but rather here migration from other parts of the state of West Bengal and India also plays a significant role (Mondal & Gavske, 2024) [16]. This migration is mainly stimulated by the employment opportunities provided by the coal mines and industries located in the region.

### Population Density:

One of the key indicators of population concentration is population density, which is the number of people per unit area. The ratio of the study region's total population to its geographic area is known as the arithmetic density. The area of the study area is 326.48 sq.km. The average population density is 3542 persons/sq. Km, which is much higher than the average population density of West Bengal, 1028 per sq km.

But if we look at the population density of Asansol city only, it records even higher density in the corporation area. The density in the city is 4431 persons per sq. km (Auddya, 2019) [2].

### LITERACY

Out of these 1,243,414 populations in the whole Asansol metropolitan area, the total number of literates is 867,142 people, out of which the majority are males. The number of literate males is high in comparison to the literate females, which is 487346 and 379796, respectively.

The average literacy is 78.71%. So this region has higher literacy than the national average of literacy, which is 74.04% (Census of India, 2011) [6]. Here male population records a higher literacy rate (85.13%) than females (71.76 %).

Some other facts on population are-

- The sex ratio is 925 females/thousand males.
- Similarly, the child sex ratio is also 925 females/thousand males.
- Although the sex ratio is much higher in Asansol City, it is 929 females/thousand males.
- Also, literacy rate in the city is 83.30%.

### CONCLUSION

The unique geographical condition is quite different from the other parts of West Bengal. This region is prosperous with coal mines, and it is mainly shaped by the Damodar River. It has a climatic type of 'Cwa', and its elevation increases towards the north and northwestern part of the study area. The population of the city as well as the city is expanding at a very fast rate, not only due to fertility but also due to migration.

### SUGGESTION

- a) As this is an active mining region, large-scale deforestation is taking place. The government should create green patches in order to balance the ecology of the city.
- b) In increasing slum population is the real problem. It needs to be addressed by city authorities.

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