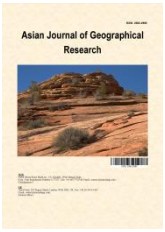

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Changes in Land Use Pattern and Policies: A Study of Bankura District in West Bengal, India

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

This study looks into the dynamic changes in land use patterns in the Bankura District of West Bengal, India, and makes policy recommendations to solve the issues that arise. Land use in the region has undergone major changes in recent decades, owing to causes such as urbanization, agricultural intensification, and forestry decline. The study's main goal was to investigate how rapid urbanization affects the existing land use pattern, from agricultural to urban. Through an in-depth review of secondary information such as reports, research publications, and other departmental data sources. It also explores the socioeconomic ramifications of these changes, such as their potential effects on livelihoods and sustainability. For this study, a mixed-methods approach was used, encompassing qualitative and quantitative methodologies such as descriptive statistics and the least squares technique, among others. According to this study, a group of census towns trail many new minor towns. It can also be claimed that unchecked urban expansion causes pollution. If

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we change just one individual ingredient, the entire system will be disrupted. Pollutants of many kinds wreaked havoc on the ecosystem. This has a significant impact on human existence and impedes healthy living. As a result, various levels of awareness and safeguards are required to achieve a balance in intake levels. People must, however, have access to various mitigation techniques.

Keywords: Land use; livelihood; urban linkage; immigration; sustainable practices.

1. INTRODUCTION

The modern world senses a swift rate of urbanization. It has become the core of in-depth prosperity in socio-economic, cultural, and other dimensions characterized by the migration of rural populations to an urban setting. This fancy urbanization, particularly in developing nations' causes successive growth of territory, rapid conversion of rural landscape into the urban. That ends up in economic activities from agricultural to non-agricultural (secondary or tertiary economic activities). It is also accounTable for the variation in expense behavior and way of living in urban circumstances. India's urban population has doubled in just fifty years, though only in an unpredicTable, unregulated manner [1]. However, they play a significant role in providing essential services to the city, towns and villages, and the encompassing areas. Here, our study area Bankura is a Class I city according to the census of India.

The fundamental issue of urbanization in our country is high urban density and urban sprawl. For instance, it was 20.2% in 2001 that reached 34.47% in 2020. It reflected the fast rate of urbanization (stastica, 2021). It is linked with many undesirable outcomes like urban environment damage [2]. Moreover, the urban land use pattern has changed enormously, affecting both the natural and social environment of the city surroundings [3, 25]. Like, forest cover, cropland, water bodies that provide ecosystem services are affected mainly by the urban expansion process [1]. These all cause changes in ecosystem functions. So, these factors resulted in soil eutrophication [4]. Air quality and urban heat islands (UHI) threaten urban residents [5, 26]. Moreover, land-water degradation resulted in adverse effects on the livelihoods of the inhabitants in rural-urban fringes [6, 27]. Meanwhile, the main priority is to boost the integrity of the food chain, organic phenomenon system through quality assurance mechanisms.

2. STUDY AREA

2.1 Description of the Area

Bankura district is situated between 22°38' to 23°38' North latitudes and 86°36' to 87°46' East longitudes. The district features a total area of 6881 sq. km. According to the organic genesis of landforms, the district has broadly divided into two major zones, namely,

- The cleft highland on the fringe of the eastern edge of the Chota Nagpur region in the Westside, and
- An uneven alluvial deposit spread on the East side of Bankura.

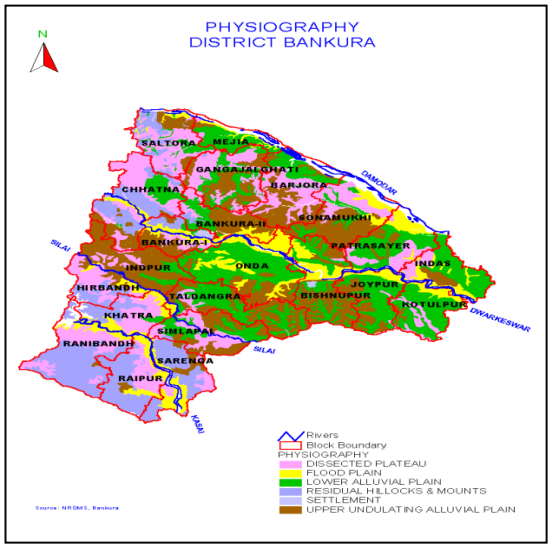

Fig. 1. Physiographic map of the Bankura district

Source: NRDMS, Bankura 2017

2.1.2 Drainage

Five rain-fed streams flow from the western upland, draining the entire district parallel from the northwest to the southeast facet. All of them have seasonal flows. The critical river of the region is Damodar, flowing from the northwest to the southeast direction.

3. METHODOLOGY

The recent study dynamicity in land patterns from agricultural to urban and associated challenges' has been made using secondary sources of information. We have studied related theories from some specific journals, the census of India report in 2001 and 2011. Here we mentioned some sources like Land Use Planning, Environment and Forestry Statistics 2015, Surface Water Investigation Department 2016, Directorate of Agriculture (Evaluation), Government of West Bengal. A physiographic map has been attached in the study area part [7] to portray the inherent difficulties of the intra-district and inter-district disparity. We have used Microsoft Office and Excel 2007 for Tables, data arrangement purposes, and Scatter plotting. A scatter diagram can easily express the correlation between the variables. We have applied Least Square Method for the scatter plot. Where it considered forestry (in hectare) an independent variable and districts domestic product in (lakh) as a dependent variable, there are some limitations in work, as we used secondary data sources. We avoided field visits due to the pandemic situation, also for a shortage of time.

4. NODAL LOCATION

Bankura connected the Bengal Plain on the East and Chota Nagpur plateau on the West side of the state. Some National (NH 14 and 60A) and State highways (SH 2,4,5,8 and 9) pass this city. One of the leading railway zones of the South Eastern Railway of the Indian Railways. Here, the city area belongs to a Functional Region. There are three municipalities and nine Census Towns as per the census of India 2011. The land utilization pattern of the district constantly changes for human interferences. Many heavy, medium, and small factories are located based on the sources of the raw material. Agriculture is the mainstay of the district because of specialization and massive competition in the job market.

4.1 Present Land Use

The economic status of specific administrative units depends on their land use pattern. The diversified ways of land use widen the paths of revenue generation. The strategic objectives of authority enhance it.

The ruling government provides favorable circumstances to the investors similarly to citizens to strengthen economic health. From Table 1, we would say that the entire land area of Bankura covered by many types of the forest is relatively higher in terms of income opportunity because we read that a higher amount of arable land is better for healthy livelihoods. Fig. 2 displays the forest land encroachment status of eight districts of Bengal as of March 31, 2014.

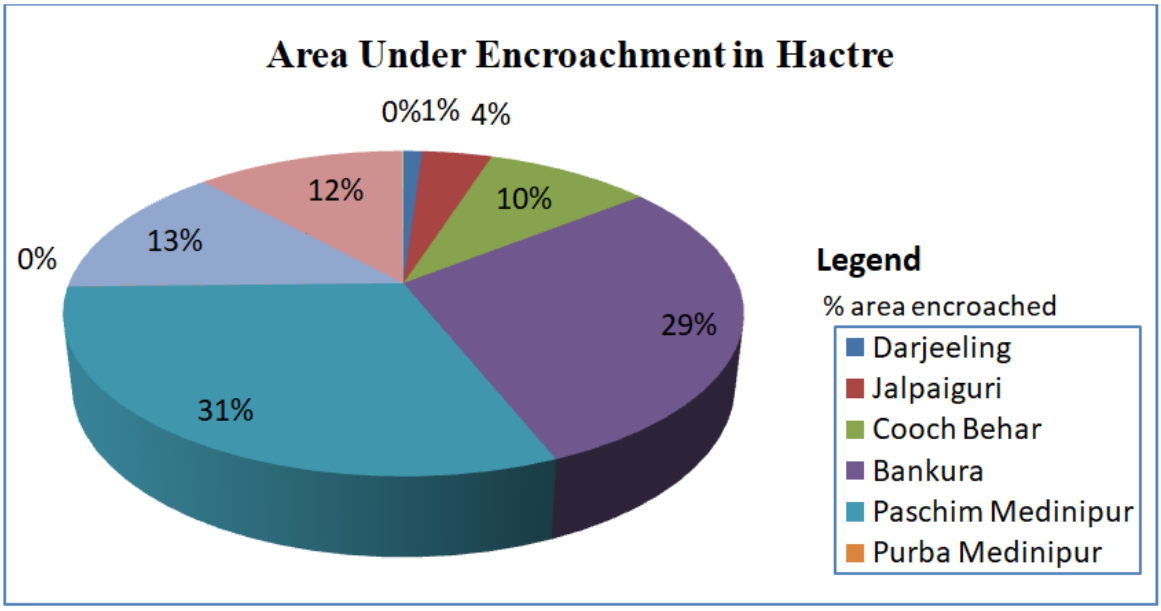

Fig. 2. District-wise land area encroachment for the new setup
Source: Environment and Forestry Statistics of West Bengal, 2015

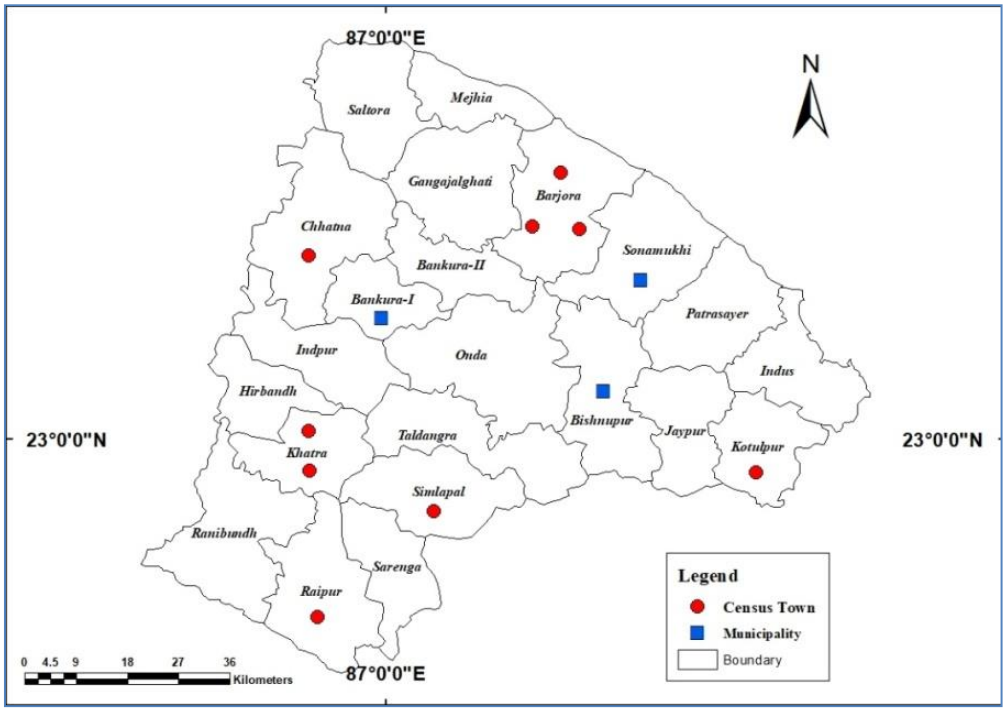

Fig. 3. Location of Municipalities and Census Towns in Bankura District
Source: District statistical handbook 2014

Here, we will analyze the reasons for land encroachment. For Bankura, this rate is 29% (2948.357 ha), next to Paschim Medinipur, 31% (3092.51 ha) out of the total state encroached area of 10040.73 hectares 2015.

Moreover, 325.38 sq. km geographic area is an unproductive wasteland, just after the district of Purulia. A gross of 478.62 sq. km area is a wasteland; from Table 4, we highlighted the challenges of cultivable wasteland. Here, the most proportion of cultivable wasteland lies in Purulia, Bankura, and Paschim Medinipur districts. The total district area under this category is 1404 hectares. This vast, unproductive land can be used in modern technology and equipment mentioned in wasteland reclamation procedures (West Bengal Environment and Forestry Statistics, 2015) [8].

Fig. 3 shows the location of all three municipalities (M), namely Bankura, Bishnupur, and Sonamukhi. The first two are the sub Divisional headquarter; Bishnupur and Sonamukhi are the district's old cultural hearth and the entire state. Bankura is the district headquarters. It means the Central Business District (CBD) of the whole community. Every kind of commodity and materialistic service is available here except the Air Transport. Therefore, these entire three municipal towns are highly populated. According to the Census of India 2011, the population density of these three central urban units is 7208/ sq.km, 3080/sq.km, and 2497/sq.km, consecutively. Nine newly born Census Towns (CTs) is a matter of concern.

These are Barjora, Beliatore and Ghutgarya, Jhanti Pahari in Bankura Sadar Sub division. Simlapal, Khatra, Ledisol, and Raipur Bazar are in Khatra Subdivision. And only one CT Kotulpur in the Bishnupur Subdivision. These all are the new nuclei that reflect the current trend of urbanization.

4.2 Major Industrial Profile of the District

The district has not progressed enough that we already discussed. Bankura, Purulia, Paschim Medinipur, the most backward south-western districts, and the newly formed Jhargram. In these districts, GDP is lower than in other affluent neighborhoods. The total gross annual GDP of Bankura from the secondary sector was like mining was Rs. 355lakh, Rs. 97,980lakh from manufacturing units (both organized and unorganized) and Rs 69534 from construction work. That is better than the underdeveloped district Purulia but way behind the Paschim Medinipur district. And many times lower than a

state's typical prosperous district like Hooghly, Howrah, etc. Data based on Bureau of Applied Economics and Statistics, 2013-14 (Q) of West Bengal.

The WB government has established many Karma Tirthas to achieve this goal.

4.2.1 Types of industry

Rural development by promoting business infrastructure facilities in rural areas is a good initiative. It is an excellent strategy for industrial expansion and economic progress. Here, we have elaborated on post-independence as well as recent industrialization.

4.2.1.2 Major formal or organised activity sources

Ferro Alloy Industries, ash bricks, Plasto Industries, Cement Industries, Stone Crushing unit, Dairy Products, Cattle Feeds, Poultry Feeds, Seed Processing Industries, and Cold Storages are significant sources of revenue. Both skilled and semi-skilled people are engaged here. Iron and Steel industries (Sibaji Electro Steel, Bhaskar Srachi Ltd., Etc.) and M/S Mejia Thermal Power Plant Ltd. were established in Bishnupur town, Barjora Mejia Census Towns. Some PVC pipes were founded in the Barjora CD block and Bankura-1, M/S Nilkamal, M/S Xpro, Tuff & Tube Pvt. Ltd., etc. Several cement factories were established in Bishnupur, Bankura city, Rasulpur, Patrasayer, and Barjora. Stone crushing mills are accessible sources of livelihood about 206 in Bankura, Barjora, Sonamukhi, Mejia, Saltora, and Khatra CD blocks [9].

4.2.1.3 Major informal or unorganized activity sources

Stone crushing mills, bricks making industries have employed central unskilled and semi-skilled laborers. Some entrepreneurs built several small plants to supply household demand like rice mills, oil mills, etc. So many cottage industries like puppetry, arts and crafts have been founded here. Brass and Bell Metal activities, Stone carving, Wood carving, Jute products, Sal Leaf products, other need-based activities like steel fabrication are small-scale industries.

4.2.3 Industrial estates

A Special Economic Zone (SEZ) is a geographically bound zone where the economic laws related to export and import are liberal. In comparison to the rest of the country's parts. SEZs are duty-free areas for trade, operations, duty, and tariffs. Some proposed SEZs in Bankura and Plasto Steel Park Phase-III Barjora in 59 acres of land. It will produce plastic and steel. Also, we proposed a long-term settlement for 99 years. It is named Barjora IE. The total targeted land has acquired 21.28 acres to realize. At the Bishnupur growth center in Bankura, the allotted area is 173 acres for Sri Vasavi Steel Ltd., Modern Concast Ltd., Gayatri Minerals, Rohit Ferro Tech. etc. (State Industrial profile 05, 2015-16, West Bengal).

5. MAJOR CHALLENGES

5.1 Urban Ecosystem

The uncontrolled new constructions blame the rapid reduction of greenery and squeezing wetlands. So, the natural ecosystem is enormously disturbed by human interference that breaks the food chains. The ever-increasing, skewed urban growth affects urban ecology, natural landscape patterns, and existing ecosystem functions. These have created huge critical issues like city resilience and vulnerability. Therefore, a kind of assessment and management is required urgently for city sustainability. India initiated the concept of the ecological footprint in the 1990s. It has evaluated urban sustainability by measuring different resources and eccentric services with urban boundaries [10,11].

Table 1. Shows the land-use pattern of Bankura district

Land Use Pattern	Area in hectare
Dense forest	3567
Thin forest	1,28,031
Orchards and miscellaneous vegetation	49,939
Cultivable waste	21,938
Cropland	4,69,541
Urban areas and similar locations	21,938

Source: Soils of Bankura District for Land Use Planning, West Bengal 2015

Table 2. The Water level condition of Bankura from 2006 to 2016

Rock Type	Hard Rock Fringes Area of West	Hard Rock Fringes Area of Middle Alluvial Area of the East	Alluvial Area of the East
Blocks covered	Bankura-I, Bankura- II, Gangajalghati, Khatra, Mejia etc.	Bishnupur(part),Onda, Simlapal, Taldangra, Barjora etc.	Bishnupur, Joypur, Kotulpur, Indus etc.
Area in sq. km.	2904	2129	1848
Average fluctuation water-level in meter (maximum)	7-8m	7.54m	6.35
Average fluctuation water level (minimum)	0.85m	1.52m	1.72

Source: State Surface Water Investigation Department of West Bengal, 2016.

Table 3. The amount of ground water utilization for different purposes

Ground-Water Utilization Classes	Amount in hectare-meter (ham.)	Name of the Blocks
Very low	<300	Bishnupur, Joypur, Kotulpur, Patrasayer, Indus
Low	300-599	Bishnupur, Onda, Barjora and Simlapal
Medium	600-899	Bankura-1, Bankura-II, Gangajalghati, Indpur, Khatra, Ranibandh, Mejia (part), Raipur(Part)
High	900 and >900	Taldangra, Mejia, Sarenga East), Hirbandh

Source: Surface Water Investigation Dept, West Bengal 2016

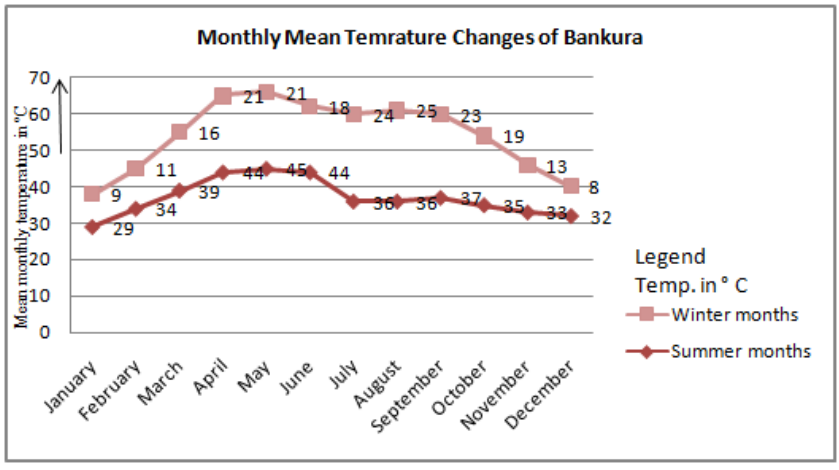

Fig. 4. Monthly mean temperature changes of Bankura, 2014
Data source: Meteorological Department Govt. of India, 2014

Table 2 shows different groundwater zones of Bankura district from 2006 to 2016. Three distinct zones, i.e., i. hard rock of the western fringes. It includes Bankura-I, II, Mejia, Khatra, etc., blocks. Its vastness is around 2904sq.km. Where was the annual average range of water level fluctuation 7-8 m to 0.85 m. This zone faces more crisis than something different from ii—the East to the Alluvial area. We must argue from Fig. 2 that the percentage share of encroachment area in Bankura was 29% (2948.357 ha) in 2014. It has interlinked with the observed water level fluctuation of the district. Because of deforestation, reduction of wetlands, new construction enhances the net encroached area [12].

5.2 Topsoil loss

Physiographic hindrances are the most crucial factor for soil profile formation. The derelict land is one of the critical factors for topsoil losses. Fig. 1 shows the topographical variation that exists in the entire territory. Some external factors and human intervention have extended it rapidly [13-15].

5.2.1 Anthropogenic causes of damages

We mentioned four vital matters of unregulated urban growth for soil layer damages. These are as follows-

- The unplanned fast growth of the urban area,
- Net population expansion in urban land,
- Open space encroachment, river bed synchronization,
- Untreated dumping of waste materials.

The above four are crucial factors for topsoil losses, as inferred from different theories.

5.2.2 Groundwater Table fluctuation trend during pre- and post-monsoon season

Bankura's geographical location and geology differ from the state's plain land. The entire section gets water only in monsoonal months. Though, less amount of rainfall is there in April. Nevertheless, it evaporated quickly due to the dryness of the soil and temperature for a long time (> 42°C). Some artificial reasons expanded the water level fluctuation trend recently. These are -reduction in open space, deforestation, indoor and outdoor concretization. These factors cumulatively impact the natural flow of the water cycle. Associated impacts have mentioned as follows-

i. Low infiltration rate,
ii. Dryness of soil,
iii. Contaminated water

5.3 Urbanization, Urban Heat Island (UHI) and its effect

A total of 54% of the population inhabited urban places of Asia alone, where the global trend is more significant than 50% of the world's population (United Nations, 2018). Here, only 8.33 % of the whole district population lives in urban land. Moreover, 32.68 % of Indian citizens dwell in different urban units [16]. Fig. 4 gives an overview of the seasonal range of temperature throughout the year. The mean monthly temperature deviation of the summer and winter months was 20-24°C. It displayed the heat resistance capacity of the soil [17].

Fig. 5 represents the decadal urban increase of Bankura city since 1901. Here, the urban population had increased by 7.5 % during 2001-2011. Before this, it decreased during two consecutive decades 1981-1991 and 1991-2001. Therefore, it will be considered a dual deficit or a tremendous financial crisis all over the nation.

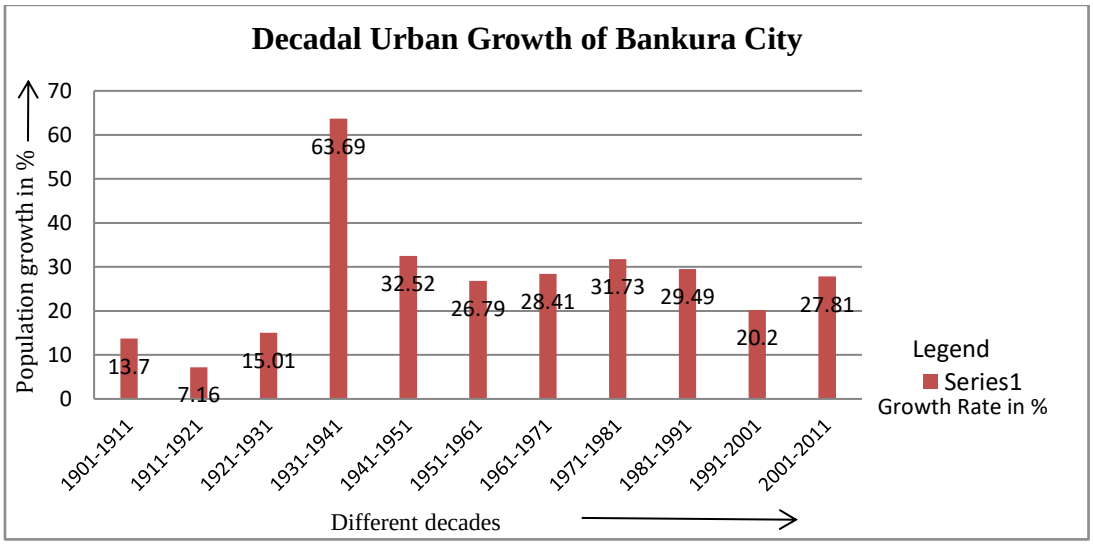

Fig. 5. Decadal urban population growths in Bankura city
Source: District statistical handbook, 2014

Table 4. Classification of land utilization & statistics by district in West Bengal during 2013-14

Districts	Forest Land in hectare	Barren & uncultivable land in hectare	Cultivable wasteland in hectare	District Domestic Product from Forestry Sector [Rs. Lakh]
Darjeeling	124575	2302	1055	17342
Jalpaiguri	179000	2390	69	29921
Coochbehar	4256	100	1223	13553
Uttar Dinajpur	580	69	11	11478
DakshinDinajpur	932	9	0	6713
Malda	1679	0	92	17481
Murshidabad	771	1523	804	23187
Nadia	1216	28	307	20954
North 24 Parganas	0	0	200	23118
Howrah	0	0	41	11564
Hooghly	530	62	789	16428
Burdwan	21165	435	3746	17396
Birbhum	15853	150	1372	13882
Bankura	148930	1620	1404	15024
Purulia	75048	1251	3473	14637
Paschim Medinipur	171935	998	2901	30395
Purba Medinipur	899	195	80	18754

Source: Environment and Forestry Statistics of West Bengal, 2015
Shows present land covered area by natural set up

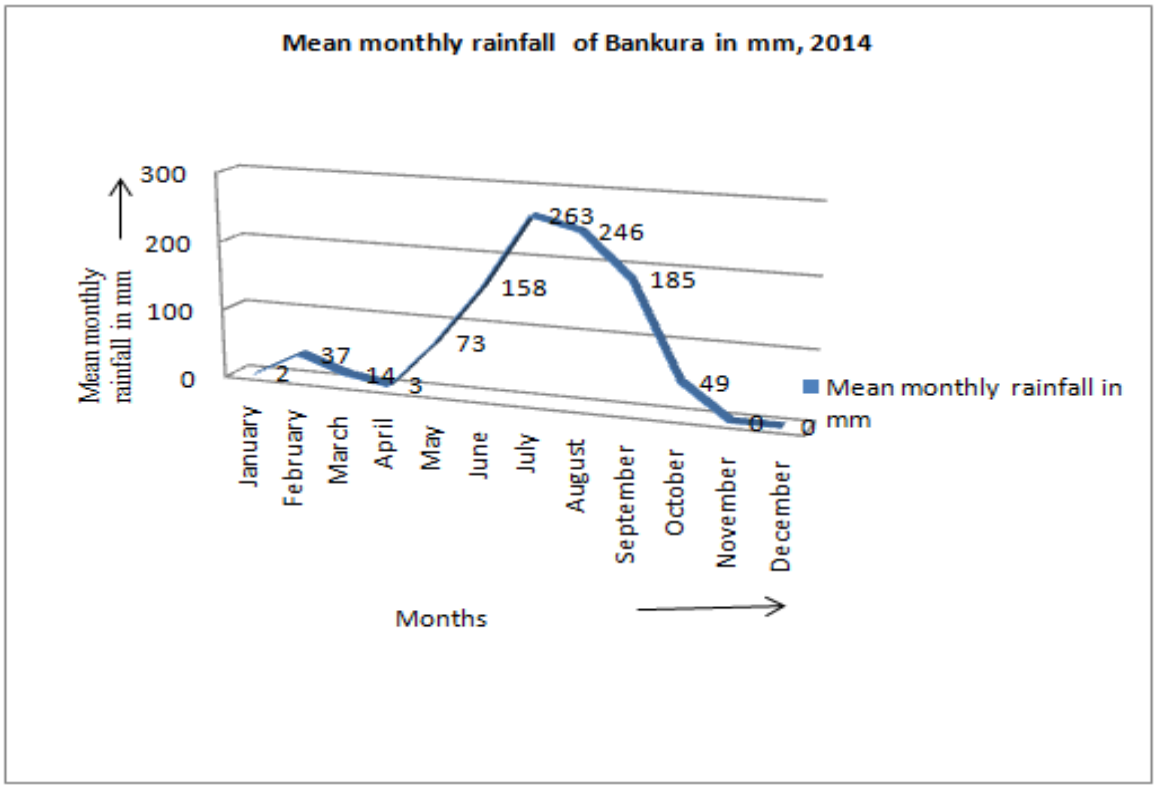

Fig. 6. The mean monthly rainfall of the year 2014
Data source: Meteorological Department Govt. of India, 2014

Fig. 6 shows the mean monthly rainfall. The maximum of the annual precipitation occurred during the monsoon and post-monsoon months. July and August months received the best yearly rain.

5.4 Urbanization, Population, and Global Climate Change Pressures on Urban Water Security

The rural-urban continuum itself is dynamic. The changes are also more marked around rapidly urbanizing or growing economically and spatially than cities with slower growth rates or stagnant urban cores. Furthermore, the transformation induces by their vulnerability to invasive species of urban ecosystems. The quantity and extent of exotic species invasions have increased. Although alien species can do and become integrated with urban habitats in some contexts, they often pose new and significant challenges for city sustenance [18].

5.5 Does rural residents suffer from an urban bias?

Given the significant concentration of economic opportunity in urban areas, one can expect that urban populations would have far better-living standards, levels of nutrition, and employability than rural humankind. Thus, the location of powerful economic interests and wealthier groups expected remarkably urban areas to provide a bias that favored them. But it might be misleading to term this urban bias if it tends only a proportion of the urban population.

The depth of urban poverty in low and middle-income nations hardly suggests that everybody would impact an urban bias. It is common for one-third of cities to dwell in illegal settlements lacking adequate water, sanitation, healthcare, and schools. The outcomes of long-run urbanization result in imbalanced exaggeration, which impacts agriculture and the food production system within the territory and fringe areas [17-19].

6. RESPONSIBLE FACTORS

6.1 Socio-Economic and Anthropogenic Factors

Agriculture plays a significant role in the GDP earnings of the Bankura district. Some anthropogenic factors added extra plight here. These are vagaries of rainfall heat waves, excessive evaporation, soil moisture loss, and groundwater Table fluctuation in pre-monsoon and dry seasons. Therefore, the farmers practiced mono-cropping within the West and southwest parts. That is near the district headquarter.

6.2 Problems related to Solid Waste Management (SWM)

Waste management challenges urban and semi-urban areas. Most of the troubles are associated with the dumping of waste materials. There are no confined places allotted by local administrators in small cities, new townships to dump. So, it is lying on roadsides, low-lying areas and vacant sites, outside drainages, etc. It resembles severe health and environmental hazards that attack the local people. For example, a medical college and hospital, a minimum of eight private hospitals, five large markets generated 351, 44.20 tons of solid waste every year (Pollution Control Board, West Bengal 2017) [8].

I. Household garbage
ii. Medical garbage
iii. Industrial Garbage – automobile, cement factories, iron and steel industries, etc.

Fig. 7 presents the district-wise total forest area in sq. km on the X-axis and the district's gross domestic product from forestry in Rs. Lakh in Y-axis. We used the Least Square Method. After plotting the data from different revenue generation sources of forestry, the two variables are strongly correlated. There are highly positive relations. Here, the value of R^2 is 0.634. It signified the intensive correlation between the two variables. Forest resources are reliable sources of livelihood here. District Bankura has earned Rs. 15000 and Paschim Medinipur has made Rs30300 Lakh from forestry itself, as of August 1, 2015. It symbolized the high dependency on forest resources after agriculture for revenue generation [20].

7. RESULTS AND DISCUSSION

After considering all the inherent factors within the towns and countryside, we must say that the seasonal water crisis could severely threaten cultivation in fringe areas and villages. The adverse geographical location is responsible for the less fertile, uncultivable, or cultivable wasteland (Table 4). table can shows the district's general situation in terms of nature dependency from Table 1. The entire area of

forest area encroachment is larger (29%) than other high forest-covered districts except for Paschim Medinipur districts in the state. So, this vast area comes under either industries or housing purposes or remains bare fallow land.

We can get an economic perception of forestry in Fig. 8. We drew a scatter diagram to determine the relations between districts' gross domestic product and forest-covered areas in 2015. A strong positive correlation (R^2=0.634) exists between the X and Y variables. Bankura has earned Rs.15024lakh revenue in the year only from forestry. It is relatively better for the economy but unviable for the environment. This gross domestic product has a significant role in building the state's economic resiliency. However, it is vital to harness the district's irrigation intensity, especially in the dry zones.

Irrigation is one of the leading indicators for regulating agricultural productivity and rural development. We used 'intensity' to define the total percentage of net area irrigated to net area sown. It identifies the lacuna or deficiency of irrigation accessibilities. Irrigation sources depend on the local climatic condition, geological formation, and other environmental factors. The significant sources of irrigation accessible to farmers are tube wells, wells, tanks, and canals. Fig. 8 shows the irrigation intensity of the whole Bankura district. We divided the irrigation intensity of our study area into five classes as there is a wide diversity in irrigation availability throughout the district. Below 20% to above 80 % irrigation intensity CD Blocks. Because of the different soil-forming factors, their characteristics, etc. Fig. 8 shows that the most northwestern CD Blocks, namely Saltora, Chhatna, and Bankura, faces extreme irrigation scarcity. These three CD Blocks are drought-prone. Here irrigation intensity is <20%. The condition of six neighboring CD Blocks Mejhia, Bankura- II, Indpur, Ranibandh etc. is almost identical, i.e., inadequate irrigation (20-40%) supply during dry months.

The other four CDs Blocks, namely, Taldangra, Khatra, Onda, and Barjora, have less good or less satisfactory irrigation intensity, i.e., 41-60%, because the water reservoir and river dams in this area zone are dry in dry seasons. However, Raipur, Sonamukhi, and Kotulpur CD Blocks have sufficient irrigation intensity (61-80%) as these zones lie in alluvial plain and very close to non-perennial rivers.

The farmers produce crops in dry months also. Therefore, get moisture content from fertile new alluvial soil. The most potential zone lies in Bishnupur, Joypur, Patrasayer, Sarenga, and Simlapal CD Blocks. Here irrigation intensity is above 80%, i.e., good. It has been no such water crisis in the agricultural tract. The cultivators get enough supply water from underground water sources, canals, and open tanks. However, in the urban and urban fringe areas, there is an acute water crisis in summer. Therefore, the utilization of groundwater increased persistently than before. In Fig. 3 and Fig. 6 rapid rate of urbanization has depicted. Agricultural drought is a vital issue everywhere in the district. It reduces the soil moisture caused by the uncertainty of rainfall in the cropping period. This condition ends up in soil dryness, breaks the natural nutrient supply chain. The annual temperature gradient is prominent in Fig. 5.

Here, we will see that the mean temperature is incredibly high for the summer and rainy

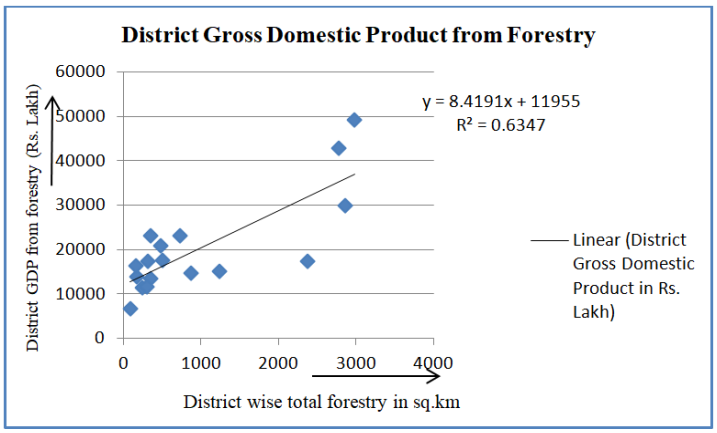

Fig. 7. Relationship between total district forest and gross domestic product
Data Source: Environment and Forestry Statistics of West Bengal, 2015

seasons. It reflected soil moisture capability. Because high heat absorbs soil moisture content, reduces available nutrition content, and enhances fertility. The summer and winter months were dry. The monsoonal rain-supported mono-cropping, only Aman paddy is cultivated within the Western, Southwestern sides, and double cropping, including Ravi crops, are produced within the Eastern alluvial plain. Because of lack of irrigation potentialities in Western and South Western parts. Here, Table 2 showed the typical average one-decade water level conditions from 2006-16. The usual maximum water level was 7-8 m, and the minimum was also 0.85m in Western tricky rocky terrain. Almost the identical top water level was within the Middle alluvial area, but the minimum fluctuation was 1.52 m. It meant droughts during this point. The condition of the Eastern alluvial track was more or less identical in the maximum change of 6.35m and worse in the average water-level fluctuation, 1.72 m.

Because, first, the rain-fed rivers and, secondly, irrigation in Ravi crops. We found the proportion of groundwater utilization in several blocks of Bankura in Table 3. There are four classes from very low (<300 ham) to high (900, more ham). The southern and South-Eastern blocks used the best groundwater in the district, mainly for industry and cultivation. Eastern blocks used low amounts of groundwater for irrigation. Farmers use open tanks. The Western and North Western blocks used a small amount of 600-899 hectare-meter for industrial and household and a tiny amount for farming. So, we will argue after the general discussion by interpreting all the considered indicators added to build a resilient habitat because the environmental components are interrelated. Therefore, the natural system of human and ecological relationships has been degrading gradually. We justified it from the earlier figures and tables. The prevailing cropping pattern, food systems are hampered by human intervention. So, this vast area comes under either industries or housing purposes or remains as bare fallow land. Lastly, we will claim various natural hindrances in our study area, people's extreme desire to lead luxurious lives attributes to the thread.

7.1 Irrigation Intensity Map

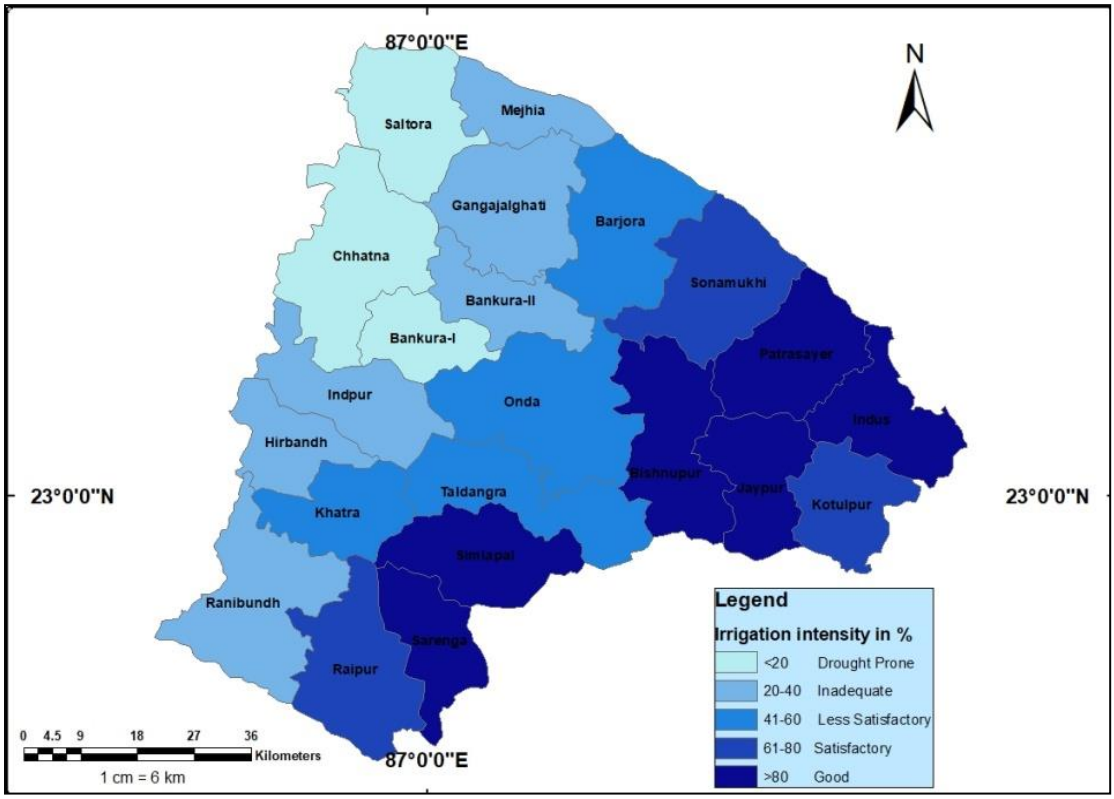

Fig. 8. Irrigation intensity of Bankura district in 2015, compiled by authors
Source: State Surface Water Investigation Department of West Bengal, 2016

8. SUGGESTIONS

Government Policies reflect on the environment itself. The so-called developed countries attained their goal by effective policy implementation that helps to upgrade the healthy living of its inhabitants. Though the developing countries framed policies are ineffective due to corruption and [21].

We can argue that the general solution is not one after considering all the prevalent issues and reasons. Some viable urban zone-specific options arrange to regulate particular matters. There must be some zones supported by capacity. Possible initiatives for measuring water cycle and earthly heat budget include increasing urban greenery in family gardening, community gardening, roadside plantation, an eco-club. Try ever to increase renewable energy sources to the maximum amount possible. Government intervention is seriously needed here. Moreover, successful management of biodiversity. Ecosystem services must base on multi-scale, multi-sectoral, and multi-stakeholder involvement. The urban population should be more careful to make the city resilient. Some remedies to minimize the challenges have taken mainly for,

i. Collection and transportation of wastages,
ii. Dumping and recycling of residues.

However, the only accessible path to check soil waste management is reducing the sources of solid waste in all manners already discussed. The way of reducing scientific design, manufacture, and packaging of things with long usability periods deals with properly [22].

The theme of SDG 11 is to create cities and Human Settlements Inclusive, Safe, Resilient, and Sustainable. So, ecosystem restoration is required to be a serious focus. In addition, there must have some special initiatives for water crisis management – conservation of urban wetlands facilitates ecosystem services, rainwater harvesting technology in every building, and takes a look at reuse of daily household wastewater.

We tried to present an appropriate way in Fig. 9. We focused on some vital steps to form the city or town sustainable; first of all, the new constructions like housing, industries, highways build scientifically. Then we focused on efficiency for reducing energy loss and pollution—more utilization of green energy for production purposes. Soil management is crucial in residential zones, industrial hubs, and cropping fields. There must be open space for vegetation cover, groundwater infiltration, and warmth absorbance. Furthermore, we must focus on using biodegradable, reusable materials. Therefore, we should follow these steps to create a resilient habitat.

We gave some suitable measures for minimizing the associated challenges. It is good to have long-term mitigation goals and connect them with the district's actions and implementation. These goals may include:

- Reduce environmental degradation and restoration of livelihood, and
- Reduce effects of the natural environment on the infrastructure

8.1 Strategies for Optimum Growth of Small Towns

The viability of small towns is possible if this town provides well-facilitated infrastructure and planning widely. Urban planners emphasized economic development and infrastructure provision to ensure the sustainable development of small and medium urban units. Significant economic growth at all levels is essential for enhancing incentives to manage immigration. Therefore, there is a cyclic relationship between economic growth and infrastructure provision. Economic development provides more significant incentives for in-migration, and eventually, this makes timely responses in infrastructure and service delivery.

On the other hand, infrastructure provisions incentivize financial investments and lead to more significant in-migration [23]. The crucial part is the large-scale acquisition of land, particularly in small and medium towns villages, for setting up an industrial unit. The large-scale land acquisition may transform small peripheral localities and minor places of small and medium cities. Such interventions would also significantly affect the land markets in the surrounding region [24]. The effect of land acquisition is varying regionally. Western districts (Bankura, Purulia, and Medinipur) have adequate barren land with investment potential. However, these districts have a small number of towns.

Furthermore, there should be an ecological city in the problematic zones that include all aspects of a green city and the Eco-energy architecture

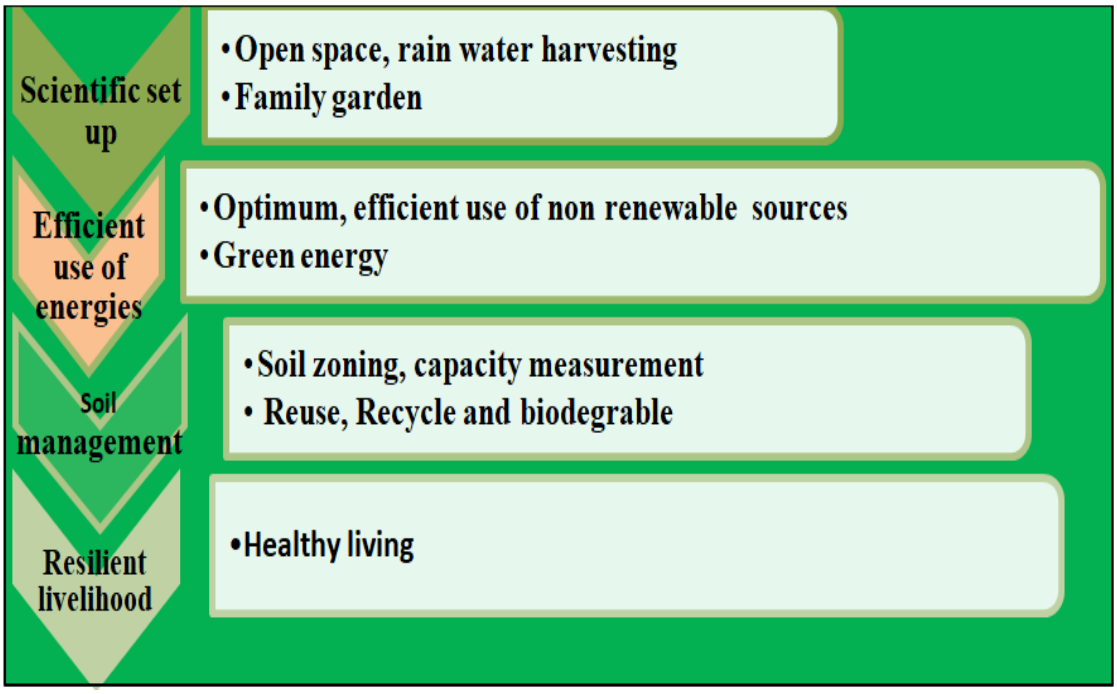

Fig. 9. Relationship among environmental components

base of the region. Side by side increasing rainwater harvesting by applying various methods along with wastewater treatment. The local administrators should encourage the neighbor to focus on organic farming, micro, and mini fields zoning by using suitable irrigation patterns [28].

9. CONCLUSION

The central focus of the study was to study how the rapid urbanization rate changes the existing land use pattern from agricultural to urban. This study shows a group of census towns follow several new small towns. We already mention that these growth poles are the main attractive point for job seekers. They migrate here in different forms of migration throughout decades.Therefore, there is a noticeable change in the urban scenario. The dwelling pattern of the urban population is also remarkable. The small and medium industrial units are intensively correlated. It helps to transform the small towns with neighboring transition zones. It becomes highly vulnerable to our study are because of its physiographic nature. However, the lack of adequate infrastructure to maintain these challenges in small and intermediate or expanding cities is a big issue nowadays.

After analyzing all the information and theories during this work, it can claim that uncontrolled urban expansion results in pollution. If we make a change in exactly one specific element, then the entire system would disrupt. As an example, the reduction of forest area impacts the earth's water cycle. Every kind of pollutant caused degradation of the ecosystem. That highly affects human life and hampers healthy living. So, varieties of awareness, precautions are required for creating balance in consumption level. However, different mitigation strategies must be accessible to people.

A unique initiative should make to control fuel burning. Efficient use of fuel within industries, household purposes—proper placements of hazardous residuals in land-filling stations after treatment. Government agencies should be more careful about existing policy execution. The government should also encourage researchers to do more research on particular fields for brand-spanking-new innovative ideas. There would be some extra facilities for entrepreneurs for an energy-based new foundation in their licensing and taxes.

Moreover, every individual should remember the adverse impacts of unbiased urbanization. Therefore, the framed environmental policies should work out properly. To make the city, towns, and surroundings healthy, viable, and resilient for any or all creatures.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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