

# IMPACTS OF URBANIZATION ON ENVIRONMENT: WITH SPECIAL REFERENCE TO GAYA, BIHAR

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**Abstract** - Over the year, due to urbanisation and population growth in the city, environmental degradation has been occurring very rapidly. All types of poisonous and contaminated water from industrial establishments, harmful smoke from factories & vehicles, growth of vehicles and concrete-made infrastructures on agricultural & Forest land are polluting the environment of the city. It is with the ever-increasing population, that life in the city is getting worse such as rising poverty, slum development, increase in waste generation, lack of basic sanitation and shortage of potable water resulting in unfit for survival. The study aimed to analyse the trend of increasing population, proliferation of slums, solid waste generation, and vehicle growth pattern and bring out the condition of water resources & air quality of Gaya city. The study is based on primary data which has been collected through empirical observation and interviews with the resident of the city. Secondary data has been collected from different government and non-government websites, district census of handbook Gaya, Gaya C.D.P. report, state pollution control board, journals, reports etc. The study shows that unplanned urbanisation is increasing the risk of environmental degradation in Gaya city. A high concentration of P.M. 2.5 in the air is a major challenge for the city. Unwanted slum development, increasing rush of vehicles and their noise, and poor waste management are degrading the social life of Gayaiets. It is time to be serious attention and should be taken adequate steps by local governance & resident of the city to control pollution, increase facilities to waste management and curb other major problems. There should be a planned settlement for a healthy leaving and working environment in Gaya city.

**Keywords** — Urbanisation, Solid Waste Management, Environment, Pollution, Population

## I. INTRODUCTION

Urbanization is one of the most essential key features of developing countries like India. Urbanization has various positive effects it has provided better health facilities, better educational facilities, and more employment opportunities. On the other hand, it bears some adverse effects too. It has become a potential threat to our environment as uncontrolled urban population growth has resulted in environmental degradation in the form of an increase in slum areas, worse water quality, excessive air pollution, noise pollution, and problems with solid waste disposal [1].

Gaya is the second largest and one of the fastest growing cities in Bihar after Patna. Gaya has also been the centre of attraction for Tourism and various commercial and

industrial activities due to its favourable geographic location. The pressure of the ever-increasing human population has resulted in significant risks of environmental degradation in the city. The high population growth with enormous human migration in the last decade has resulted in urban sprawl in the city [2]. Due to uncontrolled urbanization in Gaya, environmental degradation has been occurring very rapidly and causing many problems degraded water quality, excessive air pollution, noise pollution, issues with the disposal of wastes, etc., which causes serious health problems. With the above background, an attempt has been made to analyse the effect of urbanization on the environment with a particular reference to the city of Gaya [3].

## II. DATA SOURCE AND METHODOLOGY-

This study work is based on the collection of secondary sources of data, which have been observed and collected from various books, journals, and government authorises websites & reports like census reports, District census handbook Gaya, C.D.P. Gaya, Bihar census report, M.S.M. report Gaya, Bihar state pollution control board etc.

### 1. Reasons for Urbanization-

Cities and towns have always been a big attraction for people, especially from the rural areas of our country. The increasing trend of the urban population is due to the following reasons:

- Better employment facilities, medical facilities,
- Better facilities for trade and commerce,
- Better facilities for higher education,
- Facilities for entertainment, sports & games,
- Proximity to administration and important government offices.

Due to these reasons, such an increase in the urban population induces several environmental problems [4].

### 2. Significant problems of Urbanization-

The rapid growth of urban population both natural and through migration, has put heavy pressure on public utilities like housing, sanitation, transport, water, housing, sanitation, transport, water, electricity, health, education, and so on.

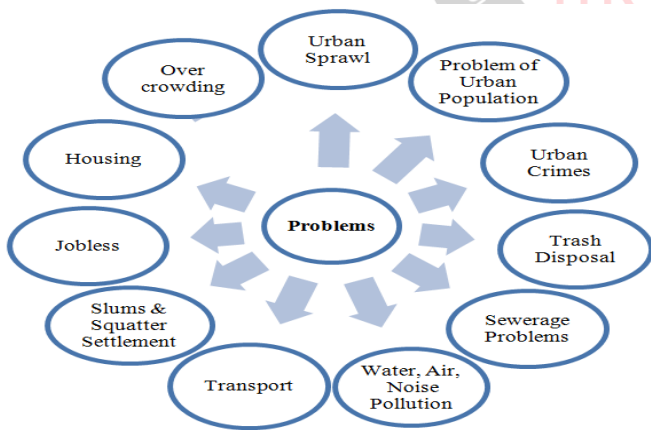


Fig No.1 showing: - Problems of Urbanization

Source: - adapted from Sultana 2020

With the help of figure.1 it is clearly visible that there are a lot of problem arises due to rapid, unplanned urbanisation in any region. Pollution, sewerage and urban waste are common problems in every locality either household or commercial.

## 3. Impacts of Urbanization on Various Components of Environment-

“The sheer magnitude of the urban population, haphazard and unplanned growth of urban areas and a desperate lack of infrastructure are the main causes of such a situation” [4]. “The rapid growth of the urban population has put heavy pressure on public utilities like housing, sanitation, transport, water, sanitation, transport, water, electricity, health, education, and so on. The provision of infrastructural facilities required to support such a large concentration of the population is lagging far behind the pace of urbanization [1].

### 4. (a) Impact on Atmosphere and Climate-

1. **The creation of heat island-** In the city of Gaya, Materials used like concrete, asphalt, bricks, etc. absorb and reflect energy differently than vegetation and soil. The city remains warm at night when the countryside has already cooled.
2. **Changes in Air Quality-** Due to various Human activities occurring around the city release a wide range of emissions into the environment, including carbon dioxide, carbon monoxide, ozone, sulphur oxides, nitrogen oxides, lead, and many other pollutants.
3. **Changes in Patterns of Precipitation-** Compare to the last decade City often receives more rain than the surrounding countryside since dust can provoke the condensation of water vapour into rain droplets.

### (b) Impacts on The Lithosphere and Land Resources –

1. **Erosion and other changes in land quality -** Rapid development can result in very high levels of erosion and sedimentation in river channels.

### 2. Pollution-

- a) **Air pollution-** The air of urban areas gets polluted by a tremendous amount of harmful substances due to a lot of anthropogenic activities. The high number of motor vehicles, Industrial processes, and tree reduction are primary reasons for urban air pollution. emission of harmful gases like CO<sub>2</sub>, CH<sub>4</sub>, SO<sub>2</sub>, NO<sub>2</sub>, CO etc., from industries, motor vehicles, and kitchens disrupt the basic structure of the atmosphere. There is a creation of pollution domes over the urban areas because of the accumulation of a large number of gases, smoke, dust and many other pollutants.
- b) **Noise Pollution-** The noise produced by automobiles, vehicles, social functions, industries, etc., causes noise pollution in urban

areas which causes psychological and physical ailments.

- c) Water pollution- The water quality has degraded with time due to urbanization that which ultimately leads to increased sedimentation thereby also expanding the pollutant in run-off [5]. The disposal of human wastes as well as from industries directly into the water bodies has increased water pollution in urban areas.

**(c) Impacts on The Hydrosphere and Water Resources**

Gaya is situated on the bank of the falgu river, which is a non-perennial river because the water flows for a few months during and after the rainy season; the rest of the year remains dry, but the river is the lifeline of the city. Most of the city’s population is dependent on underground water directly and indirectly for drinking, cooking, washing, carrying away waste, and other domestic & economic activities needs. Most of the water pumping stations are installed along the river bank for water supply to the town. Due to urbanization and population growth in the city, encroachments have been done on either side of the falgu river, waste dumping, the flow of municipal waste & drainage water into the river, and illegal mining of sand from the river bed are affecting negatively the river ecosystem. The peculiar nature of falgu river to absorb river water and maintain the groundwater level may be lost by illegal sand mining.

Urbanization, population growth, and pollution have a huge impact on significant ponds of Gaya, namely Bisar, Dighi, vaitarani, Ramsagar and, Suryakund. After a study of these ponds' water, the WQI; value of more than 130 reveals that ponds are facing heavy pollution. The pond's water and sediments are heavily contaminated with trace metals like cobalt and lead in sediments [6]. Gov. Of Bihar’s project named Ganga water lift project construction work is ongoing. The main objective of the project is to supply Ganga water through a pipeline to the falgu river. there is being built a rubber dam in the river for the storage of water. It may be a life changer for Gayaites.

**(d) Management of Solid Waste-**

The primary source of urban environmental pollution is the decomposing of waste materials into constituent chemicals. Urbanization directly contributes to waste generation and intuitive waste handling, which causes health hazards and urban environmental degradation. Urban population growth and the development of markets and new industries resulted in the quantum of a considerable amount of hazardous organic and inorganic waste daily in the city of Gaya [7],[8] and [1]

**(e) Development of Slums-**

The slum settlement rises due to the un-flux of rural people into urban is a sand shortage of housing facilities for them. They construct their dwellings by using rusted tins, empty tar barrels, jute sacks, etc. these areas become overcrowded, resulting in several environmental problems.

1. These areas do without proper water management and disposal of waste in an unplanned manner leading to pollution of air and water bodies of the city.
2. water contamination causes diseases like typhoid, cholera, enteric fever, etc.
3. The unexpected waste dumping places and open defecation become the sites of the growth of some disease carriers like flies, mosquitoes, etc.

All of these cause health hazards not only in slum areas but also in other nearby places of Gaya.

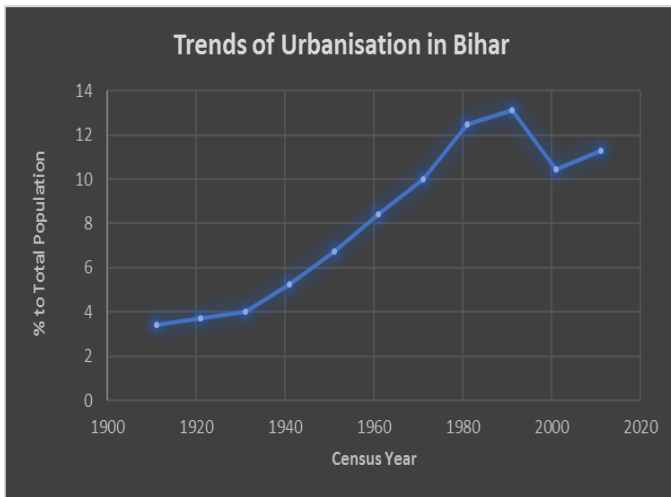
**5. Urbanization in Bihar- A case study of Gaya**

Urbanization is a sign of development, but the unscientific process of urbanization impact negatively on the environment. It is a process of population concentration and refers to the changes in size, density, and heterogeneity of the city [9]. High urban fertility rates transform rural areas resulting in an increasing population in the past few decades population of Gaya city has been growing continuously.

**Table.1: Patterns and Trends of Urbanization in Bihar**

Census Year	Urban Population	% of the Urban Population	Decadal Growth (%)
1911	13,22,953	3.44	-
1921	14,10,070	3.71	6.59
1931	16,99,552	4.02	20.52
1941(after Orissa separation)	19,91,061	5.24	17.15
1951	27,04,731	6.72	35.84
1961	39,13,920	8.43	44.71
1971	56,33,966	9.99	43.95
1981	86,99,013	12.46	54.40
1991	1,13,14,994	13.1	30.07
2001(after Jharkhand separation)	86,79,200	10.47	-23.29
2011	1,75,58,016	11.29	35.47

Source: District census handbook, Gaya 1971,1981,1991,2001,2011 [10]



**Fig No.2 showing: -Patterns and Trends of Urbanization in Bihar**

As data are shown in table 1 above, the urbanization of Bihar has increased continuously from 1901 to 2011. The separation of Orissa and Jharkhand from Bihar decreased the urban population through population migration. As we can see, there is the highest population growth in the year 1981 and the lowest population growth in 2001 because of the Jharkhand separation.

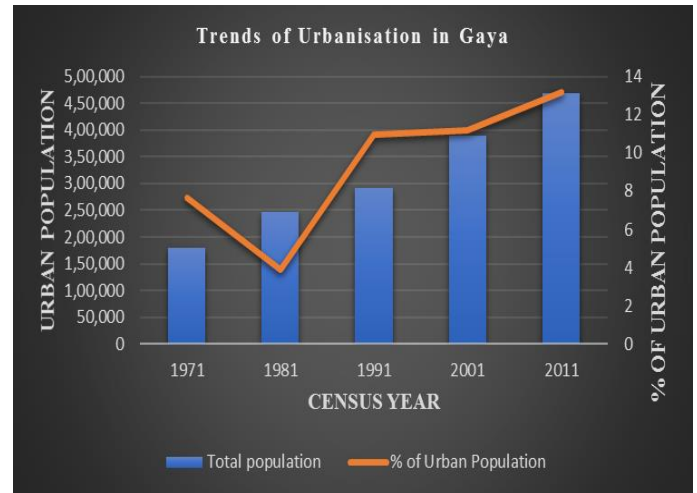
With the help of fig, no-2 we can easily identify the steady rise in urban trend from 1900 till 1990. There is a sudden decrease during 2000 due to the separation of Jharkhand and Bihar. Major labours were migrated to Jharkhand in search of better job opportunities in coal mines. It gives a setback to urban population which results in a decrease from 13.1% to 10.47% of urban population in Bihar. After the separation it again rises to 11.29%.

**7(A). Urbanization in Gaya-**

**Table.2: Patterns and Trends of Urbanization in Gaya**

Census Year	Urban population	Total population	% of Urban Population	(%) Increase in urban population
1971	1,79,884	19,24,289	9.35	-
1981	2,47,075	31,34,175	7.89	37.35
1991	2,91,675	26,65,217	10.94	18.05
2001	3,89,192	34,64,983	11.23	33.43
2011	4,75,987	43,91,418	10.84	22.30

Source: District census handbook, Gaya 1971,1981,1991,2001,2011



**Fig No.3 Showing: -Patterns and Trends of Urbanization in Gaya**

As per table no2 showing 2011 census, there were 4,68,614 no people living in Gaya municipal area. This municipal area is under the jurisdiction of the Gaya Nagar Nigam (Gaya municipal corporation), which is divided into 54 wards and spread over an area of 50.1 square km. With the help of table 2 data it can be observed that Gaya witnessed fluctuations in the population growth of the city, but there is a continuous increase in population. However, after that, the rate declined to a certain extent. But high urban population is still a serious issue to be concerned for.

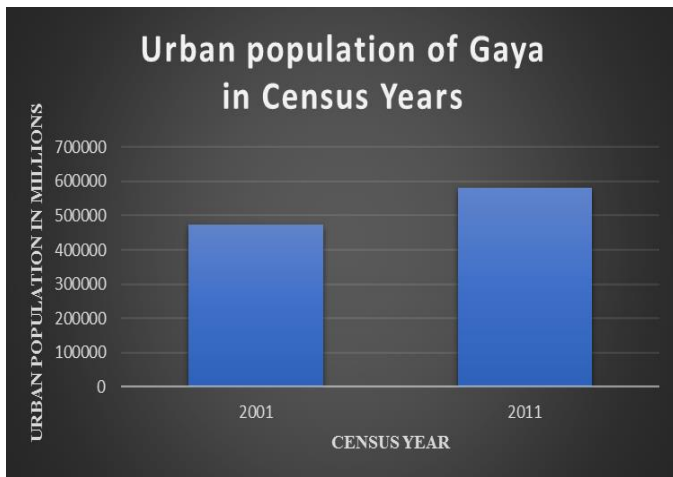
Gaya is a Class-I city with largest population size among five urban centres of Gaya district. Population of the city has been continuously increasing since 1971 with varying rates ranging from 9.35 to 11.23 percent. Growth trend of Gaya in last 10 decades is shown in Fig no3

**7(B). Urbanization in Gaya-**

**Table.3: Growth in Urban population in Gaya**

Census Year	Urban Population	Urban Population (%)	Decadal Growth (%)
2001	4,75,041	13.71	.....
2011	5,81,601	13.24	22.43

Source: District Census Handbook 2001& 2011



**Fig No.4 showing: -Urban population of Gaya**

With the help of table no.3 and fig no. 4 the researcher has been observed that the average population growth of the city in last 10 decades (2001-2011) is increased but there is a slight decrease in urban population percentage from 13.71 to 13.24. There was sudden decrease in population from 2001 to 2011 and thereafter continuous increase in population with varied rate has been observed. Since Gaya is a regional centre, lot of rural to urban migration occurs due to which there has been continuous increase in population over decades.

## 6. IMPACT OF URBANIZATION ON THE ENVIRONMENTAL QUALITY IN GAYA

### I. Status of Municipal Solid Waste Generation in Gaya-

The uncontrolled growth in the urban population has left many cities deficient in infrastructure services such as water supply, sewage, and municipal waste management [1]. Gaya is one such city in the state of Bihar. Generated municipal solid waste and other wastes are not fully collected, and a sizeable amount of waste remains uncollected on the streets, roadsides, slum areas, open places, etc., which pollutes the environment and causes several health problems [11]. The ULB; (Urban Local Bodies) in the Bihar state on average generates about 2272 Tonnes of waste per day. It can be observed from the table. 4 that Gaya generates an amount of 234.3 & 275 MT per day as per Census 2001 & 2011, which is very high and need to be improved further. 90% of the waste is being collected and rest is unattended. Door to door collections is practiced in 25% of the area, rest of the collection is from public dustbins and street sweeping. High solid waste generation leads to land pollution when it is left openly; again, it leads to water pollution when it is left in low-lying areas & the water bodies, and it further causes air pollution when it is burnt. According to various studies it has been found that water contamination causes multiple water-borne diseases in the Gaya [12] & [13].

**Table.4: Status of Municipal Solid Waste Generation in GAYA (As per Census 2001 & 2011)**

Year	Total Population	Total Waste Generation (MT per day)	Per capita generation (kg per day)
2001	389192	234.3	0.3-0.4
2011	468614	275	0.59
2030(projected)	703250	415	0.6

Source: (i) Gaya CDP Report 2011[12].

(ii) Final CSP Gaya 2015[13]

It is clearly visible from table no. 4 that in Gaya waste generation works out to be 0.39 to 0.4 kg/capita/day during the last 10 decades. As the waste generation estimated by Gaya CDP 2011 & 2015, SPUR Cell is higher, therefore, for planning purposes the waste generation is estimated as per 0.59 – 0.6 kg/capita/day. As per latest information collected from SPUR Cell, the waste collected per day in Gaya is 234.3 MT/day and efficiency of waste collection is 90%, with which the waste generation works out to be 275 MT/day. Thus, for the target year 2030, with projected population of 703250, the waste generation works out to be 415 MT/day.

### II. Slum Situation in the city of Gaya-

As per the census 2011, there is 40 slums pocket in different wards of the city where a population of 27,724 lives in dirty & dense area. These slum dwellers are deprived of basic facilities for better livelihood. Due to poverty, unemployment, rural-to-urban migration, lack of social consciousness, low economic status, the expense of houses & land in the city, and, poor governance, the city has a large slum population. They live in a blinded zone of the city; their houses are unfit for habitation, absence of potable water, poor drainage, inadequate sanitation, absence of ventilation, and narrow & dense streets [14]. Most of the slum dwellers of Gaya city belong to the BPL family, and they work as rikshaw pullers, Raj Majdoor, construction labours and other non-formal daily wage earners [15].

**Table.5: Slum Population in Gaya (As per Census 2001 & 2011)**

Year	Total Slum Population	No. of Households	Percentage of Slum Population
2001	18,881	2796	4.85%
2011	27,724	4793	5.91%

Source: (i) District Census Handbook, 2001&2011

(ii) Draft Master Plan 2027 [15]

With the help of table no.5 it is observed that as per Draft Master Plan 2027 referred to the Census of India 2001 there were 15 notified slum wards in Gaya, wherein 2796 households with 18881 population is living in slum like

condition. It can be observed that there is an increase in slum population from 4.85% to 5.91%.

### III. Growth of Motor Vehicles in Gaya-

Over the years, there has been an increase in population and strengthened transport infrastructure triggered the growing number of motor vehicles on the road in Gaya. Table 6. We can observe that the total no of registered vehicles from 10124 in the year 1980 to 4,46,863 in the year 2021 [16].

**Table. 6: Growth of motor vehicles in Gaya**

Year	Total No. Of Vehicles Registered
1980	10,124
2010	42888
2021	446863

Source: (i) Dept. Of Transport, Gov. Of Bihar 2021

As mentioned earlier, cycle, cycle rickshaw and pedestrians are important components

of the composition of traffic in Gaya. Further in motorized vehicle two wheelers is the

main modal choice. Table 6. Is showing that there is a rapid increase in total no of registered vehicles from 10124 in the year 1980 to 4,46,863 in the year 2021.

### IV. Average Air Quality Index of Gaya –

Air quality in Gaya city is getting worse due to population increase, growth of motor vehicles, heavy traffic, burning waste, construction and demolition increase, and use of fossil fuel for energy. According to an air quality database of 2018 released by WHO, Gaya has been declared the fourth most polluted city in the world in terms of PM 2.5 concentration. There was a worse condition with 149 micrograms per cubic meter of PM 2.5 concentration [17].

**Table.7: Annual average Air Quality Index (AQI) values of Gaya ,2014, 2015, 2016, 2017**

Annual concentration in µg/m <sup>3</sup>				
Parameters	2014	2015	2016	2017
PM <sub>10</sub>	180.93	76.85	-----	-----
PM <sub>2.5</sub>	----	181.6	71.97	71.85
CO	2.69	2.01	1.43	1.08
O <sub>3</sub>	23.80	23.23	14.05	21.22

SO <sub>2</sub>	6.10	10.20	7.48	5.53
NO <sub>2</sub>	54.63	20.95	44.44	19.21
Benzene	2.13	2.21	1.61	0.70

Source: Bihar State Pollution Control board, 2014,2015,2016 & 2017

It is evident from table 7, that as per the report of Bihar State Pollution Control board, Patna, the AQI Value of the collectorate station (Gaya), is 96.8. A high concentration of PM 2.5 causes various kinds of diseases and ailments like shortness of breath, chest discomfort, red eyes, and sore throat among people.

### III. CONCLUSIONS

From the above data & analysis, we can conclude that there have been many adverse impacts on the environment due to continued urbanization. Urbanization causes several damages and creates problems which are dealt with every day. Intensive urban growth leads to water pollution, noise pollution, deforestation, global warming, air pollution & air quality degradation. Urbanization creates many opportunities for a better lifespan for newly rural migrants but due to unexpected urbanization, increasing population become a burden for the resources of the city. It leads to slum formation, poverty, scarcity of potable water, overcrowding, hazardous diseases among city dwellers, etc. The study reveals that urbanization has affected the environment of Gaya city in many ways. Due to the ongoing expansion of the city, agricultural and forest cover lands are shrinking, and concrete infrastructure is being developed on fertile ground, and either side of the falgu river. The city has become the most polluted city in terms of PM 2.5 concentration, and there is a shortage of water, overcrowding and slum development in the city. Roads of Gaya town are unable to bear huge traffic with the increasing number of vehicles day by day which causes jams and noise pollution. Major ponds and rivers of the city are being polluted by sewage from illegal settlements & industries and dumping of waste on the riverside.

Local government must take a major step to curtail the current status of the following major problems of the city. Employment opportunities, better education, health care transport, and sanitation facilities should be provided in villages to decrease migration from rural to city Government should promote C.N.G. powered vehicle & electric vehicles and establish C.N. G. Refuelling & charging station points to tackle the problem of air pollution. To reduce the problem of water scarcity in the

falgu river and city, the remaining work of the Ganga Water Lift Project and the construction of a rubber dam should be completed in the stipulated time. Waste collection, transportation and disposal activity should be done properly, and scientifically by GMC. Things can be changed if gayeties can adopt the practice of segregation of waste in their home and stop dumping mixed and littering. Idol condition of urbanization is, does not allow slum development and informal settlement to flourish; sanitation work in a slum area and arranging houses for slum dwellers in the proper palaces should be done appropriately by governance. An appropriate and proper policy can control pollution and improve the quality of life of city dwellers by providing more social amenities.

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