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POPULATION GROWTH AND ENVIRONMENTAL DEGRADATION: A CASE STUDY OF MUZAFFARPUR CITY

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Abstract: Muzaffarpur is an important urban center in North Bihar plains. It is the headquarters of Muzaffarpur District as well as Tirhut Division. The city is a major commercial centre and is well connected with the rest of the country. Muzaffarpur's central location in the heavily populated and agrarian Middle Ganga plains, makes it a service provider, as well as a centre of attraction for its surrounding regions. Since its origin, the city has grown manifold in terms of population as well as area. People from the nearby places, come to the city of Muzaffarpur for availing various services like education, medical facilities, markets and jobs. This in-migration of people puts a lot of pressure on the city's insufficient infrastructure and poorly developed physical set up. The over population in the city is exploiting the resources beyond its carrying capacity. Thus, resulting in deteriorating environment and collapsing physical and economic set up. This condition has created a challenging situation for the city's overall sustainability as well. The deteriorated environment of the city has made the life difficult for the people living here. To make Muzaffarpur a more sustainable city, it is very important to maintain a healthy natural environment for its citizens. And for that, proper planning and its systematic execution is much needed. The present paper focusses mainly on the population growth and the challenges posed by this on the city's natural environment.

Index Terms - Population, Environment, sustainability, resource, pollution, infrastructure, management.

I. INTRODUCTION

Nowadays, more than 50% of the world population live in urban centers, and it is estimated that this figure will cross over 70% by the year 2050.. The cities are areas of dense population with mainly non-primary economic activities having a separate administrative identity. Cities act as central places and have a vital role to play for their surrounding regions. With technological advancements, the world economy is fast shifting from primary to secondary and tertiary. People are moving from villages to cities, and this movement of people is posing big challenges for the city's administration. These people come to the cities mainly due to economic reasons and for availing the urban amenities, putting a lot of pressure on the resources and posing big problem for the cities' management. The growing population in the cities, exploit the cities' resources (both natural and man-made), and subsequently it results in the degraded environment of the city. Any city's sustainability depends upon how it manages its resources and plan according to the growing demands of the increasing number of people.

The problem is even bigger in the underdeveloped and developing countries, where cities lack basic infrastructure, and are really short of resources. The overpopulated cities are being unable to sustain themselves. Every aspect of a city's life (its physical, social, political, economic, environmental/natural set-up) is adversely affected by the exploitation done by the city dwellers. But the worst affected aspect is the Natural Environment. Muzaffarpur is no exception in this regard. It is also facing the challenge of fulfilling demands of the increasing population with its limited number of resources and weak infrastructure. The city's environment has paid a

heavy price in its effort to fulfil the needs and demands of the people living here and in the nearby places. The air, water and land resources have deteriorated drastically and the overall environment of the city has become unliveable. Major steps are needed to be taken to improve the present condition and to make the city sustainable for long.

II. OBJECTIVES-

- To find out the trend of population growth in Muzaffarpur city after independence.
- To investigate the impact of population growth on the natural environment of the city.
- To find out the effects of population growth on Air pollution.
- To search the effects of population growth on water resources.
- To suggest some corrective measures for ensuring the city's environmental balance.

III. METHODOLOGY- Mostly Descriptive and Analytical methodologies have been adopted for the current study. Observation method has been used to find out the ground realities of the city's condition. The cause-and-effect analysis has been done for finding the effects of population growth on the city's natural environment. Population growth data has been shown through table and diagram. Table and graph have also been used to depict the air quality of Muzaffarpur city in the past few years.

Study Area- The city of Muzaffarpur, or the area under Muzaffarpur Municipal Corporation has been chosen as the study area. The city is the headquarters of Muzaffarpur District as well as Tirhut Division. The city lies on the southern banks of Burhi Gandak river and covers the total area of 26.68 Km². The city is presently divided into 49 wards. Its geographical coordinates are 26°07' Latitude and 85°27' Longitude and its altitude from the mean sea level is 187 ft.

Significance of study- Any city or region needs proper planning and a proper roadmap for its development in the long run. Recognizing the problems of the place provides the foundation for this purpose. The present paper is an honest effort in this regard. As we all know that India is going through a phase of population explosion and no city here is spared from this phenomenon. Muzaffarpur is also facing this challenge and the condition is affecting every aspect of the city, especially its natural environment. The present paper tries to identify the challenges for the city's environmental sustainability, and this effort makes the work significant for the planners.

IV. DESCRIPTION AND ANALYSIS-

Factors of Population Growth- The city of Muzaffarpur came into existence in the 18th century in British Era. Since then, the city is working as an administrative centre (headquarters of the district as well as Tirhut Division) and a commercial and business centre of North Bihar. The population of the city as well as its area is continuously growing since then. Many conditions have acted as pull factors for the nearby population and have contributed to make Muzaffarpur a large city. Some of these factors are discussed below.

1. **Strategic location-** The city of Muzaffarpur is centrally located in North Bihar. It is the largest and the most important city here. Muzaffarpur is the gateway to Nepal for various type of commercial activities.
2. **Strong connectivity-** Muzaffarpur is located on East-West corridor. NH-28, 102, 77, and 57 are connected with the city. Muzaffarpur is very well connected with the other cities of Bihar like Darbhanga, Samastipur, Hajipur, Motihari etc with railways also. Muzaffarpur falls in the East Central Railway zone and is well connected with the major cities of the country.
3. **Educational Hub-** Muzaffarpur is blessed with several higher education institutions which not only facilitate the people residing here but also people from nearby places. It has many schools (both government and private), several colleges, University, Medical and Engineering College and a Management college which attract students from far off places. Many private coaching centres also are working here and students come here to get quality education.
4. **Commercial and Business centre-** Muzaffarpur is basically a commercial town, and big wholesale as well as retail markets are located here which act as a pull factor for the people living near Muzaffarpur. Many people come to avail these facilities and contribute in the city's day time population.

5. **Industries-** Muzaffarpur is located in an agriculture intensive region. The main crops here are Litchi, Sugarcane, Rice, Wheat, Maize, Banana, and seasonal vegetables. Besides these crops, Dairy and Poultry industry is also flourishing here. Many agro-based industries are located in Muzaffarpur which provide employment opportunities to the nearby people, resulting in population growth.
6. **Medical Facilities-** Muzaffarpur has a Medical College and many multi-speciality hospitals which are well equipped with modern medical facilities. These institutions provide quality services to the people living here and to the people of surrounding places. Hence, they also act as pull factor for the city centre.

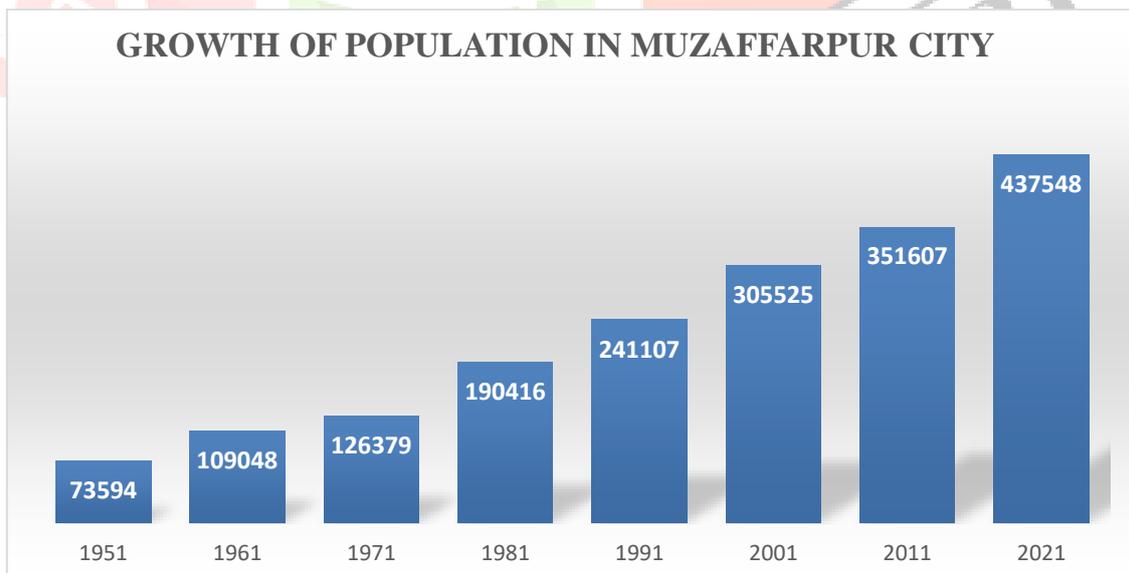
V. TREND OF POPULATION GROWTH IN MUZAFFARPUR CITY- The city of Muzaffarpur has grown very fast after independence, in terms of population. The table below shows the population of Muzaffarpur city in various census years from 1951.

Population growth in Muzaffarpur city:

<u>YEAR</u>	<u>POPULATION</u>
1951	73594
1961	109048
1971	126379
1981	190416
1991	241101
2001	305525
2011	351607
2021	437548 (APPROX)

Data source- www.censusofindia.gov.in

The table shows a remarkable growth of population in Muzaffarpur city. In 1951 the population of Muzaffarpur was 73594 which grew to 351607 in 2011 census. The census of 2021 is not yet complete due to Covid-19 pandemic, but according to a rough estimate the population of the city has reached over 4.37 lakhs. The population here is projected over 5 lakhs in the year 2030 according to government agencies.



The above diagram is a graphical representation of the population growth in the city of Muzaffarpur after independence. It clearly indicates a rapid growth in the city's population especially in the past four decades.

The city area is also having a high density of population which is an indicator of population pressure on the city's resources. The population density of Mushahri block, where the city is located, was 3712 persons per sq. km. in 2011 census, which is much higher than the population density of the state.

VI. CONCEPT OF ENVIRONMENTAL SUSTAINABILITY- Environmental sustainability is a key aspect of the overall idea of Sustainable development. Without ensuring environmental sustainability, a region cannot become sustainable. Environmental sustainability refers to rational use and management of natural resources and equitable access and distribution of these resources among the citizens. Actually, there are so many aspects of a city's life which makes the city a functional unit. Its economic base, its physical and natural setting, its social and political life etc are main aspects which are to be sustained for a city to survive for long. Natural or environmental sustainability is the most important of them all.

VII. POPULATION GROWTH AND ENVIRONMENTAL DEGRADATION- Many factors contribute to a city's sustainability. Population growth is one such factor which has great effect on the city's life as a functional unit. A certain number of populations is needed for a city's development and growth, but when the population crosses the required number, it starts putting pressure on the limited available resources. Growing population at such a fast rate especially due to in-migration of people is a matter of concern as well as a threat to the natural set up and overall environment of the city. Growing population results in excessive use of resources (both natural and man-made). Air pollution, drinking water scarcity, Land and Noise Pollution are all results of this overuse and mismanagement. The overall environmental condition of the city of Muzaffarpur has degraded a lot in the past few decades. The air and water quality has deteriorated very fast due to over exploitation and poor management of these important resources. Apart from these, water logging, poor drainage and improper solid waste management, have also made the life difficult for the city dwellers.

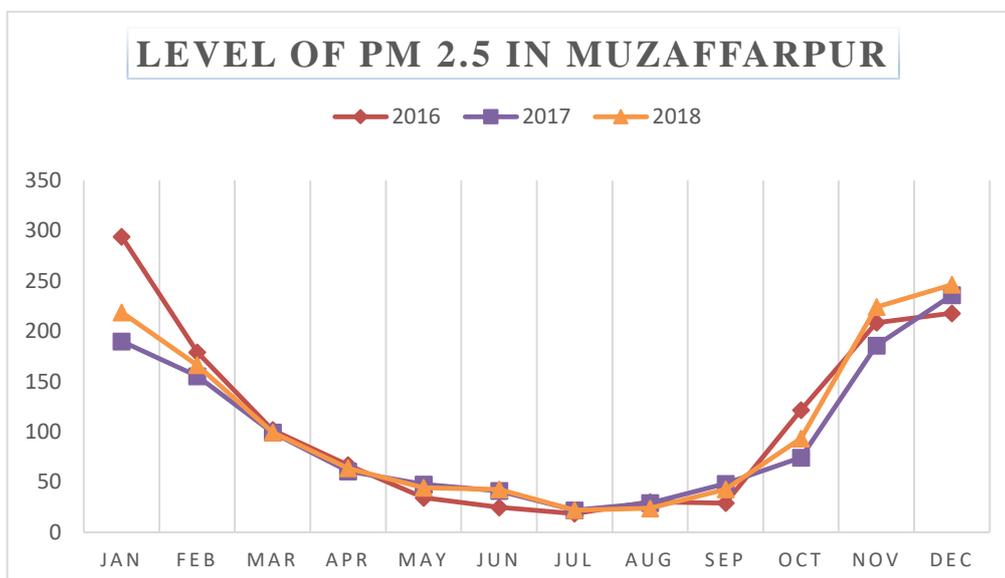
VIII. POPULATION GROWTH AND AIR POLLUTION- The city of Muzaffarpur is currently having a population of 4.4 lacs. But due to the in-migration of daily commuters the working hour population or the daytime population increases up to 6 lacs. All these people use means of communication which are mostly motor vehicles. The emissions from these vehicles and dust particles (especially coming from construction sites) are the major sources of air pollution. Burning of coal and wood, as domestic fuel, industrial emissions, increased use of CFC producing electrical appliances, cutting of trees along the street side, has also contributed to the city's poor air quality. The Air quality of Muzaffarpur has fast deteriorated due to growing pollution level, which has resulted in the city's constant presence in the list of top polluted cities. According to a study conducted by the University of Chicago, the air pollution in the city has caused decrease in average life of the people residing here by 5.8 years. The study has also shown the ill effects of air pollution on foetus. The data shows how the air quality of Muzaffarpur is highly polluted and hazardous.

AQI of Muzaffarpur city (in number of days) during 2016, 2017 & 2018

YEAR	GOOD	SATISFACTORY	MODERATE	POOR	VERY POOR	SEVERE/ HAZARDOUS
2016	14	150	40	27	94	40
2017	44	124	56	27	86	27
2018	18	120	60	30	93	35

Data source: - bspcb.bihar.gov.in

This should also be noted that the all the days when the AQI level is between poor to hazardous are in the winter months, i.e., November to February, which shows the effect of temperature on the level of air pollution. The following graph shows that how the level of PM 2.5 is much higher in the winter months and much lower in the monsoon season.



Data source: - bspcb.bihar.gov.in

IX. POPULATION GROWTH AND WATER POLLUTION- On an average the city of Muzaffarpur and its surrounding area receives 120 cms of annual rainfall. Since the area falls under monsoon climate, it receives maximum rainfall in the months of June to September. With increasing heat and increased demand of water, February onwards, the problem of drinking water scarcity increases and it ends only after the onset of monsoon. Even in the monsoon months, availability of safe drinking water is a challenge. Earlier about 30-40 years back this was not a problem at all, because of less population and less demand. But now from the last two decades, the city is constantly experiencing shortage of water especially shortage of drinking water. People are forced to buy drinking water after paying a substantial amount for that. Lack of pure drinking water also results in diseases like diarrhoea, dysentery, Typhoid, Jaundice etc. The underground water table has also suffered due to over-exploitation of these resources. Many water bodies have been landfilled to acquire land for construction. The waterbodies are natural reservoirs and help in replenishing the underground water table also. Sacrificing these waterbodies for the sake of new built-up areas will prove to be very dangerous for natural and overall sustainability of the city. Sewage water is disposed in BurhiGandak river and Furdoo nallah without any treatment, which is really unhealthy and unhygienic practice. It is not only polluting the waterbodies but also the underground water of the city area.

X. POPULATION GROWTH AND LAND POLLUTION- Another threat for the environmental sustainability is the waste generation and its improper disposal. No proper treatment or recycling of wastes has been planned. Streets and roads can be seen overflowing with garbage. The city's dumping ground is located at Dadar where the garbage is simply dumped and put to fire time to time, which further contributes to air pollution. Over population in the city is the main reason behind this situation. Growing population in the city uses a lot of resources and also produces a vast amount of solid waste. Excessive use of plastic, paper and other materials used for packaging, generates a lot of waste and the city lacks its proper management. People just don't bother to use the garbage bins. This solid waste also goes into the open drains resulting in their blockage and thus waterlogging in the streets. The streets are not cleaned properly and regularly which makes it difficult to walk through them. The stinging smell of the garbage makes the life difficult for the city residents. No proper segregation of garbage (into bio-degradable and non-degradable) is done before being dumped in the dumping ground. The dumped garbage is simply put to fire, which produces toxic fumes/ smoke to make the city air further polluted.

XI. POPULATION GROWTH AND NOISE POLLUTION- More population means more use of vehicles. The noise of vehicles adds significantly to the level of noise pollution in the city. People use loud speakers in festivals, marriage ceremonies, and religious places without following any regulation. The high level of noise increases anxiety, stress, and irritation in the citizens. Thus hypertension, hearing problems, and other diseases related to stress have become common in the people living in the city. Proper implementation of rules, regarding level of noise, is essential to control the noise pollution.

XII. CONCLUSION - Conclusively, it can be said that excessive Population growth has played a major role in the city's degrading environment. The city of Muzaffarpur, with its weak infrastructure and insufficient resources, is unable to maintain its natural or environmental balance due to overpopulation. Global warming and concentration of greenhouse gases have also contributed in the city's degraded environment. The living condition of the city has become really poor, especially due to air, water, land and noise pollution. The effect of human activities on environment is evident with the fact that in the past couple of years (2020 and 2021) during the lockdown period (due to Covid-19 pandemic) the level of pollution came down significantly, and also the region experienced an above average monsoon rainfall. This shows that how the exploitation done by the humans, negatively affects the environment. This also gives us a clue on how this environmental degradation can be reversed. We definitely need to restrict our actions, especially those which harm the environment. We must follow the rules regarding vehicle emissions, garbage disposal, maintaining noise level and use of water resources etc. We must behave in a rational and sensible manner, so that our city, its environment and its overall living conditions become better and sustainable. Also, a little more planning, its proper implementation and political will are other major aspects, which will play a vital role in the city's path to become a smart one

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