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Urbanization And Pollution: Challenges in Developing Cities of India

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R.Jayashree
Associate Professor, Department of Environmental Sciences,
TamilNadu Agricultural University,
Coimbatore-641 003

Abstract

Rapid urbanization is a vital factor in altering cities' spatial structure and affecting the ecology and environment. The main environmental challenges of urbanization in metropolitan cities are rapid changes of spatial growth and city structure, continuous increasing of CO_2 emissions, urban flooding in monsoon seasons, reduction of green cover and disappearance of natural water bodies and encroachment of natural valley and its catchments. The urban flooding is becoming frequent due to human activities and degrading air, land and water quality; at the scale of Metropolitan cities land level, surface temperature is changing due to increasing human activities. The present environmental challenge for urban planners and city bureaucrats is building sustainable spatial plans with development control guidelines for mitigating climate change, risk and resilience cities.

Key words: Urbanization, Challenges, Cities, Air pollution, Flooding

Introduction

The key factor affecting the spatial structure of cities and their environmental impact is rapid urban development. Urban areas account for about 54 percent of the world's population (UN –DESA 2006; 2007; 2014). According to the United Nations, by 2050, more than 70 % of the world's population will live in cities. Urban areas make up half of the world's population, but account for around 80% of global GDP (Seto and Dhakal 2014).

It is common knowledge that the environment deteriorates as a result of fast industrial growth and urbanization. Metro cities are becoming hotspots for economic activity and major sources of pollution that have an influence on the environment due to their high population density, numerous businesses, and production facilities brought about by the rapid urbanization of these areas (Gerd A. Folberth et al. 2015). The 20 largest cities utilize 80% of the world's energy, while metropolitan regions account for 80% of global greenhouse gas emissions (International Federation of Surveyors 2010). For the urban areas to survive, the negative externalities brought about by urbanization, particularly in large cities such as pollution, traffic, inadequate infrastructure, subpar housing, and urban sprawl that results in the acquisition of agricultural lands, must be appropriately mitigated.

Urbanization trends in selected metropolitan cities in India

The term "urbanization" describes the demographic phenomenon of more people choosing to live in urban regions. The migration of people from rural to urban regions is the main cause of this. The creation of new urban centres and the enlargement of existing urban limits could potentially be the cause of this (Gordon McGranahan and David Satterthwaite 2014). Even though urbanization is a worldwide phenomenon, there are regional variations in its patterns. It is also thought

to be the main force behind reducing extreme poverty and fostering economic growth. Compared to many developing nations, India's urban population has grown at a comparatively slow rate. From 25.86 million in 1901 to 377.10 million in the 2011 Census, the country's urban population increased at an annual growth rate of 2.76% between 2001 and 2011. Also, the Census of India, 2011 data reveals that, 377 million people lived in urban area it constitutes about 31.16% of the total population in India. The annual population growth rate of selected metropolitan cities in India, during 2001-2011 Census, Bengaluru is highest (47.2%), followed by Hyderabad (10.98%), Chennai (7%), Coimbatore (18.6%), Delhi (21.0%), Mumbai (16.0%) and Kolkata (13.9%) respectively. United Nations Economic and Social Affairs (UNESA), projected population and annual growth rate from 2016-2030 shows that, except Kolkata all selected metropolitan cities annual growth rate is declining trend. By 2030, Chennai, Bengaluru and Hyderabad joining to 10 million or more population i.e. mega cities status, by the time, India would have six mega cities.

Pattern and Trend of Urbanization in India during 1901-2001

The pattern and trend of urban population and number of towns in India during 1901 to 2001 shows that total urban population has increased more than ten times from 26 million to 285 million (Mohan.R,1996) whereas total population has increased less than five times from 238 million to 1027 million from 1901 to 2001.

Slum Situation in India and its Metropolitan Cities

A slum is a highly populated urban residential area consisting of densely packed housing units of poor quality and associated to the poor and deprived. Total slum population in India according to size/class of towns during 1991 shows that 41% of the total slum population was residing in million plus cities, where 27% of total population of India resides.

Environmental Challenges of urbanisation

In addition to causing a variety of flora and fauna, climate change, carbon storage, increased air and water pollution, high energy demands, and a reduction in natural vegetation, rapid urbanization has tremendously accelerated economic and social development. leads to a crisis of natural catastrophes, conflicts, man-made disasters, and displacement that further tests the ability of urban development and jeopardizes the infrastructure and services provided by these cities. The primary environmental issues facing big cities are the steady rise in CO2 emissions, the years-long buildup of plastic and e-waste, urban flooding during monsoon seasons, the decline in green space, and pollution of natural water sources.

Status of Municipal solid waste generation in Metropolitan Cities of India

At 5355 tonnes per day in 1996, Mumbai produced the most municipal solid trash, followed by Delhi (4000 tonnes per day), Kolkata (3692 tonnes per day), and Chennai (3124 tonnes per day). However, Chennai has the highest per capita generation of solid waste, roughly 700 g per day, when it comes to this matter. Kolkata has the lowest daily per capita garbage generation, at roughly 350g (Sunil Kumar et al, 2009).

Carbon-dioxide (CO_2) Emissions

One of the biggest dangers to public health in India's cities today is air pollution. India has one of the greatest population exposure

levels to PM 2.5, which means that Indians face some of the biggest global health hazards from PM 2.5 (WHO,2013). Both people and the ecosystem are at risk from fine PM, which can get firmly embedded in the lungs. Several studies have connected PM 2.5 to a number of major health issues, such as asthma, heart attacks, irregular heartbeats, and early mortality (USAID, 2016).

Logistics depends heavily on vehicles, which are the biggest producers of CO_2. Of the 38 Gt of CO_2 emissions that were released into the atmosphere in 2014, 8.8 Gt were related to transportation, of which 74% (6.5 Gt) came from road travel (WMO, 2014). With a contribution of over 65% to the total greenhouse gas emissions, CO_2 is the most significant anthropogenic greenhouse gas. According to a 2015 study by Ramachandra et al., Hyderabad has the greatest CO_2 emissions at roughly 56%, followed by Bengaluru at 43%, Delhi at 32%, Ahmadabad at 25%, Chennai at 19%, Coimbatore at 19.4%, and Greater Mumbai at 17%.

Delhi's air pollution problem has been a major worry for a long time. A number of causes contribute to this problem, including as construction, industrial operations, urbanization, vehicle emissions, and weather. Delhi was facing serious air pollution issues as of January 2022, particularly in the winter. With an AQI of 287, the city was deemed the most polluted in the world in November 2023 due to the extreme effects of pollution (The Hindu, 2023). Some key factors contributing to air pollution in Delhi due to urbanization included:

- Rapid Urbanization: Delhi has witnessed rapid urbanization and population growth over the years, leading to increased construction activities, infrastructure development, and greater energy consumption. The expansion of urban areas has contributed to increased pollution levels
- Burning of Agricultural wastes: In the states of Punjab and Haryana, burning wheat stalks following harvest results in thick smoke that is transported by the wind. This causes serious air pollution, especially during the harvest season. As a substitute for burning, there hasn't been a practical way to decompose agricultural wastes.
- Vehicular Emissions: The high number of vehicles on Delhi's roads, many of which run on fossil fuels, has been a major contributor to air pollution. Traffic congestion and emissions from cars, trucks, and two-wheelers are significant sources of air pollutants.
- Industrial Activities: Delhi and its neighbouring regions have a concentration of industries that release pollutants into the atmosphere. Industrial emissions contribute to poor air quality.
- Construction Dust: Construction and building activities generate a substantial amount of dust, which becomes airborne and contributes to particulate matter pollution.

Urban Flooding

Over the last 15 years, there has been a constant rise in the urban floods across metropolitan cities in India. Urban flooding is becoming frequent due to human factors and metrological/hydrological factors. The main reasons for flooding in Indian metropolitan cities are drastic reduction in the water bodies of a city and rapid increase in built-up areas. In addition, unplanned

urbanization drastically alters the natural topography of the region and leads to reduced water carrying capacity of natural rains due to encroachment, silting and poor sewer management and choke of waterways causing flood during monsoons, as is being faced by citizens presently in metropolitan cities like Mumbai, Delhi, Chennai, Bengaluru and Hyderabad.

The recent incidents of Urban flooding in the state of Tamil Nadu were in the year 2023 at December. First were the floods in the city of Chennai from December 3 to 10 due to the cyclone Michaung. The second were the floods in the southern states of Tirunelveli, Kanyakumari, Thoothukudi and Tenkasi districts from December 18 to 23. Due to the unprecedented rainfall, several parts of the state had to witness flood incidents in the year, which mainly attributes to the climate change that has happened over the years. The rainfalls are for short duration but intense, challenging urban planners. The government came up with a stormwater drainage system across Chennai at the cost of Rs.4500 crores. However, the project is still to be completed and has not been efficient throughout (The Indian Express, 2023). In the southern districts the floods were attributed to heavy rainfall and the city planners were not ready to withstand such heavy rain. This also led to flooding of River Thamirabarani in Tirunelveli (The New Indian Express, 2023). Both the floods lead to several causalities and economic losses in the flood affected parts of the state.

Status of waterbodies in Chennai

Water bodies in Chennai may have varying levels of pollution based on things like sewage discharge, urbanization, industrial activity, and environmental control initiatives. Numerous water bodies in Chennai were documented to have pollution problems as of January 2022. Here are a few examples:

- Adyar River: The Adyar River had been historically polluted due to the discharge of domestic and industrial effluents. Various initiatives and efforts were underway to clean and restore the river's water quality and surrounding ecosystem.
- Coum River: The Coum River had long suffered from pollution and encroachment problems. It had been a focus of restoration efforts and a significant environmental project aimed at rejuvenating the river.
- Ennore Creek: Ennore Creek, located to the north of Chennai, had been facing environmental challenges due to industrial activities, including the presence of coal-based power plants and the discharge of pollutants.
- Buckingham Canal: The Buckingham Canal, which runs along the eastern side of Chennai, is also affected by pollution from various sources, including urban runoff.
- Groundwater Pollution: Groundwater pollution due to contaminants from industrial, agricultural, and domestic sources was a concern in and around Chennai.

Efforts to address water pollution in Chennai included the implementation of wastewater treatment plants, regular monitoring by environmental agencies, and initiatives to promote public awareness and community involvement in maintaining water quality.

Conclusion

Rapid urbanization and industrial expansion are known to cause environmental degradation, as seen by the history of city development in the modern era. After 1989, certain Indian metropolises saw a spatial expansion from the centre of the city to its periphery or outside reaches. Given the rate of urbanization and rapid spatial growth, it might effectively highlight the fact that other natural resources are being exhausted. In addition, it causes surfaces to be paved at the city level, which raises surface flow velocity and volume while decreasing ground absorption; this led to insufficient channel capacity, which in turn caused urban floods. To some extent, this can be mitigated, though, if efforts to urbanize the nation are coordinated throughout all regions in order to prevent excessive migration to large cities. Developing sustainable spatial planning with development control rules for reducing climate change, risk, and creating resilience in cities is the current environmental challenge facing urban planners and city officials. Numerous water features, including artificial lakes and wetlands as well as naturally occurring depressions, have vanished as a result of human-caused succession that is full of garbage and development, or slum encroachment in urban areas, according to some research. This highlights the need for improved urban waste management that doesn't harm the ecosystem or result in various forms of pollution. Urban planners have to endeavour to integrate diverse strategies for integrating alternative energy sources in order to reduce the emissions resulting from the burning of fossil fuels for electricity generation. The urban environment plays a significant role in determining both the quality of life in urban areas and the urban area's impact on the environment as a whole. At the level of metropolitan cities, rising human activity and declining air, land, and water quality are causing changes in land surface temperature. Rapid urbanization in India's metropolitan areas has major effects for the environment that must be improved. Environmental concerns related to urbanization are extremely important and require delicate handling.

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