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Urbanisation and Air Quality: A Comparative Analysis of Delhi and Kolkata

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ABSTRACT: India for the past decade has been progressing on a path characterised by rapid economic growth and urbanisation along with population growth. This has eventually proved to be detrimental to the state of environment in India. As a result environmental issues have become the epitome of all the challenges in a developing economy like India. The paper would revolve around the factors which significantly contribute to the deterioration of environment specifically air and water quality which becomes the key factor for climate change and emerging health issues. The paper would highlight the situation of environment issues in two metropolitan cities Delhi and Kolkata which are known to be the most populated and urbanised cities in India. The paper observes that both the air quality in Delhi is worse as compared to Kolkata.

Key words: Environment, Environment issues climate change, urbanisation metropolitan cities.

I. INTRODUCTION

Since Independence India has come a long way in terms of development in all the spheres like food production, industrial development, socio – economic growth and generation of energy .India's two –third of population still depends on agriculture for its subsistence. Over the years rapid population growth has been causing tremendous pressure on India's limited natural resources .On one side rapid increase of population has proved to be a major concern and on other side the rapid economic growth is also responsible for undesirable consequences of environmental problems As a result the country has been trapped in this vicious cycle of growth and environmental damage.

The environment issues in India is increasingly becoming more serious owing to the recent boom in its industries, with little or no environmental education, massively growing infrastructure development accompanying excessive deforestation [10]. Concluded in his paper that there is no lack of government legislation protection laws for the environment but unfortunately it is never enforced due to political set up and vested interest groups involved. Many countries of Asia and small Pacific island states are the most threatened part of the world due to climate change. Air pollution takes a substantial toll on national health care expenditure and economies in general [9]. India's climate is affected by the North-East and the South-West monsoons. The North-East monsoon, also referred to as the winter monsoon blows from land to sea, while the South-West monsoon, referred as the summer monsoon blows from sea to land. It is the South-West monsoon which is responsible for most of the rainfall during a year in the country.

India is a country with only 2.4 per cent of land area and accounts for 7-8 percent of the recorded species of the world. India supports 16 percent of the world's population. This has resulted into severe unsustainable use of natural resources over the years in order to sustain such a large population, further leading to tremendous environmental degradation. This overuse of India's abundant forests has resulted in soil depletion, contamination throughout the country. Desertification and destruction of forests has resulted in extreme hunger and poverty .Similarly natural disasters like droughts have faced severe consequences like shortage of water in most of the parts of India State of Environment Report (2009).

At the same time association of economic growth with agricultural, industrial and services sector growth cannot be ignored. The most important by-product of urbanisation and economic growth is increase in transportation therefore the growth of vehicular transport on roads is also discussed to comprehend the state of environment As a result the following section would examine the state of population , economic growth incorporating industrial and agricultural growth. One of the important objectives of the paper is to compare the state of environment in Delhi and Kolkata; therefore all these factors leading to harmful impact on environment are reviewed in context of Delhi and Kolkata.

The paper explores the state of environment including air quality and the repercussions in terms of health hazards and climate change observed in variations in temperature This paper make a comparative analysis of two most populated, congested metropolitan cities in India namely Delhi and Kolkata.

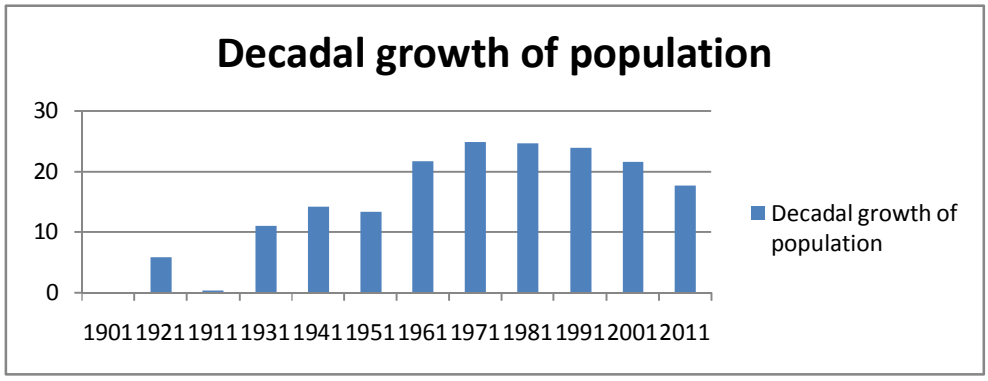

Fig. 1. Decadal Growth Rate of Population.
(Author's Calculations, Source: Population Census 1901-2011).

II. GROWTH OF POPULATION

India has experienced an explosive growth of population from 0.3 million in 1950 to 1.04 billion in 2002 along with unplanned urbanization over the last fifty years [7]. The population growth has mainly concentrated in cities with large scale migration of rural population in search of livelihood. This rapidly expanding population puts a major pressure on environmental concerns in the country. The population of India's second largest city Delhi is expected to grow 1.0 times.

III. INDIAN ECONOMY

India's diverse economy encompasses traditional village farming, modern agriculture, fisheries, handicrafts, a wide range of modern industries, and a multitude of services. The structure of the Indian economy has undergone considerable change in the last decade.

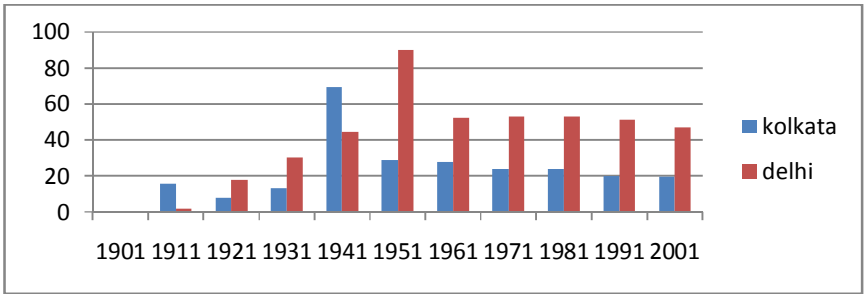

Fig. 2. Decennial Growth of Population: A comparison of Delhi and Kolkata.
(Author's Calculations, Source: Population Census 1901 to 2011, Delhi)

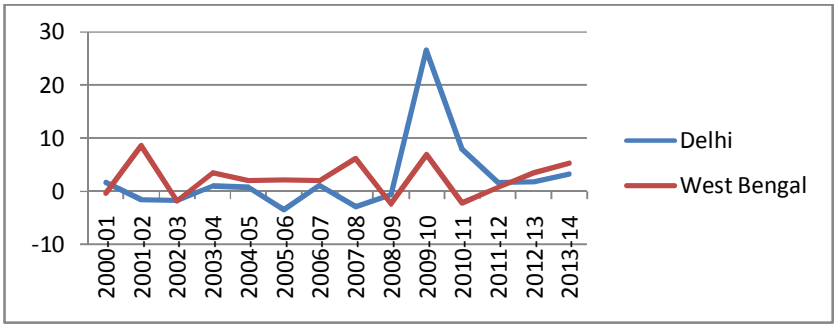

Fig. 3. Growth Rate of Gross State Domestic Product in Agriculture and allied Sector 2000-01 to 2013-14 in Delhi and Kolkata. (Author's Calculations, Source: Central Statistical Organisation (CSO) - 2014, Census of India (various issues), Final Population of U.As and Towns TCPO, Govt. of India 2005).

A. Growth of Transportation

Owing to rapid urbanization, pressure on urban transport is likely to increase substantially. The total vehicular share of India in the world is 1 percent .According to State of Environment Report India-2009 the increase in vehicles, as well as the presence of other motorized forms of transportation like taxis, autos, trains, buses, etc, will contribute to the existing large amount of vehicular emissions. The most unfortunate fact about vehicular pollution is that it is so prone to occur as the vehicular emissions are emitted at near-ground level, (State of Environment Report India-2009)

Lack of appropriate mass transport system, people buying more vehicles for personal use in Delhi, this has increased the number of vehicles in Delhi. The amount of registered vehicles in Delhi has increased fifty-one times in thirty year period. Approximately 17 per cent of the cars in India run in Delhi alone-India: Air Quality Profile 2010 Edition September 2010 stated that Delhi has more cars than the total numbers of cars in the individual states of Maharashtra, Tamil Nadu, Gujarat and West Bengal (State of Environment Report India-2009). The vehicle stock in Delhi is expected to almost quadruple by the year 2020 Report (2009).

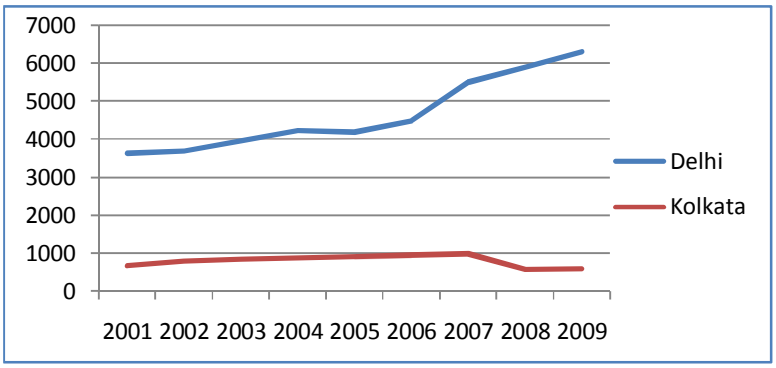

Fig. 4. Vehicular Growth in Delhi and Kolkata.
(Author's Calculations, Source: Road Transport Year Book 2012).

B. Growth of Industrial Sector

India's economy growth performance has tremendously accelerated by growth of industrial sector. The industrial structure comprises of large and small- scale industries. A considerable economic growth has also resulted in increase in investments and activities in the field of construction, mining, and industries such as iron and steel. This results insignificant rise in the industries related to brick making, iron and steel plants that are comprising of extremely polluting methods of production. Excessive growth in manufacturing of about 7.4 per cent average in last one decade indicates that the growth trends in the fields of electronics and information, textile industry, field of pharmaceuticals and chemical industry etc.

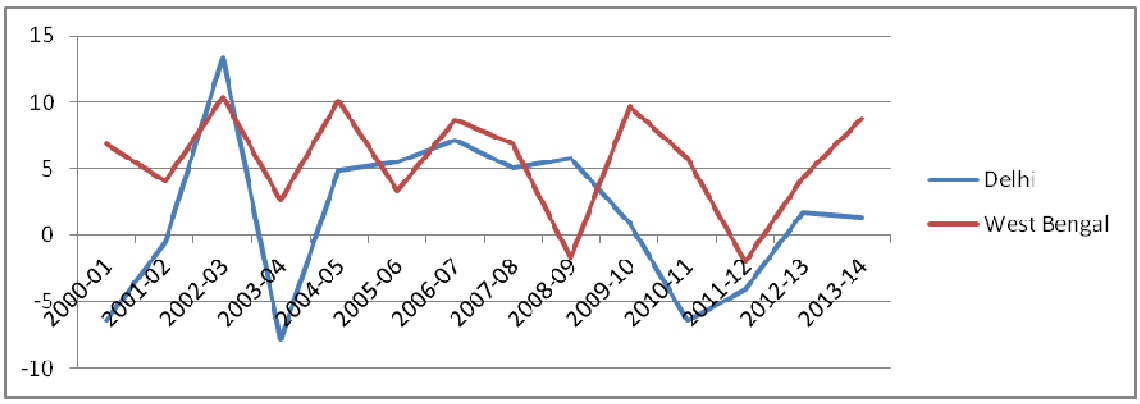

Fig. 5. Growth Rate of Gross State Domestic Product in Industry Sector 2000-01 to 2013-14.
(Author's Calculations, Source: Central Statistical Organisation (CSO) – 2014)

IV. AIR QUALITY

Rapid urbanization and industrialization has laid a tremendous pressure on infrastructure and natural resources .As a result of this air quality has become an issue of great concern in India. There are many factors responsible for sources of air pollution in India.

A. Factors Responsible For Pollution

(i.) Population Growth: There has been an excessive growth of population accompanied by unplanned urbanization over past five decades

(ii.) Vehicular Emissions: Rapid urbanization has led to increase in urban transport like taxis, autos, trains, buses etc .Approximately 17 percent of cars of India run in Delhi, and the number is even more than the total number of cars in states of Maharashtra, Tamil Nadu, Gujarat and West Bengal (State of Environment Report 2009).

(iii.) Industrial Sector Growth. Economic boom has led to investments in construction, mining and iron and steel. The process of brick making, the industry related to construction, iron and steel plants which engage excessively polluting methods. Emissions from such industries are responsible for pollution today. These emissions can be clubbed in two categories like, SPM solid particles and gaseous emissions like SO_2, NO_2, CO etc. A number of plants like thermal power plants, iron and steel plants cement and fertilizer plants, various industries related to oil refineries and petrochemical industries etc.

(iv.) Agricultural Waste Burning: This leads to emission of large amount of suspended particulate matter like methane (CH_4), carbon mono- oxide (CO), Nitrogen di oxide (NO_2), sulphur di oxide (SO_2), which leads to various health issues like respiratory diseases, skin and eye diseases .Intensive agriculture processes is also immensely responsible for accumulation of greenhouse gases GHGs in the atmosphere like methane, nitrous oxide further leading to climate change. Emissions from agriculture are approximately around 28 percent of aggregate national emissions.

(v.) Indoor Air Pollution: Indoor air pollution is mainly caused by the method of cooking like using fuels in form of coal, kerosene etc.

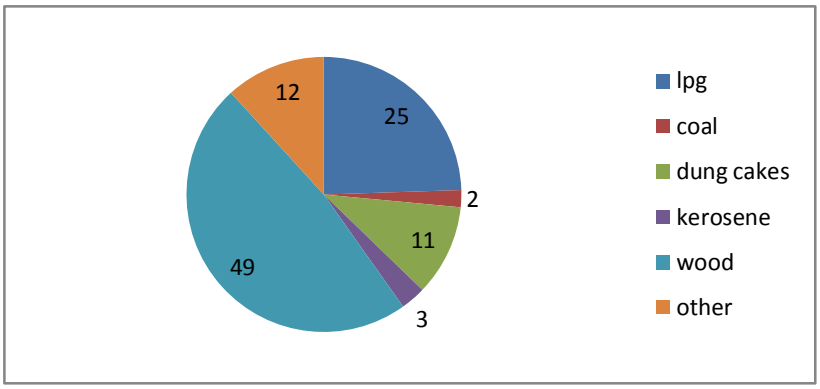

Chart 1: Proportion of household by type of fuel (NHFS).

The NSS data depicts that in India the major proportion of population is still dependent on wood as the source of fuel for cooking .

B. Air Quality Trends

Central Pollution Board CPCB has executed a nation-wide programme of ambient air quality monitoring known as National Air Quality Monitoring Programme (NAMP).The National Ambient Air Quality Standards (NAAQS) have been released by CPCB and it also concluded that for Reparable Suspended Particulate Matter (RSPM) which is of main health related issues and concern, their standards got violated at most of the monitoring stations. The variables which are significant for evaluating or accessing the ambient air quality.

(i.) Sulphur Dioxide (SO_2). In the last few years, various cities like, Delhi and Mumbai have been observing reducing trends in terms of sulphur Dioxide .Such trend is due to the fact that there has been a considerable reduction in Sulphur in diesel and extensive use of LPG in place of coal.

(ii.) Nitrogen Dioxide (NO_2)

In the last few years, decreasing trends have been observed in nitrogen dioxide levels owing to various vehicular pollution control measures have been taken in order to control pollution in Delhi , however Delhi has unfortunately observed a rising trend in the past few years and that too especially after introduction of CNG It was observed that the CNG which was specifically introduced to combat pollution , emitted more of nitrogen dioxide (NO_2) than diesel and petrol.

(iii.) Particulate Matter. Annual average concentrations of Reparable Suspended Particulate Matter (RSPM) and suspended particulate matter (SPM) exceeded the NAAQS standards in most of the cities. The source of such harmful matter is engine genets, small – scale industries, various boilers and also the emissions from power plants. Delhi has observed highest concentration of SPM. Particulate matter less than 2.5 micron (PM2.5) is considered most harmful particle as it reaches blood and gas exchange region of respiratory tract causing respiratory and cardiovascular ailments.

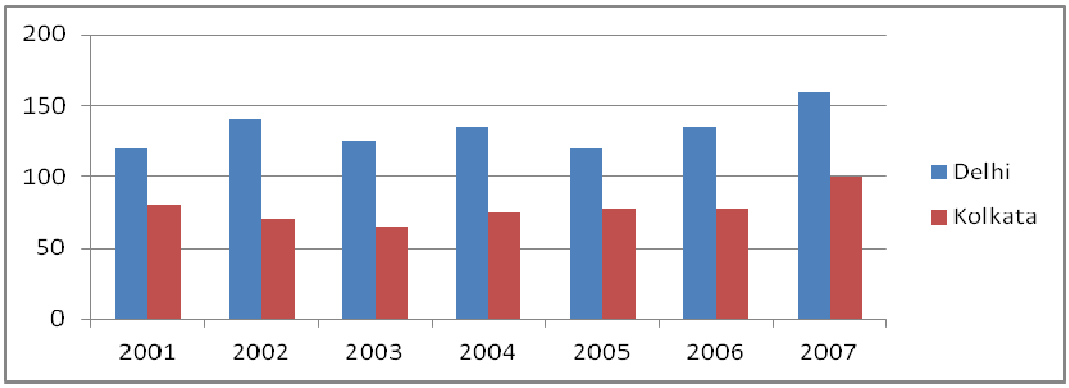

Fig. 6. Annual Average Concentration of RSPM in Delhi and Kolkata
(Author's Calculations, Source: National Ambient Air Quality Status and trends 2012).

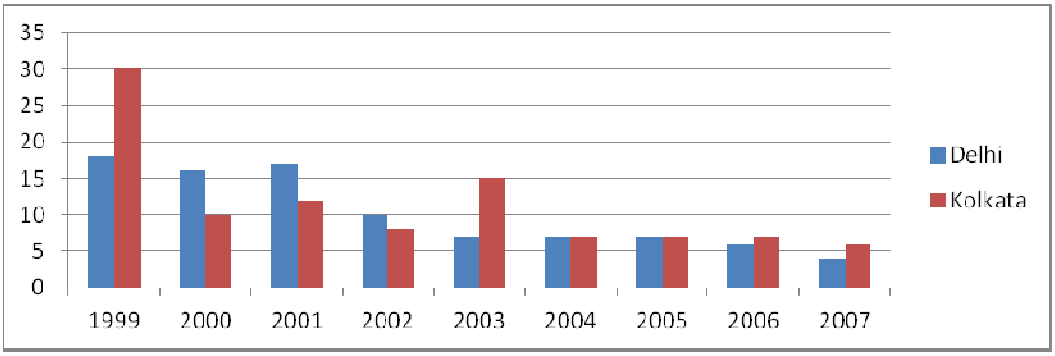

Fig. 7. Annual Average Concentration of SO2 in Delhi and Kolkata.
(Author's Calculations, Source: National Ambient Air Quality Status and trends 2012).

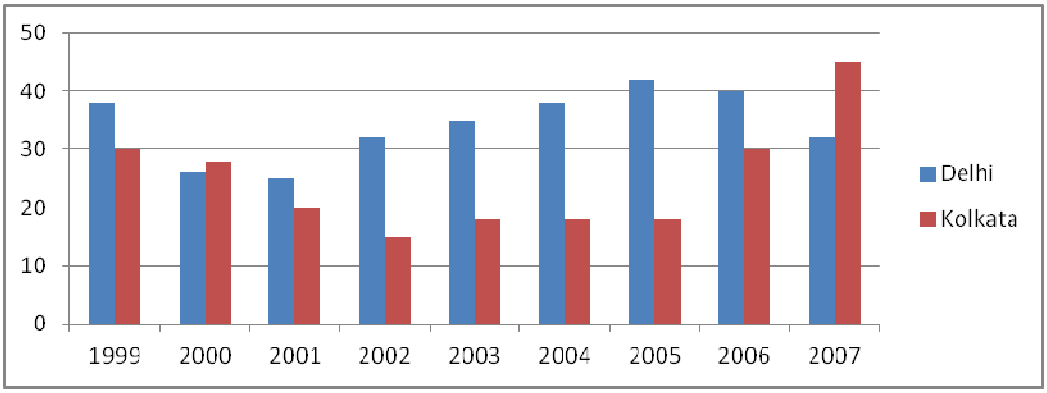

Fig. 8. Annual Average Concentration of SO_2 in Delhi and Kolkata.
(Author's Calculations, Source: National Ambient Air Quality Status and trends 2012).

C. Impact on Health

Air quality in metropolitan cities has been deteriorating mainly due to vehicular emissions resulting in high levels of ambient air pollutants .People with chronic respiratory disorders, elderly, and children are the most vulnerable lot .CPCB and All India Institute of Medical Sciences (AIIMS) in Delhi showed that exposure to higher levels of particulate matter contributed to respiratory morbidity.

V. CLIMATE CHANGE SCENARIO IN INDIA

The Intergovernmental Panel on Climate Change, in its 2007 report, predicts that global temperatures would be rising by 2-4.5 C by the end of this century, with a 2.7-4.3 C increase over India by the 2080s. It is predicted by the panel that there would be an increase in rainfall over the Indian sub-continent by 6-8 per cent and that the sea level would rise by 88 centimetres by 2100.

India is still an agrarian economy with maximum number of population living in rural areas Nearly 700 million rural populations are depended on climate sensitive sectors like agriculture, forests and fisheries and still depend on availability of natural resources such as water, biodiversity, mangroves, coastal zones, grasslands for their subsistence and livelihoods. Climate change comparison between Delhi and Kolkata can be observed using the comparison of temperature data in these cities.

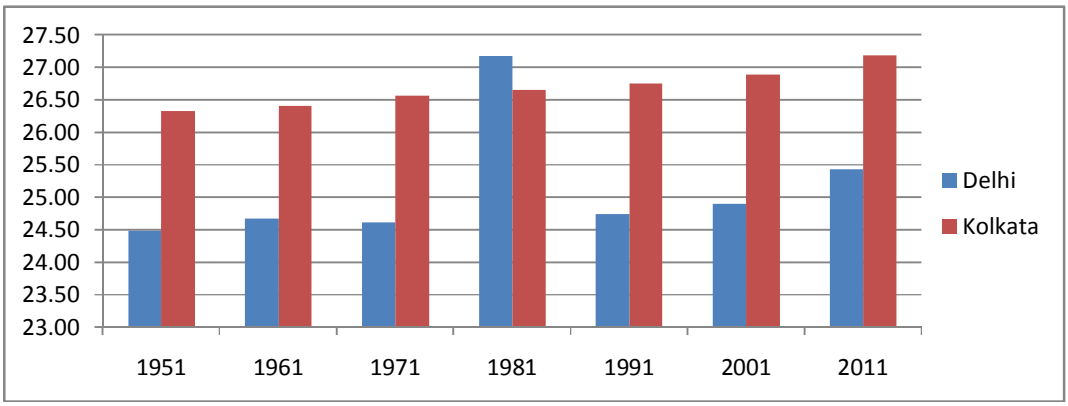

Fig. 9. Variation of Annual Mean Temperature (Temperature degree centigrade)
(Author's Calculations, Source: Goddard Institute of Space Studies (GISS), National Aerounital and Space Administration (NASA).

VI. FINDINGS AND DISCUSSIONS

The decennial growth of population has been more in Delhi since 1951 and it has been rising consistently. Till 2008-09 rate of growth of state domestic product in Agriculture and allied sector has been more for West Bengal but since 2008-09 growth rate of agriculture sector in Delhi has been more than West Bengal.

Vehicular growth of road transport has considerably been high in Delhi as compared to Kolkata. In Delhi the vehicular growth has been rising consistently since 2006. Growth rate of State Domestic Product for industry sector has been more in West Bengal as compared to Delhi. Average annual concentration of RSPM and NO_2 has consistently been more in Delhi than in Kolkata. Average annual concentration of SO_2 is comparable in both cities apart from 1999 and 2003 when SO_2 in Kolkata was relatively very high than Delhi. Temperature which is substantial variable depicting climate change shows high variations in Kolkata as compared to Delhi except in 1981.

VII. CONCLUSION

Environmental issues in the present times have been alarming central issues of immediate concern. Keeping the significance of these issues our country should aim at formulating the policies which mitigate the detrimental consequences on environment .One of the way would be effectively computing national income which accounts for environment...National income accounts conventionally allow depreciation allowance for man -made assets but no depreciation allowance is recommended for Environmental Assets. As a result reduction or depletion of environment is treated as increase in income but on the contrary this depletion has a negative effect on the economy in the future.

Attempts at incorporating environmental account of the country along with the appropriate policies for improving the water and air quality of cities which are struck with high level of urbanisation and excessive growth of population would maintain a balance in the state of environment in such areas.

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