Regional Issues of Population, Development and Environment in India: An Overview[1]

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Abstract

Increasing population and the consequent spurt in infrastructure development have had significant impact on environment in India. High population growth, urbanization and rapid economic growth have been resulting in environmental problems of serious dimensions. Notably, persistence of poverty and the consequent scramble for fast depleting resources have been resulting in irreversible environmental degradation in most of the countries in Africa. On the other hand, rapid population growth and continued economic development are the major environmental concerns in the Asia Pacific region including the Indian sub-continent. It is universally accepted that environmental degradation is taking place at a faster pace in developing countries than in developed countries. Despite this, environmental issues get more academic and policy attention in the developed countries of the world. For instance, the higher use of energy and resources per capita in the United States (US) has been widely debated in the academia and policy platforms, as a result of which, there is now greater awareness among policy makers and masses alike about the urgency of conserving resources. . The acute stress on environment as also on human health in the U S and across its contact regions is also widely debated. The present study investigates the relationship between population increase and environmental issues in India. From the degradation suffered by the natural endowments like land and water resources, flora and fauna, etc., in the six different regions in India under review, it is evident that the rapid economic growth and expansions of infrastructure in the recent decades have not been without serious environmental consequences particularly in the south, north and western

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regions. Rapid population growth and persistence of poverty have caused much higher environmental damage in east, north-east and central regions of India also.

1.1. Introduction

Undoubtedly, rapid population growth, poverty and developmental efforts are the major factors contributing to natural resources depletion and environmental pollution. However the magnitude of environmental degradation is not uniform across countries and regions of the world. For example poverty has been the major cause of depletion of natural resources and environmental degradation in Africa, while in the Asia Pacific region both rapid population growth and continued economic development are found to be the major causes of environmental pollution. In contrast in a country like the US, where population density is a much lower than in India, the main cause of environmental damage has been the extremely high per capita consumption of resources and the consequent high carbon emission. However in India, both rapid population growth and expansion of developmental activities have greatly aggravated resource depletion and degradation of environment. In a broader sense, two factors can be identified as environmental threats, viz: (i) proximate causes such as population growth, poverty, and density and (ii) ultimate factors i.e., developmental imperatives like urbanization, industrialization and economic development, all of which, often results in unsustainable use of natural resources and eventual degradation of environment. The last two decades have witnessed a, continues spurt in economic development and a steady decline in population growth in India. However, economic development and reduction in population growth have not been uniform across regions and states in the country; instead, it has aggravated regional in-equality in socio-economic development which have grave implications for environmental issues for obvious reasons.

If the predictions of economists and policy makers prove true, in a few years India would become the third strongest power in the world. However, this assumption is based on our current record of (2010-11) performance in socio-economic spheres, which need not necessarily come true. The central, east and north eastern regions of India still have huge population density, which indeed is the cause of higher levels of poverty (40 per cent in central and 35 per cent in east) and over use of natural resources like forest, water and land. Huge population, lower standard of human resources and inadequate levels of socio-economic development are the major challenges in the context of conservation of natural resources and protection of environment in

the central, east and north-eastern regions of the country. On the other hand comparatively low population growth and higher levels economic development are the culprits behind environmental stress in southern and western regions of the country (Lakshmana, 2010). What is intended by this paper is a detailed qualitative assessment of the myriad factors responsible for environmental decay and its possible remedies in the context of the Asia Pacific region with particular focus on India.

1.2. Data and Objectives:

Data for the study have come from Census, Statistical Abstracts, and as well as from Compendium of Environmental Statistics published by the Central Statistical Organization, New Delhi and World Population data sheets. Relevant data such as population growth, density, share of urban population in the total, and poverty ratios have been considered to understand the linkages between population, development and environment. In order to quantify the extent of environmental degradation an appropriate conceptual frame work is prepared and used the same for the study. Summary and policy implications have been drawn to assist the respective authority to halt environmental problems which is experiencing at different levels across the regions in India.

Following are the major objectives of the study:

- To study the relationship of population growth, poverty and environmental nexus in India based on the physical characteristics of a region
- To address environmental damage by growing urbanization and industrialization during the recent periods
- To quantify environmental decay across the regions in India by applying an appropriate methodology with the help of conceptual frame work.

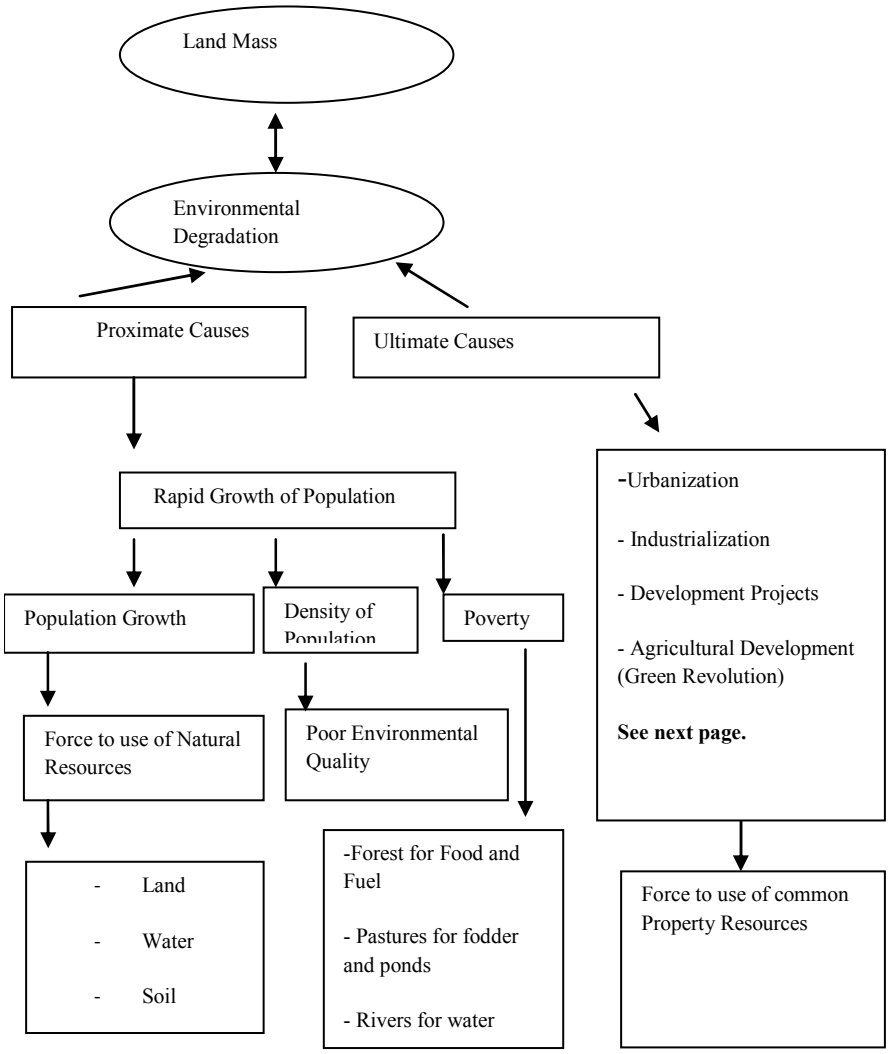
1.3. Conceptual Frame Work:

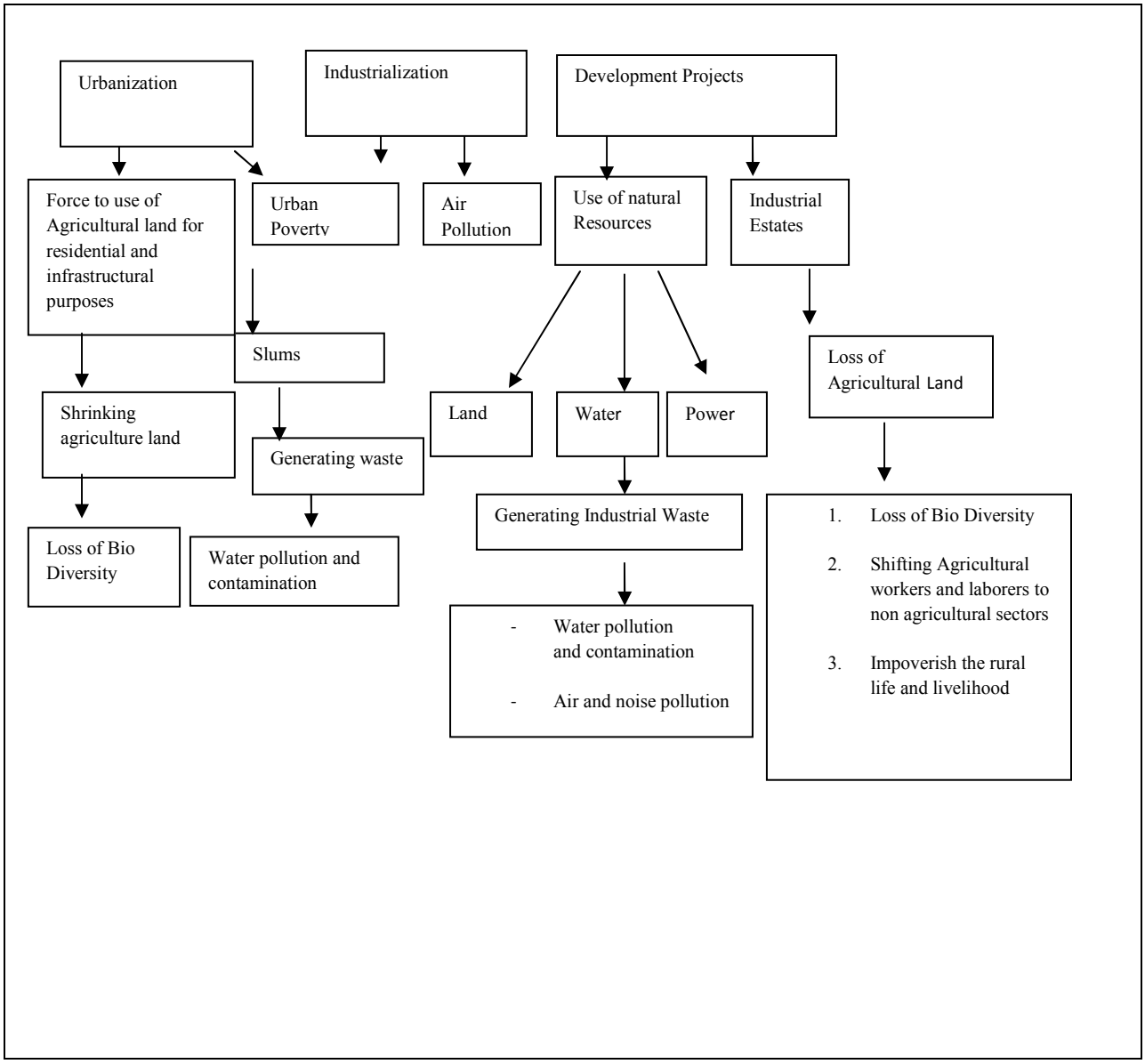
The present paper is constructed under the conceptual frame work which is shown in figure 1. Generally, environmental damage in India due to rapid population growth and increase of economic development is well documented. These proximate and ultimate causes have been degrading the environment in India at different levels. However most of the countries in Africa

and India in South-east Asia have been the climate change hotspots in the world. Nevertheless the impact of population growth and economic development is not one and the same. But, it is depending up on the physical characteristics of a region. And hence in order to assess the development and process of environmental degradation an appropriate conceptual frame work has been drawn for the study.

Fig 1

Conceptual Frame work- Process and Development of Environmental Degradation in India




Urbanization
Industrialization
Development Projects
Force to use of Agricultural land for residential and infrastructural purposes
Urban Poverty
Air Pollution
Use of natural Resources
Industrial Estates
Slums
Shrinking agriculture land
Generating waste
Land
Water
Power
Loss of Agricultural Land
Loss of Bio Diversity
Water pollution and contamination
Generating Industrial Waste
- Water pollution and contamination
- Air and noise pollution
1. Loss of Bio Diversity
2. Shifting Agricultural workers and laborers to non agricultural sectors
3. Impoverish the rural life and livelihood

1.3.2. Hypotheses:

1. The rapid growth and bigger size of population in central and eastern regions of the country would be a cause for higher degree of environmental degradation?

2. The ultimate causes of onset of Economic Development (urbanization) in the recent decades in the west and southern regions of the country would be a sign of sustainable environment or is it degradation of the environment?

1.4. Population Growth, Poverty and Environmental Degradation:

Population of a particular region is both a major asset for development and also a major source of environmental degradation in general and especially in the developing countries of the world in particular. Population growth impacts on the environment primarily through the use of natural resources and generation of wastes. It causes environmental stress and loss of bio-diversity by polluting air and water and exerting increased pressure on arable land. Over the years, urban population has been increasing rapidly, necessitating expansion of urban areas, which invariably entails diversion of agricultural land for infrastructure, industrialization and residential purposes. This has resulted in smaller cities becoming bigger cities, and bigger ones emerging as metro cities, and metros transforming into mega cities. Population pressure naturally leads to over-exploitation of natural resources like land, air and water, and quite often results in contamination and exhaustion of scarce water resources.

As population increases, more food and other facilities are required. Hence, more land is brought under cultivation. This consequently increases the deforestation rate (Ganesh Kawadia, Gunjan Malhotra and Manasranjan Dasmishra, 2007). It is evident that in India, the rapid population growth and the resultant acceleration of economic activities (industrialisation, infrastructure development etc.) are the two major reasons for degradation of environment. India has been able to reduce the rate of population growth remarkably, but the country still has the dubious distinction of being the second most populous nation in the world, and if the present trend continues, it will rank first and push China to the second position by 2045. While India's landmass is only 2.4 per cent of the world total, it is currently home for 16.7 per cent of the world's population.

Fig 2 illustrates the comparative figures of population growth by regions in India. It is apparent that the country's socio-economic development has caused noticeable reduction in the rate of population growth. However, across the six regions, the north-eastern region has registered the highest growth, i.e., 22 per cent, even in the decade 2001-2011. In contrast, the southern region has registered the lowest growth rate, i.e., from 12.93 in 1991-2001 to 9.59 in 2001-2011, apparently due to the socio-economic development achieved by this region. Likewise, the eastern and western regions have also brought down their growth rate below the national average of 17.25 per cent by the decade 2001-2011. The corresponding figures for the northern and central regions are 15 and 16 per cent respectively, which are visibly above the national average of 17.25 per cent.

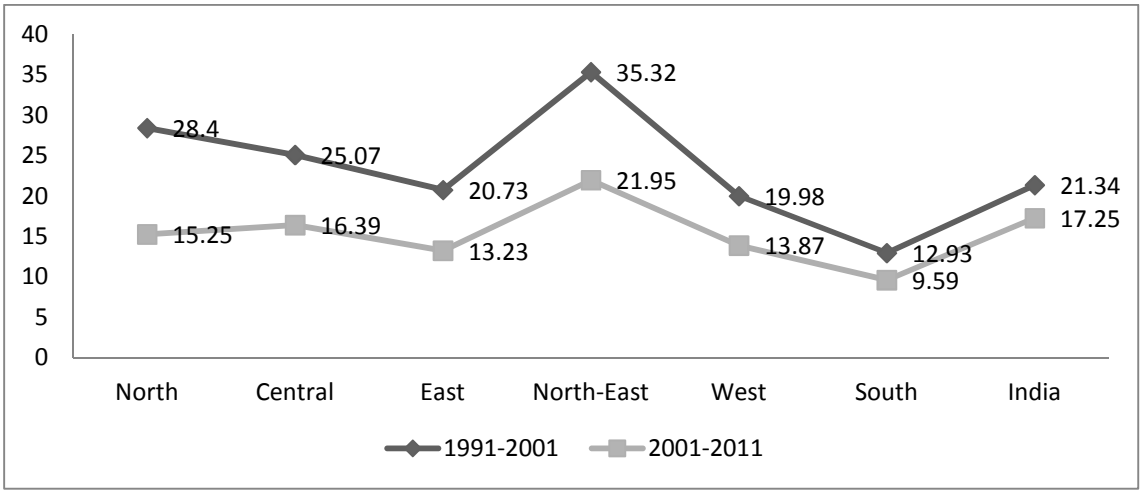


Fig 2: Decadal Growth of Population in India by Region

As mentioned in the beginning part of the paper, the rapid growth of population and expansion of economic development are the two important causes for the degradation of environment in India. Undeniably, the southern region has a lower growth rate of population; nonetheless, the ongoing developmental activities here could trigger environmental problems in the near future. Similarly, though the north, west and east regions have registered growth rates below the national average; but the degree of environmental degradation in these regions is high for a variety of reasons. Here one must note that generally defining environmental degradation is a difficult task. Hence, here an effort has been done to explain the experience of environmental pollution based on the physical characteristics of the regions. Viewed from the background of the conceptual framework which has been drawn for the study, the north-eastern region, with its highest rate of

population growth, has not registered a higher degree of environmental degradation commensurate with its high rate of population growth. In other words, physical characteristics relating to land, forest, water and socio-economic factors here do not show signs of more environmental degradation in spite of its higher growth rate of population. The following discussion elucidates the situation further.

As already pointed out that population aspects like density, proportion of urban population in the total and, more importantly, the quality of population seem to have distinctive roles to play in the process of degrading environment. Higher population density affects the environment through excessive use of natural resources and generation of wastes, in addition to formation of carbon dioxide gas which is harmful to living beings. A higher population density, therefore, indicates poor environmental quality. Hence, if we examine the density of population of India by region fig 3 reflects that the man-land ratio in India in 2001 was 267 persons per square kilometer and it has increased to 366 in 2011. The man-land ratio has been above the national average of 366 in 2011 in all the regions excepting the north-eastern region. However, figure 3 clearly shows that the northern region, which includes the national capital Delhi, has a higher density of population: the average density of population in 2001 was 1,237 which has further increased to 2,170 persons per sq.kms., in 2011. Further, it is important to note that Delhi has the highest density with 11,513 persons per sq km – an acutely high figure compared to any other state/region in the country.

Interestingly, the central region, though ranking first in terms of population size, has a much lower average density of population than the northern region: it stood at 248 in 2001 and it reached to 370 in 2011. It means that population pressure on land is much higher in the northern region than in other regions. However, the elements of population, like density, size and growth rate, are found to have created one or the other environmental problem in the entire central region. For instance, if we examine the population pressure on land, it would be evident that excluding north, in all the other regions, the higher the area, the larger is the population size and *vice-versa*; but in the northern region, the man-land ratio is extremely unfavorable. It means that environmental degradation in this region is primarily due to population pressure on limited and un-expandable land.

As it can be seen from figure 3, the overall population pressure in the backward eastern region is quite acute and understandably its impact on environmental degradation is comparatively very high in this region. The average density of population of this region was 557 persons per sq km in 2001 and it has increased to 784 persons per sq km by 2011. The population density in the southern and western regions is also high, but only second to the eastern region. In absolute terms, the north-eastern region has comparatively less population density as compared to other regions and consequently it has been caused for lower degree of environmental degradation due to a proximate cause.

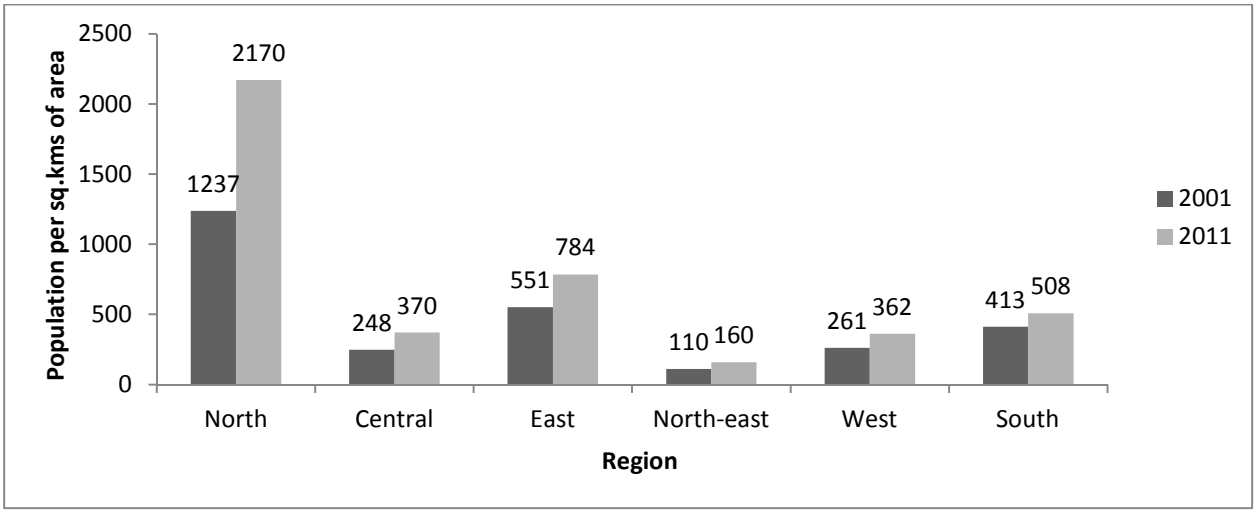


Fig 3: Man Land Ratio in India by Region

It is generally accepted that environmental degradation, rapid population growth and stagnant productivity are the causative factors behind the fast spread of acute poverty in many countries of Asia (Anantha Duraiappah, 1996). However, thanks to the rapid economic growth taking place around the world, particularly since the last quarter of 20th century, the world has witnessed a considerable reduction in incidence of poverty. According to World Bank Report on 'Global Economic Prospects' published in 2007, about 472 million (33.2 %) of population in the total population of 1421 million was living in absolute poverty in South Asia (2003). However, a second estimation shows that, by the year 2015, the total number of persons living under absolute poverty could come down to 273 (16.2 %) million in South Asia. Further, the number of poor which was 320 million out of a total population of 711 millions in the year 2003 is estimated to reach 345 million out of a total population of 922 million by the year 2015 in Sub-

Saharan Africa. Interestingly, the reduction in absolute poverty will be from 45 per cent in 2003 to 37.4 per cent by the year 2015 in Sub –Saharan countries of Africa.

However, poverty estimates in a global context shown that the percent of the population living in absolute poverty is much higher in Sub-Saharan Africa and South Asia, followed by East Asia and the Pacific regions, as compared to the other regions like Europe and Central Asia, Latin America and the Caribbean and Middle East and North Africa. Further according to the estimation index from the above report shows that the relative poverty index for South-Asia and Sub-Sahara Africa was 79 and 74 respectively and which is expected to decline to 60 for South-Asia and 66 for Sub-Sahara Africa respectively. It means still eradication of poverty is a difficult task to these regions when compared to the other regions of the world. Given this scenario, studying the nexus between population growth, poverty and environmental degradation in the context of a developing country like India, would be more appropriate for unraveling the actual causes and remedies for global warming and climate change.

There is much controversy surroundings the poverty-environmental- degradation nexuses. However, a predominant School of thought argues that poverty is a major cause of environmental degradation. And hence it is suggested that if the policy makers want to address environmental issues, then they should first to address the poverty problem with respect to a region/ country. Another School of thoughts argues that this causal link is too simplistic and that the poverty- environmental degradation- nexus is governed by a complex web of factors. Poverty is said to be both cause and effect of environmental degradation, because poorer people who cannot meet their subsistence needs through purchase, are forced to use common property resources such as forests, for food and fuel, pastures for fodder and ponds and rivers for water. Hence, this directly contributes to environmental degradation through over exploitation of natural resources in an unsustainable manner.

It is a known fact that most of the India's poor live in rural areas and are engaged in agriculture. It is gratifying that government intervention through various schemes and programmes implemented under Five-Year Plans to eradicate poverty and provide employment has been generally successful. Over the years, anti-poverty and employment generation schemes and programmes have brought down poverty and rural unemployment substantially. Traditionally the problem of poverty and employment was rampant in rural India, and

conditions in urban India was better, but surprisingly, after the onset of economic liberalization and globalization, there has been a alarming rise in urban poverty in India. .

According to Tendulkar (2008) Committee Constituted by Planning Commission, Government of India, the estimated number of poor in the country was nearly 38 per cent, which shows almost about 380 million in the total population of India are poor. This report is based on a new methodology, and the figure is 10% higher than the earlier poverty estimate of 28.5%. According to this method, the proportion of rural poor in India in 1993-1994 was 36 percent which came down to 27.5 percent by 2004-2005, primarily due to the initiatives taken by government to reduce poverty (Fig 4). It is undeniable that there has been a considerable reduction in poverty in India in the last few decades. However, there is still significant number of poor in almost all regions in India. For instance, in the year 1993-1994, the percentage of poor was 46.39 in the eastern region and 41.68 in the central region, while the corresponding percentage for north-east was 37.11. However, the southern and western regions had respectively 28.95 and 25.33 per cent of population below poverty line in 1993-1994. Interestingly, the corresponding figure for the northern region was about 22 per cent.

Further if we compare the poverty scenario across the regions in India, as between 1993-1994 and 2004-2005, it could be seen that the government efforts in reducing poverty was quite successful, but a researcher's mandate is to probe the reality behind the scenario . No doubt there has been a substantial reduction in poverty in India over a period of time, but this reduction was confined to regions like north, west and south only, and in the backward regions of central, east and north-east, the reduction in poverty was quite marginal. For example, reduction in poverty over a period of ten years (from 1993-1994 to 2004-2005) in the central and west regions was only 1.26 per cent and at 5 percentage points respectively. In contrast, there was substantial reduction in poverty in all regions excepting central and west. There was a drastic decline of poverty in case of north-eastern region (20 per cent), and the reduction was 9 to 10 per cent in the east, south and north regions.

However, the pertinent question is "What is the relationship between poverty and environmental degradation in India?" Several studies (Dewaram, 2005, Anantha Duraiappah, 1996, Kalipeni, 1992) have shown that meeting the subsistence needs of poorer people such as forests for food and fuel, pastures for fodder, and ponds and rivers for water is at the crux of the

problem. Therefore meeting such needs of the poor with no damage/less damage to the environment is pivotal in halting environmental degradation or reversing damage wherever it had taken place. As the poor generally to depend directly on natural assets of a country/region poverty and rapid population growth tend to reinforce each other.

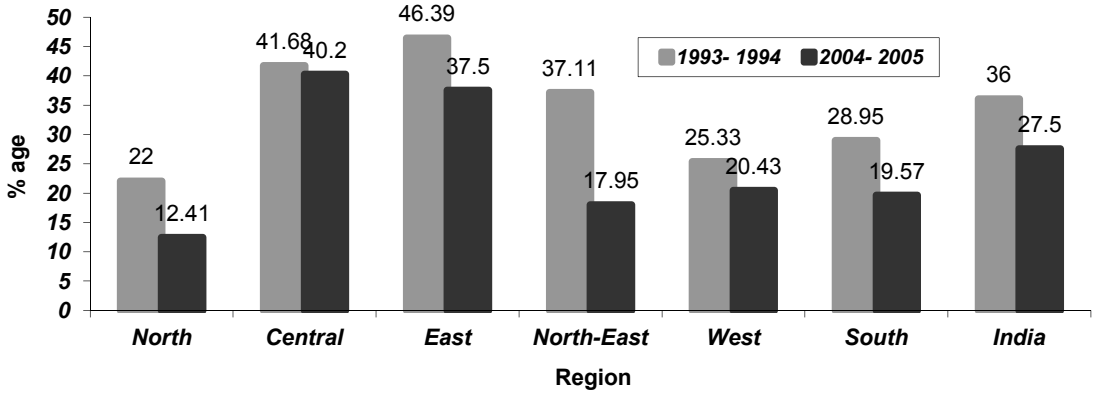


Fig 4: Percentage of population below poverty line in India by region

Keeping the above fact in mind here one can conclude that environmental damage due to over use of natural resources such as forest, water would be more acute in the central and eastern parts of the country, followed by west, south and north-eastern regions of the country. In fact, the northern region has experienced a lower degree of environmental degradation attributable to total poverty, unlike other regions.

1.5. Impact of growing urbanization on Environment:

In recent decades, the urban population in total population has been growing faster than rural population in India due to several reasons. The lack of opportunities for gainful employment in rural areas has been pushing villagers to towns and cities in search of employment, training, etc. This rural influx has been causing tremendous pressure on available urban infrastructure and amenities, like shelter, water and sanitation. Understandably, this leads to over-use of natural

resources, like land water, and generation of waste and emission of carbon, causing environmental degradation on a large scale. Therefore, it could be stated that the lower the degree and extent of urbanisation, the better will be the environment, and *vice-versa*.

The share of urban population in the total population of India was 23.34 per cent in 1981; it increased to 27.78 per cent in 2001 and it further increased to 31 per cent in 2011 (fig 5). It is evident that since 1981, the share of urban population in the country has been higher in all the census years including the latest census of 2011, in the northern, southern and western regions. Also, the share of urban population in the above regions has been higher than the national average of such population throughout the period under review. In contrast, the central and eastern regions always had the urban population below the national average in all the census years. Incidentally, the increase of urban population even in the central and north-eastern regions in the decade 2001- 2011 was above the national average.

In the light of the above scenario of increasing urban population, it can be said that India's economic development has been accompanied by urbanization, industrialization and certain amount of avoidable environmental damage. There is virtually little perspective urban planning where even city developments plan (CDP) have been overlooked or violated to socio-political factors which have augmented the environmental damage. Long-term vision and planning could have minimized the damage. In general terms, economic development has been relatively more in the southern and western regions of India in recent times. The western region consists of the states of Maharashtra, Gujarat and Goa.

It may be noted that Mumbai, which is the business hub of India presumably has a great impact on the economic development in the western region. In this region, over 50 per cent of the total population lives in urban areas unlike in the other regions where the percentage is much low. The increase of urban population in the western region during 30 years of development (1981-2011) was almost 25 per cent. Surprisingly, there is a big jump in the share of urban population in the total population even in the north-eastern region (25 per cent). One can observe that the impact of urbanization on environmental degradation in the west and north-eastern regions is noticeable. The issue of sudden increase in the proportion of urban population in certain regions of the country will be discussed in detailed later in this study. Besides the western

and north-eastern regions, the central region have also registered a slight rise in the proportion of urban population, the increase during the 30-year period (1981-2011) being about 16 per cent.

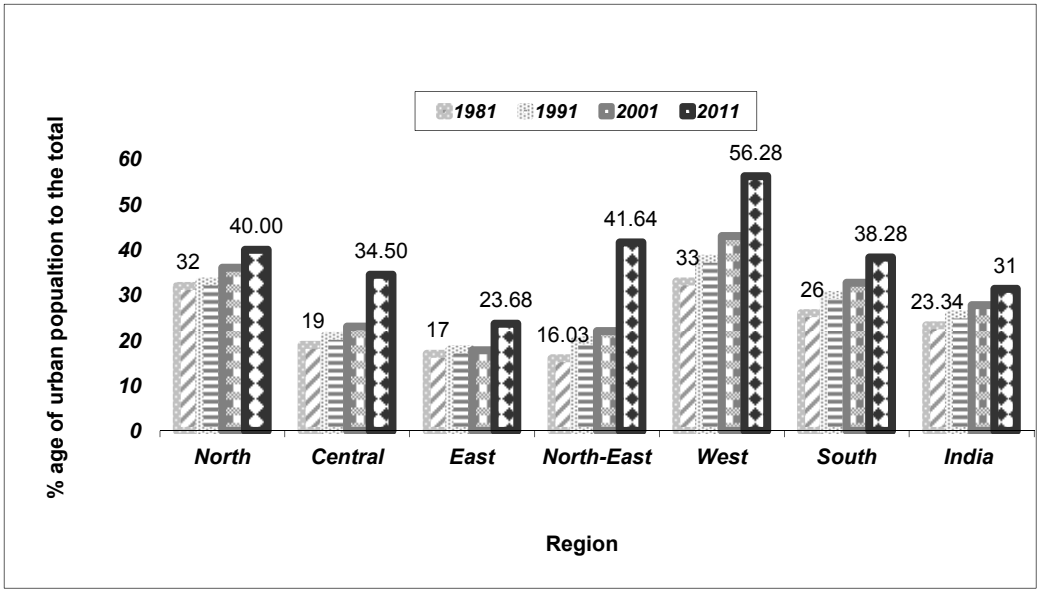


Fig 5: Region-wise Urban Population in Total Population by Region in India

In contrast, the cumulative increase of urban population during the 30-year period (1981-2011) in the other regions was: 12 per cent in the south, 8 per cent in the north and 7 per cent in the east.

The study further attempts to quantify the relationship between urbanization and environmental decay with an appropriate mechanism to assess environmental degradation in India across regions. In this regard Table 1 mirrored that as per the 2001 census, there are about 192 highly populous cities with a minimum population of 0.2 millions in Mijapur of Uttar Pradesh and the maximum population of 11 millions in Mumbai of Maharashtra in India. There were about 47 most populous cities located in the southern region which is followed by 46 in central, 36 in west, 32 in east and 28 in the north. Interestingly only three such highly populous cities are found in the north-eastern region. As stated earlier, the study has attempted to quantify the environmental decay attributable to higher population concentration in the cities across

regions. It is seen that both population size and density of population were responsible for environmental degradation in the regions. It is therefore imperative to focus on the trends in urbanization and its related environmental problems across regions. The population size was the highest in the western region in both 2001 census (39.91 million) and 2011 census (55 million 2011).

Table 1: Most Populous Cities and their Population by region in India

Region	No.of Cities	Population (in millions) 2001	% age	2011	% age	Proportion of Urban Area to the total Urban Area	Man-Land Ratios per sq.kms
North	28	24.61	17.90	31.65	18.03	14.00	2893
Central	46	27.28	19.85	34.62	19.72	23.00	1926
East	32	16.36	11.90	19.93	11.35	10.14	2516
North-East	3	1.25	0.91	1.56	0.89	3.18	629
West	36	39.91	29.04	55.01	31.33	16.76	4200
South	47	30.22	21.99	35.13	20.01	32.92	1365
India	192	137.45	100.00	175.57	100	100.00	2246

Source: Compliled by the Author used census data `

But, the western region is in the third position with 36 most populous cities, and in the first position in regard to the size of total population (55 millions in 2011). Therefore, counting the number of highly populous cities in a region does not appear consequential. Instead, the study focuses on how population pressure or man-land ratio is bringing about environmental degrading.

The southern region has the highest number of highly populous cities but ranks only second in terms of the size of population (30.22 million in 2001 and 35.13 million in 2011). The central, northern and eastern regions come next in that order. If we examine the percentage share of urban population in the total most populous cities in India, the west region has the highest with 29 per cent in 2001 and 31.33 per cent in 2011. But the picture is unlike with regard to the proportion of urban population in southern region: it was about 22 per cent in 2001 and is estimated to decline to 20 per cent by 2011. The central region is at the third position with more or less the same proportion of urban population in both the censuses (minus19.85 per cent) in 2001 and 19.72 per cent in 2011. The northern and eastern regions had proportion of 18 per cent and 11 per cent respectively by 2011.

In order to understand the relationship between population pressure and environmental degradation, one must correlate the population proportion and urban area of the region. For instance, by 2011 the western region with 16.76 per cent of area would have double the proportion of population, i.e., 35.13 per cent of the total. Similarly, the northern region with 14 per cent of area would have 18 per cent of population in the same time-span. It means that the most populous cities are located in the western and northern regions, and therefore, one could conclude that urban environment would be more degraded in the western and northern regions. Further, the eastern region has also been experiencing environmental degradation due to higher population and lesser area. It has 10.14 per cent area to sustain 11.35 per cent population.

In contrast, the southern, central and north-eastern regions have lower proportion of urban population and larger areas. This indicates that the population pressure on urban land and its impact on environment here are relatively lower than in the other regions of the country. Further, it is estimated that due to the ongoing and future developmental activities, the man-land ratio in the western region would become unfavorable and the population density will reach 4,200 persons per sq km. Similarly, population density in the northern and eastern regions would reach 2,893 persons and 2,516 persons per sq km, respectively in the same period. Population density in the southern and central regions is 1,926 and 1,365 persons per sq km respectively. The lowest population density is found in the north-eastern region with 629 persons per sq km.

By the overall understanding of the relationship between urbanisation and environmental degradation across regions in India, one can conclude that the effect of urbanisation on environmental degradation is more in the western and northern regions. It does not mean that the other regions do not experience environmental degradation due to population pressure; but the degree of environmental degradation is higher in the western and northern regions than in the southern, central and north-eastern regions. Here one must note that the ongoing and future developmental activities in the states of Karnataka, Andhra Pradesh and Tamil Nadu in the south, and Madhya Pradesh and Uttar Pradesh in the central region could adversely impact the urban environment in these states in the future. However, as of now, these regions have a lesser degree of environmental degradation attributable to urban growth. There are, however, other factors like air and water pollution in these regions, which are not directly attributed to population pressure. Subsequent sections of the study will focus on environmental degradation caused by reasons

other than population pressure. Another interesting finding of the study is that the north-eastern region has not suffered much environmental degradation due to the growth of urban population compared to other study regions.

1.6. Development Impact on Environment:

Undoubtedly, using up of natural resources by ongoing development activities is one of the prime reasons for reduction in agricultural land and consequent loss of bio-diversity, and more importantly, decline in food production. In this context, the present section of the study tries to highlight some relevant issues with regard to adverse impact of shrinking agriculture land in food security and also its relationship with environmental degradation. In recent years the creation of special economic zones (SEZ) along with increasing population has also resulted in huge diversion of agricultural land for non-agricultural purposes like construction of new industrial estates, peripheral roads, dams, railway lines and residential use. Diversion of considerable agricultural land for SEZs in the name of promoting exports through increased industrial development is a matter of grave concern from the point of view in food security and conserving India's bio-diversity. Besides this, reduction in agricultural land has resulted in extinction of flora and fauna in many parts of the country, and this is a matter of great concern from the point of view of our future survival.

Impact of shrinking agricultural land is adversely affecting our quest for food security. The country needs to increase the production of food grains to 340 million tones per year by the year 2020. Current production of food grains in India is 217 million tones per year (2007). Growing deforestation and consequent environment preservation activities would bring about a situation where in the present 170 million hectares of arable land would not be fully available for cultivation. (It is estimated it may to shrink to 100 million hectares by 2020). In this view one can assume that the country could face massive shortage of food grains and also several environmental problems in the future.

Table 2 provides data on land available cultivable/arable for agriculture in India, by regions, for the years of 1995-1996 and 2005-2006. The total land available for cultivation in India was 1836.26 lakh hectares in the year 1995-1996, which decreased to 1825.75 lakh hectares by 2005-2006. Over a period of 10 years the total cultivable land in the country declined

by about 10.51 lakh hectares. Similarly, it can be seen from a given table that per capita land availability for agriculture in India declined from 0.22 hectares in 1995-96 to 0.18 hectares in 2005-2006. Shrinkage of agricultural land has been extensive in all regions with the exception of west and north; the loss being highest in the central region at 69.37 lakh hectares, followed by 48.38 lakh hectares in the east region. Loss of arable land is comparatively low in south at 4.12 lakh hectares followed by north-eastern region at 0.08 lakh hectares.

Table 2: Available Cultivable/Arable Land for agriculture in India by Region

State	Available Land (in Lakh hectares)		Shrinking Arable Land (in Lakh hectares)	Availability of Land Per-capita	
	1995-1996	2005-2006	1995 to 2005	1995-1996	2005-2006
North	355.84	355.92	0.08	0.35	0.27
Central	435.81	366.44	- 69.37	0.21	0.13
East	246.99	198.61	- 48.38	0.13	0.1
North-East	62.55	61.67	- 0.88	0.2	0.16
West	337.27	337.67	0.49	0.28	0.23
South	395.76	391.64	- 4.12	0.2	0.18
India	1836.26	1825.75	- 10.51	0.22	0.18

Source: Calculated by the Author using Census Data.

Increase in population has been directly responsible for the reduction of per capita land availability. In this regard table 2 also presents the per capita land availability for agriculture in India, by regions. In the year 1995-1996 the per capita land availability in north and central regions was 0.35 hectares and 0.21 hectares respectively, which has shrunk to 0.27 and 0.13 hectares respectively by the year 2005-2006. It confirms that the reduction in per capita land availability was highest with 8 points in north and central regions. Next in order is the west region with 5 points followed by north-east (4 points), east (3 points) and south (2 points).

As already noted, India is endowed with state quantity extent of land, forest and rich variety of bio-diversity. Rapid changes in land use pattern have been adversely impacting forest resources and bio-diversity in India, which is one among the 12 mega-biodiversity countries of the world. In this regard according to a survey about 70 per cent of the total geographical area in the country has about 46,000 plants species and 81,000 animal species found. This represents

about 7 per cent of the world's flora and 6.5 per cent of the world's fauna (Compendium of Environment Statistics, 2009). In recent decades, acquisition of land by governments for special economic zones (SEZ's) has been resulting in diversion of huge chunks of arable land to non-agricultural activities, particularly since 2005. At present there are about 762 special economic zones in the country under various stages of completion, and for this purpose vast tracts of agriculture land had been acquired by the government at below-market prices.

Here one important aspect needs reiteration: SEZs have not only eaten away fertile and often multi-crop agriculture land but have also impoverished the large number of villages coming under the notified area in several ways. Most importantly, the predominantly agrarian and rural way of life in the villages is lost forever, and in its place, industrial estates and its corporate culture has taken hold. The total land area of India is 29,73,190 sq.kms, of which about 16,20,388 sq.kms area (55 %) is currently used for agriculture. The area slated or SEZ is about 2061 sq.kms, i.e., 0.12 % of the total land area. According to the Ministry of Agriculture, Govt. of India, diversion of such a minimal acreage cannot adversely affect India's food production, though some experts contest this position.

However, this view might be true in a macro perspective but not so at the micro or regional level. It is therefore necessary to take serious steps to maintain food production at pre-acquisition levels. The impact of environmental decay is felt in myriad ways: For example, the construction of outer ring roads, peripheral roads and express ways with the laudable objective of decongesting city traffic, reduction of air and noise pollution and to cut down distance and time of travel. While these are justifiable objectives with significant welfare content, its negative externalities are seldom factored in while taking up such projects. It is quite common to see around big cities like Bangalore premature conversion of valuable agricultural lands for non agriculture use. Urban fringe has become land grabbers and speculators paradise depriving real conversion and uses. Much thought needs to be given to the trade- off between developmental needs and the imperative of protecting environment from a long term perspective. It is high time that planners thought about alternative mechanisms for mega projects that require massive land acquisition and rehabilitation of evacuees.

Most of the land acquired for the above purposes is agricultural land; after acquisition, many a time, land is diverted to purposes other than those originally contemplated. This is

particularly true in case of Public-Private Partnership (PPP) arrangement, under which most projects are currently being executed. There are several instances where these agencies have used agriculture land for various purposes other than road construction (Example flats, hotels etc). Paradoxically, PPP has become synonymous to divesting farmers of their only possession, i.e., agricultural land. Shrinking of agricultural land has several adverse consequences apart from environmental damage and ecological imbalance. Its ill-effects could manifest in various dimensions such as declining food production, shifting laborers from agriculture to industry, decline in net sown area, etc. The high priority accorded to promotion of exports through increased industrial development has often resulted in unbridled diversion of agricultural land to industrial and other purposes, to the detriment of agricultural production and food security.

This process threatens to further damage the country's bio-diversity and ecological balance, which are vital for our very survival. Generally there is an argument that a second green revolution only can bring up grain production to the levels needed to feed the increasing population. Our agricultural scientists and technologists have to brace themselves for the challenge of doubling the productivity of the available agricultural land consistent with the availability of irrigation and other inputs. The requirement of land for food production to feed the increasing population, as well as that needed for aforestation and environmental preservation activities would force a situation where in the currently available 170 million hectares of arable land would get further reduced to about 100 million hectares by the year 2020.

Here more importantly it is to be noted that the rationalization of Environmental procedures prescribed in the relevant acts for SEZ not required No Objection Certificate (NOC) from the respective department. And as per the SEZ act 2005 part 49 the SEZ have free from central and state amendment rule. Environmental conservation act are not applicable to SEZ in India. No one has right to question to polluted environment by SEZ even if it is dangerous to health. Every Indian has to think about how this project initiative in the name of globalization and development leads to sustainable environment. What would be the impact on the future generation and conserve environmental sustainability.

If the present trend of decline in cultivable land is allowed to continue, there is a likelihood of serious food shortage in the not too distant future. Such food shortage could cause several environmental problems in addition to the apparent human misery. These issues need to

be debated threadbare in academic and policy circles to arrive at policy prescriptions and political consensus to forestall such tragedies.

Shrinking agricultural land as well as increase in population has been causing higher levels of environmental degradation and loss of bio-diversity in central and east regions. However, by the evident of population size and growth one can assess that a huge chunk of shrinking agriculture land in central and eastern regions of the county was not only due to development it is too due to over population. May be a large amount of land converted into residential purpose during the last two decades of 20^{th} century to provide shelter for the residents in the central and eastern regions. However, to strengthen the statement one has to investigate to measure the converted land from agriculture to other purpose especially in the central and eastern regions of the country.

However, currently, west and south regions (loss measured at 5 points in west and 2 points in south) are comparatively less environmental decay and loss of bio-diversity. But here one has to bear in mind that the present analysis examines the shrinking agriculture land only up to the year 2004-05. Hence, on-going developmental activities in the southern and west regions of the country could change the situation in future. Only a multi-pronged action plan with emphasis on both halting the decay and reversing it wherever possible will be able to save our bio-diversity and conserve the natural environment. In fact, two highly industrialized as well as urbanized states viz; Maharashtra and Tamil Nadu have huge chunk of valuable agricultural land converted in the recent years for industrial development and urban uses. These two states have provided sufficient lands to SEZ, industries and transport related developments.

1.7. Quantitative Assessment of Environmental Degradation:

The previous discussion of the study has been presented the detail investigation on how proximate and ultimate causes degrading the environment in India by region. However, at the same time here an attempt has been done to quantify the issue in order to construct appropriate quantitative index of environmental degradation for the study. The most ten responsible factors in proximate and ultimate causes which directly responsible for the environmental degradation in India have been selected to construct a Quantitative Index of Environmental Degradation (QIED). This is presented in table 3 and 3.1. Here the proximate causes on the other hand define that the rapid population growth; and similarly ultimate causes means economic development impact on environment. The indicators of proximate causes were including population parameters like growth, density, proportion, poverty and so on. The ultimate causes include growth of urban population, growth of motor vehicles, growth of industries and shrinking agriculture land etc. Based on the cumulative ranks of the respective indicators the index has been prepared and this may be classified into three; here the sequence is that higher the cumulative ranks lower is the environment degradation and vice versa. Hence the degradation index has been classified into three; as relatively low, relatively medium, relatively high.

As per the derived index is shown in table 3.2, the experience of environmental degradation by the proximate cause were relatively high in the central, east and northern regions of India. The study hypothesis, the effect of rapid growth and bigger size of population was positively confirmed that there is a direct impact of population growth for higher degree of environment degradation in central and eastern regions of the country. The cumulative ranks of the respective regions were between 25 to 35 points. The environmental degradation experience was comparatively low in northeast with highest points of 47. In this regard the expected study hypothesis whether over population growth leads to higher environmental degradation was vice versa in case of north-eastern region. The experience of environmental degradation was quite low as compared to the other regions in the country. Relatively moderate in west and south regions between 36 points to 45 points respectively (Table 3.2). Similarly by the ultimate cause environmental degradation was an experience relatively high in the west, north and south their cumulative ranks were between 25 to 35 points.

The study hypothesis; the ultimate cause of onset of economic development influence on environmental degradation in the south and western regions of a country is not a sign of sustainable environment but it confirms the higher degree of environmental degradation. And similarly the expected hypothesis economically developed region of north is not confined to lower degree of environmental degradation and it is also witnessed for higher degree of environmental degradation due to ultimate causes. However, relatively moderate level of environmental degradation had experience in the central and east regions with 36-45 points. The experience of environmental degradation in the north-eastern region was relatively low with 46-55 points.

The experience of environmental degradation by both proximate and ultimate factors was relatively high in west, the cumulative ranks of this region was 50 with lowest points. The experience of environmental degradation by both the factors was medium in north, central and southern regions. The cumulative ranks were between 60-70 points. The experience of environmental degradation was relatively low in the east and northeastern regions with the cumulative ranks of 71 in east and 99 in north eastern region.

Table 3: Selected Indicators of Proximate causes in Environmental Degradation

Indicators of the Proximate Causes	North	Central	East	North-East	West	South
Ranks						
1. Decadal Growth of Population (1991-2001)	2	3	4	1	5	6
2. Size of Population (2011)	5	1	3	6	4	2
3. Percentage of Population in total India (2011)	5	1	3	6	4	2
4. Man Land Ratio (2011) in total population	1	4	2	6	5	3
5. Man Land ratio (2011) in most populous cities	2	4	3	6	1	5
6. Forest Degraded Area in hectares per 1000 sq.kms (2001)	6	1	4	5	2	3
7. Shrinking Arable Land in hectares (2005-2006)	5	1	2	4	6	3
8. Percentage of Population below poverty line (2004-2005)	3	1	2	6	4	5
9. Percentage of Households with Toilet Facility (2004-2005)	3	6	5	1	2	4
10. Consumption of pesticides in metric tones (2004-2005)	1	3	5	6	2	4
Total Ranks	**33**	**25**	**33**	**47**	**35**	**37**

Source: Data collected from secondary sources and the ranks have been calculated by the Author

Table 3.1: Selected Indicators of Ultimate causes in Environmental Degradation

Ultimate Causes (Indicators)	Region					
	North	Central	East	North-East	West	South
Ranks						
1. Percentage of Urban Population (2011)	3	5	6	2	1	4
2. Percentage of urban Population below Poverty line (2004-2005)	5	1	2	6	4	3
3. Man Land ratio (2011) in most populous cities	2	4	3	6	1	5
4. Shrinking Agriculture land in hectares (1995-2005)	5	1	2	4	6	3
5. Density of Motor Vehicles per sq.kms (2006)	1	5	4	6	2	3
6. Registered Motor Vehicles per 1000 persons (2001)	2	4	6	5	1	3
7. Decadal Growth of registered Industries (1991-2001)	1	6	2	5	4	3
8. Consumption of Fertilizers products in metric tones (2004-2005)	4	5	3	6	2	1
9. Solid Waste Collection in metric tones per day (2002-2003)	4	3	5	6	2	1
10. Consumption of Pesticides in metric tones (2004-2005)	1	3	5	6	2	4
Total Ranks	**28**	**37**	**38**	**52**	**25**	**30**

Source: Data collected from secondary sources and the ranks have been calculated by the Author

Table 3.2

Quantitative Index of Environmental Degradation

Responsible Causes	North	Central	East	North-East	West	South
	Cumulative Ranks of the selected Indicators					
Proximate Causes	33	25	33	47	35	37
Ultimate Causes	28	37	38	52	25	30
Both	61	62	71	99	50	67

Classification

Responsible Causes	Relatively High	Relatively Medium	Relatively Low
Proximate Causes	(Ranks 25-35) Central, East and North	(Ranks 36-44) West and South	(Ranks 45-55) North-east
Ultimate Causes	(Ranks 25-35) West, North and South	(Ranks 36-44) Central and East	(Ranks 45-55) North-east
Both	(Ranks 50-60) West	(Ranks 61-70) North, Central and South	(Ranks 71 and above) East and North-east

Note: The quantitative Index is prepared and classified by the author.

Summary and Policy Implications

In the Indian context, it is the proximate causes such as rapid population growth and poverty those have mainly caused degradation to environment. The contribution of ultimate causes like polluting technologies, affluence related wastes, land and uncontrolled urbanization to environmental degradation can by no means be ignored. Success/failure of environmental protection efforts vary across regions in India and these differentials are not due to poverty but also institutional failures were the root causes of environmental degradation. Hence, India needs to make concerted efforts to reduce poverty and also give pointed attention to institutional failures in order to check and possibly reverse environmental degradation due to over use of natural resources of the country.

All the six regions (the country has been divided into six regions based on the physical location) have been experiencing environmental degradation in various degrees due to one or the other reason, and in most cases, the extent of environmental decay has been directly related to the physical characteristics of the region in question. For example, the north-eastern region has the highest growth of population, but due to its unique physical characteristics such as small size of population, low population density and larger forest area, it has experienced a lower degree of environmental degradation. Though the east and central regions have higher size of population, they are however endowed with larger geographical area, and therefore, have experienced relatively low level of environmental degradation. The same trend is visible in both south and west regions. In contrast, environmental degradation is severe in the north region due to over population; the man-land ratio here is highly unfavorable with 2170 persons per sq.km, while the national capital territory of Delhi, coming under the north region, has 11,513 persons per sq.km.

Unfavorable land-population ratio has always been a sure recipe for environmental degradation, proving the old adage 'population pressure is the highest environmental problem'. The study suggests that in order to curb environmental degradation that accompanies rapid population growth and accelerated economic activities in the north region, we have to evolve appropriate and timely policy prescriptions. The urbanization effect on environmental degradation in west and north regions is much higher than in other regions, while increasing urbanization and accompanying developmental activities in the south and west regions could further worsen the situation in the future. Even the north-eastern region has experienced environmental degradation

due to urbanization, though at relatively lower level. At present, the degree of environmental degradation due to urbanization is relatively moderate in central and east regions, but recent developmental initiatives through the ongoing industrial projects could cause further damage to environment.

There is evidence of close relationship between poverty and environmental degradation in central, south, east and west regions. Both rural and urban poverty is higher in these regions; hence environmental decay directly attributable to poverty is also high in these regions. The degree of environment degradation due to urban poverty is comparatively low in north-east and north regions of the country. The huge shrinkage of agriculture land coupled with increase in population size in the central and east regions has had a greater impact on their natural environment as manifested in the reduction of bio-diversity in these regions. The diversion of agriculture land for developmental activities in south and west regions is less even after taking into account the going developmental projects as compared to other regions. However, the data used here relates to the year 2005-2006, and hence the suggestion that the southern and western regions have not experienced environmental degradation due to land degradation can only be tentative. Here one must bear in mind that recent (post- 2006) developmental initiatives especially in the states of Karnataka, Andhra Pradesh and Tamil Nadu in the south, and Gujarat in the west, have caused diversion of huge chunks of agricultural land for non-agricultural purposes.

By the overall investigation based on the physical characteristics of a region study confirms that the rapid population growth is surely deteriorated the environmental degradation more badly in central, east and northern regions. On the other hand economic development (ultimate causes) is deteriorated the environmental degradation worse in west, north and southern regions. Similarly both proximate and ultimate causes deteriorated the situation most badly in west and this is followed by south and central regions of the county. However, the situation was quite controllable in east and north-eastern regions. Hence in view of this the study strongly suggests to the policy makers to take immediate attention to these serious issues. Need to take immediate steps through policy implications to halt environmental damage and to conserve environment for healthy society and sustainable environment which is most important our survival.

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