Environmental Degradation: Issues and Concerns in India*

By
C.M.Lakshmana†

Abstract:

In recent times, increasing Environmental Degradation has been impacts human health but also has a negative influence on the global environment. Rapid growth of population has been the main cause of environmental degradation. And this has been formed several environmental problems such as reduction of agricultural land, productivity, deforestation, soil erosion (including land slide), shortage of drinking water etc. In the earlier decades, particularly during 1960's and 1970, people began to think that human existence on this globe would not be possible unless they adjusted their relationship with the environment. It has been fully realized that these environmental problems are now not limited to local, regional and national level alone but to the entire globe. Along with human resources, land, water and vegetation are the three important natural resources necessary for sustainable national growth. Rising population leads to overuse of natural resources, thereby endangering the welfare of future generations. The global population increased from 3.85 billion in 1971 to 6.1 billion in 2001 and is currently growing by 77 million people a year. Most of the growth is concentrated in developing regions, with nearly two thirds in Asia and Pacific. The population of India has grown steadily from 1901, except for a decrease in the decade 1911-1921. The total population of India was 23.8 crores in 1901 which increased to 36.1 crores in 1951 and to 102.7 crores in 2001. India has only 2.4 per cent of the total land area of the world, but, is home for 16.7 per cent of the world's population.

There has been high degree of Environmental Degradation witnessed in the states of Madhya Pradesh, Himachal Pradesh, Haryana, Gujarat, Maharashtra, Orissa, Rajasthan, and Jammu-Kashmir. On the other hand the backward state of Bihar and smaller state of Sikkim have shown relatively low level of environmental degradation. The rest of the states like Andhra Pradesh, Manipur, Megalaya, Punjab, Tripura, West Bengal, Karnataka, Kerala, Tamil Nadu and Uttar Pradesh have shown relatively medium level of environmental degradation in the country.

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† Associate Professor, Population Research Centre, Institute for Social and Economic Change (ISEC), Bangalore-560072. Email-lakshmana@isec.ac.in

1.1. Introduction:

In India, the problem of environmental degradation is more severe due to the problems of un-employment and acute poverty. The impact of environmental degradation has not been uniform. This is more resulted to weaker section of the society. This is because in general, India's economic development depends mostly on agriculture. Degrading environment has an impact not only on their livelihood but also on key environmental areas like environment and health environment and development. Like-wise development will impoverish the poor even further and destroy their base for livelihood.

In recent decade several studies have explored the relationship between economic development and environment quality. The empirical evidence from different studies conducted by the World Bank in 1992 (Shafik), 1994 (Holtz-Eakin) and 1995 (Selden) have shown economic growth in underdeveloped countries involve worsening in environmental outcomes. The theoretical study by Selden and Song (1994) has derived transition paths for environmental pollution, social welfare functions and pollution damage and productivity of capital. The focus has given for understand the environmental degradation with economic development. The study shifting cultivation and population growth by Amelung and Diehl (1992) has shown that correlations between deforestation and multiplicative causative are many and vary, revealing no distinct pattern. A study conducted by Panayotou in 1993 shows that as economic development accelerates with the intensification of agriculture and other resource depletion begin to exceed the take-off in industrialization.

In the present paper an attempt has been made to understand the environmental degradation caused by the growth of population in India and its States. The analysis has been done for the last three decades: 1971-1981, 1981-1991 and 1991-2001. The three major aspects, deforestation, growth of industries and growth in numbers of registered motor vehicles have been selected for the study. A detailed investigation has been done to understand the State-wise environmental degradation and its link with population growth. Overall understanding is arrived at by computing the environmental degradation index (EDI). In the concluding part, viable policy recommendations have also been drawn.

1.2. Objectives:

1 To study the effects of population growth on environmental degradation in India by States,

2 To investigate the status of environmental degradation under aspects of deforestation, growth in numbers of industries and growth in number of motor vehicles in India by States,

3 To construct Environmental Degradation Index (EDI) by States in India and link it up with population growth figures.

1.4. Data and Methodology:

The data for the study has been collected from the available census reports and Environment Statistics published by the Ministry of Statistics for the years 1971, 1981, 1991 and 2001. Collected data pertaining to the registered motor vehicles and industries have been converted into simple growth rates for the respective decades: 1971-1981, 1981-1991 and 1991-2001. The analysis has been done to link it up with population growth. Further, in order to understand the overall status of environmental degradation, the Index of Environmental Degradation (IED) has been prepared. Suitable illustrations have been drawn up and appropriate policy suggestions and conclusions have been stated in the study. An issue of environmental degradation is a complex and wider. In this background the present study looks the issue pertaing to environmental degradation by the selected aspects of deforestation, growth of registered motor vehicles and similarly growth of registered industries in India by states. Hence the study has certain limitations in order to understand environmental degradation in India across the states. Here one must note that there are no rural-urban divide in the registered motor vehicles and also for industries. Hence the present study has some limitations in analyzing environmental degradation in rural and urban areas. The analysis has only considered all over India across the states.

1.5. Population pressure, Land and Environmental Degradation:

Increasing population has created several environmental problems, some of which are: overall reduction in agriculture land, lower productivity, deforestation, soil erosion, land slides and expansion of wasteland, problem of drinking water and malnutrition. Population pressure also leads to gradual change in climatic conditions like increasing frequency of floods and draughts. Increasing level of pollution has adverse effects on human health and quality of life.

In this view, if we examine the per capita land availability for agriculture in India Table 1, indicates that, over thirty years period it had shown a steady decline, while the per-capita land availability of agriculture was 0.30 hectares in 1971, it came down to 0.21 hectares in 1991 which was further reduced to 0.18 hectares by the year 2001. There are three reasons for such decline viz., (i) In general, increasing population leads to reduction of per capita land availability for agriculture (ii) where land is in-elastic in its availability and (iii) in recent years, especially after 1990s, rapid growth of industries and establishment of various institutions under Economic Liberlisation, Privatization and globalization, a large amount of agricultural land is used for the various purposes (like residential, development projects like railways, industries, mining, river valley projects and defense etc.,). It is further evidence from all India report on Agriculture Census (2001) that the average size of holdings had shown a steady decline over all the censuses; while it was 2.3 hectares in 1970-71 it came down to 1.84 hectares in 1980-81, which was further reduced to 1.55 hectares during 1990-91(All India report on Agricultural Census (1991-92).

Off late, creating of Special Economic Zone's (CEZ's) which is under-way. In the name of promotion of exports through increased industrial development often on this shrinking agricultural land is a serious aspect. This has directly influenced the reduction of gross agricultural land, and its further impact on reduction in net sown area, vanishing wild animal's flora, fauna and animal species. This process has been further damaging the whole bio-diversity which is also vital for our survival. Further it indicates that India must find the second green revolution, to meet future food grains needs necessitated by increasing population growth. Because as per the estimated figures by 2020 India would need to produce over 340 million tones of food grains to our population. Hence, our agricultural scientists and technologists have to work for doubling the productivity of the

available land for agriculture as well as within the availability of water. The requirement of land for the increasing population as well as for greater aforestation and environment preservation activities would force a situation whereby the present 170 million hectares of arable land would not be fully available. It is estimated to shrink to 100 million hectares by 2020. Hence in future it is predicted that it may create shortage of food production and also several environmental problems in India.

Table 1: Population and Per-capita availability for agriculture (in hectares) in India

Year	Population	Per-capita land availability for agriculture	Change in every 10 years
1971	54.79,49,809	0.30	-
1981	68,51,84,692	0.25	About 0.05 hectares
1991	84,63,02,688	0.21	0.09 hectares
2001	102,70,15,247	0.18	0.12 hectares

Source: All India Report on Agricultural Census, 1990-91 and www.indiastat.com.

1.6. Population Growth, Deforestation and Environmental Degradation:

In India, deforestation is increasing on at a very fast rate, the overexploitation of forests started during World War II, when the British started clearing forests to meet their need for land etc., (H.M.Saxena, 1999). In the post-independence period, the process of exploitation has been continuing to meet the needs of development projects like housing, railways, industries, mining, river valley projects and defense etc. The impact of deforestation on the environment can be seen in the form of micro climatic change, increase in temperature and decrease in humidity/rainfall flood and soil erosion.

In this regard Fig 1 (a) represents the over all growth rate of population by States in India for the decades 1971-1981, 1981-1991 and 1991-2001. Similarly Table 2 presents the percentage of forest area in total geographical area by States for the years 1981, 1991 and 2001. The average growth rate of population of India in the decade 1971-

1981 was 24.66 per cent, it decreased to 21.34 percent by the decade 1991-2001. But there is a substantial rise in absolute growth of population in different States. In the last decade there is a gradual decline in the growth rate of population in India, and it's States except for a few

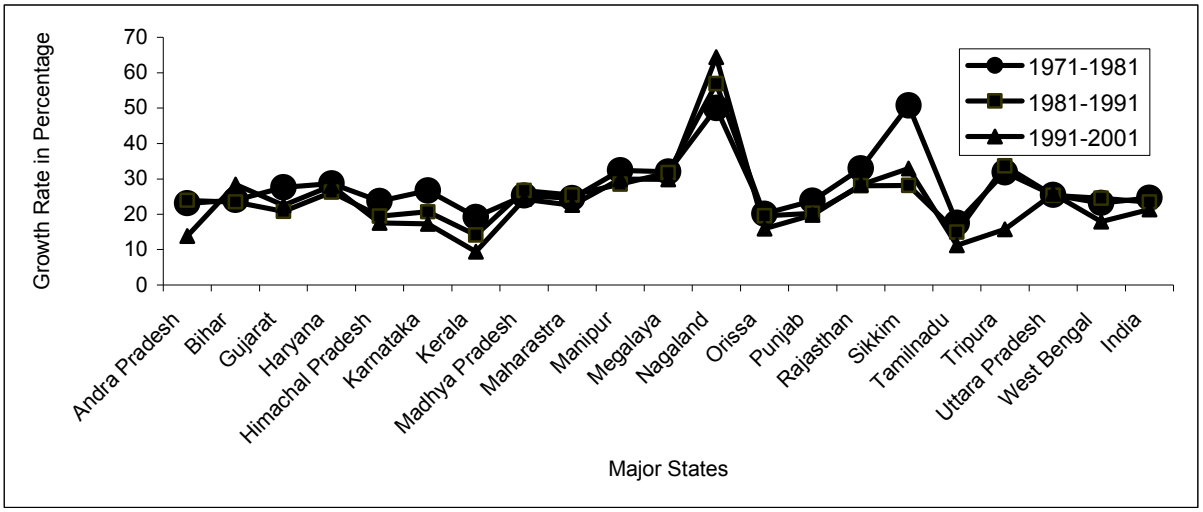

Fig 1 (a): Decadal Population Growth in India by States

States namely, Nagland, Bihar and Uttar Pradesh. This is mainly due to higher percentage of tribal and SC/ST population and also to some extent the backwardness. The per cent of forest area to total geographical area of the country has slightly increased to 23.38 per cent in 2001 from 22.41 per cent in 1981. It indicates a marginal increase of forest area in the country. But, in many States this has been decreasing over the years.

There was a drastic decline of forest area in Bihar (16.83 per cent in 1981 to 6.45 per cent in 2001), Uttar Pradesh (17.39 per cent in 1981 to 6.98 per cent in 2001), and Madhya Pradesh (34.63 per cent in 1981 to 30.89 per cent in 2001). Interestingly these states have had relatively higher growth rate of population and higher proportion of STs in the country (See Table 3). It may be note that the higher growth of SCs and STs has resulted for higher land for agriculture, housing etc. Probably it is met by clearing the forest or from agricultural land. There is no interchange. As, there is sizeable SC/ST population it denotes that there would be more dependence on forests for fire wood etc.

The prevailing forest use practice and the inherent contactor- government nexus often deprive the traditional rights of local tribes to go the fire wood, minor forest

Table 2: State-wise Population and Forest Area for the year 1981,1991 and 2001

Sl.No	State	Decadal Growth rate of Population			Percentage of Forest area to the total Geographic Area			Forest Degraded Area (Per 1000 sq.kms)
		1971-1981	1981-1991	1991-2001	1981	1991	2001	2000
1	Andra Pradesh	23.1	23.91	13.86	23.3	23.18	23.2	37.34
2	Arunachal Pradesh	*	35.86	26.21	61.54	61.54	61.55	N.A
3	Assam	N.C	52.44	18.85	36.47	39.14	34.45	7.95
4	Bihar	24.06	23.49	28.43	16.83	16.8	6.45	15.62
5	Chhattisgarh	@	@	18.06	@	@	43.85	N.A
6	Goa	*	15.96	14.89	*	33.76	33.07	N.A
7	Gujarat	27.67	20.8	22.48	9.96	9.85	9.69	6.83
8	Haryana	28.75	26.27	28.06	3.67	3.84	3.51	0.74
9	Himachal Pradesh	23.71	19.39	17.53	38.05	38.3	66.52	5.34
10	Jammu& Kashmir	29.69	N.A	29.04	10.17	9.08	9.1	10.34
11	Jharkhand	@	@	23.19	@	@	29.61	N.A
12	Karnataka	26.75	20.66	17.25	19.74	20.14	20.19	20.43
13	Kerala	19.24	14.06	9.42	28.95	28.86	28.87	2.26
14	Madhya Pradesh	25.27	26.75	24.34	34.63	35.04	30.89	71.95
15	Maharastra	24.54	25.43	22.57	20.82	20.84	20.13	28.41
16	Manipur	32.46	28.56	30.02	67.87	67.87	78.01	14.24
17	Megalaya	32.04	31.8	29.94	36.68	37.95	42.34	11.03
18	Mizoram	*	38.98	29.18	*	75.58	75.59	N.A
19	Nagaland	50.05	56.86	64.41	17.25	52.02	52.05	8.78
20	Orissa	20.17	19.5	15.94	38.67	38.24	37.34	32.27
21	Punjab	23.89	20.26	19.76	4.45	5.6	6.07	0.79
22	Rajasthan	32.97	28.07	28.33	8.95	9.14	9.49	19.33
23	Sikkim	50.77	28.17	32.98	76.8	37.34	81.24	1.5
24	Tamilnadu	17.5	14.94	11.19	16.75	17.2	17.59	10.09
25	Tripura	31.92	33.69	15.74	57.2	60.06	60.01	8.65
26	Uttara Pradesh	25.49	25.41	25.8	17.39	17.43	6.98	14.26
27	Uttaranchal	@	@	19.2	@	@	64.81	N.A
28	West Bengal	23.17	24.55	17.84	13.33	13.38	13.38	3.59
	India	24.66	23.5	21.34	22.41	22.41	23.38	_

Source: (1) Compendium of Environment Statistics, India 2002

(2) Statistical Abstract 1986, 1992 and 2003

Note: @ New state

* Union territory

N.C: Census was not conducted

Table 3: State-wise proportion of Scheduled Tribes Population in the total population of the respective States in India (with size and decadal growth rates)

State/ Uts	Total Population			% Age in total India's Population	% Age in total State's Population		Decadal Growth Rate		Decadal Variation
	1981	1991	2001	[2001]	1991	2001	1981-1991	1991-2001	
(1) M. P	11867960	15399034	18850070	22.65	23.30	23.21	22.93	18.31	-4.62
(2) Maharashtra	5645915	7318281	8577276	10.31	9.30	8.85	22.85	14.68	-8.17
(3) Orissa	5834870	7032214	8145081	9.79	22.20	22.13	17.03	13.66	-3.36
(4) Bihar	5732515	6616914	7845419	9.43	7.70	9.45	13.37	15.66	2.29
(5) Gujarat	4788075	6161775	7481160	8.99	14.90	14.76	22.29	17.64	-4.66
(6) Rajasthan	4130125	5474881	7097706	8.53	12.40	12.56	24.56	22.86	-1.70
(7) A.P	3119905	4199481	5024104	6.04	6.30	6.59	25.71	16.41	-9.29
(8) W.B	3036905	3808760	4406794	5.30	5.60	5.49	20.27	13.57	-6.69
(9) Assam	CNC*	2874441	3308570	3.98	12.80	12.41	0.00	13.12	0.00
(10) Karnataka	1803960	1915691	3463986	4.16	4.30	6.55	5.83	44.70	38.86
(11) Meghalaya	1064965	1517927	1992862	2.39	85.50	85.94	29.84	23.83	-6.01
(12) Nagaland	642661	1060822	1774026	2.13	87.70	89.14	39.42	40.20	0.78
(13) Tripura	579976	853345	993426	1.19	30.90	31.05	32.03	14.10	-17.93
(14) Mizoram	459597	653565	839310	1.01	94.70	94.45	29.68	22.13	-7.55
(15) Manipur	385110	632173	741141	0.89	34.40	32.30	39.08	14.70	-24.38
(16) T.N	512555	574194	651321	0.78	1.00	1.04	10.73	11.84	1.11
(17)ArunaChal .Pradesh	432775	550351	705158	0.85	63.70	64.22	21.36	21.95	0.59
(18) Kerala	256220	320967	364189	0.44	1.10	1.14	20.17	11.87	-8.30
(19) U.P	206740	287910	364092	0.44	0.20	0.20	28.19	20.92	-7.27
(20) H.P	196968	218348	244587	0.29	4.20	4.02	9.79	10.73	0.94
(21) D &N Haveli	79403	109380	137225	0.16	79.90	62.23	27.41	20.29	-7.11
(22) Sikkim	73756	90901	111405	0.13	22.40	20.59	18.86	18.40	-0.46
(23) Lakshdweep	37535	48163	57321	0.07	93.20	94.51	22.07	15.98	-6.09
(24) A &N.Islands	22023	26770	29469	0.04	0.00	8.27	17.73	9.16	-8.57
(25) Daman Diu&Goa	10546	12100	14563	0.02	11.50	9.20	12.84	16.91	4.07
INDIA TOTAL	50921060	67758389	83220261	100	8.80	8.19	24.85	18.58	-6.27

Source: Population Figures, Series 1, part viii (b) Census of India 1981, 1991 and 2001. Government of India, New Delhi

Notes: * In the State of Assam, the census was not conducted in the year 1981. Total Population excludes the States of Jammu and Kashmir, Punjab, Haryana and Pondichery

produce etc. so much so that they indulge in overuse of accessible forests and often resort to unhealthy forest use like cutting immature trees and stealing forest produce. These areas with higher percentage of forest area and lower absolute size of population suffer relatively lower environmental degradation. However, rising forest based industries, demand for horticulture and floriculture crops etc., placed higher demand on forest lands with resultant degradation.

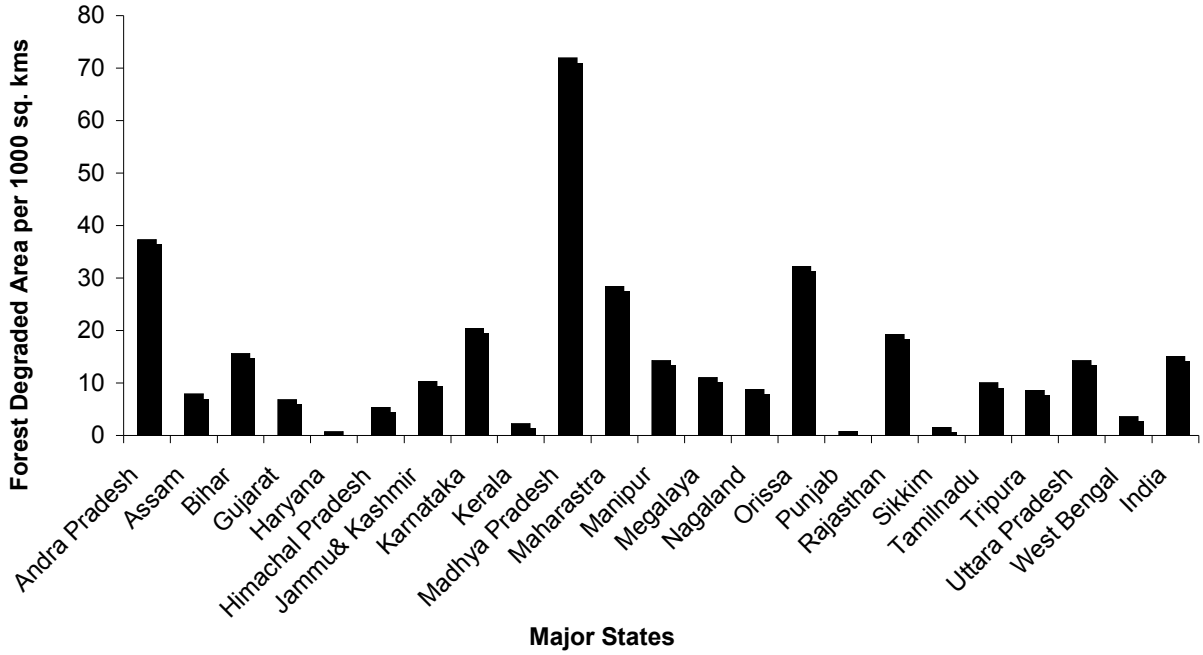

Fig 1 (b): State-wise Forest Degraded Area in India (2001)

The north and north-eastern States of Sikkim, Nagaland, Manipur, Megalaya, Mizoram, Arunachala Pradesh, Jammu-Kashmir have higher growth rate of population as compared to the southern States. But, these States also have higher per cent of forest area in their total geographical area. The State of Sikkim has 81.24 per cent, highest in the country, followed by Manipur- 78.01, Mizoram- 75.59, Himachal Pradesh- 66.52, the newly constituted state of Uttaranchal- 64.81, Arunachala Pradesh- 61.55, Tripura- 60.01, Nagaland- 52.05, Chattishgarh- 43.85 and Megalaya 43.34 per cent. It can be noted that from the following analysis these States have suffered relatively lower degree of environmental degradation. In this regard table 2 reveals that the percentage of forest area in the above said states is higher than the growth rate of human population.

Also Fig 1 (b) indicates that, forest degraded area per 1000 sq kms, is low in Sikkim (1.5 sq. kms), Himachala Pradesh (5.34), Nagaland (8.78), Tripura (8.65) and Assam (7

sq.kms). As they are hilly States and from these evidences, we could infer that, environmental sustainability and degradation are within limits in these States compared to other States. With this evident one can note that the states of Madhya Pradesh, Arunachal Pradesh, Orissa, Maharastra, Rajasthan, Bihar and Uttar Pradesh the deforestation is more severe. The loss of forest is about 2 million hectares in Madhya Pradesh, while in Maharastra, Orissa, Andhra Pradesh and Jammu- Kashmir, loss is over a million hectares. In Rajastan and Himachal Pradesh it is over half a million hectares each (H.M.Saxena, 1999). Hence, in this regard urgent attention needs to be given to forest management. Action to halt deforestation and to conserve bio-diversity is absolutely necessary.

1.7. Population Growth, Industries and Environmental Degradation:

The rapid growth of industries in the post 1970's has resulted in environmental degradation. Various industrial processes release a large spectrum of pollutants into land, soil, water and air. Industries like cement, iron and steel, fertilizer, petrochemical etc. are particularly harmful not only because of the difficulty in controlling the emission of pollutants by these industries, but also due to the rapid rise in their number with least concern for environment friendly in recent years.

The industrial units in India are largely located in the States of Gujarat, Maharastra, Tamilnadu, West Bengal, Karnataka, Uttar Pradesh and Bihar. The highest concentration of sulfur dioxide and oxides of nitrogen is therefore often found in cities located in these States. Improper management of industrial effluents and solid wastes from industrial estates of Delhi, Punjab, Rajasthan, Andhra Pradesh, Maharastra, Tamilnadu and Karnataka have been causing influenced to the environmental irreparable damage in these States.

Table 4 represents the over all growth rate of industries in India by States for the decade 1981-1991 and 1991-2001. In the decade 1981-1991 few States like Himachal Pradesh, Andhra Pradesh, Uttar Pradesh, Rajasthan and Gujarat recorded a higher rate of growth in number of industries as compared to other states in the country. But, in recent

Table 4: State-wise Industries in India for the year 1981,1991 and 2001-02						
Sl.No	State	Decadal Growth rate			Growth of registered	
		of Population			Industries (in %)	
		1971-1981	1981-1991	1991-2001	1981-1991	1991-2001
1	Andra Pradesh	23.1	23.91	13.86	17.18	-1.87
2	Arunachal Pradesh	*	35.86	26.21	*	N.A
3	Assam	N.C	52.44	18.85	-6.14	-14.56
4	Bihar	24.06	23.49	28.43	-13.19	-124.69
5	Chhattisgarh	@	@	18.06	@	@
6	Goa	*	15.96	14.89	*	*
7	Gujarat	27.67	20.8	22.48	5.49	21.2
8	Haryana	28.75	26.27	28.06	0.58	37.93
9	Himachal Pradesh	23.71	19.39	17.53	20.69	48.52
10	Jammu& Kashmir	29.69	N.A	29.04	-40.53	25.84
11	Jharkhand	@	@	23.19	@	@
12	Karnataka	26.75	20.66	17.25	0.83	19.42
13	Kerala	19.24	14.06	9.42	-0.81	36.7
14	Madhya Pradesh	25.27	26.75	24.34	11.03	-12.88
15	Maharastra	24.54	25.43	22.57	3.84	18.36
16	Manipur	32.46	28.56	30.02	0	25.42
17	Megalaya	32.04	31.8	29.94	-21.43	6.67
18	Mizoram	*	38.98	29.18	*	N.A
19	Nagaland	50.05	56.86	64.41	N.A	N.A
20	Orissa	20.17	19.5	15.94	-3.86	14.11
21	Punjab	23.89	20.26	19.76	10.29	15.97
22	Rajasthan	32.97	28.07	28.33	14.23	38.15
23	Sikkim	50.77	28.17	32.98	N.A	N.A
24	Tamilnadu	17.5	14.94	11.19	9.02	36.42
25	Tripura	31.92	33.69	15.74	-14.29	-11.3
26	Uttar Pradesh	25.49	25.41	25.8	19.83	2.4
27	Uttaranchal	@	@	19.2	@	@
28	West Bengal	23.17	24.55	17.84	-3.99	11.03
	India	**24.66**	**23.5**	**21.34**	**7.08**	**19.04**

Source: Statistical Abstract 1986, 1992 and 2003

Note: @ Not shaped

* Union territory

N.A: Census was not conducted

decades, due to Economic Liberlisation, Privatization and Globalisation, and off-late creating of Special Economic Zone's industrial growth rate has been higher in India. The average decadal rate of growth has increased from 7.08 per cent in the decade 1981-1991 to 19.04 per cent in the decade 1991-2001. The State of Himachal Pradesh recorded the highest growth rate in industries in both the decades.

Industrially fast growing States like Rajasthan, Haryana, Tamilnadu, Manipur, Karnataka and Maharastra achieved 38.15 per cent, 37.93, 36.42, 25.84, 19.42 and 18.36 per cent growth respectively. Further, these have achieved a growth rate higher than that of human population. This has contributed a great extent in polluting land, air and water. The environmental degradation is more as a result of industrial pollution in the States of Himachal Pradesh, Rajasthan, Haryana, Tamilnadu, Manipur, Karnataka and Maharastra.

Conversely States of Assam, Bihar, Madhya Pradesh, and Tripura have negative growth rates of industries (Table 4). While rest of the States i.e., Megalaya, Orissa, Punjab and West Bengal have comparatively low growth rate of industries and correspondingly as well as lower environmental degradation index. But some of these States have earlier industrial base for example West Bengal, Tamil Nadu, Karnataka, Maharastra and Gujarat) and some of them have sensitive forest and water ecosystem (Karnataka, Maharastra, Bihar, Uttar Pradesh and Madhya Pradesh).

There may be Western Ghats and mid Himalayan sections where mineral discharge and often industrial growth with least concern for environment has been created ecological damages (Lime stoning in Uttaranchal, Iron ore and coal mining in other States and establishment of aluminium and a host of cement industries etc). Due to rapid growth of industries in states of Maharastra, Gujarat, Tamilnadu and Karantaka have comparatively higher degree of environmental degradation. This is proved with respect to the states of Karnataka, Maharastra, and Tamil Nadu.

States having either lower or negative growth of industries does not mean that they have low or negative index of environmental degradation. States which have had rapid industrially and consequent absolute rise in population (case of West Bengal etc), immigration to big industrial cities like Bangalore in Karnataka, Lucknow, in Uttar Pradesh, Patna in Bihar etc., too have recorded much higher levels of environmental damage. The recent policy of taking industries to backward areas for example the mindless location of Multi National Companies (MNCs) in backward areas is also adding environmental degradation which have necessitated due to the need to building coal

based thermal power stations. Increased infrastructure though to some extent justified has often resulted in such projects eating away useful agricultural lands.

Of course, in the real term India needs development. In this direction here one can note that India is doing well. As a result, one side there is a development and on the other side this will leads to environmental degradation by damaging the bio-diversity, ecology, and environment due to the reduction of agriculture land over a period of time. In Indian experience the on-going and up-coming development of infrastructure such as widening the national highways and state high ways, construction of roads, bridges, flyover and canals especially in the agriculture land have occupied the huge amount of agricultural land. This has already impacted the whole bio-diversity and environment in the country. As well, we have to wait and watch the further impact of creation of Special Economic Zone's on environment.

However, there is a need to halt this mindless growth. Comparing Indian situation with that of industrial set-up in western nations and off-late with China is not a healthy trend. There is a need to link growth with sustainability and to our needs rather to complete with always western standards.

1.8. Growth of Motor Vehicles and Environmental Degradation:

The environmental problems in India off late are getting aggravated by the kind of socio-economic development vis-à-vis the availability of natural resources as also the life style of its population. In India, rapid growth of population, poverty, urbanization, industrialization and several related factors are responsible for the rapid degradation of the environment. A near lack of vision is apparent on the part of our planners and they have instead of promoting means of mass public transport, allowed corporate automobile industry to market a dangerously high number of cars, two-wheelers etc., in total disregard to environmental factors and carrying capacity of our road net work.

Public transport like buses and trains are the prime mode of transportation for the most of the Indian people. The middle class people used two wheelers and three wheelers (Auto's) for their daily routine work and employment. Hence, it is evident that in recent years there has been huge traffic was created in most of the cities in India. There was a rapid increase of two wheelers and three wheelers on Indian roads. And further, these are majority in urban areas. Most of the middle class and weaker sections of population are

Table 3 State-wise Decadal Growth of Population and Transport and non Transport Motor vehicles in India by States

Sl.No	*State*	*Decadal Growth rate*			*Growth of registered Motor*	
		of Population			*Vehicles (in %)*	
		1971-1981	*1981-1991*	*1991-2001*	*1981-1991*	*1991-2001*
1	Andra Pradesh	23.1	23.91	13.86	62.46	66.31
2	Arunachal Pradesh	*	35.86	26.21	*	72.43
3	Assam	N.C	52.44	18.85	60.05	52.41
4	Bihar	24.06	23.49	28.43	70.63	-1.94
5	Chhattisgarh	@	@	18.06	@	@
6	Goa	*	15.96	14.89	@	64.13
7	Gujarat	27.67	20.8	22.48	54.16	65.84
8	Haryana	28.75	26.27	28.06	60.54	72.65
9	Himachal Pradesh	23.71	19.39	17.53	43.69	72.53
10	Jammu& Kashmir	29.69	N.A	29.04	57.47	65.65
11	Jharkhand	@	@	23.19	@	@
12	Karnataka	26.75	20.66	17.25	52.77	60.59
13	Kerala	19.24	14.06	9.42	60.8	72.02
14	Madhya Pradesh	25.27	26.75	24.34	72.9	53.97
15	Maharastra	24.54	25.43	22.57	48.88	63.54
16	Manipur	32.46	28.56	30.02	77.4	39.27
17	Megalaya	32.04	31.8	29.94	55.09	52.86
18	Mizoram	*	38.98	29.18	*	53.34
19	Nagaland	50.05	56.86	64.41	90.94	63.55
20	Orissa	20.17	19.5	15.94	73.73	65.09
21	Punjab	23.89	20.26	19.76	56.95	57.16
22	Rajasthan	32.97	28.07	28.33	64	71.91
23	Sikkim	50.77	28.17	32.98	94.36	-74.1
24	Tamilnadu	17.5	14.94	11.19	68.21	72.8
25	Tripura	31.92	33.69	15.74	50.01	63.36
26	Uttar Pradesh	25.49	25.41	25.8	58.24	63.3
27	Uttaranchal	@	@	19.2	@	@
28	West Bengal	23.17	24.55	17.84	44.47	46.91
	India	24.66	23.5	21.34	54.03	67.49

Source: Statistical Abstract 1986, 1992 and 2003

Note: @ Not existing

* Union territory

N.A: Census was not conducted

using autos i.e. three wheelers. However, the transport department and pollution control board have been implemented a strict traffic and emission rules. But, for their livelihood some autos are still using mixed petrol (with kerosene). Because petrol involved higher investment and lower earning and hence many autos using a mixed petrol in expectation of higher earning in a daily basis.

Generally this has polluted higher air pollution in the air. Increasing vehicular traffic in India is the main source of air pollution in most of the cities. They emit carbon monoxide, sulphur dioxide, nitric oxide sulfur oxide and create dust particles in the air etc. In India the southern State of Tamil Nadu has recorded the higher growth rate (72.8 per cent) of registered vehicles (Table 5). This is followed in ranking order by States of Haryana, Rajastan, Kerala, Himachal Pradesh, Arunachal Pradesh, Andhra Pradesh, Orissa, Gujarar, Goa, Nagaland, Maharastra, Tripura, Uttar Pradesh and Karnataka. Further, these States had also registered higher growth rates in number of registered vehicles in the decade 1991-2001 over that of human population growth.

The various reasons are responsible for higher growth of registered vehicles in India by state. for instance the state of Rajasthan, Delhi and Uttar Pradesh have base fro tourism and hence for business there may be higher number of vehicles are reported in these states. Similarly the states of Punjab, Haryana, Maharastra and Karantaka have been progressive in socio-economic development and especially the northern states of Punjab and Haryana have higher economic development in the country. As a result the above said states had higher growth of transport and non-transport vehicles and consequently this will led to higher environmental degradation by air.

If we examine the States of Sikkim and Bihar have shown negative growth in number of registered vehicles (-74.1 and -1.94 per cent respectively). Comparatively the State of Manipur registered lower rate of growth (39.27 per cent). The rest of other States have recorded growth ranging between 50 to 60 per cent.

From the above analysis, it is clear that, States of Sikkim and Bihar have less environmental degradation caused by vehicular pollution. However, in reality the quality of vehicles and fuel (purification etc,) used for vehicles has less pollution, and other kind of fuel like kerosene which is used for especially for three wheeler (Auto's) has has been already mentioned in the earlier part have omitted higher pollution. The States of Tamilnadu, Haryana, Kerala, Himachal Pradesh, Arunachal Pradesh, Rajasthan, Andhra Pradesh, Orissa, Gujarat, Nagaland, Maharastra, Tripura, Uttar Pradesh and Karnataka

have higher degree of vehicular pollution levels, due to increasing number of transport and non-transport vehicles.

Except West Bengal, other States have relatively lower levels of environmental degradation caused by vehicular pollution. But, industrialized States like West Bengal where generation of thermal power is the main polluter and affluent states like Punjab and Haryana have remarkable air pollution in urban areas. In general, it is the proliferation of motor vehicles (two and three wheelers) that has been causing significant levels of environmental degradation. There is a need for evolving of people and environmental friendly transport policies (mass transit in cities) to prevent not only degrading environment but also conserve precious foreign exchange which otherwise would be spent on importing oil.

1.9. The Index of Environmental Degradation:

In order to understand the Environmental Degradation Index (EDI) has been prepared for the different States in India by selected indicators for the present decade (1991-2001). The appropriate weightages have assigned to selected aspects of Growth in number of Industries, growth in number of registered motor vehicles and forest degraded area (per 1000 sq.kms) and their link with population growth. If the growth rate is below 20 per cent, the scoring is 1; for growth rate between 21-40 per cent the scoring is 2; followed by 41-60 (3), 61-80 (4), and if the growth rate is negative the scoring assigned is 0.

As per the EDI the States of Madhya Pradesh, Himachal Pradesh, Haryana, Gujarat, Maharastra, Orissa, Rajasthan and Jammu- Kashmir have relatively high degree of environmental degradation. The States of Andhra Pradesh, Manipur, Meghalaya, Punjab, Tripura, West Bengal, Karnataka, Kerala, Tamilnadu and Uttar Pradesh show relatively medium level of environmental degradation. The backward State of Bihar and the smaller State of Sikkim have relatively low environmental degradation (Appendix 1 b).

Similarly an effort has been made to understand the EDI by individual aspects. According to this the southern States of Kerala and Tamilnadu suffer from relatively low level environmental degradation due to deforestation. The States of Maharastra, Nagaland, Orissa, Sikkim and Madhya Pradesh suffer from relatively high levels of environmental degradation due to deforestation. Rest of the States which have been listed in appendix 1 (c), suffer from relatively medium level environmental degradation due to deforestation.

Interestingly, in spite of hosting a very high in numbers of registered industries the southern State of Andhra Pradesh still show relatively low environmental degradation. Environmental damage by growth of industries in the backward States of Bihar, Madhya Pradesh, and north-eastern State of Tripura is relatively moderate. States like Himachal Pradesh, Gujrat, Haryana, Jammu-Kashmir, Manipur, and Rajasthan suffer from relatively very high environmental damage and rest of the States (Appendix 1 d) show relatively high levels of environmental degradation due to growth of registered industries.

If we examine the environmental degradation by the individual aspect of growth in number of registered motor vehicles, the States of Bihar and Manipur have relatively low levels of degradation(scores 2 and 3). States of Andrha Pradesh, Kerala, Madhya Pradesh, Manipur, Megalaya, Punjab, Tamilnadu and West Bengal have show relatively moderate levels of environmental degradation (scores 4 and 5). The rest of the States i.e., Nagaland, Gujarat, Haryana, Himachal Pradesh, Jammu-Kashmir, Karnataka, Maharastra, Orissa, Rajasthan, Tripura, and Uttar Pradesh., show relatively high levels of environmental degradation attributed to vehicular pollution (Appendix, e).

1.10. Summary and Conclusions:

In the current circumstances Indian economy and development have grown with environmental degradation. Similarly on the other hand emissions have grown with population. Per year the global has been adding about 77 million populations. Due to drastic decline and its degradation in forest area witnessed in States of Bihar, Uttar Pradesh and Madhya Pradesh which have significantly higher growth of population. Hence, it is safe to infer that deforestation and degradation of forest areas in Bihar, Uttar Pradesh and Madhya Pradesh are the cause of environmental degradation in these States.

Though, the north and north-eastern States of Sikkim, Manipur, Nagaland, Megalaya, Mizoram, Arunachal Pradesh, Jammu- Kashmir have higher growth rate of population and also endowed with a higher percentage of forest area to the total geographical area. Hence, the man-environment relationship is seems to be good. It means there will be a lesser environmental degradation by forest area. So in these States the degradation of environment is not so much deteriorated. One could note that, these States show less environmental degradation by deforestation. In the States of Madhya Pradesh, Arunachal Pradesh, Orissa, Maharastra, Rajasthan, Bihar and Uttar Pradesh degraded forest area is more. Hence, more attention needs to be given to forest management and appropriate and useful steps to avoid further deforestation and conservation of bio-diversity are need to be taken expeditiously.

The rapid rate of industrialization since the 1970s has been causing massive environmental degradation. In the wake of globalization and Economic Liberlization, the growth rate of industries in the States of India was quite high in the decade 1991-2001, as compared to previous decades. The decadal growth of industries of India increased from 7.08 per cent in 1971-1981 to 19.04 per cent by the decade 1991-2001. The States of Himachal Pradesh, Rajasthan, Haryana, Tamilnadu, Kerala, Jammu & Kashmir, Manipur, and Karnataka have a growth rate of industries which is higher than the national average of 19 percent. Further, the growth rate of industries is higher than the rate of human population growth. Hence, environmental degradation is higher in these States compared to other States in India. Therefore there is need to implement stringent industrial policies to control industrial pollution in order to ensure sustainable environment.

Increasing vehicular pollution in India is the main source of air pollution in most of the cities. The States of Tamilnadu, Haryana, Kerala, Himachal Pradesh, Arunachal Pradesh, Rajasthan, Andhra Pradesh, Orissa, Maharastra and Karnataka have higher

industrial growth with rapid increase in number of motor vehicles and this rate of growth is found to be higher than the rate of human population growth. Hence, comparatively these States suffer from higher air pollution by the increased number of transport and non-transport vehicles. In this regard, the study recommends that there is a need to implement strict vehicular emission norms by the respective State Governments. The situation further warrants to follow the Central Pollution Control Board (CPCB) recommendations to prohibit 20 years old vehicles from plying with effective from Dec. 1998, followed by phasing out of 17 year old vehicles from Nov.98. Above all long range environment friendly mass transit must be developed.

North-eastern State of Sikkim and the economically backward State of Bihar registered negative rates of growth in the number of registered motor vehicles. Therefore there is comparatively less environmental pollution in these States caused by motor vehicles. Similarly, the States of Manipur, Megalaya, Mizoram, West Bengal, Assam and Madhya Pradesh have low levels of environmental degradation caused by vehicular pollution as compared to other States.

Appendix 1 a

Environmental Degradation Index (EDI)

Sl No	State	P.G	I.G	V.G	F.D.A	PG+ IG	PG+VG	PG+FDA	Total
1	Andhra Pradesh	1	0	4	2	1	5	3	7
2	Arunachal Pradesh	_	_	4	_	_	_	_	_
3	Assam	_	0	3	1	_	_	_	_
4	Bihar	2	0	0	1	2	2	3	3
5	Goa	_	_	4	_	_	_	_	_
6	Guzarat	2	2	4	1	4	6	3	9
7	Haryana	2	2	4	1	4	6	3	9
8	Himachal Pradesh	2	3	4	1	5	6	3	10
9	J &K	2	2	4	1	4	6	3	9
10	Karnataka	2	1	4	1	3	6	3	8
11	Kerala	1	2	4	1	3	5	2	8
12	Madhya Pradesh	2	0	3	4	2	5	6	9
13	Maharastra	2	1	4	2	3	6	4	9
14	Manipur	2	2	2	1	4	4	3	7
15	Megalaya	2	1	3	1	3	5	3	7
16	Mizoram	_	_	3	_	_	_	_	_
17	Nagaland	3	_	4	1	_	7	4	_
18	Orissa	2	1	4	2	3	6	4	9
19	Punjab	2	1	3	1	3	5	3	7
20	Rajasthan	2	2	4	1	4	6	3	9
21	Sikkim	3	_	0	1	_	_	4	4
22	Tamilnadu	1	2	4	1	3	5	2	8
23	Tripura	2	0	4	1	2	6	3	7
24	U.P	2	1	4	1	3	6	3	8
25	West Bengal	2	1	3	1	3	5	3	7

Source: Computed by the scoring from the individual aspects.

Note: P.G refers to population growth, I.G, industrial growth, V.G, vehicles growth and FDA, forest degraded area in sq kms. Population growth in per cent age.

Appendix 1 b

Classification of Environmental Degradation by the selected aspects of P.G., I.G, V.G, and FDA by States of India

Relatively Low (Total scoring 3 to 4)	Bihar and Sikkim
Relatively Medium (7-8)	Karnataka, Kerala, Tamilnadu, U.P, Andhra Pradesh, Manipur, Megalaya, Punjab, Tripura and West Bengal
Relatively High (9-10)	Himachal Pradesh, Gujarat, Haryana, J & K, Madhya Pradesh, Maharastra, Orissa, Rajasthan

Appendix 1 c

Classification of Environmental degradation by Forest Degraded area in India by States

Relatively Low (Total score 2)	Kerala and Tamilnadu
Relatively Medium (3)	Andhra Pradesh, Bihar, Gujarat, Haryana, Himachal Pradesh, J & K, Karnataka, Manipur, Megalaya, Punjab, Rajasthan, Tripura, U.P, West Bengal
Relatively High (4)	Maharastra, Nagaland, Orissa, Sikkim
Relatively Very High (6)	Madhya Pradesh

Appendix 1 d

Classification of Environmental degradation by industrial growth in India by States

Classification	States
Relatively Low (Total Scoring 1or 2)	Andhra Pradesh, Bihar, M.P, Tripura
Relatively Moderate (Total Scoring 3)	Karnataka, Kerala, Maharastra, Megalaya, Orissa, Punjab, Tamilnadu, U.P, West Bengal
Relatively High (Total Scoring 5)	Himachal Pradesh, Gujarat, Haryana, J&K, Manipur, Rajasthan

Appendix 1 e

Classification of Environmental degradation by vehicles growth in India by States

Relatively Low (Total score 3 and 4)	Bihar, Manipur
Relatively Moderate (Total score 5)	Andhra Pradesh, Kerala, Madhya Pradesh, Manipur, Megalaya, Punjab, Tamilnadu, West Bengal
Relatively High (Total score 6 and 7)	Nagaland, Gujarat, Haryana, Himachal Pradesh, J & K, Karnataka, Maharastra, Orissa, Rajasthan, Tripura, U.P.

Source: Computed From Table 1, 2 and 3.

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