# Development, Land use Pattern and Environmental Degradation in India

**By**

**Ms. Soumya Mohanty, Research Scholar, IIPS.**
**E-mail: soumya7@indiatimes.com**

## ABSTRACT

This paper makes an attempt to study the trend in urbanization, socioeconomic development, and changes in land use highlighting the extent to which land under forest have declined over time and across states of India. It is hypothesized that urbanization which is considered as an indicator of development is likely to be associated with increased land utilization for non-agricultural purposes and density of population with intensity of cropping pattern. The study reveals that there is a phenomenal increase in population and urbanization. The population increase has taken place even in relatively land abundant and semi-arid states such as Rajasthan and Gujarat. The level of urbanization in India is also on rise and it has to deal with problems of land intrusions on productive agricultural lands. This is because urban land-uses persistently compete with rural land-uses on the basis of more favourable land rent in free market. However, from this study we did not find strong support for either of the hypotheses. The paper stresses that land use data produced by Indian government sources should be strengthened and publication should be made timely. The paper also reviewed the existing policies for controlling population and preventing forest land degradation and environmental pollution in India.

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## Introduction

The twentieth century has been a century of unprecedented population growth, economic development and environmental change. For which there has been extensive debate worldwide on the relationship between population growth, depletion of resources and environmental degradation in the past few years. The world population grew by four times from 1.6 billion to 6.1 billion persons during 1900 to 2000 (United Nations, 2001). Decreases in famine related deaths and infant mortality rates are partially responsible for this rapid population growth. In addition, advances in public health and medicine have increased the life expectancy of countries worldwide. Industrialization has provided for better economies and has sustained human development. However, this rapid population growth and development has occurred unevenly throughout the world simultaneously with increasingly unsustainable utilization of world's natural resources. In this context, the question about the impact of population growth with limited and often degraded resources is most relevant for developing country like India.

During the last few decades there has been phenomenal increase in population in India and it has taken place even in relatively land abundant arid and semi-arid states such as Rajasthan and Gujarat. India accounts for 18 percent of world population, and is growing at 1.93 percent per annum. India supports its population with only 2.3 percent of the world's land area and 1.7 percent of the world's forest. In India, by mid-nineties, more than 85 percent of the cultivable area had already been brought under cultivation. Taking into account the total land resources including hills, mountains, lakes, rivers and lands of all description, the availability of land per head in India comes to only 0.58 hectares.

The consequences of population growth for India span three areas; changes in land use, increase in toxic chemical released to the environment and depletion of natural resources. As population increases, this expanded growth begins to distort our environment, leaving what scientists call an ecological footprint. This concept draws upon the idea that each person has certain basic needs such as land, water and energy use. As these resources are used, wastes are generated and disposed of. Thus, the extent of resource exploitation, waste generation and environmental damage relies on that society's lifestyles and pattern of consumption. India's massive population base of which ample number are living below poverty line, non sustainable agricultural and industrial practices, and relatively small scope for further expansion of agricultural land, make it all the more important to understand the relationship between population pressure, changes in land use and environmental degradation in the country. This paper makes an attempt to study the trend in population growth, socioeconomic development, and changes in land use highlighting the extent to which land under forest have declined over time and across states of India. It is

hypothesized that urbanization is likely to be associated with increased land utilization for non-agricultural purposes and density of population with intensity of cropping pattern.

**Data and Methods**

For the present study data set complied from various secondary sources since independence are used to study the levels, trends and differentials for India and its states. It includes information on population growth, urbanization, land use pattern, socioeconomic and agricultural variables. Most of the demographic and socioeconomic data are taken from Census publications (Registrar General of India) for different time periods under study. The land use classification data are compiled from various reports of the Indian Ministry of Agriculture and forest data are compiled from various reports published by Indian Ministry of Environment and Forests. To assess the trends in urban air pollution since 1998, data from NAMP (National Air Monitoring Programme) and CPCB (Central Pollution Control Board) are used in the present study. Data on wastelands are referred from Forestry Statistics of India.

In the analysis cropping intensity is measured as the ratio of grossed crop area to net cropped area multiplied by 100. Population density, measured as number of persons per square kilometer, is used as an indication of population pressure. The most common measure of urbanization i.e. the level of urbanization is measured by the percentage of the population living in the urban areas. The indicators of social development are: (1) literacy rate, measured as percent literates in the total population; (2) percentage of schedule caste and schedule tribe population in each state ; and (3) sex-ratio of literates, measured as female literates per 1000 male literates. The indicators of economic development are: (1) non-agricultural labour force, measured as the percentage of workers in the non-agricultural sectors; (2) per-capita income; and (3) BPL (below poverty line) population, measured as percentage of population living below the poverty line. Regression analyses are carried out to estimate for changes in cropping intensity and forest degradation by using different demographic and socioeconomic variables.

**Trends of Population Growth in India, 1951-2001**

At the time of its independence in 1947, India's population was about 345 million. The decades following the 1940s have seen great changes. Even the poorest people experienced some improvements in their living conditions. For example, average levels of calorie availability and income have risen. Water supplies and sanitation facilities and rural electrification have well progressed. In addition, the control of certain communicable diseases has been important. Thus the reduction in the death rate after 1947 resulted in a significant rise in the rate of population growth, which reached almost 2 percent during 1951-61. In this context, India's population growth after independence can be classified into the following two phases:

1951-1981: Rapid high growth

1981-2001: High growth with sure signs of slowing down of the growth rate.

It needs to be noted that during the decade of 1981-91, the population of India increased by 23.86 percent and the average annual exponential growth rate was 2.14 percent per annum. It was lower than that observed during 1971-81. It can be further noted that the lowering of the population growth has continued during 1991-2001, with the average annual exponential growth rate being 1.93 percent per annum. the population of rural India increased around two and half times from 298.7 million in 1951 to 741.7 million in 2001, where as the urban population has grown more than four fold during the same period, which is from only 62.4 million in 1951 to 285.3 million in 2001. The density of population has increased from 117 in 1951 to 312 persons in 2001.Despite the fall in the growth rate; the absolute addition to the population is quite high over the decades, because of the age structure of the population, which is still fairly young.

**Table 1: Trends of Population Growth in India, 1951-2001**

| Census Year | Population in Million | | | Growth rate of Population | Population Density |
|---|---|---|---|---|---|
| | Total | Rural | Urban | | |
| 1951 | 361.1 | 298.7 | 62.4 | - | 117 |
| 1961 | 436.4 | 360.3 | 77.8 | 1.96 | 142 |
| 1971 | 547.9 | 439.1 | 109.0 | 2.20 | 173 |
| 1981 | 685.1 | 523.9 | 159.7 | 2.22 | 216 |
| 1991 | 838.5 | 628.7 | 215.7 | 2.14 | 267 |
| 2001 | 1028.6 | 741.7 | 285.3 | 1.93 | 312 |

**Urbanization in India**

Urbanization, involving a change in pattern of human settlements, is by far the most important social transformation that has taken place in recent times. However, the degree of urbanization in India varied considerably over the decades. India has 62.4 million urban population at the 1951 census, and this number has increased to 285.3 million in 2001. In other words, its urban population has increased to almost five times during the last fifty years. In recent years, approximately 6-7 million persons have been added every year to the country's total population.

States like Tamil Nadu and Maharashtra were the most urbanized major states in 2001 followed by Gujarat. Karnataka and Punjab were the only other states with levels of urbanization significantly above the national average in 2001. It is clear that the southern and western states of India are generally more urban than those in the north and east. Levels of urbanization are particularly low in Assam, Bihar, Orissa, and, to a lesser extent Uttar Pradesh. During 1991 to 2001 most states experienced only modest gain in percent urban. States like Gujarat, Haryana, Karnataka, Punjab and Maharashtra all experienced fairly strong rises due to the comparative socio-economic advancement of these states. The most

important dimension in the process of urbanization in the country relates to the shifting importance of the different states. Fuelled by continuous movement of people from one part of the country to another and by no less important factor of differential natural increase some states and districts have attained high levels of urbanization while others have not been able to reach even the 1951 national level of urbanization.

**Table 2: Trend of Urbanization in India, 1951-2001**

| Census Year | Number of UAs/ Town | Urban Population (in million) | Percent Urban | Decennial Growth rate of urban population | Tempo of Urbanization | | |
|---|---|---|---|---|---|---|---|
| | | | | | Annual exponential growth rate | Annual gain in percent urban | Annual rate of gain in percent urban |
| 1951 | 2,843 | 62.44 | 17.29 | 41.42 | 3.47 | 0.34 | 2.48 |
| 1961 | 2,365 | 78.94 | 17.97 | 26.41 | 2.34 | 0.07 | 0.39 |
| 1971 | 2,590 | 109.11 | 19.91 | 38.23 | 3.24 | 0.19 | 1.08 |
| 1981 | 3,378 | 159.46 | 23.34 | 46.14 | 3.79 | 0.34 | 1.72 |
| 1991 | 3,768 | 217.18 | 25.72 | 36.19 | 3.09 | 0.24 | 1.02 |
| 2001 | 4,378 | 286.12 | 27.86 | 31.74 | 2.76 | 0.21 | 0.83 |

Thus the level of urbanization in India is on rise and it has to deal with problems of land intrusions on productive agricultural lands. This is because urban land-uses persistently compete with rural land-uses on the basis of more favourable land rent in free market. Again, higher level of urbanization would automatically lead to greater proportion of area under non-agricultural uses. In this context issues relating to the subject of resources generates a somewhat different meaning, as it relates not only to resource exhaustion or depletion but also equally to its under-use, over-use, and often even its misuse. Later this aspect is discussed with some illustrations with specific context of urbanization and environmental degradation.

**Socioeconomic Development:**

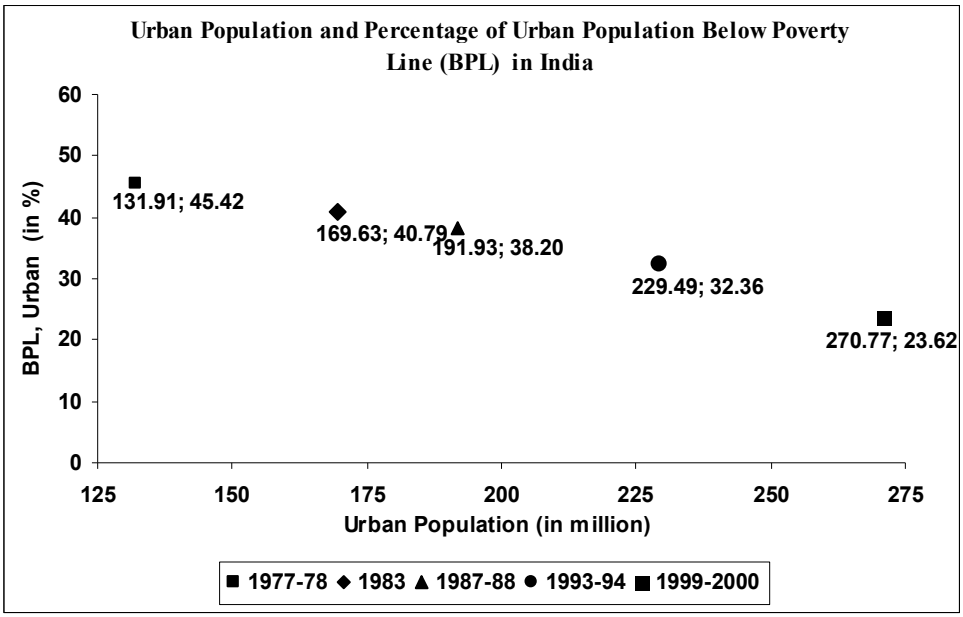
Socio-economic development is believed to be critical of both population planning and wise management and use of resources for a country. The literacy rates have increased in all most all the states of India from 1951 to 2001. This increase in literacy has been faster in the western states of Gujarat, Maharashtra and, southern states like Karnataka, Kerala and Tamil Nadu. The prosperous states like Punjab and Haryana and the northeastern states of Mizoram and Tripura have also experienced a relatively rapid increase in literacy. However, schedule castes (SC) and schedule tribes (ST) tend to be less educated, more traditional, and economically backward than others. The proportion of SC/ST in a state is expected to be negatively correlated with overall level of development. Moreover, schedule castes and tribes have distinctly different patterns of consumption and utilization of resources. Thus, the proportion of SC/ST in

a state is included as an indicator of socioeconomic development. It is found that areas of higher population pressure have relatively lower proportion of SC/ST population.

The proportion of the workers in nonagricultural sector is an indicator of economic development in a state. States like Gujarat, Maharashtra, Kerala and Tamil Nadu have relatively high proportion of workers engaged in nonagricultural sector. The spatial pattern in nonagricultural employment has remained more or less static since 1951. The percentage population living in urban areas also reflects the level of economic and infrastructural development in a state. However there is no clear spatial association between socioeconomic development and level of population pressure.

The percentage of India's population living in absolute poverty has declined considerably over the decades. Rural poverty was higher than urban poverty by at least five percentage points in the 1970s and early 1980s. Currently the gap has gone down and with increasing level of urbanization population living below the poverty line has declined over the period of time (Figure 1).

**Figure 1**




The states like Uttar Pradesh, Bihar, Orissa and Madhya Pradesh have higher proportion of population living below the poverty line both in urban and rural areas and these are also the states where higher growth of population has taken place. However, poverty is related to a host of factors, including income, health and education and all these have significant impact on resource demand as well as proper utilization of resources. At one hand as a cause poverty contributes to environmental degradation and on the other due to deterioration of natural resources and unsafe living condition health of the poor people is also affected.

**Land Use Data at Regional Level:**

Before spelling out the relationship between population growth and land use, it appears appropriate to discuss about land use data. The collection of land use data in India begins at the village level. The land utilization or land use statistics formed part of the agricultural statistics and the source for these data is the Ministry of Agriculture, which, however, collects primary data from individual state Authorities. The technical Committee on Co-ordination of Agricultural Statistics, set up in 1948 by the Ministry of Food & Agriculture, recommended a nine-fold land-use classification and also recommended standard concepts and definitions for all the states to follow for better comparability and comprehension. Prior to this land use statistics was collected and available in five categories: (i) forests; (ii) area not available cultivation; (iii) other uncultivated land excluding current fallows; (iv) fallow land and (v) net area sown. However, further detailing the existing categories formed the new categories.

The statement below gives the nine-fold land-use classification.

1. Forests.

- Area not available for cultivation, which includes:

2. Area under non-agricultural uses;
3. Barren and unculturable land.

- Other uncultivated land excluding fallow land, which includes:

4. Permanent pastures and other grazing lands;
5. Miscellaneous tree crops and groves, not included in net area sown;
6. Culturable wasteland.

- Fallow land, which includes:

7. Fallow lands, other than current fallows;
8. Current fallows.

- And lastly:

9. Net area sown.

**Land use Pattern in India, 1950-51 to 1999-2000**

The physical, economic and institutional framework taken together determines the pattern of land use of a country at any particular time. In other words, the existing land use pattern in different regions in India has been evolved as the result of the action and interaction of various factors taken together, such as the physical characteristics of land, the structure of resources like, capital and labour, available and the location of the region in relation to other aspects of economic development, e.g. those relating to transport as well as industry and trade. Table 3 depicts the land use trend based on these nine-fold classification from 1950-51 to 1999-2000.

**Table 3: Land Use Pattern in India, 1950-2000**

| Classification | In Million hectares | | | | | |
|---|---|---|---|---|---|---|
| | **1950-51** | **1960-61** | **1970-71** | **1980-81** | **1990-91** | **1999-2000** |
| Reporting Area for land Utilization statistics | 284.32 (100.00) | 298.46 (100.00) | 303.76 (100.00) | 304.15 (100.00) | 304.86 (100.00) | 306.54 (100.00) |
| 1. Forest | 40.48 (14.24) | 54.05 (18.11) | 63.91 (21.04) | 67.47 (22.18) | 67.80 (22.24) | 69.02 (22.52) |
| 2. Not available for cultivation | 47.52 (16.71) | 50.75 (17.00) | 44.64 (14.70) | 39.62 (13.03) | 40.48 (13.28) | 42.40 (13.83) |
| (a) Non Agricultural uses | 9.36 (3.29) | 14.84 (4.97) | 16.48 (5.43) | 19.66 (6.46) | 21.09 (6.92) | 22.40 (7.31) |
| (b) Barren and unculturable land | 38.16 (13.42) | 35.91 (12.03) | 28.16 (9.27) | 19.66 (6.46) | 19.39 (6.36) | 19.31 (6.20) |
| 3. Other uncultivated land (Excluding fallow land) | 49.45 (17.39) | 37.64 (12.61) | 35.06 (11.54) | 32.31 (10.62) | 30.22 (9.91) | 28.47 (9.29) |
| (a) Permanent pastures and other grazing land | 6.68 (2.35) | 13.97 (4.68) | 13.26 (4.37) | 11.97 (3.94) | 11.40 (3.74) | 11.04 (3.60) |
| (b) Land under Miscellaneous tree crops and groves not included in net area sown | 19.38 (6.82) | 4.46 (1.49) | 4.30 (1.42) | 3.60 (1.18) | 3.82 (1.25) | 3.61 (1.18) |
| (c) Culturable Waste land | 22.94 (8.07) | 19.21 (6.44) | 17.50 (5.76) | 16.74 (5.50) | 15.00 (4.92) | 13.82 (4.51) |
| 4. Fallow land | 28.12 (9.89) | 22.82 (7.65) | 19.88 (6.54) | 24.75 (8.14) | 23.36 (7.66) | 24.89 (8.12) |
| (a) Fallow land other than Current fallows | 17.44 (6.13) | 11.18 (3.75) | 8.76 (2.88) | 9.92 (3.26) | 9.66 (3.17) | 10.10 (3.29) |
| (b) Current Fallows | 10.68 (3.76) | 11.68 (3.91) | 11.12 (3.66) | 14.83 (4.88) | 13.70 (4.49) | 14.79 (4.82) |
| 5. Net area sown (6-7) | 118.75 (41.77) | 133.20 (44.63) | 140.27 (46.18) | 140.00 (46.03) | 143.00 (46.91) | 141.23 (46.07) |
| 6. Gross cropped area | 131.89 (46.39) | 152.77 (51.19) | 165.79 (54.58) | 172.63 (56.76) | 185.74 (60.93) | 189.74 (61.90) |
| 7.Area sown more than once | 13.14 (4.62) | 19.57 (6.56) | 25.52 (8.40) | 32.63 (10.73) | 42.74 (14.02) | 48.51 (15.83) |

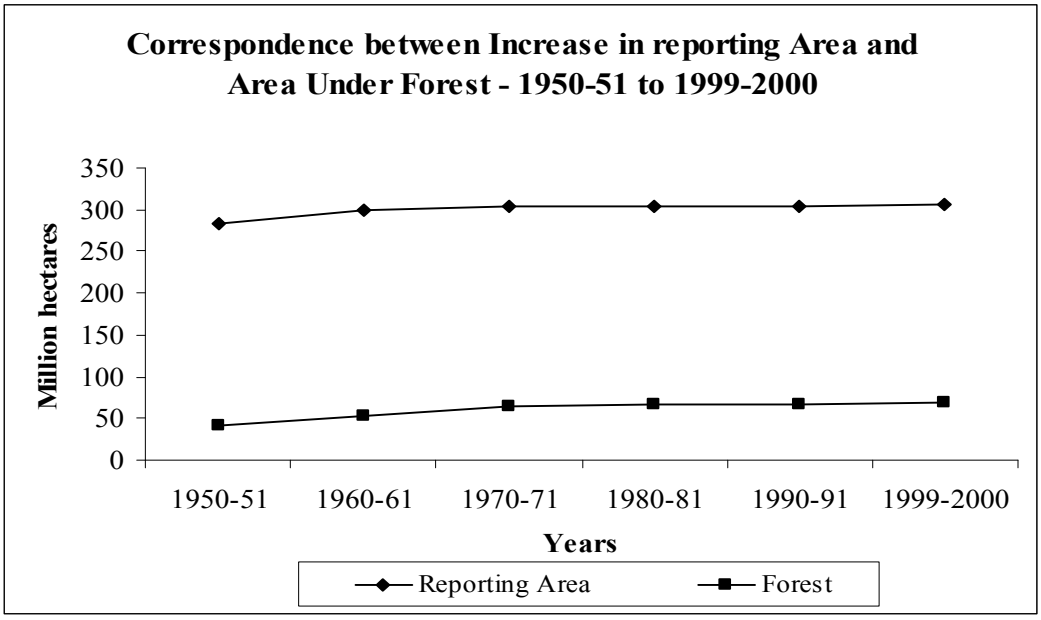
Note: Figures in parenthesis are percentages.

The main conclusions emerging from the analysis regarding trend of land use in India during the period 1950-51 to 1999-2000 are as follows. Out of the total geographical area of 328 million hectares, the land use statistics were available for roughly 284 million hectares in 1950-51; however, in 1999-2000 the reporting area is around 306 million hectares. The area, for which data on the land use classification are available; is known as the reporting area. Area under forests includes all lands classed as forest under any legal enactment dealing with forests or administered as forest, whether state-owned or private, and whether wooded or maintained as potential forest land (Map 1). The area of crops rose in the forest and grazing lands or areas open for grazing within the forests should remain included under the forest area.

There has been perceptible increase in the forest area up to the year 1999-2000. It increased from 40.48 million hectares in 1950-51 to 69.02 million hectares in 1999-2000. In percentage terms, the area under

forest, which constituted 14.24 percent of the reporting area, increased to 22.52 percent in 1999-2000. It is apparently indicative of a healthy land-use management. However, literature indicates that this is not suggestive of a real increase of area under forest but is due to incremental increase of reporting area under forest (Chadha et. el., 2004). That this observation is not without basis may be clearly observed from Figure 2.

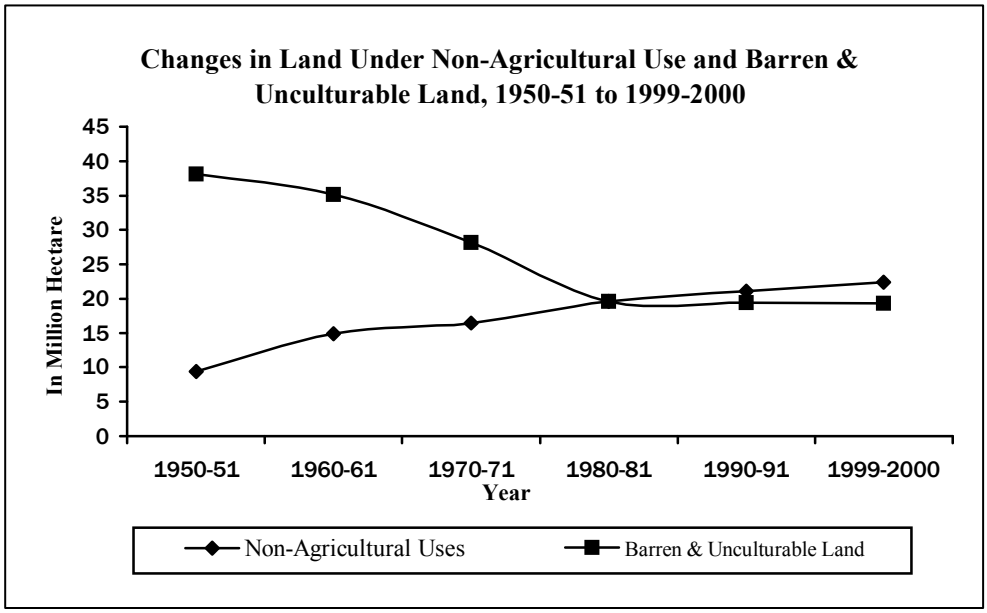
**Figure 2**




Area under non-agricultural use includes all lands occupied by buildings, roads, railways or under water, e.g. rivers and canals and other put to uses other than agriculture. Land put to non-agricultural uses increased by 11.73 million hectares during the reference period. This dose augurs well in our economy that is predominantly agricultural. The increase may be attributed to rise in human population as well as launching of development programmes/projects for boosting the economy of the country and urbanization as well.

Land like mountains, deserts, etc. which can not be brought under cultivation except at an exorbitant cost should be classed as unculturable whether such land is in isolated blocks or within cultivated holdings. The area under 'Barren and unculturable land' has substantially decreased by 18.77 million hectares during reference period. It came down to 19.39 million hectares in 1999-2000 from 38.16 million hectares in 1950-51. However, when the degree of correspondence between land under non-agricultural use and barren and unculturable land is seen; it is found that the degree of correspondence between the two categories is very high. So, the decline in barren and unculturable land can essentially be attributed to the increase in area under non-agricultural use, which can be seen from Figure 3.

**Figure 3**




Fallow land other than current fallows includes all lands, which were taken up for cultivation but are temporarily out of cultivation for a period of not less than one year and not more than five years. The reasons for keeping such lands fallow may be one or more of the following reasons like poverty of the cultivators, inadequate supply of water, climate, silting of canals and rivers and unremunerative nature of farming. It witnessed a decrease of 7.34 million hectares from 1950-51 to 1999-2000, which is a sign of better utilization of land in the form of bringing it into cultivation.

A reverse trend is observed in case of 'current fallows', which represents cropped areas, which are kept fallow during the current year. The trend of current fallow has been fluctuating; during the fifties to nineties the overall increase is around one percent only i.e. 4.1 million hectares. It is discouraging to note that in spite of massive efforts made by the Govt. to increase agricultural production, the area under 'current fallows', instead of decreasing, has slightly increased. However, it is encouraging that the area under 'culturable waste' decreased by 9.12 million hectares during 1950-510to 1999-2000, which by and large, might have been brought under cultivation.

Land under miscellaneous tree crops and groves includes all cultivable land which is not included in 'net area sown' but is put to some agricultural uses. Land under thatching grasses; bamboo bushes and other groves for fuel, etc., which are not included under 'orchards' should be classed under this category (Map 2). It witnessed a steep decrease by 15.77 million hectares during the period 1950-51 to 1999-2000. It reveals that much of the tree crops and pastures representing common property resources have reduced in significance over time. Common property resources is important in terms of providing fuel supplies,

grazing area, employment and income generation options for rural poor as they depend on it for their sustenance.

However, the net area sown in 1999-2000 increased to 141.23 million hectares from 118.75 million hectares in 1950-51, witnessing an increase of 22.48 million hectares. In percentage terms, it increased from 41.77 percent of the 'reporting area' in 1950-51 to 46.07 percent in 1999-2000. Share of net area sown increased substantially in the fifties but during sixties and seventies, the share of net area sown increased only by two percentage points, then it has stagnated. The pressure for human beings on land is higher because the net area sown has been around 46 percent of the total reporting area, which has not changed much after seventies but increase in population has trebled. However, area sown more than once, on which crops are cultivated more than once during the agricultural year, has moved up sharply in the last fifty years from 13.14 million hectares to 48.51 million hectares. When we tried to regress the population density on the change in cropping intensity, it is not found statistically significant. This could be mainly due to the fact that there has been relatively little change in cropping intensity between 1951 and 2000.

**Environmental Degradation**

Population growth is a contributing factor to many type of environmental stress. The role of increasing population size is especially prominent as the major force driving the need to increase food production, and environmental stresses on water, forests, soil and air that stem from agriculture. While the plan documents have echoed India's commitment to achieving sustainable development goals, the question that needs to be answered is whether this understanding and resolve have translated into concrete answers? The National Environmental Policy (MoEF, 2006) recognizes that 'environmental degradation is a major casual factor in enhancing and perpetuating poverty, particularly among rural poor, as degradation impacts soil fertility, and quality of water, air, forest, wildlife, and fisheries'.

**Forest Degradation and the Wastelands**

The per capita availability of cultivable land in India is meager and with the fast increasing population coupled with the area under nonagricultural uses availability of land will further shrink to very low level. The per capita availability of agricultural land in rural areas has decline consistently from 0.638 hectares in 1950-51 to 0.271 hectares in 1998-99 and is expected to decline further due to population growth. The per capita availability of forestland was around 0.113 hectares in 1950s, which has declined consistently over the period to 0.071 hectares in 1998-99. This is extremely low compared to the world standards.

It is estimated that the livelihood of 70 million tribal and 200 million non-tribal rural people in India is dependent on forest (MoEF, 2006). Apart from fulfilling subsistence needs, forest provided them with

employment and monetary income. On the other hand, this large-scale dependence exerts pressure on forests, leading to their unsustainable exploitation and eventual degradation. Unregulated extraction of fuel wood is a major cause of forest degradation and also for environmental pollution. A sample survey by the FSI estimates that grazing affects approximately 78 percent of India's forests (MoEF, 1999), leading to their degradation.

There are also vast areas in India under waste and degraded lands, which are not being put to agricultural use. Wastelands can result from inherent/imposed disabilities such as by location, environment, chemical and physical properties of the soil or financial or management constraints. Thus, land under this category is vulnerable for severe degradation (Iyengar, 2003). This is also against the interest of reducing pollution and improving the environmental status of the country. With our population growing at an exponential rate it is most important for us that every possible inch of land is brought under some vegetation cover. According to Forest Survey of India (2003) 20 percent of total geographical area is considered as wastelands. The proportion of wastelands in different states of India varies considerably. The north-eastern states and states like Jammu and Kashmir, Gujarat and Rajasthan have higher proportion of wastelands due to the topography. But it is matter of concern for states where major share in wastelands areas are by the saline and alkaline areas, degraded pastures and grazing lands, and degraded land under plantation crops.

The proportion of land under forests and grazing areas provide fairly good proxies for the magnitude of environmental degradation in an area. The spatial pattern in percent forest cover and percent pastures and grazing land show that both these environmental dimensions are negatively associated with spatial patterns in population pressure. Keeping this in view there is an imperative and urgent need for reclamation and development of wastelands should be formulated.

**Air Pollution**

The exploding urban population in India contributes in some way to the increasing pollution. The number of cities with a population greater than one million has increased form 23 in 1991 to 35 in 2001. Increasing urbanization is leading to an increased demand for various services like transport and energy, which, in turn, is increasing the amount of pollutants being released to the air. On the basis of the AQI (air quality index) 84 percent of the population in the 83 cities for which NAMP data is available is exposed to ‘poor’ (34 percent), ‘bad’ (14 percent), and dangerous (36 percent). Only 3 percent of the population are exposed to good quality air. The average NOx (oxides of nitrogen) in all most all the cities/big towns are below the annual standard for residential areas up to 2004. However, in some cities/big towns, the levels are showing an increasing trend and slowly approaching the standard. The worst affected cities in terms of NOx pollution are Pune, Jharia, Kolkata, Dhanbad, and Delhi (TERI,

2006). There has limited monitoring of other pollutants such as hydrocarbons (benzene, and toluene) PAHs (polyaromatic hydrocarbons), and heavy metals (such as lead) in some cities.

From the air pollution perspectives, the worrisome trend has been the rapid growth of two wheelers and cars, and the marginal growth of buses. This indicates that the public transport has failed to keep pace with the growing need of urban transit, resulting in more vehicles on the roads of our cities and a subsequent in crease in air pollution. During 1996-97 to 2002-03, the total pollution load for particulate matter, carbon oxide, oxides of nitrogen and hydrocarbons increased by 52 percent. Improvements in vehicular technology and fuel quality have contributed to a lower rate of increase in emission load. However, with continual and rapid increase in personal vehicles, Indian cities are likely to face further congestion and deterioration in air quality, unless remedial measures are taken. Emissions from industries also contribute to urban air pollution, with many cities doubling up as homes to many polluting industries. The large scale industries are better organized to adopt pollution control measures, the small scale industries suffer from outdated technology, poor quality fuel, and inadequate enforcement measures, which make them ill-equipped to control emissions. Reducing emissions from the small-scale sector is, therefore, a critical issue in India.

Indoor air pollution (IAP) is another major environmental health concern, especially for the poor, women, and children. With rising population and growing demand for cooking fuels the household energy consumption has increased. For many women, cooking with inferior quality solid fuels was associated with levels of air pollution that are far higher than those experienced outdoors in urban areas. Concentrations of particulate matters in kitchens due to burning of biomass were known to be as high as 30 times the WHO guidelines. Despite heavy subsidies, only 10 percent of the biomass dependent households actually use improved stoves. Census data reveals that by 2001, LPG (liquefied petroleum gas) had become the most commonly used primary cooking fuel in urban areas. It also shows a decline in the percentages of households using kerosene. WHO reported that IAP doubles the risk of pneumonia and other acute lower respiratory tract infections among children below five years and increases the risk of chronic obstructive pulmonary diseases among women by three times (WHO, 2006).

**Government Policies Concerning Population and Environment in India**

At the United Nations Conference on Environment and Development (1992), a consensus was established that population, the environment and development were inextricably linked. This consensus view was reaffirmed at the International Conference on Population and Development (1994). In addition reports and statements produced by Governmental and non-governmental organizations provide a solid basis on which to assess how far the various stakeholders have gone in operationalizing the linkages among population, environment and development.

India has adopted many plans and policies to control its rapidly growing population and for the protection and improvement of the environment for sustainable development. These processes have largely focused on setting national priorities and it is found that policy implementation is lagging far behind policy formulation. Here we can have a glance on major plan and policy recommendations up till now regarding population and the environment in India.

*National Population Policy, 2000:* The National Population Policy document issued in 2000 set following objectives for the year 2010 to curtail its population growth and to improve the quality of life in India: (i) achieving replacement level of fertility by 2010, (ii) the attainment of compulsory and free school education up to the age of 14 years, and the reduction of drop-out rates to under 20 percent at primary and secondary school levels for both boys and girls, (iii) the reduction of infant mortality rate to 30 infant deaths per 1000 live births, and the maternal mortality rate to less than 100 per 100,000 births, (iv) the achievement of universal child immunization against all vaccine preventable diseases, (v) raising institutional deliveries to 80 percent, and those by trained persons to 100 percent, and (vi) the promotion of delayed marriage for women to 18 years (legal age at marriage for women India) and preferably to over 20. Moving in the direction of these targets is clearly desirable. However, these are yet unrealistic targets. Their attainment by 2010 requires both increased financial resources and improvements in the functioning of several social sector programmes. The National Population Policy, 2000 does not directly say anything about linkages between population growth and environment.

*The Forest (Conservation) Act, 1980:* In view of rapid deforestation and the resulting environmental degradation, Parliament of India enacted the Forest (Conservation) Act in 1980. The act made it obligatory on the part of a state to take prior approval before it 'dereserves' a reserved forest, uses forest lands for non-forest purposes, assigns forest lands to private person or corporation, or clears forest land for the purpose of reforestation. The Act also envisages an Advisory Committee to advice the Central Government.

*Air (Prevention and Control of Pollution) Act, 1981:* It was passed on the basis of the recommendation of Stockholm Conference on Human Environment in 1972. This Act contains several interesting features. The Air Act, 1981 was amended in 1987 to remove the difficulties encountered during implementation, to confer more powers on the implementing agencies and to impose more stringent penalties for violation of the provision of the Act.

*National Forestry Action Programme, 1999:* The national Forestry Action Programme was introduced in the year 1999 to fulfill the needs for a long term forestry action programme for sustainable management of forest resources, and increase forest cover and forest productivity. Its thrust was on protecting existing forest resources from further degradation, improving forest productivity, reducing demand for forest

products, strengthening policy and institutional frameworks, and expanding forest area. However, its implementation is constrained by lack of funds (TERI, 2006).

*Forest Development Agencies:* The MoEF has initiated the concept of FDAs (forest development agencies) at the forest division level, and the pattern of districts rural development agencies. The move is expected to accelerate decentralized implementation of centrally sponsored afforestations schemes. Though the concept is quite credible, the lack of regular fund and the issues involve in collaborating with other rural development departments have again limited the success of these agencies.

*National Environment Policy:* In 2004, MoEF proposed a draft NEP (National Environment Policy) to 'infuse a common approach to the various sectoral, including fiscal, approaches to environmental management'. The Union cabinet approved the draft in May 2006, making the NEP India's first environmental policy. It enumerates the following specific action to control air pollution.

- Strengthening the monitoring and enforcement of emission standards for both point and non-point sources.
- Preparing and implementing action plans for major cities to address air pollution for both point and non-point sources, relying on a judicious combination of fiats and incentive based instruments.
- Formulating a national strategy for urban transport to ensure adequate investment, both public and private, in low-pollution mass transport system.

*Draft Schedule Tribes (Recognition of Forest Rights) Bill, 2005:* To vest forest rights and occupation of forest land for forest dwelling schedule tribes, the Ministry of Tribal Affairs has prepared a draft Schedule Tribes (Recognition of Forest Rights) Bill, 2005, which is now being examined by a joint parliamentary committee. Among other things the bill seeks to provide ownership to a maximum of 2.5 hectares of forest to a nuclear family. However, the provision of the bill have resulted in a 'tiger-tribal' controversy, with conservationists vehemently opposing the bill on grounds that regularizing tribal settlements in protected forest areas and providing people to reside on forest fringes access would increase the poaching of animals.

While India agrees to the adoption of MDGs (*Millennium Development Goals, 2000*), it follows some indigenously set targets for the Tenth Five Year Plan to monitor socio-economic and environmental performances; this agrees with the spirit of the MDGs but is more attuned to the country's specific socio-economic requirements (see Table 4).

**Table 4: Comparing India's indigenously set targets vis-à-vis the Millennium Development Goals**

| Issues | Target set for Tenth Five Year Plan (2002-2007) and beyond | Corresponding Millennium Development Goals/target |
|---|---|---|
| Poverty | Reduction in poverty ratio by 5% in 2007 and 15% by 2012 | MDG1: Eradicate extreme poverty and hunger<br>Target: Halve, between 1990 and 2015, the proportion of people whose income is less than 1 dollar a day |
| Health | Reduction in infant mortality rate to 45 per 1000 live births by 2007 and to 28 by 2012<br><br>Reduction in maternal mortality rate to 2 per 1000 live births by 2007 and 33% by 2012 | MDG 4: Reduce child mortality<br>Target: Reduce by two thirds, between 1990 and 2015, the under five mortality<br><br>MDG 5: Improve maternal deaths<br>Target: reduce by three-fourths, between 1990 and 2015, the maternal mortality ratio |
| Forest | Increase in forest and tree cover by 25% by 2007 and 33% by 2012 | MDG 7: Ensure environmental sustainability<br>Target: Integrate the principles of sustainable development into country's policies and programmes, and reverse the loss of environmental resources. |
| Employment | Gainfully employing the labour force that will be added during the Tenth Plan period | MDG 8: Build up global partnership for development<br>Target: In cooperation with the developing countries, develop and implement strategies for decent and productive work for youth |

**Source:** Planning Commission (2002); <http://unstats.un.org/unsd/mi/mi_goals.asp>, last accessed on 26th October 2006.

**Summary and Conclusion:**

Temporal analysis of population and land use data for the last fifty years demonstrates that population growth in India is now slowing down but its impact on land use trend is quite distressing. The changes in land use obviously reflect the pressure on land resources due to rising population. The distressing features are in the form of considerable increase in land put to non-agricultural uses, rise in fallow land, steep decrease in area under miscellaneous tree crops and groves. Area under non-agricultural use has grown very fast but not at the cost of cultivable area. From the regression analysis it is concluded that the effect of an increase in population density on change in cropping intensity is not significant statistically. This could be mainly due to the fact that there has been relatively little change in cropping intensity between 1951 and 2000. Yet again the country did not have remote sensing technology in the 1950s, one is not sure about the actual lost of forest over the decades in India. In this regard, Iyengar (2003) criticized the definitions assigned to land use categories in India and the definition of 'forest' does not imply that the land under forest has to be wooded. It is also clear from the analysis that from 1980-81 onwards there is hardly any changes in different land use categories.

However, it is a fact that there is a lack of sufficient, accurate and up-to-date data on land conversion and infrastructure deployment patterns as a serious impediment for designing better land management and

human settlement policies in India. The study also reveals that from environmental monitoring point of view, the land use data as they are collected are of very limited use and at times they may be misleading. Thus, the present system of land use fails to capture both the quantitative as well as qualitative changes. There is a need to strengthen the land use statistics in this context, so that, the objective for which it is generated, i.e. to asses the agricultural performance of a region can be fulfilled.

Despite their valuable contributions to the country forests have been neglected in planning, and agencies working to mange them are poorly funded. Along with this neglect, forests are subjected to overexploitation, encroachments, illegal felling, and so on, leading to their degradation. To check forest degradation and fulfill the needs of forest-dependent people, rehabilitating of degraded forest areas and afforestation of wastelands, improving forest management through involvement of local communities are the strategies that need to be taken up.

The most disturbing trend over the past few years has been the spread of dangerous or bad air quality. Despite many developments in the control of air pollution, India still faces major challenges in many cities and urban areas. To address the problem of air pollution comprehensively, an integrated air quality management approach is required, which cuts across different sectors and addresses social, economic, and technological issues. It should consider issues related to population distribution, regional land use, and siting, transport planning, infrastructure development and environment.

Thus greater efforts are required for bolstering data collection and dissemination mechanisms in this context. Integration of decision across different institutions and levels of the government is a prerequisite for ensuring effective implementation of policy. In India, the lack of integrated resource management is often regarded as a major weakness of policy. This precludes a comprehensive and long-term view of fund availability; the multifarious pressure on it and how they interact and change overtime; and the available options to mange it. Close interaction is essential among the three levels of government: centre, state, and local bodies and also between various departments of government, so that, India can move in the direction of set targets to control population growth and environmental degradation.

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