Effects of Demographic Change on Environmental Degradation: Evidence and Implications for India

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Abstract In the recent decade, India has seen remarkable changes in the age structure due to demographic transition. This has further influenced the society and economy in a positive side and however, changing demographic trends and consumption pattern in India has been causing eco-degradation and environmental pollution, and therefore an issue of changing demographics and its effects on environmental degradation is a serious issue in the present pattern of population dynamics. Though there is a currently fair understanding of the ways in which the India's population is changing as well as of the social and economic implications of these changes, little attention has so far been paid to its possible environmental impacts. In this background, this particular paper tries to understand how the changing demographic trends have affected environment in India, and seeks to identify measures both to mitigate environmental damage and increase resource use efficiency.

1 Introduction

Currently the annual average world population growth has been increasing at 1.1 %. It is slightly higher when compared to India. Though, India has 2.4 % of the world's geographical area, it is home to nearly 17 % of the world's population. The demographic trends such as increase in the total population, changing age structure, change in household size, distribution, and size of urban population across various segments have been seriously caused to environment decay, which directly degraded the human welfare, health, and well-being. However, in India, demographic trends are not uniform across the country; the backward states such as Bihar, Madhya Pradesh, Chhattisgarh, Uttar Pradesh, Orissa, and Rajasthan have witnessed above the average growth rate of population while other states are

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experiencing the growth rate of population relatively low. But, on the other hand, the level of socio-economic development in the above said states is also low when compared to the southern states and western states of India. In this background, measuring environmental pollution in India based on the physical characteristic of a region is deemed appropriate. This paper highlights the linkage of changing demographic trends and its potential environmental impact in India.

2 India's Demographic Change

Rapid decline of fertility in most part of India in the recent decades has significant impact on the changing age structure of population. However, primarily, three important factors have been emerged from the recent demographic change in India. They are: (a) people are living longer (b) there will be more number of households and the average number of people per household will be lower (c) the rate of population growth varies across regions in the country. And further, the demographic character is changing rapidly and the country is now entering the final stage of demographic transition. But due to regional inequality in the progress of socio-economic development especially in some states like Bihar, Rajasthan, Madhya Pradesh, Rajasthan, and Assam were not reaching the replacement level fertility. However, it has evidence in most of the state in southern, western, and northern states of Punjab and Haryana. However, India exhibits one of the highest demographic heterogeneities ever experienced anywhere in the world at the regional and state level. Despite the recent decline in the birth rate in the country, India has recorded a growth rate of 1.6 % per year during 2001–2011 census periods, adding around 181 million people to the total, but the annual addition to the total population has remained nearly the same. However, there is a general consensus that demographic change in India has led to opening up new economic opportunities and has had a greater impact on economy and society (Bloom and Williamson 1997). But, at the same time the demographic change such as the size of population, household numbers, age structure of population, urbanization, etc., are found to be important proximate causes for adverse impact on environment. Additionally, our current patterns of consumption such as the amount of energy and water use in homes, waste generation, changing landscape, and biodiversity loss are going to have a greater impact on the environment than all the above demographic factors.

3 The Changing Age Structure

The increase in life expectancy—an important driver contributing to an increase in population—and the consequent growth in the number of older people are likely to continue in India. This calls for timely action to ward off the social and economic

consequences of aging population. For instance, the most advanced country of the United Kingdom has already taken precautionary measures to mitigate the potential impact of environment to anticipate by these demographic trends, particularly the increasing number of older people in total. In this regard, the Royal Commission on Environmental Pollution in the UK has found that, if people have more years of active life that will potentially have a greater environmental impact. Older people and particularly those over the age of 75, on average, contribute disproportionately to carbon emissions from heating their homes, etc. This is because they spend a greater amount of time at home and feel the cold more intensely. Further, there is growing body of evidence to show that the potential environmental impact of residues of pharmaceuticals released into the environment by excretion or disposal particularly by the elderly is greater as they use more medicines than younger people. And now a similar situation is evident in India. For example, as per 2001 census, India had 49.10 million people in 65+ age group which increased to 90 million (7.43 %) in 2011. And by the year 2050, their number is expected to reach 315 million, constituting about 20 % of the total population. Hence, it is considered that the increasing number of older people in the country will be a potential source of environmental effects in the future.

In this regard, an effort has been done to understand the role of fertility and changing age structure population across southern states of India focusing the elderly population in Table 1. The TFR decline was evident in all four southern states of India during the last two decades. Interestingly, a decline of 1.6 in Karnataka has resulted in an increase of about 3 % in the proportion of aging population during 30 years. Surprisingly, the absolute TFR decline was very low in Kerala (0.9), but it has resulted in significant increase in the proportion of aging population in the state with 4.8 %. Tamil Nadu also witnessed a comparatively higher increase in the proportion of aging population (4.7 %) during the period.

Coming to the extent of increase in the share of aging population in the total, across the southern states in the decade 1991–2001, it can be seen that a slight TFR decline of −0.1 % in Kerala and Tamil Nadu had caused a relatively higher in the proportion of aging population. During the same period, the TFR decline was relatively high at −0.4 in both Andhra Pradesh and Karnataka, but increase in the proportion of aging population in the total was not significant, i.e., below 1 % in Karnataka and below 0.5 % in Andhra Pradesh.

In the following decade of 1991–2001, the decline in TFR and resultant change in age structure of the population was substantial; proportion of aged population in the total population increased in all the southern states. Percentage increase in the proportion was relatively higher in both Kerala and Tamil Nadu (1.68 and 2.15 % respectively). Karnataka and Andhra Pradesh also had registered considerable increase in the proportion of aging population in total population in the decade 1991–2001, but the increase in proportion was below one per cent in Karnataka, and about one percent in Andhra Pradesh. Further, if we look at the major changes in the proportion of aging population in the total attributable to TFR decline, it can be seen that TFR decline was almost identical in both the decades of 1991–2001 and 2001–2011 in the respective states. However the effects of TFR decline on the

Table 1 Decadal change of TFR and age structure transition in southern states of India (60+ population)

State	TFR decline				Total increase of age 60+ population			
	In 30 years	Decadal change			In 30 years	Decadal change		
	(1981–2011)	1981–1991	1991–2001	2001–2011	(1981–2011)	1981–1991	1991–2001	2001–2011
Andhra Pradesh	−2.1	−1.3	−0.4	−0.4	2.7	0.38	1.02	1.3
Karnataka	−1.6	−0.8	−0.4	−0.4	3	0.79	0.81	1.4
Kerala	−1.1	−0.8	−0.1	−0.2	4.8	1.32	1.68	1.8
Tamil Nadu	−1.7	−1.3	−0.1	−0.3	4.7	0.95	2.15	1.6

Source (1) Census of India, series-1, paper 5 of 1984, registrar general, government of India
(2) Technical group of population projections, registrar general, and census commissioner of India, 2001–2026

increase of aging population was quite impressive in the recent decade not only in India but also in the southern states. For example, a TFR decline of −0.04 had resulted in an increase in the proportion of aging population by about 1.4 % in Andhra Pradesh and Karnataka. In contrast, a TFR decline of just −0.02 % resulted in a significant increase in the proportion of aging population in Kerala (1.8 %) and Tamil Nadu (1.6 %).

What is clear from the above discussion on change in age structure of population and fertility transition across the southern region in over 30 years is that the total increase in the proportion of aging population in total was comparatively higher in Kerala and Tamil Nadu. It is relatively low in Karnataka and Andhra Pradesh. But finally, the above description is evident that there has been a positive decrease of child population under age 6 and increase of elderly population in the total population is relatively higher across southern states with a continues decline of TFR. This has certainly influenced the environmental degradation having more elderly and working population in future. It means, more is the working population and elderly more is the utilization of energy use and generating huge waste at the household level, which caused land degradation, water and air pollution, which further caused human welfare, health, and well-being.

4 The Changing Household Structure and Energy Use

It is widely assumed that, in general, smaller size households make higher energy use and results in higher CO_2 emissions per head. The data collected and conclusions reached as part of the integrated impact assessment of the London Housing Strategy by The Royal Commission on Environmental Pollution (2011) in the UK has found that larger households consume proportionately fewer resources than the smaller ones, with a three-person household using only about twice (rather than three times) the water used in a one-person household. Hence, household size is one of the factors which contribute the amount of water consumed per head. A similar trend was also observed in India (UN 1999; NCAER 2011). Electricity use, gas use, and waste generation show quantitatively the same trends not only in the UK but also in other countries like US, China, and India (Lakshmana 2013). Although, the changing demographic trends have led to a reduction in the size of family, and nuclear family[1] is the common trend in India.

Reduction in family size naturally increases household income. This means, less number of dependents, and more money available for savings, investments, and consumption. Besides, demographic change has led to the preponderance of young and working-age population in the country. Population in 15–29 age group is

[1]A nuclear family is a family unit that consists of father, mother, and children.

growing at a faster rate than the other age-groups (Census of India 2011). This has led to two important developments: (1) the proportion of those joining the labor force and earn wage/salary has increased many fold; and (2) joint family system[2] is losing ground and nuclear families are gaining ground (Census of India 2011). Therefore, increased per capita expenditure at the household level has been leading to acquisition of household assets like cars, refrigerators, etc., which consume enormous quantities of energy on one hand, and release carbon and other pollutants on the other. Now the burgeoning middle class in Asia, particularly China and India is consuming energy that is more or less equal to the US energy consumption (UN 1999; NCAER, New Delhi 2011). The demand for new housing and related development as a result of demographic change will increasingly come up against environmental constraints in all parts of the country.

As per 2011 census, India has 24.66 million households as against 19.19 million of the previous census of 2001. The overall increase in growth rate of total households during the period of 10 years is 29 % of which urban areas account for over 50 %. Percentage of nuclear families in India increased from 61 % in 2001 to 68 % in 2011. The total reduction in fertility rate of 0.71 % (3.39 % in 1991 and 2.68 % in 2005) has resulted in an increase of about 8 % in the number of nuclear families over 15 years. The reduction in fertility rate is found faster in rural areas than in urban areas. Hence, on the one hand, a reduction of fertility has led to a decline in population growth, but at the same time it has also led to an increase in the nuclear families with fewer members per household. Increasing household income has resulted in the acquisition of electronic goods and personal motor vehicles by individuals. And, the socio-economic transformation in the context of technological change has been accompanied by huge acquisition of television sets, computer, telephone/mobile phone and automobiles not only by urbanites but also by rural people. Interestingly, the percentage of households that do not have such household goods decreased from 34.5 % in 2001 to 17.8 % in 2011. According to the latest (2013) report by the Planning Commission, Government of India, this is exactly equal to the proportion of population below poverty line (BPL). Hence, it confirms that drastic decline of fertility in most part of the country (except perhaps in the backward states) has consequent increase in disposable per capita income and empowered individuals to acquire household assets like automobiles and electronic goods extensively. Therefore, there is a need to address the emerging issues of population and development in general and seek answers to the question whether demographic change in terms of fertility decline is a dividend or a disaster in terms of its adverse affect on environment.

[2]A family includes in one household near relatives in addition to a nuclear family or a family that includes not only parents and children but also other relatives (such as grandparents, aunts and uncles: (An Encyclopaedia, Britannica Company).

5 The Effects of Urbanization

Generally the urban population growth in India was slow during pre-independence; however, there was a gradual increase of urban population during the liberalization period. And as per the latest census of 2011, about 31 % of population in the total is urban. Interestingly this population is mostly accumulating in class I cities. And the class three tier cities are losing the ground. However, during the post-liberalization period, India has witnessed a rural influx into urban areas. This has put tremendous pressure on fertile land and resulted in resource depletion and environmental pollution. The most striking feature of India's urbanization is that it is 'large-city oriented' and almost 70 % of India's urban population is now concentrated in class I cities (Lakshmana 2008). The poor quality of India's urban centers and the consequent haphazard kind of urbanization has been worsened by the burden of this rural influx. The magnitude of environmental degradation in such urban sprawls is alarming. However, increased urban population over the past 30 years is of greater significance in the western region compared with other regions in India. Besides, the west region has the highest number of most populous cities with only 16.76 % of the total land area, and double the proportion of population, i.e., 31.33 % of the total (Table 1). Similarly, the northern region with 14 % of land area had 18 % of population in the same time-span. This means that the most populous cities are located in the western and northern regions, and therefore one could conclude that urban growth and urbanization has led to increased use of natural resources; as a result, environmental pollution could be expected to be higher in the western and northern cities. While the determinants of population growth such as birth rate, death rate, etc., have declined over time, migration seems to have neutralized the expected advantages, as evidenced by the fact that there has not been any decline in the rate of resource use and consequent environmental decay (Table 2).

Table 2 Most populous cities and their population by region in India

Region	No. of cities	Population (in millions) 2001	% age	Population (in millions) 2011	% age	Proportion of urban area to the total urban area	Man-land ratios per km^2
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 Compiled by the author from census data

6 Summary and Conclusion

Currently, annual average growth of world population has been growing at the rate 1.1 %. However, India has witnessed for higher than the world population with an increase of 1.7 %. No doubt the population and health policies have certainly helped in reduction of fertility. But even though, the size of population is second highest after China. Increasing working population is caused to have more money and they are going to spend on electronic gadgets and motor vehicles. This has directly influenced to air pollution and the use of high energy. The current patterns of consumption in India have a greater impact on the environment than all the above demographic factors. Therefore, demographic trends not only imply significant social and economic issues but also potential environmental impacts. Therefore, meaningful efforts need to be done to increase resource use efficiency to protect the environment. At the same time, the rapid change in age structure and resultant increase in the number of nuclear families demands for new housing, and the related development will increase and despite inherent environmental constrains in most regions of the country. Hence, remedial measures need to be taken to reduce consumption level and waste generation by individuals and households in order to protect the environment. Until and unless the government gives adequate attention to the implications of demographic change for the environment, the country will not be able to face the challenge of environmental decay and the related human issues in the coming decades. Efforts have been done in India in order to reduce population growth. But the size and quality of population were the major threat to environment in the country at different levels due to regional inequality in terms of geographic, social, and economic variables. However, changing demographics in the country certainly is a ray of hope for the economic development; however it should not be the disaster to the sustainable environment in India.

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