Estimating effect of population on agricultural land use: A macro analysis from major Indian states

Man as producer, consumer and decision maker has significant role in shaping the pattern of land utilization over a region. In India, out of total land area (i.e., 329 mha) only 22 mha are occupied for non-agricultural uses and 263 mha for agricultural, forestry, pastures and other biomass production. This paper aims to study the effect of population characteristics on land use pattern in Indian states. The study is based on secondary data collected from various sources (like, Census of India 1991 and 2001 and statistical data base, the citizens' fifth citizens' fifth report). To understand land use practices 'cropping intensity' (i.e., Total gross cropped area/ Net shown area x 100) was measured. Lastly, multivariate technique was used for analyzing interrelationship between population and land use. Result shows that population density, as well as, composition (like, ethnicity) has significant effect upon maximum utilization of cultivable land, and on cropping intensity.

Agriculture and population as pivot of human evaluation and development from times immemorial enjoy global differentiation, kaleidoscopic maze description at various levels, stages and growth patterns. The world at this stage appears to be at the crossroad of human history. Our population at various scales is growing fast and still faster are our varied and galloping demands of the agricultural products from fields when not only per capita land in all categories is declining but our land on the whole is symptomatic of all round decoration through more of resource inputs do reflect higher productivity and growing total production, but no one can assure for its such a continuity for ever. The situation reveals in our present day, exploding population and ever increasing level of scientific and technological researchers and development to further intensify, mobilize and manage resource to the advantage of few and as a consequence give rise to Island of affluence amidst oceanic all round poverty. Agricultural land use in any region is often the product of varying factors, existing and operating in different combination. However the land use in the region is highly influenced by relief, composition of soil availability of water resource and the suitability of climatic condition but apart from these indispensable physical and environmental factors, there are many made factors, which is, determine the course of land utilization. Man as a producer, consumer or decision makers have significant role in giving raise the pattern of land utilization in bringing the spatial variations in it over a region. The utilization of land is such a complex reality that it cannot be explained by few variables, but the variation in it can be associated with the variations in the combination of twenty variables, which have direct or indirect influence on land utilization. In this perspective, that the present analysis has been attempted to understand the impact of population growth on land use pattern.

The specific objectives of this paper are

1. To evaluate the utilization pattern of land and population base of the major states of the country.

2. To trace the growth of the agricultural land utilization pattern during last two decades.
3. To analyse the effect of high population density on significant changes taking place in land use practices.

Data

To capture the aims of this paper secondary source of data for fifteen major Indian states (namely, Andhra Pradesh, Bihar, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Utter Pradesh, and West Bengal) have been largely used for analysis. The data on agricultural land use by different usages like forest, not available for cultivation, uncultivated land, net shown area, irrigated land, fallow land, area cropped more than once have been taken from the Indian agricultural in brief, Compendium of environment statistics, Bulletin on food statistics Data on the population density, growth of population, S.C. population as percentage of total population, S.T. population as percentage of total area, Literacy as percentage of total population, Workers as percentage of total population, cultivators as percentage of total, workers, agricultural labourer percentage of total workers, number of useful wells per 100 ha. of total area, No of electric & diesel pump sets per 100 useful wells, No, of tractors per 1,000 ha of cultivated land have been taken from Census of India 1991 and 2001 and statistical data base, the citizens fifth citizens fifth report.

Analysis

The first two objectives of the paper are descriptive in nature. Mainly level and trend of the related variables have been presented here to fulfil the research objectives. To capture the third objective in the paper two main variables have been identified as population variable and land use variable at the state level. Here population variable includes (i)Density of population, (ii) percentage of schedule caste population to total population, (iii) percentage of schedule tribes to total population, (iv) percentage of literates to total population, (v) percentage of workers to total population, (vi) percentage of cultivators to total population, (vii) percentage of agricultural labourer to total population, (viii) number of useful wells per 100 ha of total area, (ix) number of electric and diesel pump sets per 100 useful wells, and (x) number of tractors per 1,000 ha of cultivated land. Land use variable constitutes ten factors including (i) forest land as percentage of total area, (ii) proportion of area not available for cultivation, (iii) other uncultivated land as percentage of total area, (iv) fallow land as percentage of total area, (v) net shown area (NSA) as percentage of total area, (vi) cultivated land as percentage of total area, (vii) area cropped more than once as percentage of NSA, (viii) irrigated land as percentage of NSA, (ix) fallow land as percentage of cultivated land, and (x) cultivated land in ha per 100 person.To understand the land use practices cropping intensity was calculated by using the formula, i.e., Total gross cropped area/ Nat show area* 100 = cropping intensity.

Lastly, Pearson correlation was computed among these twenty variables to understand the nature of association among these variables.

Finding of the Study

Land use pattern

Forest land
The paper shows that the states like, Himachal Pradesh (63.60), Madhya Pradesh (34.84) and Orissa (37.73) have higher share of forestland areas to total land areas whether the state like Harayana (3.78) and Punjab (5.76), are having lower proportion of forest cover.

The area of not available for cultivation
The state like, Tamil Nadu (18.17), West Bengal (18.60), Orissa (19.64), Gujarat (19.09) is having high percentage of area not available for cultivation as compare to state like Haryana (9.98), Kerala (9.24) and Punjab (9.67) for the same.

Other cultivated land
The state like, Himachal Pradesh (24.6), Rajasthan (19.74) and Gujarat (14.42), Orissa (11.26) are having higher share of other cultivated land as compare to state like Harayana (1052), Kerala (2.26), Punjab (0.83), West Bengal (1.48).

Fallow land as percentage of total area
The proportion of fallow land to total land is not constant over time. The states like Bihar (15.97), Tamil Nadu (16.50) and Andhra Pradesh are having higher share of fallow land and on the other hand the states like, Punjab and Himachal Pradesh and West Bengal are having very lower proportion of fallow land to total land.

Net shown area
The states like Harayana (82.2), Punjab (82.19), and Uttar Pradesh (59.49) are having higher share of net shown land whereas the states like Himachal Pradesh (10.02) have the lowest share for the same.

Cultivable land
In all the states 70 percent of land of total land area is used as cultivable land.

Area cropped more than once
The states like, Punjab (94.30) Haryana (69.0) is securing highest position in area cropped more than once whereas, the states like Gujarat (10.51), Karnataka (16.09) and Tamil Nadu (17.51) are having very limited proportion of area for cropping more than once.

Irrigated land
The states like Harayana (75.96), Punjab (92.95) are having higher proportion of irrigated land whereas the states like Maharashtra (14.45), Kerala (15.06) and (Himachal Pradesh) (18.10) having lower proportion of irrigated land.

Fallow land as percentage of cultivated land
The high percentage is in Andhra Pradesh (60.43) and lowest in Kerala (0.95) and Harayana (1.60).

Cultivated land in ha per 100 person
The states like Himachal Pradesh (0.18), Haryana (0.05) and Punjab (0.04) have the higher proportion of cultivated land in ha per 100 person as compared to other Indian states.

Population Base

Density of population
The states like West-Bengal (904), Bihar (880) and Kerala (819) have highest density of population and the states like Himachal Pradesh (109), Rajasthan (165) and Madhya Pradesh (196) have very low population density.

Schedule Caste Population
The states like Tamil Nadu (), Punjab (28.31) and Himachal Pradesh (25.34) have highest proportion of SC population to the total population whereas the states like Haryana (1.97) and Gujarat (7.41) have the lowest SC population.

Schedule Tribe Population
The states like Madhya Pradesh (23.27) and Orissa (22.21) have higher proportion of ST population and the states like Haryana (0.0) and Punjab (0.0) have lowest proportion of ST population to total population.

Literacy
The states like Kerala (80.49) and Himachal Pradesh (66.30) have the higher percentage of literates to total population whereas the states like Rajasthan (49.73) and Madhya Pradesh (53.21) have the lower percentage of literates to total population

Workers
Workers as percentage of total population is highest for the states like Himachal Pradesh (49.22) and Andhra Pradesh (46.04) and lowest for the states like Kerala (32.32) and West Bengal (36.78).

Cultivators
Cultivators as percentage of total workers is highest for the states like Himachal Pradesh (65.55) and Rajasthan (55.37) and lowest for the states like Kerala (7.19), Tamil Nadu (18.39) and West Bengal (19.03).

Agricultural labourers
Agricultural labourer as percentage of total workers is highest for the states like Andhra Pradesh (39.63), Orissa (35.04) and Tamil Nadu (31.16) and lowest for the states like Himachal Pradesh (3.10) and Bihar (8.98).

Useful wells
Number of useful wells per 100 ha of total area is comparatively higher for the states like Punjab (76.39) and Haryana (63.18), whereas; comparatively lower for the states like Himachal Pradesh (1.89), Maharashtra (8.34) and Kerala (9.01).

Electric and diesel pump sets
Number of electric and diesel pump sets per 100 useful wells is comparatively higher for the states like Punjab (42), Kerala (32) and Tamil Nadu (32) and lower for the states like Himachal Pradesh (0), Madhya Pradesh (6) and Karnataka (7).

Tractors
Number of tractors per 1,000 ha of cultivated land is comparatively higher for the states like Punjab (1024), Haryana (387) and Uttar Pradesh (215) and lower for the states like Himachal Pradesh (0), Kerala (3) and Orissa (5).

Cropping intensity
The states like Punjab (187.2), Himachal Pradesh (170.8), and Hayana (166.5) have highest cropping intensity on the other hand, the states like Gujarat (104.9), Karnataka (114.7) and Tamil Nadu (117.3) have the lowest cropping intensity.

Result of correlation matrix

The result of Pearson bivariate correlation matrix has been depicted that (i) forest land area is inversely associated with the number of useful wells per 100 ha of total area. The reason might be that in this region wells are rarely in use because in forest land areas modern technology neither afford nor require.
(ii) Other cultivated land is inversely associated with population density and useful wells, but positively associated with workers as percentage of total population and Cultivators as percentage of total workers. The reason might be that as density of population increases the transformation of land from cultivation purpose to domestic purpose also increases, whereas due to cultivation purpose concentration of cultivators also increase in that area; and since in India a major proportion of population find their means of livelihood from agriculture related work so concentration of workers also increases in such areas.
(iii) From this paper it is evident that Net shown area is positively associated with useful wells, electric and diesel pump sets, and tractors, and negatively associated with workers as percentage of total population. This indicates that the scope for more use of technology is much better where proportion of net shown area is much higher, and in these area need for worker is not much higher so concentration of workers also declines.
(iv) 'Area cropped more than once' variable is positively associated with useful wells and tractors. This means as number of useful wells and tractors in a particular area increases the scope for multiple cropping also increases.
(v)Irrigated land is positively associated with useful wells, electric and diesel pump sets, and tractors, and inversely associated with schedule tribe population. It is clear that as number of useful wells and electric and diesel pump sets increases in a particular area the scope for irrigation facility also increases, which prompt to use of modern technology

like tractor to improve agricultural production. Still tribal population in India are lagging behind in utilization of modern facilities to improve production. They still today depends on traditional method (like rain fall) for production purpose, so in the tribal dominated area proportion of irrigated land to total land area is very poor.
(vi) 'Cultivated land in ha per 100 person' is significantly positively associated with cultivators; whereas inversely associated with agricultural labourer. The reason behind might be that as cultivators take initiative to use a land for cultivation purpose, then transformation of other land into cultivable land increases, whereas, since cultivable land is fixed, as number of agricultural labourer increases the cultivated land in ha per 100 person declines.

Summary and Concluding Remarks

From the analysis it is clear that population has a definite impact on land use practices. The states like Orissa and Madhya Pradesh, where concentration of forest land as well as tribal population is much higher, agricultural labourer as percentage of total workers are high; there proportion of irrigated land as well as multiple cropping systems is not very satisfactory. In these states use of modern technology like use of well, electric and diesel pump sets and tractors are also very poor. The cropping intensity is also not very high. The state of Himachal Pradesh is showing a different picture, though this state has a large forest cover, but this state has very small share of tribal population, with a lowest population density. The uses of modern technology like use of well, electric and diesel pump sets and tractors are also very poor. This state has very poor proportion of net shown area and irrigated land. But this state has shown the evidence of highest proportion of multiple cropping as well as high cropping intensity as compared to other states. The states like West Bengal, Bihar have very high population density, with lower proportion of tribal population to total population, have higher proportion irrigated land and multiple cropping systems. Particularly, the state of West Bengal has been showing high cropping intensity. Lastly, the states like Hayana and Punjab where density of population is more than average with negligible proportion of tribal population, there the use of modern technology like use of well, electric and diesel pump sets and tractors are also very high, where proportion of irrigated land and net shown land is also very high, and use of multiple cropping is also very high. The cropping intensity is also very high in these two states.
So from this study it can be concluded that composition of population (i.e., ethnicity) has a significant effect in changing the land use practices. To universalize these changes in land use practices it can be suggested that modern technologies of agriculture should be promoted to the remote tribal dominated areas of these states.