Chapter - IX

CONCLUSION AND FINDINGS

In this Chapter an attempt is made to bring together the main findings and to arrive at some conclusion, apart from providing a brief summary of the entire work, includes a decision of the problems and prospects of agriculture in Thane district. The work it is hoped will have served its purpose if it can at least provide a basis for planning changes in agricultural landuse for the optimum utilization of the regions resources. The regional frame developed and the model agricultural location may together be useful for making policy decisions, especially for the allocation of resources with respect to the potential and problem regions, delineated in terms of the existing agricultural patterns.

The study is concerned with the spatial analysis of agricultural landuse in Thane District with a view to evaluate the influence of certain physical and cultural factor on the distribution pattern. It is very difficult to offer an exhaustive explanation of the location of agricultural landuse, but the approaches made in that direction and the finding together with the perspectives on the dynamics of agricultural landuse are summed up here. The observations, analyses and findings of the preceding chapters are presented as follows:

In order to analyses the influence of physiographic factors on agricultural patterns, the areal unit of study has to be based on some aspects of physiography. In view of the general variation in agricultural landuse over the area of the district, slope, relief and soil were selected as the significant factors of the physical environment for the identification micro level study.
The spatial analysis of agricultural landuse needs to understand the characteristics of some cultural variables which influencing current landuse pattern. A study of population reveals some significant variations of population characteristics in the study area. The region has shown a consistent growth of population from the beginning of the 20th century. The relative importance of agriculture in the economic activities is indicated by the size of working population engaged in agricultural (21.96 percent to total workers) in the district as a whole. This lower percentage could be attributed to the process of urbanization and industrialization. However, in the rural areas agriculture is the main source of livelihood. In the western hilly parts of the district above ninety percent workers are engaged in agricultures and elsewhere about eighty per cent of the work force is still in agriculture. The proportion of owner cultivators in the total farm workers is more in the northwestern and southeastern parts and the proportion of agricultural labour is more in the western parts and irrigated tracts. Inequality in agricultural income basically has stemmed from the inequality in the distribution of land holdings. The average size of holdings in the district is 2.023 ha. (small holders less than 2.023 ha.).

The district has a relatively lower proportion of NSA under irrigation (5.4 per cent) as compared to Maharashtra. The western part of the district has larger irrigated areas as compared to the eastern hilly tracts. Availability of irrigation facilities is a very significant factor influencing the productivity as well as the progress from subsistence to commercial level of economy. An analysis of temporal variations in the irrigated areas under different crops reveals very insignificant position that the future of agricultural
development mainly lies in the proper and optimum utilization of available water resources.

The increase is accessibility is mostly linked with the extension of road system in the district. Many villages, particularly in the eastern and northeastern hilly parts are partly or totally cutoff in the monsoons. In the eastern mountainous areas with high rainfall, market centres are absent or less frequent on account of low marketable surplus, poor accessibility and low purchasing power of the farmer. In the irrigated tracts an increase in the number and size of weekly markets and regulated markets is observed.

The temporal analysis of general land utilization indicated clearly that the landuse pattern has remained the same since 1981. Land under forests, NSA and area not available for cultivation account for a major share of the total area and these categories do not display considerable fluctuations. The significant changes observed in case of area under cultivable waste, pastures and grazing lands, fallows and areas sown more than once can be attributed to the variations in the human response to the various aspects of land. The marginal changes in the landuse are associated with the cultural factors like urbanization and industrialization. Remarkable changes in the area sown more than once can be attributed to the human efforts in the direction of intensification of agriculture.

Spatial variations in land utilization bring to the fore the influence of certain physical and cultural attributes, particularly relief. Variations in the net sown area indicate a strong influence of relief and slope. The proportion of NSA is very small in the central north-south hill ranges running parallel to the Arabian Sea and eastern hilly parts with steep slopes. It increases progressively westwards in the broad open valleys and western coastal plain. The
spatial distribution of cultivable wastes and forests exhibit a concentration in the eastern hilly tracts and decreasing proportion in the western coastal plain and northern parts. Land not available for cultivation does not show much variation in the different parts of the district.

A temporal variation of agricultural land use gives past and present position of principal crops grown in the district. The cereals which occupy about forty five per cent of the NSA have experienced a noticeable decline in the volume of change in the three decades. Rice and Hill Millets both have lost some areal strength, pulses and fruits have shown some positive change in the volume. Pulses show fluctuating trends but fruits and vegetables show a high positive volume of change. The groundnuts and total oilseeds do not show a noticeable increase in the last three decades. These trends clearly indicate a shift from traditional Pulses and Hill Millets pattern to the increase in importance of the cash crops.

A study of crop ecology helps understand the spatial patterns of crops. The choropleth maps demarcate clearly the areas of concentration of a crop. Distribution of Hill Millets is largely governed by relief, nature of slope and type of soil i.e. the moisture retaining capacity of the soil. Heavy rains are disastrous to both Pulses and Hill Millets. This explains their absence in the western coastal plain. In the south east and north east zone Pulses and Hill Millets compete with each other for area1 spread but in the western parts the soils do not support Hill Millets. The distribution of oilseeds and pulses is strongly influenced by rainfall and temperature conditions during growth period. Both are spread over small areas in the eastern, northeastern and southeastern part. Pulse crops like tur (kharif) and gram (rabi) are taken along with major crops, generally in alters the rows. Besides the physical environmental
factors, irrigation and the farmer’s economic strength are other two major factors influencing the distribution of cash crops. Rainfall is the main limiting factor in case of rice followed by temperature and type of soil, whereas, The hill millets are concentrated in the eastern parts of the district and generally are grown on sloping lands with poor soils as better lands are given to rice in this part. Thus the spatial distribution of crops shows a strong influence of climatic and edaphic factors except for the cash crops which show strong association with irrigation and economic strength of the farmer.

The location of agricultural landuse is further analysed with the help of correlation and multiple regression techniques and time series analysis. In all fifteen variables were included in the analysis. NSA, grass, rice, pulses, hill millets, and fruits and vegetables were treated as dependent variables. Irrigation, accessibility, owner cultivators, population density, slope > 30, slope > 60, < 60, distance from coast and distance from stream were the independent variables. The simple bivariate correlations are useful in the initial stages of locational analysis. These correlations tell us what are the relationships. The correlation analysis brings out clearly the importance of physical factors like slope and distance from coast (rainfall) and economic factors like irrigation and accessibility as factors influencing the landuse patterns. The higher proportion of cultivators in the hilly tracts and higher proportion of agricultural labour in the irrigated tracts is clearly brought out. However, the distance from major streams which differentiates between valley and divide locations does not show significant relationships with the landuse types except for hill millets. The multiple regression model.

\[ Y = a + b_1x_1 + b_2x_2 + b_3x_3 + \ldots \ldots + b_mx_m + e \]

brings out the functional relationships between the variables. In all six regression equations were derived for six landuse types. The partial
correlation coefficients derived indicate the relative importance of each independent variable in explaining the total variance. The multiple regression analysis reveals that among the set of selected independent variables those related to physical environment like slope \( \geq 3^0 \), slope \( > 6^0 \), \( < 6^0 \), distance from coast and distance from stream to be more important than the factors chosen to represent the socio-economic environment like irrigation, accessibility, owner cultivators and population density. Only in case of cash crops the most important variable contributing to the total explained variation is irrigated area. Accessibility does not appear in any of the regression equations. The total variation explained \( (R^2) \) is maximum (69 percent) in case of NSA, for rice, hill millets and cash crops it is between 50 to 60 per cent, for grass it is 48 per cent and is minimum in case of pulses (26 per cent).

The time series analysis to the temporal data for the observations of (1981-2008) is aimed at investigation the temporal changes of agricultural landuse and general landuse. Time series analysis helps us to predict future condition with help of forecast trend. Forecast trend explain that there is growth in the areas of area sown more than once. Based on the loading of the fourteen variables on the seven components the following seven dimensions are identified.

Delimitation of crop association region is done in three steps i.e. analysis of areal strength of crop by arbitrary choice method, crop combination analysis using Doi’s method and lastly demarcation of crop diversification regions. Ranking by arbitrary choice method reveals dominance of rice and grass in the western part of the district, of hill millets in the eastern transitional zone and of pulses in the northeastern parts as first rank crops, Rice and hill millets are found to be associated with each other in the eastern
parts, pulses and oilseeds in the transitional and eastern parts, rice and cash crops in the irrigated area and hill millets and pulses or fruits in some isolated patches. Pulses, grass and cash crops are important as third rank crops to define one hundred fourteen villages. The combinational analysis reveals that thirty villages are identified as monoculture areas, with rice as important crop; hill millets, pulses and rice appear in various combinations with each other to define one hundred thirty two crop combination regions. Three hundred fifty five villages have three crop combinations where rice, hill millets and fruits and vegetables continue to be the main constituents. All crops appear in various combinations to identify three hundred fifteen villages in four crop combination regions. Lastly, two hundred fifty eight villages have five crop combinations. The generalized spatial pattern of crop combinations from west to northeast is patches of monoculture – two crop combination – three, crop combinations are in various patches – four, five crop combinations along eastern margin and some patches in the central and northwestern part. The spatial variation in the number of crops in combination reflects their relationship with the physico-socio-economic attributes. Monoculture is practiced in the western coastal plain and central low land parts but the transitional zone moderate slope offers a variety of crops that can be successfully grown. This analysis results into identification of crop association regions.

The sample villages selected from each crop diversification region exhibit some characteristics which are common to all of them but in other aspects they differ from one village to other. In all the sample villages there is not much scope for further expansion of the area under cultivation. The only possibility of raising the production is through Intensification of agriculture. The small farmers (holding
below 5 acres of land) do not possess all the implements needed for agricultural operations. They have to borrow some of them (including even bullocks) at crucial periods. Medium (5 to 10 acres) and big (above 10 acres) farmers generally possess all the necessary implements. In the irrigated areas medium and big farmers own some mechanized equipment including electric pumps and tractors. Among the agricultural workers proportion of owner cultivators is very high in the villages where agriculture is predominantly of the subsistence nature. In the irrigated tracts (e.g. Vangaon) the higher productivity and intensification of agriculture leads to a higher demand for agricultural labourers and, at times, labour migrates to these areas.

The input-output structures of the crops grown in different parts of the district bring out the importance of irrigation, the size of holding, and the economic strength of farmers. The inputs for the crops grown with irrigation are two times that for the same crops grown in unirrigated area. The inputs in case of vegetable and fruits are comparatively higher, for these crops the fertilizers and manures account for about 30 to 35 per cent of total input and irrigation charges vary between 5 to 20 per cent of total inputs. The yields also differ with respect to differences in inputs and quality of land. The yield of rice varies from 12 quintals / acre in the case of small holders with fewer inputs to 20 quintals / acre in the case of big farmers with higher inputs. Yields of hill millets and pulses in the eastern tracts are very low i.e. 4 quintals and 5 quintals per acre respectively.

In the hilly tracts and unirrigated areas farmers are by and large conservative in their attitudes towards adoption of new techniques. In the irrigated tracts, however, even small farmers are progressive in their attitudes. In general the landless labourers and small
farmers placed “Jobs” as their first priority whereas the big farmers needed capital to carry out various agricultural operations. In the irrigated tracts even the small and medium farmers asked for capital inputs and an efficient distribution system to avail themselves of the improved seeds, pesticides and fertilizers at proper time.

The observations and results of the analysis summed up above indicate that the objective with which the research project was taken up has been fulfilled. Though the general landuse pattern has not changed significantly over the last three decades, the spatial variations in land utilization being to the fore the strong influence of physical environmental factors. This is reflected in the farmer’s decision making process leaving not much room for choice of crops. The process of commercialization has begun but is mainly confined to the irrigated tracts. The farmers operating unirrigated lands are still at the subsistence level and are likely to remain in as subsistence farmers unless a breakthrough in the methods of cultivation brings about any significant change. The quantitative techniques like simple correlation, multiple regression and time series analysis used here further substantiate the strong influence of physical factors upon agricultural landuse. This quantitative analysis has helped to find out the contribution of each independent variable in the explanation for locational variation in agricultural landuse, and time series forecast trend helps to analyse temporal variation and predict future condition.

It can be stated that in the conclusion, present study brings out clearly the relationships between the factors of physical environment and the spatial and temporal variations in the agricultural landuse in a developing region as well as the general landuse. Also it can stated that the temporal variations in socio-economic conditions. The initial hypothesis is strong influence of
physical environment on agricultural patterns which formed the basis of regionalization using physiographic and climate as the major influencing factors, has been validated by the quantitative analysis of these spatial and temporal variations.