ROLE OF TRANSPORT AS A CONSTRAINT FACTOR IN AGRICULTURAL LAND USE IN NASHIK DISTRICT BY

MRS. ASMITA PRATAPRAO DIGHAVKAR

THESIS SUBMITTED FOR THE DEGREE OF
VIDHYAVACHAPATI
(DOCTOR OF PHILOSOPHY)

FACULTY FOR MORAL AND SOCIAL SCIENCES
DEPARTMENT OF SOCIOLOGY
TILAK MAHARASHTRA VIDYAPEETH
PUNE

UNDER THE GUIDANCE OF

Dr. Vishal Jadhav
Mumbai University, Mumbai

August 2014

DECLARATION

I hereby declare that this dissertation entitled **ROLE OF TRANSPORT AS A CONSTRAINT FACTOR IN AGRICULTURAL LAND USE IN NASIK DISTRICT** is written and submitted by me at the Tilak Maharashtra Vidyapeeth for the degree of Doctor of Philosophy.

The present research work is of original nature and the conclusions are based on the data collected by me. To the best of my knowledge this piece of work has not been submitted for the award of any degree or diploma in any University or Institution.

I further declare that the material obtained from other sources has been duly acknowledged in the thesis.

Date:- —/—/2014
Place: Pune

Mrs. Asmita Prataprao Dighavkar
(Research Student)

CERTIFICATE

This is to certify that the entire work embodied in this thesis entitled **ROLE OF TRANSPORT AS A CONSTRAINT FACTOR IN AGRICULTURAL LAND USE IN NASIK DISTRICT** has been carried out by the candidate Mrs.Asmita Prataprao Dighavkar under my supervision/guidance in Tilak Maharashtra Vidyapeeth, Pune. Such materials as has been obtained by other sources and has been duly acknowledged in the thesis have not been submitted to any degree or diploma of any University or Institution previously.

Date: —/—/2014
Place: Mumbai

Dr. Vishal Jadhav
(Research Guide)

Acknowledgements

This thesis is written under the Guidance of **Dr. Vishal Jadhav**, Research Guide Tilak Maharashtra Vidyapeeth, Pune. I thanks to **Shri C.S.Sangitrao- I.A.S**. (Retd.) then Secretary Transport & Excise Government of Maharashtra, **Dr. Shri. Shailesh Kumar Sharma**, I.A.S. Secretary Transport Government of Maharashtra,

Mr. V.N.More, I.A.S. Transoprt Commissioner Maharashtra, for there kind Co-operation and support. I also express my sincere gratitude to my father **Shri Vasantrao Daulatrao Deore** and my mother in law **Mrs.Kamlabai Ramchandra Dighavkar , Prof. Dr.Jaiprakash Jadhav** and **Dr. Suyog Kulkarni** being so Co-operate and supportive with me for last three years.

Nobody has been more important to me in pursuit of this work than the members of my family. I wish to thank my loving and supportive husband **Dr. Prataprao Ramchandra Dighavkar, I.P.S.** for assisting me in every possible way and also motivate me, **my daughter Dr. Sharyu, son Himanshu** all of them ensured that I get conducive atmosphere to complete my research work with zeal great contribution and with high sprit.

I am grateful to **Dr. Umesh Keskar** Registrar, Tilak Maharashtra Vidyapeeth,

Dr.Karker Dean, and Faculty for Moral and Social Sciences, Tilak Maharashtra Vidyapeeth,Pune.

This work is an outcome of sincere help and co-operation from many other people. I express my deep sense of gratitude and sincere feelings to all of them. Without their support this project could not have seen the ray of the day.

Mrs. Asmita Pratap Dighavkar

CONTENTS

LIST OF TABLES

LIST OF MAP

Chapter 1

INTRODUCTION

1.1 Introduction

Transport is considered as a major plank of infrastructure for growth and development as it provides basically) linkage of nodes and canters with its means and modes. The meaning of transport has been understood by economists, Planners, engineers and geographers with a different sense and widening the horizon of the text. Transport is studied in terms of spatial expression which examine the pattern. Broadly speaking the subject matter of transport can be categorized as (i) pattern of transport network (ii) Study of junctions and nodal Joints or terminals i.e. ports and airports (iii) Study of commodity movement forming commodity flow and flow analysis (iv) Study of people movement forming traffic flow and flow analysis and
(v) The entire system of hinterlands and hierarchical relationship associated with network.

Transport network plays a pivotal role in reducing the spatial disparities and bringing about a balanced and integrated development, this could be “basic infra-structure helping in the proper exploitation of the regional resources of the region and transport network is thus a necessary element of spatial expression. The linkage and flows between centers, their nature and size, function and accessibility are basic consideration in structural aspects.

The earth surface is not uniform if isotropic. Some areas are favorable for human habitation, some are rich in minerals, some have abundance of water, plants and animals and some areas have deep fertile soils suitable for agricultural purpose. If these different areas could move freely to the places of their demands, then there would be no need of developing artificial system of movement and in that situation the space economics would be perfectly uniform. But the practical situation is quite different. These areas are quite far apart from each other and are fixed. Unless they are joined or linked or made to interact with each other no space economy of any

sort is possible For the basic needs of his survival, man directly depends on the environmental resources, which if not available or scarcely available may narrow down the chances of human survival. Human beings are therefore bound to move to various places for various resources and requirements just to augment and ensure the possibility of their existence.

The creation of society and economy may be considered as the byproduct of this critical movement process. This necessitates the development of a system of spatial interaction which in turn demands the creation of a comprehensive and an efficient transportation system. The development of an efficient transportation system is important not only for effective unitization of resources and the mobility of people and goods but also for creating all organized society and space economy.

The space economy thus responds to requirements of intra-sectoral and inter-sectoral and intra-regional and inter-regional relationship through bilateral and multilateral commodity flow occurring over a range of varying distance from one discrete node to another in the network of an interactive system and not along spatial continuum as is the case of surface flows in a stream. The spatial elasticity of demand and the critical range of these flows are greatly influenced by two factors (1) the dynamic requirement of the development process as reflected in the structure and pattern of the inter-sectoral linkages, and (2) the resources availability and the location of economic activities over space.

An efficient road transportation system is of vital importance to economy of any nation. Road transport occupies a dominant position in the overall transportation system of India due to its advantages in terms of easy availability, flexibility of operation, door-to-door service and reliability. Road transport has been acknowledged as the primary requirement for the development of basic infrastructure such as agriculture, industries, and power sector leading to overall economic growth of the country. Roads are an enormous national investment and require maintenance to keep them in satisfactory condition and ensure safe passage at an appropriate speed and with low road user costs. Without timely maintenance, roads deteriorate considerably, leading to higher vehicle operating costs (VOC), increased number of

accidents and reduced reliability of transport services. When the maintenance work can no longer be delayed, it will often involve extensive rehabilitation, and even reconstruction, costing many times more than timely maintenance treatment carried out earlier. Late or inadequate maintenance will increase the ultimate repair costs, road user costs and inconvenience to road users, and reduce safety. Road maintenance is therefore an essential function and should be carried out on a timely basis.

1.2 Perspectives on the Role of Transportation in Regional Development

The basic objective of the thesis is to focus the role of transportation in regional development. To illustrate the relevant issues, examples have been drawn from India. At the outset concept of regional development is precisely discussed. Prior to summing up, an agenda for the future is also presented.

Regional development may be defined as a strategy to achieve certain desired socio-economic goals such as provision of minimum basic needs to the masses and elimination/minimization of striking dichotomy in the standard of living of the two distinguished groups of people, one residing in the big cities and the other in the rest of the vast rural areas (Singh, 1973) taking care of disparities also within the cities that the rural areas in a holistic perspective. Obviously, it involves building-up and strengthening of resources base and spatial as well as functional co-ordinating of settlement system starting from the lowest level to cover up the entire country in an integrated manner. For this purpose the country needs to be divided into hierarchies of regions characterized by intrinsic wholeness and social unity. Of late has been added the dimension of sustainability (economic, social and ecological). It follows from the ‘foregoing that the realization of the objectives described above is not being possible without an appropriate provision of transportation facilities in a spatio-temporal frame-work. Needless to mention that in the light of regional development being a joint venture of experts from various associated disciplines, the geographers equipped with their unique integrative synthesizing technique embodying theories and methodologies based on spatial variables, and economic models and generalizations can contribute significantly to these fields.

1.3 Transportation and Regional Development Relationship: An Overview

Transportation being a seminal factor for any kind of economic activity plays a crucial role in the process of development particularly in terms of spatial economic integration, a key element of regional development and planning. In general a reciprocal relationship has been observed between transportation and regional development, the former providing infrastructural base for the latter and the latter acting as stimulant to evolution and expansion of the form. It is pertinent to mention that the nature of relationship between transport and regional development is subject to change with reference to time and space. And investments in transportation have been found to be positive as well as negative in spectral and spatial consequences. In a broader perspective, two possible impacts (Gauthier 1970) of transportation on development" could be noticed viz. (a) positive (B) permissive investment in transportation may create polarized space inconsistent with the spatial objective of their regional development programmers (Hoyle, 1973). Thus it has to be meticulously investigated. It is advantageous to extend or otherwise improve the net whether limited capital resources available for investment might more efficiently or beneficially be used in other ways. (Weitz, 1971) Ironically; India's transport network considered suitable forty years ago and large in the same form with similar problems. The positive role of transportation in regional development has however, been better acknowledged. In this context Wheeler (1973) stressed the need to study transportation in societal perspective underlining its contribution to the process of industrialization, economic specialization and socio-economic underdevelopment. Similar are the ideas of Hoyle (1973) who observed that the interaction between the level of living pattern of transportation facilities and the average level of living of the population of an area is a critical factor affecting economic and social progress and it needs to be taken into account at all the stages of national and regional development planning. As a matter of fact the formation of regional hierarchies is initially related with the levels and patterns of development of network of transportation and communication. As experiences have shown the objective of a country to achieve optimum economy through regional planning can be realized

effectively by controlling transportation and therefore circulation (London, 1959) in many cases, in order to avoid bottlenecks in the execution of the plan it becomes imperative to provide for a well coordinated transport network with requisite capacity in advance. So, quite relevant is the observation of Belousov (1964) that ·no regional planning scheme can be considered complete or can be properly evaluated if it does not provide for transport links and does not envisage transport network necessary to achieve the planned development.

1.4 Transportation and the Rural Development:

The transport network introduces an element of dynamism and mobility in the locational structure and pattern of the region. It provides an effective system of vital arteries around which the functional organization of an area takes place. It serves both the short term function of satisfying the demand for movement between areas and long-term function of helping the growth of places by inducing changes in comparative advantage as a result of changes in accessibility and relative location. Thoman and Corbin (1974) rightly observe that today's volume of consumption, production and trade would not have been

possible without large-scale transportation and communication. Particularly vital is commodity movement which is as important to the functioning of the world's economy as the flow of blood through the human body. Without transportation the functional differentiations of areas into various specialize types of land and indeed the existence of cities themselves, in the modem sense, would be impossible. Transportation by providing a means for moving people and goods to places, where they can be more useful permit to concentration of labour -force and material for carrying on manufacturing and trade and is, therefore, indispensable to the development of cities. However, the improved facilities of transportation in, a region considerably favour the growth of productive opportunities and potential market and increase the possibility of economic expansion. In fact the transport networks are demonstrably part of the development infrastructure with high and low densities may be reasonable linked to their general level of economic development.

In view of the diversity of resources availability over space, it is expected that various regions would specialize in different production processes. As regional specialization proceeds with development, the economy of scale, agglomeration and urbanization emerges on the scene as important determinants of location of productions process at different levels of settlement hierarchy. Each region thus specializes in the production advantage compared to other regions. However it' may be noted that comparative advantage by itself is not a sufficient conditioning for inter-regional trade. The absolute difference between prices in different regions must also be considered in relation to transport costs.

There is a tendency in various regions of an economic system to concentrate their trade with a few regions rather than job. All the regions of the on system is because of the friction of distance or distance decay process. In this way the system of inter-settlement interaction gets enmeshed in to the system of inter- regional trade. The inter-meshing of these two operates within the national space economy which is bound by traffic barriers, a common currency and an integrated transport network. It is through these processes that a loosely knit and weakly connected system of settlements gets transformed into a highly differentiated and well integrated field of unified home market in national space. Thus, the interdependencies of various sectors of economy form the basis of spatial interaction and through a transport

Network, result in commercial exchange within regions. The whole process thus goes on and strengthens the process of regional development and transportation. There is, of course a symbiotic relationship between the levels of transport development (level of interaction) and the process of urban-industrial growth and the concomitant process of culture change in any region. If the interactions are symbiotic and not exploitative the rural areas would specialize in products which would be shipped to the urban areas in form for food products add and raw-materials in exchange for wage goods and technological inputs into agriculture which are the specialties of the urban manufacturing sector. Viewed thus, the exchange of commodities is intended to provide intermediate inputs and final demand

requirements to both the rural and urban segments in terms of their respective economic basis. The process of such exchanges is linked to the system determining the level of spatial interaction and the national development by formulating the widening of domestic market which is essential to regional economic growth.

An efficient system of transport helps accentuate the process of resource utilization and management in various regions, creation of employment opportunities, utilization of local skill and enterprise, improvement in income and living standard of the people and elimination of poverty, inequality, deprivation, exploitation etc. which ultimately lead to the balanced rural development and growth. Hence the study of evaluation and meaning for the transportation facilities which aim at rationalizing the routes and the modes of transport in a region should constitute the regional part of regional development planning.

1.5 Review of literature

The project opens up with an article of D.N. Singh (1969) on “Perspectives on the Role of Transportation in Regional Development” He emphasizes development making contextual perusal. Moreover, D.N. Singh (1969) explored the certain practical limitations of rail network quoting two examples of two states one from Bihar and another from Madhya Pradesh. In this rail net has overlooked the places of potential deposition of mineral resources whereas construction of Howrah-Patna-Mugalsarai line is an irrational layout of the rail net in Uttar Pradesh. D.N. Singh (1969) reviewed the studies carried out by geographers and economists and put forth a possible agenda for transportation and its layout for the future. An article entitled “Road Transport and Regional Development - A case study of Mandya District” written by Dayanand. He has presented, and analyzed the level of regional development and later on this is correlated with the road transport in Mandya district in Karnataka. This study is based on the certain selected indicator regarding road transport. The author has computed component analysis to identify road transport region at tahsil level.

B.N. Mishra and Vandana Shukla (2010) have stressed and examined the analytical analysis of existing transport of Bara Tahsil in Uttar Pradesh in which the authors have the problems of transportation confronted in the study region and have suggested a suitable possible plan for the deve1opment of effective transport network. Here emphasis was given to rural transport development. The proposal suggested regarding transportation planning for the study area seems to be worthwhile. B.C. Vaidya (2003) studied transportation of Backward and Tribal Dominant region entitled "Transport network and planning strategy for backward region in Maharashtra - A case study of Gadchiroli District'? This study explicitly examined the existing transport and its importance and future infrastructure in the district. Vaidya (2003) felt lack or road network in some tahsils is responsible for the slow development in the district.

Another paper on "Transport Development in India - A Case Study of Andaman Island" is written by Ratan Majumdar (1990). Majumdar outlined the historical evolution of transportation in Andaman Island. The author found out the linkages through various means is considered as a crucial factor in handling the goods and people of this Island in order to explore local resources and is hopeful of opening up a newer transport network in the study region.

Abani Kumar Bhagabati (1984) wrote paper on "Road Network and Accessibility Pattern of Urban Centers in Assam". In this paper the author has tried to highlight major characteristics of transport in Assam. He has selected major urban centers for the study in Assam state and its transportation. Finally the author has mapped out accessibility of various urban centers and correlated with transport indicators. It was found that the size and spacing of towns are significantly correlated with transport development.

The article entitled "Transport and Rural Development in Dakshmin Dinajpur District of West Bengal" was written by M. M. Jana. This paper deals with the development of transportation and its impact on rural areas. He has studied transportation with using at police stateion data for the district. Moreover the author

has found out that the lack of transportation in rural area is a crucial factor for accelerating the slow pace of development and has suggested some new effective measures for rural development in order to enhance and increase agricultural activity in the region transport network and the amputation of Sprinkler irrigation in desert land also. Such irrigated patches are linked with the transportation network in Bhiwani district. The author has rightly pointed out 'the positive relationship with irrigation and road density. Moreover he has stateistically proved that road length increased with increasing area extent under sprinkler irrigation in the study region.

Transport and economic development in Andhra Pradesh was studied by J. Shivaram in which transport development has been thoroughly examined using huge data In addition the author has assessed the types of transportation available in Andhra Pradesh. The development was assessed through various five year plan periods and finally he has dealt with expenditure estimated on transport. C.K. Degaonkar (1998) in her paper on "Transport Development in Karnataka -' A regional Analysis" outlined road and railway network in the state and she correlated transportation network with the development by computing the index value. The interpretation is found quite worthwhile.

The paper written by P.C.Tawari and Bhagwati Joshi (2012) on "Socio-economic and Environmental Implications of Road development in Himalaya" has thoroughly assessed road development and finally found out the road density pattern in the study region. The authors have stressed .The Central Himalayas transport where there is a scope to enhance transport facilities that would be practically helpful to exploit local and regional resources of the study region. Moreover the authors have outlined the road density of all the districts belonging to the study area. The authors have also estimated the road length for the year 2001 in Central Himalaya. It was noteworthy that the authors explained and correlated" the road and rural transformation growth of settlements and urbanization and possible tourist's places for the future lay outing of road network. In conclusion the authors have pointed out the need of inter-development collabouration among road, forest and soil conservation departments in order to have an effective transport development in the

study area. S.K. Sharma (1979) in his article entitled “The Study of Transport Development in Madhya Pradesh” has mainly dealt with the association between industrial development and transport network in the study area. For this he has assessed the transport progress and industrial development in Madhya Pradesh and computed the degree of development within Madhya Pradesh. The author supplied huge data of growth and length of roads and railway routes from the year 1956-1993. He has computed the road density for all 459 development blocks and finally mapped out six areas/zones of various levels of transport development with mearung interpretation in the text.

The research paper on “Planning Strategy for Road Transport Network in Sheonath Basin in Madhya Pradesh” Written by Z.T. Khan and T. R. Dehre (2001) rightly focused on the problems encounter in the existing transportation in the study region and has suggested a meaningful and sound plan for future worthwhile transport development. The authors concentrated in this study on the aspect of road transport as it has highly linked and connected the rural under-development and the developed area. The block wise study of Sheonath Basin has been mapped out to identify the accessibility level interpreted in the text. The capability of roads and utilization level has been computed and explained with the feasibility of new strategy to be adopted for speedy transport development in Sheonath Basin in Madhya Pradesh. T.R. Nath thoroughly examined the role of State Bus Corporation in the article entitled “The study of Working of Andhra Pradesh State Road Transport Corporation”. He discussed personnel structures, security and vigilance, passengers amenities, maintenance of Bus and finally examined the Financial Operation of Andhra Pradesh State Road transport Corporation in providing services and social responsibility.

The article on “The Study of Transport Facilities and Market Centers in Madhya Pradesh”, jointly written by S. K. Sharma and Archana Bhargava (1991) examines the mandi market centers in the state according to size, class, castee, income structure and availability of transport facilities in the mandies in the region. The main purpose of this study is to analyze the distributional perspective of the means of transport. The authors efforts was exhaustively related with the aspect of density

of regulated mandies, mandi-population ratio, spacing and annual income of mandies Manaranjan Behra in his paper on “Block Level Planning for Transport Development - A case study of Backward Block (Khunta) of Orissa” has critically examined the role of transport at village level. The author considers that inadequate and inefficient transport facilities cannot initiate any sort of development in an area. Therefore, it is essential to integrate the isolated villages of the block with a network of transport system. Manaranjan Bahra has rightly prepared a sound and rational plan to transport for Khunta block in Orissa.

S.K. Mahajan in his article “Road Transport and Regional Planning in Himachal Pradesh” explains the role of road transport in the state. The main objective was to analyze the importance of road transport in the regional development of the hill state of Himachal Pradesh in lieu of insufficient mechanized modes of transport viz. Railway roads, water and airways. This study is based on the secondary data for the period of 10 years (1985-1995) herein the author has circulated the growth of nationalized roads transport. Moreover the author has emphasized regional development through road transport in Himachal Pradesh to integrate rural economy with urban growth centers.

Amitava Mitra and Debarti Mitra in their article “The Role of Transport in the Economic Development of Arunachal Pradesh” have explain the existing transport system and have assessed expenditure during then seven year plan on transport and communication. The authors have also compared road development aspect of Arunachal Pradesh with all states, belonging to the Northeast region in India. The present study clearly reveals the lack of road transport which in turn prevents the growth and progress of Arunachal Pradesh in extending road transport due to difficult mountain terrain interspersed with a large number of streams and rivers. The eighth Five Years Plan has considered new road connecting Tezu in Lohit district to Ruksin in East-Siaba district that would open up access in remote areas in the state.

Debasis Das has identified the relationship between transport and agricultural land use in Birbhum district in West Bangal in an article on “Relation between

transport Factor and Agricultural Land use- A case Study. The present study was carried out with clear objectives: (i) to identify relationship between length, density of road and land use (ii) to examine the nature of association between local degree, capacity of road and land use, (iii) to study the relationship between accessibility of road and land use and (iv) to enumerate interdependence between direct connectivity of aggregate travel distance and land use. In this paper the author emphasizes the re-orient of the transport planning while considering rural environment in order to see better prospect to gear up rural resources in the district.

Article written by R. P. Tiwari on Devepoment of Transport in Tikamgarh District in Madhya Pradesh The main purpose of this study was to carry out the survey of road development through various Five Year Plans in Tikamgarh district. This study was confined to years 1951 to 1981 revealing the acts that the development of road transport began in the British period but road development took place when India became Independent from British rule.

The extensive clarification and elabourative explanation on rural transport was given by S. Samual Sundersing and E. Raja (1991) Justus in an article on "Transportation and Rural Development in India". It was that the Indian road and railway transport in rural area can' speed up effectively to make progress in countryside and therefore the authors studied transport development after the year 1950. The Maps in this regard reveal the progress of rail and road transport in India and provide easily access to mobilize local and regional resources of the region. The author not only explained transport situation in India but also identified the problems of transport in rural area where attachment is quite appreciable and praiseworthy.

P.K. Chakrabarti (1995) has attempted to focus on railway transport in an article "Transport and Economic Development - A case study of Indian Railways". The author has systematically presented certain highlights of railway transport and access railway progress right from its inception. The author also gives an account of various aspects of railway facilities and others like coach, luggage wagons and

finally establishes a positive correlation providing huge data, facts and Maps to prove the benefit of the railway in India.

The study of road transportation in Northeast India was carried by D.K. Nayak and Surendra Singh in 1998 an article on "Assessment of Transport Development in Northeast India" The authors have examined the various parameters of socio-economic development and have justified how transport factor contributes as a major factor in the process of development of the region. It was found that road density in Northeast part is very low due to the physical hindrance of mountain terrain. After study, in depth analysis of transport the authors have emphasized the orient policy to build newer road network in this region, particularly in rural areas urban centers should be linked with countryside to mobilize local and regional resources in Northeast India.

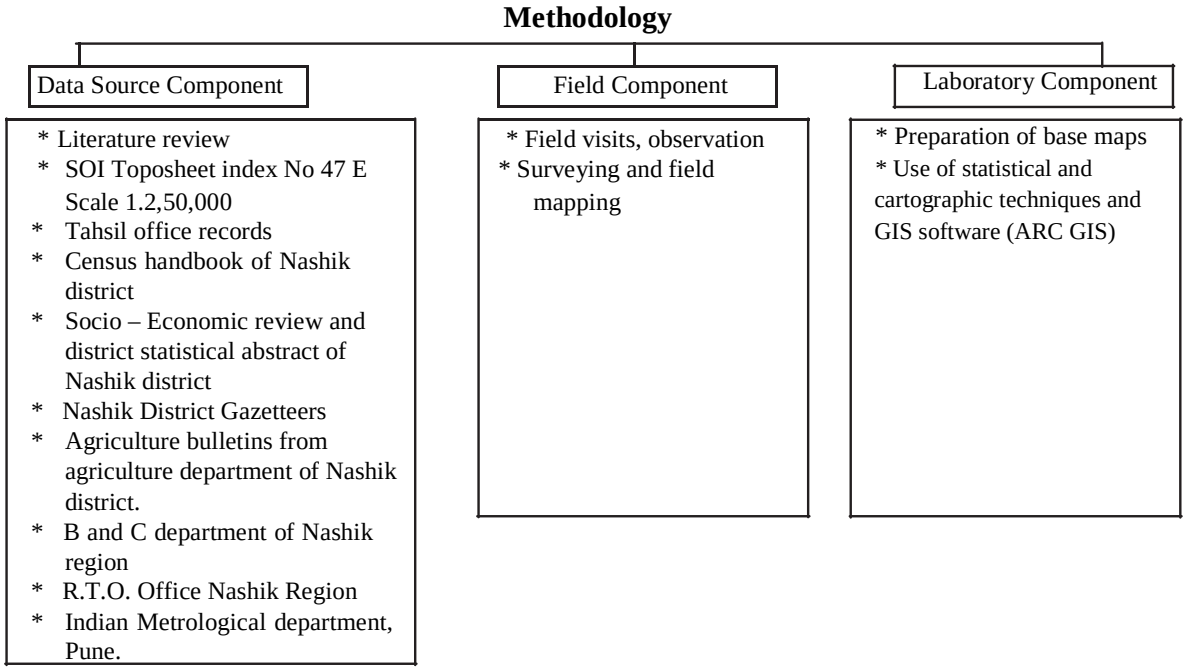
1.6 Objective

1. To study the regional variation of study region.
2. Understand the impact of transportation on General land use pattern.
3. Understand the impact of transportation on Agricultural land use pattern.
4. To understand changing economic stateutes of region with respect to changing land use pattern and transportation network.

1.7 Hypothesis

5. Transportation plays an important role in regional development of land use pattern, with impact on the economic stateus of regional people in respect of changing cropping pattern

1.8 Methodology:



The spatial aspects of agricultural land use in Nasik District are studied. This necessitates the development of a regional frame for the analysis data. The spatial patterns of land use revealed through maps were based upon quantitative analysis. The data collected through primary and secondary sources were processed and represented by stateistical and cartographic techniques. The various methods and techniques used" are explained the work of systematic analysis has been accomplished mainly through the use of the cause and effect models of analysis avoiding the relevant sections in the text. The work of systematic analysis has been accomplished mainly through the use of cause and effect models of analysis avoiding passive description, as for as possible. A spatial analysis based on this methodology covering a period of twenty years from 2001 to 2011has thus facilitated the understanding of land use behaviors of the region. For enhancing the quality of the work further the smallest viable administrative unit of tahsil has been used' in the study.

1.9 Sources of Data:

The main body of the data used is collected from the secondary sources. The study is based on the use of tahsil as a unit of observation to understand the spatial variation in the general and agriculture land use.

1.10 Secondary Sources:

It includes published and unpublished reports and abstracts such as socio-economic review and district stateistical abstracts, Census handbook, Gazetteers, Agricultural bulletins, published by Department of Agriculture, Maharashtra state, Nasik, periodicals published by ground water survey and development agency, Government of Maharashtra, and some unpublished documents by irrigation and power departments. These documents provide a rich back ground material in the form of vast amount of information, which is both comprehensive and iterated tahsil and district as unit of reference. Season and crop report published by the Government of Maharashtra formed a major source of data on land use and cropping patterns at District level.

District census handbook (2001 and 2011) of Nasik District compiled by the Maharashtra census office, Bombay were the other important sources of data on population, occupational classes and general land util1zation.

The offices of Talathi's provided information regarding the distribution of crops, landholding, irrigation, general land utilization, population distribution and settlements at tahsil level. However, certain limitations of data have restricted the scope of study. Tahsil is the area unit in this study.

Data of some aspects of irrigation and transport were collected from the, office of the executive engineer and office of the superintendent engineer departments of irrigation, Nasik B. and C. department, Maharashtra and Nasik region, Zilla parishad offices at Nasik, Maharashtra Engineering research institute (MERI) Nasik, and R.T.O. office of Nasik region.

1.11 Other Sources:

1 Census Nasik District 2001

2 Map of Nasik District, published by the Government of Maharashtra. 3

Topographical maps of the survey of India

1.12 Choice of the Region:-

The scale problem is fundamental in social studies. A district study would provide as with a frame on which further research can be based. Keeping this view in mind, Nasik District is chosen as an area of investigation. The choice was influenced by several considerations. Such study would provide a useful approach to obtain a more complete understanding of the problems of transportation and land use in the region.

Secondly Nasik District has a significant location in respect to the Sahyadri ranges. It is a good representative of Maharashtra State in many respect viz. geology, physiography, drainage, natural vegetation and soils. Therefore the study of the land use and transportation of Nasik District will help to a certain extent to understand the transportation of the state.

Thirdly the district has special physical base i.e. it represents large variations in the topography (mountains, hill-ranges, plain, flat topped interfluves, steep slopes - and genital slopes etc.) and climate (rainfall from above 500 mm to below 4000 mm.).

1.13 Design of the Proposed Research Work

1. First chapter is devoted to introduction to research work.
2. Second chapter shows spatio- temporal changes in land use
3. Third chapter deals with Physical and cultural aspect of study region.
4. Fourth chapter gives the idea about General land use pattern of Nasik district.
5. The fifth chapter explain agriculture pattern in study region.
6. Sixth chapter is devoted to impact of transportation on land use in Nasik district.
7. Seven chapter explain Role of transportation on agricultural land use of tribal people case study of Surgana, Igatpuri, Dindori and Trimbak tahsils.
8. The last chapter deals with Observations and Conclusions based on the study.

Finally the references, bibliography, articles and reports are listed

Chapter 2

Spatio-Temporal change in Land use

2.1 Introduction

Since 1910s agricultural land use are studies in United States under the title of rural sociology. This kind of study mainly focuses on the rural social life and cropping pattern. Such studies are done under national Department of Agriculture and land-grant university colleges of agriculture.

The farmers economy is mainly depend on the cropping pattern which studies under the sociology of food and agriculture. Other areas of study include rural migration and other demographic patterns, environmental sociology, amenity-led development, public lands policies, so-called "boomtown" development, social disruption, the sociology of natural resources (including forests, mining, fishing and other areas), rural cultures and identities, rural health care and educational policies. Many rural sociologists work in the areas of development studies, community studies, community development and in environmental studies. Much of the research involves the Third World.

According David Harvey (1982) agricultural land use and traditional thinking is the main them to understand rural sociology. Haussmann and Robert Moses (1942) focus on the process of capital accumulation from the constraints of older spatio-temporal structures. In the 21st century agriculture land use are similar in the entire world which studies under space and time, environment and place. Such kind of study came under social processes and with what effects. Continuous capital accumulation, for example, will produce a quite different set of land use forms from those achieved under some regime seeking an emancipatory, egalitarian and ecologically sensitive politics. Alternative anti-capitalist possibilities are to some degree already present, even though they are the subject of acute contestateion and struggle between factions and classes pursuing radically different interests. The issue is not one, therefore, of gazing into some misty crystal ball or imposing some classic form of utopian scheme in which a dead spatiality is made to rule over history and process. The problem is to enlist in the struggle to advance a more

socially just and politically emancipatory mix of spatio-temporal production processes rather than acquiesce to those imposed by finance capital, the World Bank and the generally class-bound inequalities internalized within any system of uncontrolled capital accumulation. Fortunately, the latter powers, however hegemonic they may be, can never entirely control changing land use (let alone the discursive and imaginary space with which thinking about the land use is always associated). Intensifying contradictions within a rapidly accelerating and often uncontrolled changing land use process create all sorts of interstitial spaces in which all sorts of liberatory and emancipatory possibilities can flourish. How and where these social movements within this process might be mobilized into a more general anti-capitalist politics is then the crucial question.

In the Europe there is also from Society similar to Rural Sociology in United State name as The European Society for Rural Sociology (ESRA) was founded in 1957. In it most of studies are based on agriculture and fisheries, food production and consumption, rural development and change, rurality and cultural heritage, equality and inequality in rural society, and nature and environmental care." (Friedland, W. H. 1982 603)

There is on international association who work for rural sociology name as The International Rural Sociology Association (IRSA). The subject matter of this association is "foster the development of rural sociology; further the application of sociological inquiry to the improvement of the quality of rural life; and provide a mechanism whereby rural sociologists can generate dialogue and useful exchange." It published in the International Journal of Sociology of Agriculture and Food. (Home Page of IRAS Web 2012)

Population of the world is increase day by day so the demand of the food increases. It leads to commercialization of agriculture production. This commercialization happens on the basis of change in technology of means of transportation. So the farmers invest more and more capital in his field also there is found change in cropping and general land use pattern. It leads to capitalism.

Capitalism is under the impulsion to accelerate turnover time, to speed up the circulation of capital and consequently to revolutionise the time horizons of development. But it can do so only through long term investments (in, for example, the built environment as well as in elabourate and stable infrastructures for production, consumption, exchange, communication, and the like). A major strategem of crisis avoidance, furthermore, lies in absorbing excess capital in long-term projects (the famous "public works" launched by the state in times of depression, for example) and this slows down the turnover time of capital. There is, consequently, an extraordinary array of contradictions that collect around the issue of the time-horizon (the temporalities) within which different capitals function (the time-horizon of finance capital, for example, is hard to match with the requirements of long-term urban and environmental development).(Harvey 1990)

Capitalism is under the impulsion to eliminate all spatial barriers, but it can do so only through the production of a fixed space. Capitalism thereby produces a geographical landscape (of space relations, of territorial organization and of systems of places linked in a "global" division of labour and of functions) appropriate to its own dynamic of accumulation at a particular moment of its history, only to have to destroy and rebuild that geographical landscape to accommodate accumulation at a later date. Reductions in the cost and time of movement over space therefore run up against the building of fixed physical infrastructures to facilitate the activities of production, exchange, distribution and consumption. More and more capital is embedded in space as landed capital, as capital fixed in the land, creating a "second nature" and a geographically-organized resource structure that more and more inhibits the trajectory of capitalist development in the midst of greater facility of movement. This tension becomes even more emphatic as the institutions of place become strongly articulated and loyalties to places (and their specific qualities) become a significant factor in political action. The production of territorial organization (the formation of local and metropolitan government systems for example) understood as a process makes territorialization, de-territorialization and reterritorialization a continuous feature in the historical geography of capitalism. (Harvey 1990)

Many if not all of the major waves of innovation that have shaped the world since the sixteenth century have been built around revolutions in transport and communications - the canals, bridges and turnpikes of the early nineteenth century; the railroad, steamboat and telegraph of the mid nineteenth century; the mass transit systems of the late nineteenth century; the automobile the radio and telephone of the early twentieth century; the jet aircraft and television of the Fifties and Sixties; and most recently the revolution in telecommunications. Each bundle of innovations has allowed a radical shift in the way that space is organised and therefore opened up radically new possibilities for the urban process. Breaking with the dependency upon relatively confined bioregions opened up totally new vistas of possibilities for urban growth. Cronon (1991) shows, for example, how the rapid urbanization of Chicago in the nineteenth century realized these new possibilities so that the footprint of that city across the whole of the American mid-West and West became ever larger as its metabolic-ecological relations changed and as it itself grew in a few years into one of the largest cities in the world. And within the city, as Platt (1991) so brilliantly shows in his Chicago-based study of The Electric City, the progress of electrification allowed the construction of radically new and dispersed urban forms.

Each round of innovation breaking the barriers of space and time has provided new possibilities. The steam engine, to take just one highly significant historical example, liberated the energy supply of cities from relatively inefficient and highly localised constraints, at the same time as it freed local hinterlands from a chronic conflict over whether to use the land for food or firewood (contemporary students now find it very odd, for example, that one of the closer rings of production with which von Thunen surrounded his city in The Isolated State of the early nineteenth century is given over to forestry). But the steam engine could only accomplish its revolutionary role to the degree that it was in turn applied to the field of transport and communications: the coal had to be shunted around. It was and is, therefore, the total bundle of innovations and the synergism that binds them together that is really crucial in opening up new possibilities.

And in this, seemingly quite small things can figure large in what created

possibilities for city growth. The military engineers and mathematicians of the eighteenth century, for example, in using water flow as a form of fortification learned that networks were far more efficient in moving water than direct pipes and channels: this recognition (and the study of the mathematics of networks that went with it) had immense significance once it was applied to cities in the nineteenth century: a given head of water flowing down one pipe can provision no more than 5,000 people but that same head of water when flowed around a network can provision twenty times that. This is a useful general metaphor for urban growth possibilities: the development of an interrelated and ultimately global network of cities drawing upon a variety of hinterlands permits an aggregate urban growth process radically greater than that achievable for each in isolation. (Harvey 2001, Pp19)

One of the peculiar and counterintuitive consequences of this process has, however, been the reassertion of the importance of monopoly power. It is not merely the fact that competition (as Marx long ago remarked and as the Microsoft example so recently demonstrates) always ends up in monopoly or oligopoly, though this has obvious relevance to understanding how a few urban centers (usually dubbed "global cities") have emerged to dominate and control the world of global finance. But it also leads cities to cultivate "monopoly rents" as attractions for highly mobile capital by selling the uniqueness of their location, their culture (frequently produced and invented at will with tremendous emphasis upon so-called "culture industries"), their urban qualities of life (infrastructure and aesthetics) and the security of their real estate markets (booming office and housing rents and values). Such locational monopolies are attractive lures for finance capital for obvious reasons. (Harvey 2001, Pp22)

But the other perspective from which to view the recent history of urbanization is in terms of popular (if not "populist") seizure of the possibilities that capitalist technologies have created. To some degree this is about the vast historical migrations of labour in response to capital, from one region to another if not from one continent to another. That formulation basically made most sense in the nineteenth and even the early twentieth century's (though there were always exceptions such as the flood of Irish overseas in the wake of the potato famine that may have been prompted by conditions

of imposed agrarian capitalism but which was hardly a "normal" migration of rural population in search of urban liberties and waged labour). But the flood of people into developing country cities is not fundamentally tied to the pulls of employment attached to capital accumulation or even to the pushes of a reorganising agrarian capitalism destructive of traditional peasantries (though there are many segments of the world where that process is very strongly in evidence). It is a far more populist search to take advantage of capitalist produced possibilities no matter whether capital accumulation is going on or not, and often in the face of economic conditions that are just as, if not more appalling than those left behind. And while one of the effects may be to create vast "informal economies" which operate both as proto-capitalist sectors and as feeding grounds for more conventional forms of capitalist exploitation and accumulation, the explanation of the movement in itself can hardly be attributed to the machinations of some organised capitalist class action. (Portes, Casteells and Benton, 1989)

Due to change in production and organizational forms there was an increasing geographical dispersal and fragmentation of production systems, divisions of labour, specializations of tasks, albeit in the midst of an increasing centralization of corporate power through mergers, takeovers or joint production agreements that transcended national boundaries. (Harvey 2001, Pp32)

The world population has almost doubled in the last thirty years. This leads to increase rapid population growth but also through mobile capital mobilizing more and more of the world's population (including women) as wage labourers.

Increase the profit is desire of each farmer so there is change in land use which leads Capitalism in farms there are many theory of land use put forward by many other. In it one known as Johann Heinrich Von Thunen was a prominent nineteenth century economist. Von Thunen was a Mecklenburg (north German) landowner, who in the first volume of his 1826 treatise The Isolated State developed the first serious treatment of spatial economics and Economic geography, connecting it with the theory of rent. The importance lies less in the pattern of land use predicted than in its analytical approach.

Von Thunen theory is a partial equilibrium approach designed to explain the type of agricultural production that would be best carried out at a given location i.e. deterministic and normative. This theory show how and why agricultural land use varies with distance from market. The intensity of production of a particular crop declines with distance from the market. Intensity of production is a measure of the amounts of inputs per unit area of land i.e. labours, fertilizers, irrigation water, pesticides etc. The type of land use varies with distance from market.

The basic principle underlying the Von Thunen theory is economic rent where by different types of land use produce different net returns per unit area. The two other relationships Thunen emphasized were distance of farms from the market and price received by the farmers.

The relationship between distance and market price is in essence a simple one. The price a farmer obtains for any unit of his product is equal to its price at the market minus the cost of transporting it to the market.

Economic rent is defined as the measures of the level of return, that the market at large would expect a particular price of land to produce. It is basically a measure of the advantage of one price of land over another. This implies that prices of land differ in some respect and that such differentiation is reflected in higher or lower returns per unit of land. Since all farmers receive the same price at any one time and production costs are also assumed to be the same for all farmers, the only basis for such differentiation is the friction of distance, that is, the only advantage that one price of land can have over another price of land is its locational in relation to the market for agricultural products. For this reason, the term lacational rent is used.

The locational rent can be calculated using the formula $LR = Y (m – c) – Ytd$

Where,

LR = location rent per unit of land.

Y = Yield (quantity produced) per unit of land

m = market price per unit of product

c = production cost per unit of product

t = transport rate per unit of distance

d = distance of the unit of land from the market.

It is mostly observed that intensity of cultivation decreases away from the city. If the farm is located close to the city will have an intensive cultivation than the one located away from it. This is because the locational rent on the crops of the farm near the city will be higher than the crops on the farm away.

The market price being the same and the price obtained at the market being the same, the locational rent will be determined by the cost of transportation. The cost of transportation will be less for produce of the farm near the city and hence a higher locational rent.

Intensity of production can be increased with the application of inputs like fertilizers, seeds, irrigation, labour etc. for both the farms nearer the city and away from city. Increase intensity will leads to higher yields and higher the yield higher will be the transportation cost. For the farm away from the city the cost of transportation will be higher and this increased transportation cost will offset to a larger extent the increased the production. For the crops grown on the farm near the city the locational rent will be higher because 1. The yields and consequently production will be higher 2. The cost of transportation is low.

Thus greater distance from the market one cannot afford to intensify the production with additional inputs and costs because the returns that are received from higher yields do not outweigh the greater transport costs to the market. More extensive cultivation is better for agricultural land away from the market since it can be done at lower cost making the returns greater.

2.2 History of agriculture in the India

In India agriculture is started 10000 years ago in which there is found domestication of crops and animals. The beginning of agriculture leads to settled life with techniques improvements and application in the field. The climate of India is monsoon types which promote two harvests seasons in a year. Due to the trade Indian products reached to world market and foreign crops were introduced to India.

In the middle age techniques of irrigation was improved remarkably it affecting the crops which leads to economies of Islamic kingdom in India. Land and water management systems were developed with an aim of providing uniform growth despite some stagnation during the later modern era the independent Republic of India was able to develop a comprehensive agricultural programme.

In India and its surrounding country there was only dominancy of wheat and barley crops and after that domestication of sheep and goat in early age of agriculture (10000 years ago). In the period of the Neolithic revolution (roughly 8000-5000 BC.), agriculture was far from the dominant mode of support for human societies. But those who adopted it, have survived and increased, and passed their techniques of production to the next generation. This transformation of knowledge was the base of further development in agriculture. By the 5th millennium BC agricultural communities became widespread in Kashmir. The cotton was grown in India in between 5^{th} millennium BC to 4^{th} millennium BC. The modern base of cotton industry is rooted very ancient time. Method of cotton spinning and fabrication continued since ancient time in India.

In Indian subcontinent there is found various fruit like mango, muskmelon etc. Wild Oryza rice appeared in the Belan and Ganges valley regions of northern India as early as 4530 BC and 5440 BC respectively. Rice was cultivated in the Indus Valley Civilization. This rice cultivation was found in Kashmir and Harrappan region of India since 2^{nd} millennium. Also mixed farming was performing in Indus valley.

The irrigation facility was developed around 4500 BC in Indus Valley civilization. This irrigation facility is developed with planned settlements. Also in this area there was

found artificial reservoirs at Girnar dated to 3000 BC and canal irrigation was started 2600 BC.

Vedic period- Post Maha Janapadas period (1500 BC – 200 AD)

In India summer monsoon is longer and have contained moisture in excess. In India, both wheat and barley are held to be Rabi (winter) crops and—like other parts of the world—would have largely depended on winter monsoons before the irrigation became widespread. The growth of the Kharif crops would have probably suffered as a result of excessive moisture. Jute also cultivated in this period for making ropes and cordage. Some trees also domesticated for worshiped and medicinal uses.

Also in this period there was found soil classification and metrological observation for the purpose of agriculture (322 – 185 BC The Mauryan Empire). In this period there was constructed and maintenance of dam for irrigation purpose.

Early Common Era – High Middle Age (200 – 1200 AD)

In the Early Common Era there was found the evidence of agricultural crops such as rice, sugarcane, millets, black paper, various grains, coconuts, beans, cotton, tamarind, sandalwood, palm etc. in Tamil people they also know about Systematic ploughing, manuring, weeding, irrigation and crop protection. Water storage systems were designed during this period. Kallanai (1st-2nd century AD), a dam built on river Kaveri during this period, is considered the as one of the oldest water-regulation structures in the world still in use.

In India the Spice trade is much popular at this time. Also in this era Chinese sericulture are practiced in India. The technique of Crystallized sugar was discovered and the earliest reference of candied sugar comes from India.

Late Middle Ages - Early Modern Era (1200 – 1757 AD)

In this age there is found the fusion of Indian and Persian irrigation technology which brought revolution in agriculture techniques. It leads to economic growth and

growth of material culture. In this era there was found agricultural zones which producing rice, wheat or millets. Rice production found in Gujarat while wheat production was mainly north and central India.

1. Colonial British Era (1757 -1947 AD)

British Empire rule over India there is found global market for commercial crops such as Cotton, indigo, opium, and rice. The second half of the 19th century saw some increase in land under cultivation and agricultural production expanded at an average rate of about 1% per year by the later 19th century. Due to extensive irrigation by canal networks Punjab, Narmada valley, and Andhra Pradesh became centres of agrarian reforms. Roy (2006)

2. Republic of India (1947 AD onwards)

After the independence Indian government drives the special program name as five year plan for the improvement of food and cash crop supply. For this they grow more food campaign and Integrated Production Programme. In this five year plan government pay attention towards Land reclamation, land development, mechanization, electrification, use of chemicals—fertilizers in particular, and development of agriculture oriented 'package approach' of taking a set of actions instead of promoting single aspect soon followed under government supervision.

In India from 1960 there was improvement of agricultural production and it supportive activity because Green Revolution (1960), Yellow Revolution (1986-1990), White Revolution (1970-1996) and Blue Revolution (1973-2002). It means that use of Biotechnology for the earlier reforms and the newer innovation of agriculture. After that market based agriculture are practiced by some Indian farmers.

Agro processing industry was emerged after 1980 which gives the more benefits to farmers. Also exports of agricultural product grow at well over 10.1 % annually since 1990s. Now a day there is one new trend known as contract farming is arise, it also gives the more benefit to the farmer.

After the independence India become one of the larger producers of wheat, edible oil, potato, spices, rubber, tea fruits and vegetables in the world. The government of India pay attention for improvement of quality and quantity of agricultural product for this they established the various institution for agriculture related research. These organized under the Indian Council of Agricultural Research (1929), The National Dairy Development Board (1965) and National Bank for Agriculture and Rural Development (1982).

Now agriculture acquires 22% of India's GDP and 58% of country's workforce engaged. Also India is leading country for the production of milk, fruits, cashew nuts, coconuts, ginger, turmeric, banana, sapota, pulses, and black pepper. India is the second largest producer of groundnut, wheat, vegetables, sugar and fish in the world. India is also the third largest producer of tobacco and rice, the fourth largest producer of coarse grains, the fifth largest producer of eggs, and the seventh largest producer of meat.

2.3 INDIAN COMMERCIALIZATION OF AGRICULTURE

When agriculture products are primarily use for sale in distant markets, rather than to meet their own needs for food or to sell in local markets is known as commercialization of agriculture. In India now a day's many commercial crops are taken like cotton, tobacco and sugarcane which fairly grow in British rule because land revenue had to be paid mostly in cash and the prices of these crops were much higher at that time relative to the prices of food grains. Thus, commercialization of agriculture in pre-British period existed only in its embryonic form.

The base of commercial agriculture in India was started during British rule because in British Rule market are expands and agricultural crops are improved by qualitative as well as quantitative. In India qualitative changes found in three stages 'First, before the British rule, product markets were constrained and subject to imperfections, given multiplicity of weights and measures, backward and risky transportation systems, and extensive use of barter. British rule and the railways weakened these constraints. By doing so, it enabled closer integration of global, regional and local markets. Second, from the time of industrial revolution, a new international specialization began to emerge

as a result of trade. India specialized, in agricultural exports. Third, in turn, changes in the product market induced changes in land, labour, and credit markets'.

A. Effects of Globalization

According to economists, there are a lot of global events connected with globalization and integration.

It is easy to identify the changes brought by globalization.

1. Improvement of International Trade. Because of globalization, the number of countries where products can be sold or purchased has increased dramatically.
2. Technological Progress. Because of the need to compete and be competitive globally, governments have upgraded their level of technology.
3. Increasing Influence of Multinational Companies. A company that has subsidiaries in various countries is called a multinational. Often, the head office is found in the country where the company was established.
4. Power of the WTO, IMF, and WB. According to experts, another effect of globalization is the strengthening power and influence of international institutions such as the World Trade Organization (WTO), International Monetary Fund (IMF), and World Bank (WB).
5. Civil Society. An important trend in globalization is the increasing influence and broadening scope of the global civil society.

B. World Trade Organization (WTO)

Until the end of 1994, there was no multilateral or international trade organization. Between 1947 and 1994, eight rounds of negotiations took place under the aegis of the General Agreement on Tariffs and Trade (GATT). The first seven rounds concentrated on tariff reductions and commodity agreements. The last round, the Uruguay Round, lasted over seven years from 1986-1994, and widened the ambit of discussions to cover subjects like tariffs, non-tariff measures, rules and services, intellectual property rights,

dispute settlement, textiles and clothing, and agriculture. The Uruguay Round of trade negotiations ended with an agreement founding the World Trade Organization. In April 1994, 104 members became signatories to the agreement with minor changes in the original draft and the final Act came into force from January 1, 1995. At this stage, the WTO membership grew to 135 countries.

The formation of WTO has posed certain challenges such as reduction of tariff barriers and liberalization of traditional trade in goods and services, etc. The WTO is not a simple extension of GATT. It completely replaces GATT and has quite a different character. While GATT was applied on a provisional basis, WTO commitments are full and permanent. Secondly, GATT applied to trade in merchandise goods whereas WTO covers a whole range of trade-related issues.

Chapter 3

PHYSICAL AND CULTURAL ASPECTS

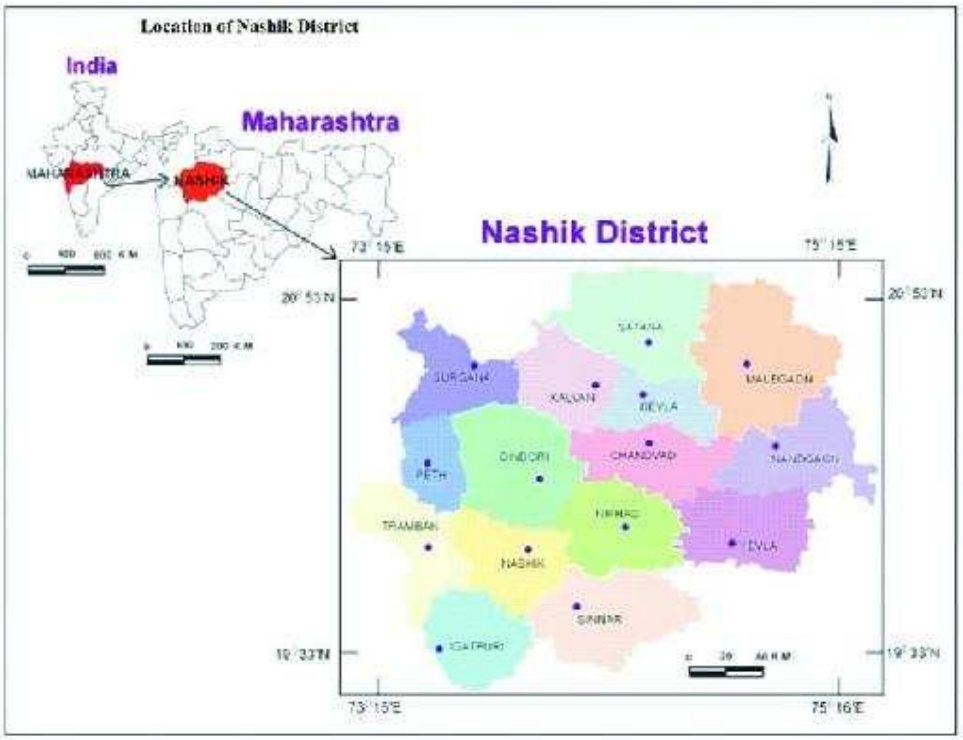
3. A: Physical Aspects

3. A.1: Introduction

Land is the basic resource of human society. Its utilization shows a reciprocal relationship between ecological conditions of a region and man. Visher (1932) has rightly put forward the theory that a specific field of sociology concerns itself with the study of the influence of natural environment on the nature and distribution of men's activities. The varied nature namely, Soil, water, climate provides different area with variety of possibilities of development (Hettner, 1947 Pp 1). It is therefore, necessary to evaluate the agricultural land use of the study region, needs to unfold the nature of ecology of the Nasik District. This chapter covers the profile of physical background of the district, i.e. Relief, Geology, Climate, Drainage and Soil.

3 A.2: Location, Situation and Site

The study region is located in 19^0 35'18" North latitude to 20^0 53' 07" North latitude and $73^0$16'07" East longitude to $74^0$56'27" East longitude, contain an area 15530 sq.km (Map no. 3.1). The total population of the study area was 4987923 as per 2001census. The length of study region is about 170 km. from South-West to North-East and breadth is about 170 km. from North to South. The study region is bounded by the Dangs and Surat districts of Gujarat state on the North-West side, on the North side Dhule district, on the East side Jalgaon and Aurangabad district, on the south side Ahmadnagar district and South-West side Thane district is located. The name of district is given due to its headquarters town of Nasik, for the origin of which two interpretations are given. The town is sited on the nine peaks or navashikhara and hence its name. The study region contain 13 Tahsils before 2000, after 2001 there was 15 tahsils like Nasik, Peth, Surgana, Trimbak, Igatpuri, Sinner, Niphad, Dindory, Kalwan, Satana, Malegaon, Chandwad, Nandgaon and Yeola. Nasik district covers 5.05% area of Maharashtra (Map no. 3.1).



Map No. 3.1

3. A 3: Geology

The study region is situated on Deccan Trap. Deccan Trap is origanated due to volcanic activity. This Deccan Trap is made up of compact, stratified basalts, and an earthy trap. The basalts are the most conspicuous geological feature. The western side of study region is in flat-topped ranges, separated by valleys, trending towards east. In few ranges the- basalt is vertical in nature which weathers into different shapes. The base of the Deccan traps is mostly amygdaloidal, showing quartz in vertical veins, crystals and zeolitic minerals, especially apophyllite which change into a gray soil. Upper area of the hills towards the south contain laterite, is a striking feature of the study area. The basalt is converted into fine texture or it is coarse and nodular in whole study region.

3. A.4: Relief

Relief features are most important in development of agricultural land use. The factors of relief such as altitude, angle of slope, aspect of slope, relative relief control

size and shape of forms and types of crop grown etc. Above 3500 meters of altitude agriculture practice is mostly not found but in very few patches agriculture practice is performed in this altitude. Because of decrease in temperature and pressure, low humidity, thin soil cover limit agricultural land use. If one observes the western part of the district it shows highly elevated terrain of the Western Ghats with peaks like Kalsubai (1646 m) and Trimbak (1294 m.). The eastern southern parts of study region shows lower plain area. Near Salher fort is found the highest peak of the study region which is 1567 meter in height and the lowest height of study region is 354 meter above mean sea level which is found near South of Bhruj.

Table 3.1 Relief: Height and total area

Sr. No.	Height (meters.)	Total Area (Sq. km)	% Area
1	300 to 450	3980.0	25.63
2	450 to 600	4889.0	31.48
3	600 to 750	4066.0	26.18
4	750 to 900	1989.0	12.81
5	Above 900	606.0	3.9
	Total	15530.0	100

(Source: Research Student)

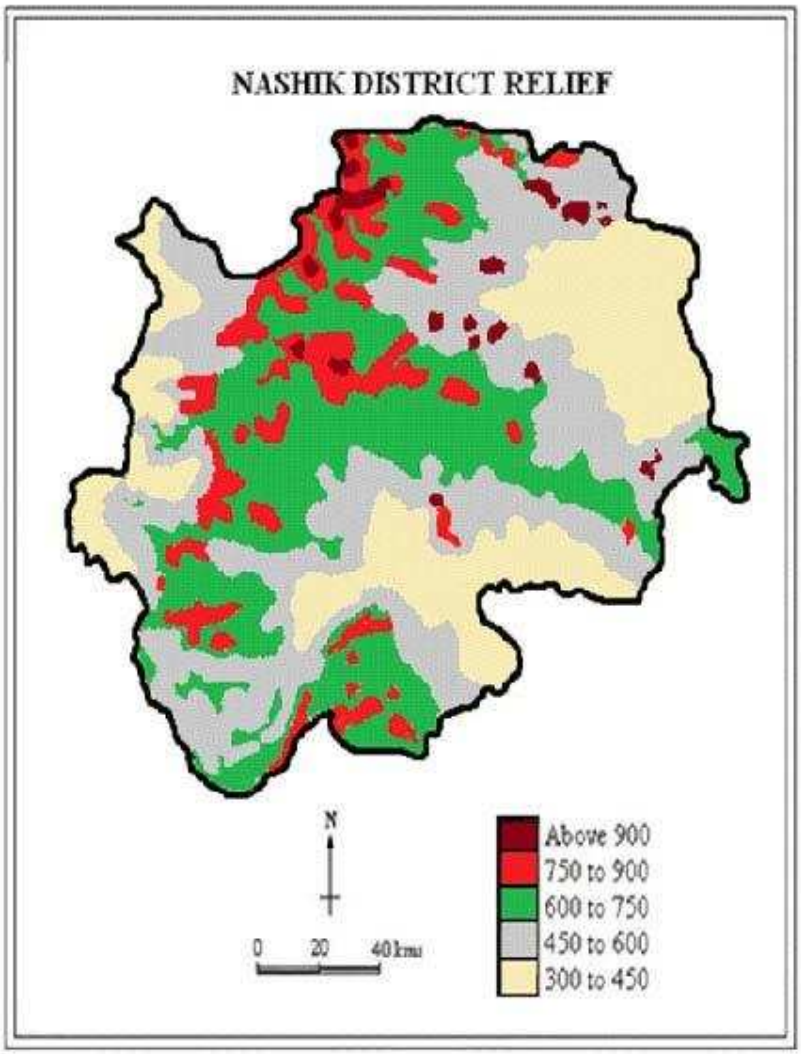
For the study purpose researcher divided the relief into five groups contain 150 meters interval they are 300 to 450, 450 to 600, 600 to 750, 750 to 900 and Above 900 these groups showing the heights in meters i.e. the study region ranges between 354 to 1567 meters. Each group contain specific area extent in the study region these areas are (Table No. 3.1)

1. The 300 to 450 group contain 3980 Sq. km. area which is 25.63% to whole study region.
2. The 450 to 600 group contain 4889 Sq. km. area which is 31.48% to whole study region.
3. The 600 to 750 group contain 4066 Sq. km. area which is 26.18% to whole study region.

4. The 750 to 900 group contain 1989 Sq. km. area which is 12.81% to whole study region.

5. Above 900 group contain 606 Sq. km. area which is 3.9% to whole study region.

The study region shows 57.11 % area comes under the height between 300 to 600 meters. On the other hand area of high height i.e. above 900 is near about 4 % to whole area. This shows available area for agriculture production is more than 60 % to total area in study region. It is good sign for development of agriculture land use in study region. (Table No.3.1 and Map no. 3.2)



Map No. 3.2

3 A. 5: Drainage

The drainage patterns are influence by the geology of the region. In the study region most of the part are made up of basaltic rocks its impact the drainage pattern of study region. This rock shows the slope towards the directions north-south (strike direction), north-west, south-east, and north—north-east, south—south-west in whole study region. So the directions of streams generally flow in one or other three sets of direction. In the study region most of river valley shows direction almost straight.

The study region contain two main river systems namely the Godavari and the Girna and their tributaries. These two river systems are separated by Satmala ranges. Also in the study region, it is observed that small west flowing rivers which go through Konkan and merge in the Arabian Sea.

Konkan Rivers: These are small streams which flow towards west side towards the Arabian Sea.

Nar: The source of Nar River is found on northern part of the Kem hill. It flows below Waghdhond, Bhintghar, Umbharade and Waghadi and forms the district boundary between Madhuri and Karanjul Petare before leaving the state to join the Par outside.

Par: The source region of the Par River is found on southern slopes of Kem hill. Upto 5 km it flow towards southwards and turn to west. This river becomes the boundary between Surgana and Dindori tahsil. This river contains one small tributary known as Barik River. This tributary joins Par River in north side. Barik River found in the Chowitta hill just north of Barhe.

Damanganga: The Dawan River also known as the Damanganga in its upper course, its source region is near Mangone (Mangunpada). This river flows towards southwards and turns westwards near Ekadare. From Ekadare this river become long and deep, near the Borpada it is joined by its tributary known as the Gordi nadi.

Val: The source region of the Val nadi is on the northern slopes of Bhaskargad. This nadi flow sometime inside and sometime outside of the study region. This nadi is tributary of the

Vag River. This river becomes boundary for study region from west of Ozarkhed. This river is tributary of the Damanganga River.

Vaitarna: The source region of the Vaitarna on the southern slopes of the Trimbak-Anjaneri range and combine into three southward flowing streams which unite to form the Vaitarna a little north of Dapure. This river contain one tributary known as Alvand nadi, whose source region is in the same Trimbak- Anjaneri range on the southern slopes of the Bhaskargad, Phani dongar and Harish dongar. After the confluence with the Alvand River, the Vaitarna turns and flows nearly straight in a south-south-west direction cutting a deep gorge in the scarp of the Sahyadris. A small tributary from the north-west to south-east in a gorge continues the course of the Vaitarna in a remarkably deeply cut valley.

Girna: The source region of the Girna is just south of Cherai village at about 8 km. South--west of Hatgad in the Sahyadris and flows nearly east along a wide bed, with high banks in some parts, but as a rule, low enough to admit of the use of water for irrigation. This river holds water up to eight month with sandy bed. Several dams have been built across the main stream, irrigating large areas of garden land. After its course through Kalwan, Satana and Malegaon talukas, it tourn towards north-eastwards as it nears the Jalgaon frontier.

Tambdi: It is the first tributary of the Girna River which joins on the left or north bank at Chandkapur. The source region of the Tambdi River is in the Hatgad which is north part of Western Ghat. The dam is constructrd on this river.

Punand: The next tributary of the Girna River is the Punand which is joining at Bej. The source region of the Punandriver is west of the Salher fort, has a fairly long southerly winding course nearly parallel to the Sahyadris before it turns and flows eastwards and south-east-wards. Its valley is deep and its banks steep and rocky, and, along its channel, in the rainy season the water flows from the hills in considerable quantities and with great rapidity.

Aram: The source region of the Aram river just south of Salher fort and after a short southerly course flows eastwards and south-eastwards to join the Girna. This river contains many tributary chiefly from the south. The Aram joins the Girna about 5 km. east of Thengode.

Mosam: This is the tributary of the Girna rise in the Sahyadris south of Hanuman hill. The Mosam has cut a wide valley where its waters suffice to irrigate plentifully, until the banks become too high to admit the use of the natural flow of the stream, which, in the dry weather, lies too far from them to allow the cultivators to raise by lifts, budkis. It joins the Girna about 3 km. below Malegaon.

The rest of the right or south bank tributaries of the Girna further up, those up to Malegaon are of small size but useful for irrigation. The chief of them are the Masa nadi joining the Girna just below Chandkapur, the Baindki and the Markandi draining the northern slopes of the Saptashring and Markinda hills respectively, uniting together under the name of the latter river to flow past Kalwan to join the Girna a kilometer to the north, the Khatki nala and the Kolthi nadi passing by Devla, the Kharf nadi, and the Parsul. There are also a few minor tributary streams such as the Suki nala and the Gulandi nala.

The two easternmost tributaries of the Girna in the district, the Panjan and Maniad are much larger in size than others, but they flow in valleys which are deep and narrow arid the banks are so high that irrigation is not practicable. These characteristics are due to the fact that they are able to cut across the Satmala watershed so as to abstract some of the headwater streams draining the southern slopes. In fact this tendency is to be found even in the Parsul on a much lesser scale. These Girna tribu-taries are very active in their headward erosion because of the much lower base level of the Girna as compared with that of the Godavari.

Panjan: The source region of the panjan is to the east of the Chandvad fort on the southern slopes of the Satmalas and after an initial southernly course, curves eastwards and then makes its way north-eastwards past Manmad by a gap cut through the Satmalas. It drains parts of Chandvad, Malegaon and Nandgaon talukas before it joins the Girna at Panjan in the last mentioned taluka.

Maniad: The source region of the Maniad is little south-west of Rajapur south of the Satmala range as the Kher nala and after a short east-south-east course bounded by a ridge to the north of it, turns abruptly to a point little beyond the district, where after it turns abruptly northwards continuing the course of a tributary and re-enters the study region. After cutting a passage in the hills near Manikpunj, it continues its northerly course and after receiving the Sakhi (Sakhambari) nala draining past Nandgaon, turns northwards to the boundary of the study region. Then it forms the district boundary for some distance and then after a short course in Chalisgaon taluka of Jalgaon district joins the Girna at Saigaon in that taluka.

Godavari: The Godavari, other local name the Ganga is very important river not only of this study region, but of the whole of the peninsular India. The source region of the Godavari is of the western side of the Trimbak amphitheatre. A larger and more distant branch takes its rise in the ridge that joins the Trimbak and Brahma mountains in a region of higher rainfall owing to greater exposure to moisture bearing winds.

Kashyapi: The source region of the Kashyapi (Kas) river is a little above Wagira in the Sahyadris and augmented by the waters of the Wotki and the Muli. This is the tributary of the Godavari River. Just at this confluence is constructed the Gangapur dam, whose storage backs up both the main river and its tributary, the Kashyapi.

Darna: The source region of the Darna is on the northern slopes of the Kulang hill fort in the Sahyadris about 13 km. south-east of Igatpuri. This river has a very long and winding course. The bed of this river is sandy in nature. There is a dam which constructed across the Darna near Nandgaon village giving rise to the storage known as Lake Beale.

Vaki: The Vaki nadi rises in the Dhoria hill and flows in a general southerly direction and passing between Igatpuri and Ghoti joins the Darna.

Unduhol: The source region of the Unduhol nadi is the south of Anjaneri hill and flows in a south-easterly course and turns in a northerly direction to the north of Kavnai hill and has a very long winding course trending to the east before it joins the Darna below the Darna dam.

Valdevi: The source region of the Valdevi River is on the eastern slopes of the Anjaneri hill and it flows in eastern direction passing by Ambe Bahula and Deolali and joins the Darna near Chehedi.

Jham: The Jham river, the easternmost tributary of the Godavari which flow in south bank.

Banganga: It is north bank tributary of Godavari River which emerges in the north-west of Ramsej hill. This flows towards east side passing by Ozar where a dam crosses it to divert the water into canals on both sides for irrigation.

Kadva: The Kadva rises in the Sahyadris to the north-west of Dindori in the angle between the former and the Satmala range, and crosses Dindori from north-west to south-east. It is rocky both in bed and bank, but the bed is wide, and the average volume of water is small compared with the area through which it flows. Irrigation works of considerable importance have been established on it.

Unanda: The Unanda is the first of these having a long course nearly parallel to the Satmalas and receives several small streams draining its slopes. Among these are the small Dev nadi flowing past Vani, the Parasheri river flowing by Pimpalgaon Basavant, the Netravati nala flowing by Vadner, the Vainatha nodi joining it near Niphad and formed by the union of two rivers, the Vadali flowing by Vadali Bhoi and the Shelu.

Gui: The Gui nadi rises in the Satmalas just west of Chandavad and is joined at Maralgoi by a similar stream, the Pimpalad nadi, rising a little further west and flowing past Lasalgaon. After a long course southwards, it joins the Godavari just outside the limits of the district.

3. A.6: Climate

The climate of study region dries except in the south-west monsoon season. In the study region there is observed four seasons they are cold season from December to February, hot season from March to May, the south-west monsoon season from June to September and the post-monsoon season during October and November.

Temperature: In the study region there are two metrological stateions they are situated in Malegaon and Nasik. These stateions are representative of the climatic The Night temperatures during June are slightly higher than during May. With the onset of the south-west monsoon early in June day temperatures decrease appreciably and the weather throughout the south-west monsoon season is pleasant. The first half of October the south-west monsoon withdraws from the study region. It is also observed that the average temperature in the month of October increase two to three degree centigrade. The night temperatures decrease progressively after September. From November temperatures decrease rapidly. In the study region December is the coldest month with the mean daily minimum temperature is 11.3 °C (52.3 °F) at Malegaon and 10.2 °C (50.4 °F) at Nasik. The mean daily maximum temperature of December month is 29.5 °C (85.1 °F) at Malegaon and 28. 3 °C (82.9 °F) Nasik.

Humidity: Humidity is amount of water vapour in the air. In the study region humidity is higher during south-west monsoon. But in other season (post-monsoon, cold and summer) there is low humidity or dry air is found. In the summer season the lowest relative humidity is between 20 to 25 percent in the afternoon.

Cloudiness: In the study region during south-west monsoon skies are heavily clouded to overcaste otherwise skies are clear or lightly clouded.

Winds: In the study region speed of wind is light to moderate except second half of summer seasons. In latter summer it is observed that velocity of wind is higher in study region. The direction of the wind in study region in south west monsoon is westerly and post monsoon season it is easterly in afternoon. In cold and summer season direction of the wind are from south-west to north-west.

Special Weather Phenomena: Due to the storms and depression in Arabian Sea second half of summer responsible for rain and thunderstorms.

Rainfall: In the study region rainfall occurs in the month of June to September. The average rainfall of the study region is 2600 to 3000 mm.

3. A.7: Soils

Soil is important factor for the agriculture land use pattern. Production and cropping pattern is influenced by soil type and soil productivity. This soil is the link between biotic and abiotic components.

Table 3.2: Soil Distribution in Nasik District

Sr. No.	Soil Type	Total Area (sq. Km)	Area (%)
1	Literate Soil	403.8	2.6
2	Redish Brown Soil of Hill Slope	4985.1	32.1
3	Deep Black Soil (Valleys)	1615.1	10.4
4	Medium Black Soil (Plains)	3059.4	19.7
5	Coarse Shallow Soil (High Level)	5466.6	35.2
	Total	15530.0	100

(Source: Research Student)

Soil has certain physical chemical and biological elements in it, which determine the thickness, structure and fertility of the soil. Jainedra Kumar (1985) has rightly pointed out the need for careful study of soil in order to make efficient land use as soil provides basic nutrients to plants for longer than chemical fertilizers.

The parent material of soil in study region is lava base. The climatic condition and topography play an important role for formation of soil in study region. The tahsils like Igatpuri, Trimbak, Surgana and Peth soil is influenced by humid climatic condition where literate soil is observed at higher altitude of the hills. The deep and fertile soil is found in Godavari, upper reaches of Girna and Mosam valley.

In the study region it is also observed that on the hill slope contain light shallow soil. The upper section of hilly area hold very coarse textured soil. Soil contain higher amount of organic matter where the rainfall is higher in study region. The rain shadow areas hold alkaline soil which contain low organic matter and nitrogen

The distribution of soil in study region is shown in Map 3.3 which are divided into five soil types these are I) Literate soil, II) Redish Brown soil of hill slope (Trap), III) Deep Black soil (Valleys), VI) Medium Black soil (Plains) and V) Coarse Shallow soils (High level).

Classification of soil type and its distribution in study region is as follows (Table No. 3.2 and Map No. 3.3)

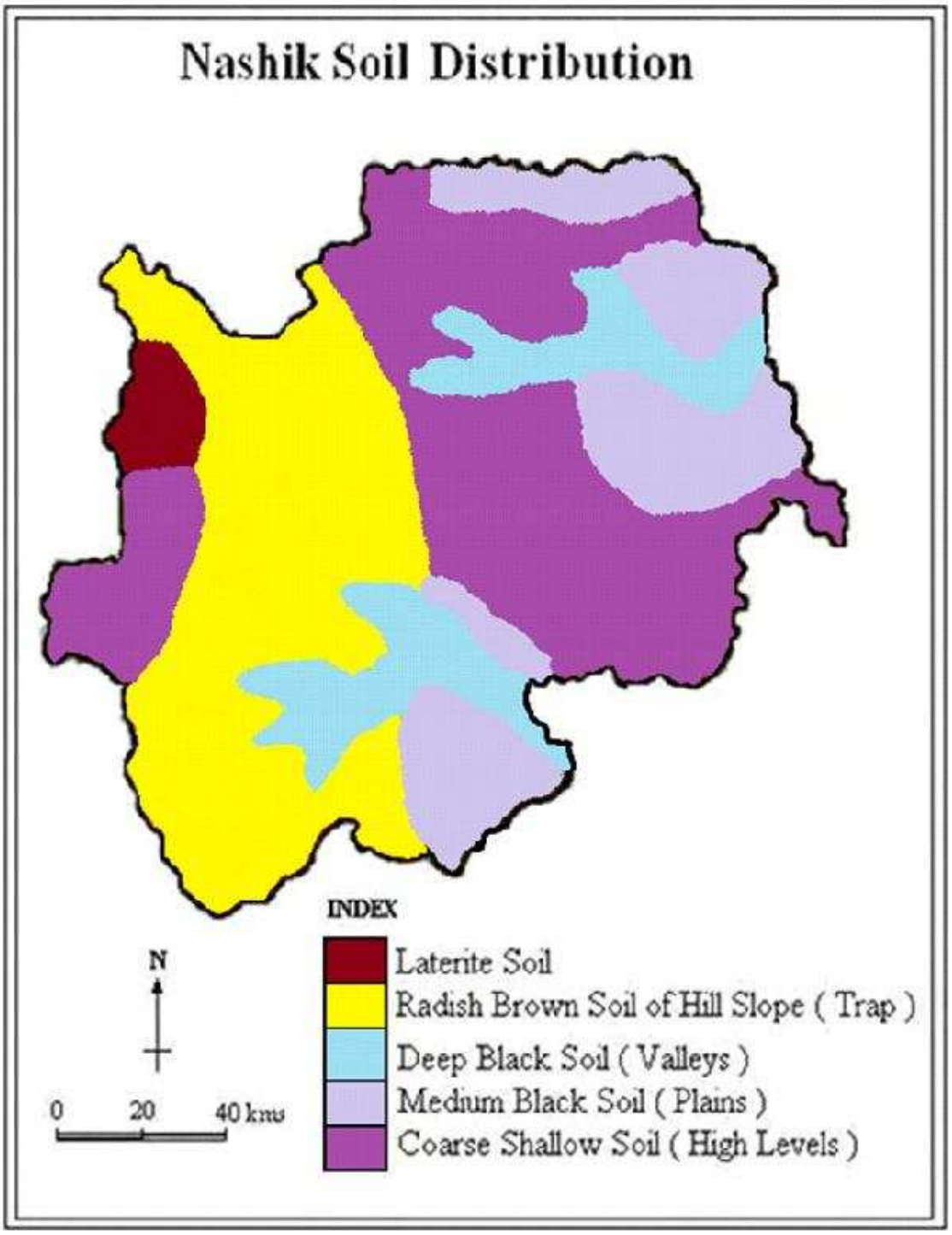
1. Literate Soil: - Total area of Literate soil is 403.8 Sq. Km. or 2.6% to total area of study region. This soil observed only in Surgana tahsil.

2. Redish brown soil: - This type of soil is found only in hill slope area of study region. It covers an area 4985.1 Sq. Km. or 32.1% to total area of study region. This type is observed in hilly slope of Surgana, Kalwan, Dindory, Chandwad, Nasik, Igatpuri and Trimbak tahsil.

3. Deep Black Soil: - Deep Black Soil is found in valley area of study region. It covers an area 1615.1 Sq. Km. or 10.4% to total area of study region. This soil is found in river valleys of Godavari and Girna.

4. Medium black soil: - Medium black soil spread in plain area of study region. It covers an area 3059.4 Sq. Km. or 19.7% to total area of study region. This soil is found in the plain area of tahsils like Sinner, Niphad, Chandwad, Nandgaon, Satana and Malegaon.

5. Coarse shallow soil: - Coarse shallow soil covers an area 5466.6 Sq. Km. or 35.2% to total area of study region which spread in the tahsils like Peth, Trimbak, Yeola, Niphad, Dindory, Chandwad, Deola, Kalwan, Satana, Malegaon and Nandgaon in study area.


Nashik Soil Distribution
INDEX
Laterite Soil
Radish Brown Soil of Hill Slope (Trap)
Deep Black Soil (Valleys)
Medium Black Soil (Plains)
Coarse Shallow Soil (High Levels)
N
0
20
40 kms

Map No. 3.3

3 B: Cultural Aspects

3. B.1: Introduction

Human determent plays an important role for changing land use pattern. Labour, literacy, capital etc are important factor in Indian agriculture land use. Basically Indian agriculture is backbone of Indian economy. About 63% people directly or indirectly depends on agriculture. In India intensive subsistence agriculture or subsistence agriculture are practiced. So the most of the farmers are poor that is why many small scale farmers along with the agriculture they also practiced animal rearing. This affected the economy of farmer i.e. it changes life style of farmer in all respect. Availability of labour play an important role for defines wages. Also there is found spatial variation in agriculture practices with respect to cultural region. In the study region there is found different caste like open caste, Scheduled caste, Scheduled tribe, Nomadic tribe etc people, there cultural aspects are differ from each other so that agriculture practices and working style differ from each other

Agriculture sector that have been ultimately forming land use pattern and yield per hectare. The Present study, therefore, is significant in this respect. The objectives of this section is to highlight the cultural background of the region or district , namely, population, density of population, education, transportation, land holding and their impact on land use pattern of the area under study. The data of population from 1961 to 2001 have been collected from Nasik district Census Handbook, Nasik. The data of occupational structure have been collected from the socioeconomic abstract of Nasik district, while the data of land holding and transportation collected from Nasik district Gazetteer and socio-economic handbook of Nasik district.

3. B.2: Population

Population is function of labour force in agriculture. It has spatial stateus in economy. Also agriculture wages depend on availability of workers and skill of workers. According to 2001 census, the population of the Study region was 4987923 persons. If one can compare this population to Maharashtra 2001 population it was 5.15 %. The

study of decadal growth rate of study region is important because availability of workers and fragmentation of agriculture land is function of decadal growth rate. It is as follows

Table 3.3: Population Growth and Decade Variation

Year	Population	Decade Variation	Growth in %
1951	1429916	—	—-
1961	1855246	+425330	+29.75
1971	2369221	+513975	+27.7
1981	2991739	+622518	+26.27
1991	3851352	+859613	+28.73
2001	4987923	+1136571	+29.51
1951 to 2001		+3558007	+71.33

(Source: District Census Handbook, Nasik)

Researcher studies this growth rate from 1951 and fined the trend of population expansion which is shown in Table No 3.3. It is observed that the total population of the study region was increase 71.33 % from 1951 to 2001. The average decadal growth rate of study region was 23.66%. The growth rate of study region is higher in 1961 which is 29.75 and lower in 1981 which is 26.27 %. The trend of growth rate is fall and rise type i.e. from 1951 to 1981 it decrease and after that it increase. The total population of study region in 1951 was 1429916 it increases up to 4987923 in 2001. The total variation in the study region population from 1951 to 2001 was 3558007.

3. B.3: Density of Population

Population is the man land ratio. This ratio also shows the burden of human on land. It is also indicator of human resource availability for agricultural purpose. Density shows distribution of population and variations in population.

Table 3.4: Density of Population (Years 1951 to 2001)

Year	Population	Area (sq.km.)	Density (Persons per sq.km.)
1951	1429916	15530	92
1961	1855246	15530	119
1971	2369221	15530	152
1981	2991739	15530	193
1991	3851352	15530	248
2001	4987923	15530	321

(Source: District Census Handbook and Gazetteer, Nasik)

Table No. 3.4 shows that there was increase in density of population from 1951 to 2001 i.e. 92 persons per Sq. km. to 321 persons per Sq. km. this shows that the density of population in study region is increase 3.5 times during 50 years.

3. B.4: The Spatial Distribution of Population Density

The spatial variation of population density distribution is shown in table No. 3.5 i.e. tahsil wise density distribution of study region which is shown in persons per Sq. km. From 1961 to 2001 the population density of Nasik tahsil was higher among whole tahsils of study region i.e. 259 persons per Sq. Km. to 1631 persons per Sq. Km. This is due to in Nasik tahsil there is merge urban area of Nasik city which is holy city for Hindu. Also in this city industrial setup is found which lead the migration of works from different areas towards Nasik city. It is the oldest city. The lowest population density is found in Surgana tahsil in 1961 it was 70 persons per Sq. Km. and it increase 173 persons per Sq. Km. in 2001. The lowest density of population is found in Peth, Dindory, Kalwan, Satana, Yeola and Sinner tahsils. The density of Trimbak tahsil was very less i.e. 159 persons per Sq. Km. in 2001. The less density tahsils are from due to uneven topography, tribal area etc.

Table 3.5: Nasik District: Tahsil wise Population Density Per sq.km. (1961 to 2001)

Sr. No.	Tahsil	1961	1971	1981	1991	2001
1	Nasik	259	336	423	707	1631
2	Peth	74	88	112	137	173
3	Dindory	86	104	131	158	200
4	Surgana	70	83	107	130	173
5	Kalwan	95	119	148	189	190
6	Satana	96	122	154	183	211
7	Malegaon	163	220	278	347	430
8	Chandwad	102	121	152	171	213
9	Nandgaon	110	132	168	184	214
10	Yeola	97	118	151	175	220
11	Niphad	138	205	258	338	413
12	Sinner	99	121	153	169	215
13	Igatpuri	111	133	170	198	267
14	Trimbak	—-	—-	—-	—-	159
15	Deola	—-	—-	—-	—-	226
	Total	119	152	193	248	321

(Source: Nasik District Census Handbook)

Malegaon is second largest population density region in entire study region. Which is ranging between 163 persons per Sq. Km. to 430 persons Per Sq. Km. after that Niphad (138 persons per Sq. Km. to 413 persons per Sq. Km.), Igatpuri (111 persons per Sq. Km. to 267 persons per Sq. Km.), Nandgaon (110 persons per Sq. Km. to 214 persons per Sq. Km.) and Chandwad (102 persons per Sq. Km. to 213 persons per Sq. Km.)

3. B.5: Education

The first school in the Nasik was opened in 1861 as 'Superior Anglo vernacular school', which was transformed into Nasik High school in 1871 and was the first Secondary School in the district. In 1883-84 Church Mission started another school at Satpur. In 1923-24 Nasik Education Society was established which later on came to be known as Peth High School in 1948.In the year 2000-01 Nasik District was having 3322 primary schools, 648 secondary and higher secondary schools. Out of the total 10.65 lakh students in primary and secondary schools, 49.89 percent were girls and remaining 50.11 percent were boys. Out of the total students in primary, secondary and higher secondary schools 9.83 percent and 20.67 percent students were from scheduled castee and scheduled tribe respectively in the district. During the year 2000-01 Nasik District was having 32 Arts, Science and Commerce Colleges. The students studying in these colleges from XI onwards were 37216, out of this 40.12 percent were girls and remaining 59.88 percent were boys. The District is having Eight Engineering and Nine Polytechnic institutions, One Medical College, Three Ayurvedic colleges, Eighteen Industrial Training Institutes, Fourteen B. Ed., Sixteen D.Ed. and Two Law colleges. Apart from this the district has education institutes in the areas like Management, Computer Science, Hotel Management and Catering Technology etc.

3. B.6: Transportation

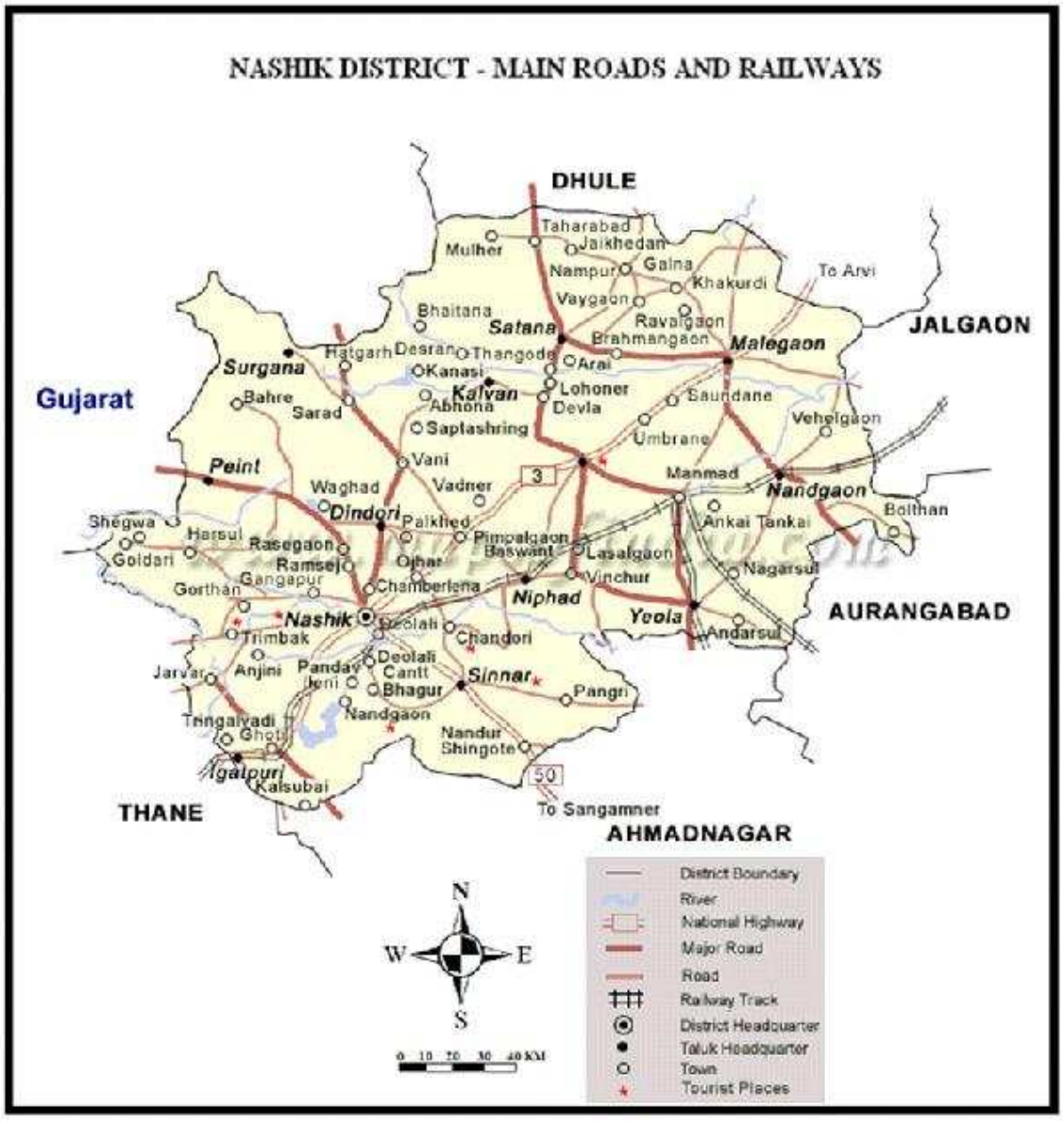
The role of means of transport in the economic development is significant in agricultural regions. It acts as a main vehicle for bringing different raw materials, seeds, fertilizers, implements, and distributes the product within the region. The improvement in transport network extends the hinterland of markets and brings isolated productions area into light (Date, 1983). Such improvement and change in frequency, speed and capacity indicate the changes in traditional agriculture patterns. From this point of view, it would be necessary to examine the existing means of transport in study region.

Table 3.6: Road Length of Nasik District

Sr. No.	Type	Road Length (Km.)
A	**Roads**	
I	National Highway	236.00
II	State Highway	1727.00
III	Major District Road	2285.00
IV	Other District Roads	2361.00
V	Village Roads	7290.00
	Total	13899.00
B	**Railways**	
I	Broad Gauge	257.00
II	Meter Gauge	Nil
III	Narrow Gauge	Nil
	Total	257.00

(Source: Socio-Economic Abstract, Nasik District 2001)

The entire study region enjoys two types of means of transportation they are roadways and railways and the total length of this means of transportation is 14156 Kms. The area under study has dense linkages of roadways and railways. The railway plays a significant role in collecting and distributing agricultural products. The roadways are classified in five types in entire study region they are, National Highway (NH), State Highway (SH), Major District Highway (MDR), Other District Highway (ODR) and Village Road or Kachcha Roads (VR). The total length of roadways in the study region is 13899.00 Kms. In it length of national highway is 236 kms (Mumbai-Agra road 186 Km and Nasik - Pune 48 Km) those are medaled roads while the state highway length in study region is 1727 Km.



Map No. 3.4

There is a dense network of transportation of major district road and other district road in entire study area. These roads are linked with remote area of study region either by metalled or unmetalled roads. The total length of major district roads and other district roads are 2285 Km and 2361 Km respectively in the study region. The village roadways are kachcha in nature and are linked to major district roads and other district roads. Some kachcha roads are unsuited for transportation in the monsoon season because it becomes dirty and muddy and hence it reduces the transportation. The most common

and traditional modes of transport is bullock carts and tractors in the villages to collect and distribute the agricultural products. Trucks are occasionally used for transportation.

State Transport buses are linked to most of villages in entire study region. At list two S.T. bus frequencies to each village are observed in study region. S.T. bus frequencies are reduced in rainy season in remote part of study region where unmetalled road is found.

The limited network of railway is observed in the study region in which Manmad is the railway junction. Mumbai-Delhi-Kolkata broad gauge railway passes through the study region and covering 203 km length. Also Manmad - Pune, Manmad -Aurangabad is the broad gauge railway line covering 54 km. length. This railway is much significant from agricultural point of view.

3. B.7: Land Holding

The land holding is one of the aspects influencing on agriculture land use patterns. The easy applications of inputs are possible if the size of land holdings is large and extensive. In study region, like other regions has heavy pressure of growing population coupled with the customary laws of inheritance has resulted in subdividing agricultural plot into small holding. During the field work and interview with farmers, the fact uncovered that the land of small size creating numerous difficulties, such as proper supervision accessibility of easy inputs, wastage of time, use of improved implements, pest control in proper time, and limitations for mechanization and experimentation, therefore small sizes of land holdings have adverse effect on efficient land utilization. Moreover, it is observed that the average size of land holding in the district is 2.52 hectares. The unequal and uneconomic small size land holdings are observed in western part of the basin resulted backward agriculture. It is, therefore, needed to consolidate the land for efficient land use in entire district.

3. B. 8: Agricultural

If one can compare the total area of Maharashtra 84 percent area under agriculture is depened upon monsoon. The study region is situated in Maharashtra in which 75

percent of agriculture land is depending on the monsoon according to 2001 survey. The monsoon, s oil, topography and climate of the study region are favorable for some tahsil for agriculture purpose. It cause increase in production and rotation of crop. In study region unfavorable condition of topography, soil and climate area suffer by low production of crop, one crop harvest in a year.

Chapter 4

GENERAL LAND USE PATTERN

4.1 General Land Use Pattern of Nasik District –

The pattern of land use of an area at a particular time is determined by the physical, economic, and institutional framework taken together. In other words, the existing land-use pattern in different regions has been involved as a result of the action and interaction of various factors. Such as the physical characteristics of land, the institutional framework, the structure of other resources available and the location of the region in relation to other aspects of economic development. For example, those related to transport as well as trade. The present pattern can, therefore, be considered in some sort of stateic harmony and adjustment with the other main characteristics of the economy of the region. A close study of the present land-use pattern and the trades during the recent years will help to suggest the scope for planned shifts in the pattern. Land classification is directly influenced by slope of land, soil characteristics, degree of erosion, drainage, water supply, climatic factors, and similar environmental conditions. In the recent past, according to various view points and purposes, many attempts have been made by different countries in the world to classify the general land use. This classification is done by using various methods. Stamp (1962) has done a pioneer work about land classification. “The Land of Britain :-Its Use and Misuse” is the book written by Stamp wherein he classified land into six categories, namely, forest and woodland, arable land, meadows land and permanent grass, health and moorland, gardens, orchards, nurseries and unproductive land like land under buildings, mines and wastelands etc.

Internationally, land use has been classified into nine categories. These categories are (a) Settlement and non-agricultural use, (b) Horticulture, (c) Trees and permanent crops, (d) Cropland, (e) Improved permanent pastures, (f) Improved grazing land, (g) Woodland, (h) Swamps and marshes and (i) Unproductive land. In Union of Soviet Socialist Republics (USSR) land are classified in six categories as (a) Land belonging to the urban-rural localities of the industrial and transport department, (b) Arable land and

perennial plantation, (c) Natural grasslands, (d) Forests, (e) Bogs and peat bogs and (f) Unsuitable land. In United States of America Land use classification is done on the basis of land capability, local relief, climate, soils and vegetation cover. These categories are (a) land capable of carrying various crops or grass in rotation or permanent (b) Land suitable for economic uses, grazing or afforestateion and (c) Land suitable for the poorer grades of permanent pasture. The National Resource Planning Board (NRPB) of the United States of America has also classified the land into varies categories, namely (a) Land classification in terms of inherent characteristics, (b) Land classification in terms of present day use, (c) Land classification in terms of recommended uses, (d) Land classification in terms of program implementation and (e) Land classification in terms of land use capabilities.

In Japan, initially, land utilization is classified into four categories as (a) Rise land, (b) High land with dry agriculture, (c) forest land and (d) Uncultivated land. From 1953 land use surveys were conducted in Japan and a large number of maps were published. On the basis of these land use maps, land use is categorized. These categories are (i) Paddy area, (ii) Upland field, (iii) Tree crops, (iv) Forest Area, (v) Grassland, (vi) Other included salt bed, barren land, fish culture area and boundaries of different fields, (vii) City and town, (viii) Transportation, (ix) Land improvement and land conservations facilities, (x) Special facilities, such as power plants, mine, transportation substateions and (xi) Land features such as marshy land and peat bog. These eleven main categories of land use have been further sub-divided into many micro-subdivisions. In China A.K. Phibrick (1980) has classified land into seven categories as (a) Agricultural land, 60 percent or more under cultivation, (b) Agricultural land, at least 20 percent under cultivation, (c) Advancing agriculture and afforestateion, (d) Upland with some cultivation and patches of forests, (e) Natural forest, (f) Steppes and desert, grazing land, some cultivation and patches of forests and (g) Major drought prone areas.

In India, land use classification is done according to various schemes. Before 1951, the land use stateistics was collected by the Ministry of Agriculture, Government of India and was arranged into (a) Total geographical area, (b) Area under forests, (c) Area not available for cultivation, (d) Current fallow land, (e) Other uncultivated land

and (f) Net sown area. In 1954 rural land use was classified by E. Ahmad, into categories like (a) Single cropped land, (b) Double cropped land, (c) Triple cropped land, (d) Fallow land, (e) Land under grove and orchards, (f) Land under scrubs and grasses, (g) Land permanently under water, (h) Built-up land, (i) Land under transport and communication, (j) Barren land and (k) Forests. The National Atlas Organization, Kolkata in 1957 classified land into eight categories : (a) Forest, (b) Scrub, (c) Arable land with trees, (d) Plantation, (e) Pasture, (f) Wasteland, (g) Alpine grass and scrub and (h) Glaciated region. The Damodar valley region has been classified land into ten major categories, (a) Field crops, (b) Orchards, (c) Dense forests, (d) Light forests, (e) Non-agricultural land, (f) Unproductive land, (g) Water bodies, (h) Cultivable waste (i) Village and (j) City and towns.

Land Record Department, Government of India, has officially classified land as : (a) Reported area for land Utilization purposes, (b) Forests, (c) Barren and uncultivable land, (d) Land put to non-agricultural uses : (i) Cultivable waste, (ii) Permanent pasture and other grazing land, (e) Land under miscellaneous trees, crops and groves not included in net area sown (i) Current fallows (ii) Other follow land, (f) Net sown area (g) Area sown more than once and (h) Total cropped area. These categories are finally grouped into five classes such as: (a) Forest land, (b) Net sown area, (c) Land not available for cultivation, (d) Cultivable waste and (e) Fallow land. For the present study these five categories have been considered as below.

4.2 Forest area in Nasik District –

Forest area is defined as, all lands, more than one hectare in area, with a tree canopy density of more than 10 percent.

4.2 a Classification of Forest Area –

According to table no. 4.1 and Map no. 4.1 and 4.2 the forest area of Nasik district is divided into five classes. They are,

1. Very low forest area 10.62 – 94.76

2. Low forest area 94.76 – 178.91

3. Moderate forest area 178.91 – 263.05

4. High forest area 263.05 – 347.20

5. Very high forest area 347.20 – 431.35

Table: 4.1 General Land use pattern (Forest) Area in '00' hectors

No.	Name of Tahsil	2000-01	2010-11
1	Nasik	156.81	958
2	Peth	263.54	263.54
3	Dindory	217.33	217.33
4	Surgana	431.35	431.85
5	Kalwan	317.39	N. A.
6	Satana	407.10	N. A.
7	Malegaon	386.06	386.06
8	Chandwad	89.15	89.15
9	Nandgaon	246.39	246.39
10	Yeola	59.05	59.05
11	Niphad	10.62	10.62
12	Sinnar	187.07	137.08
13	Igatpuri	200.00	216.90
14	Trimbak	336.68	336.68
15	Deola	78.13	N. A.
	Total	3206.68	3352.65

(Source: Socio-Economic Abstract, Nasik District 2001 and 2011)

1. Very low forest area (10.62 -94.76 in '00' hectors)-

In the study region there are four tahsils namely, Yeola, Niphad, Chandwad and Deola. In both the decade, it is observed that there is very low forest area.

2. Low forest area (94.76 – 178.91 area in '00' hectors) –

Low forest density was observed in Nasik tahsil in 2001, while in the decade 2011, Sinner tahsil got merged in this group.

3. Moderate forest area (178.91 – 263.05 area in '00' hectors)

The tahsil like Igatpuri, Dindory and Nandgaon hold the moderate forest area in two decade i.e. in 2001 and 2011. But In 2001, Sinner tahsil contained moderate forest area and it has shown changes in 2011.

4. High forest area (263.05 – 347.20 area in '00' hectors)

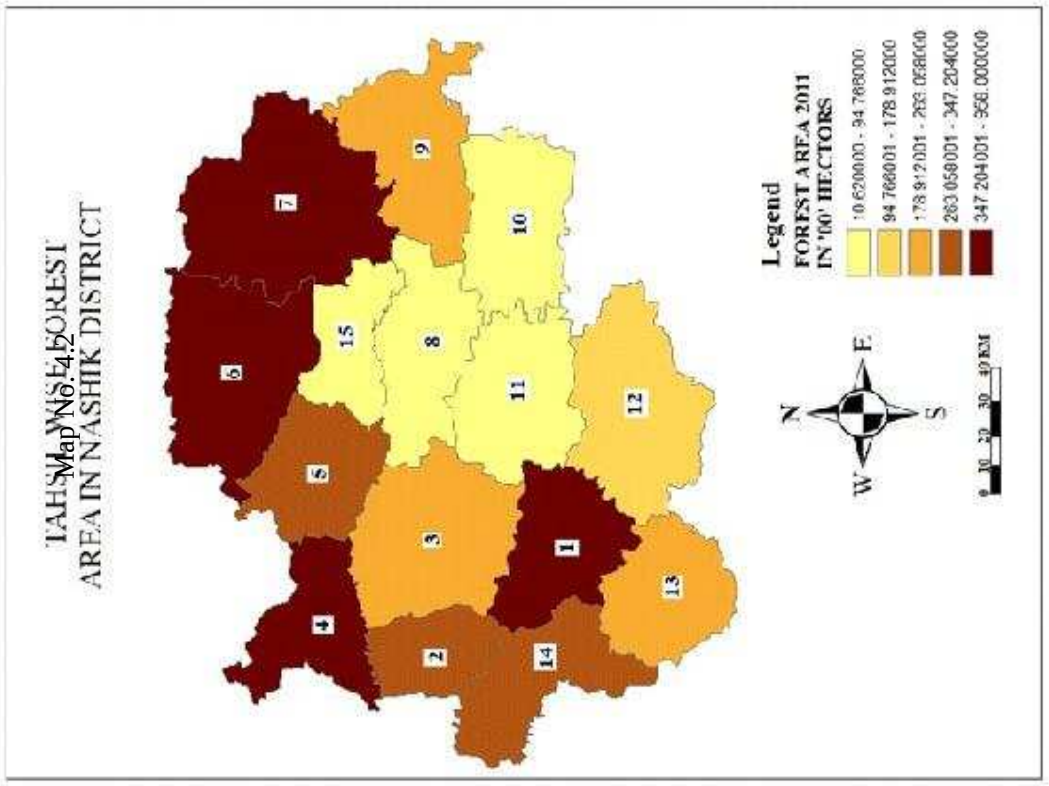
There are three tahsils namely, Trimbak, Peth and Kalwan areas which lie in this group in both decades (2001 & 2011)

5. Very high forest area (347.20 – 431.35 area in '00' hectors)

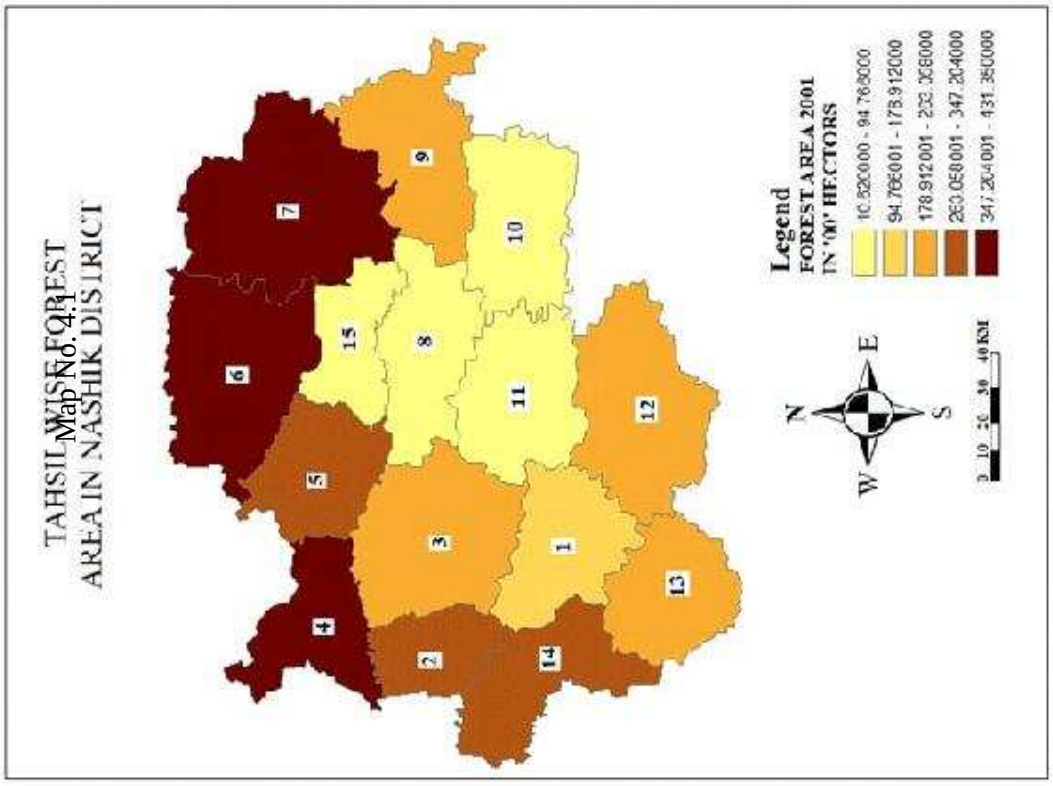
In this last group Surgana, Satana and Malegaon were found in 2001 and 2011 decade. On the other hand, Nasik tahsil was uplifted in this group in the decade 2011.

4.2 b Temporal Changes in Forest Area in Study Region-

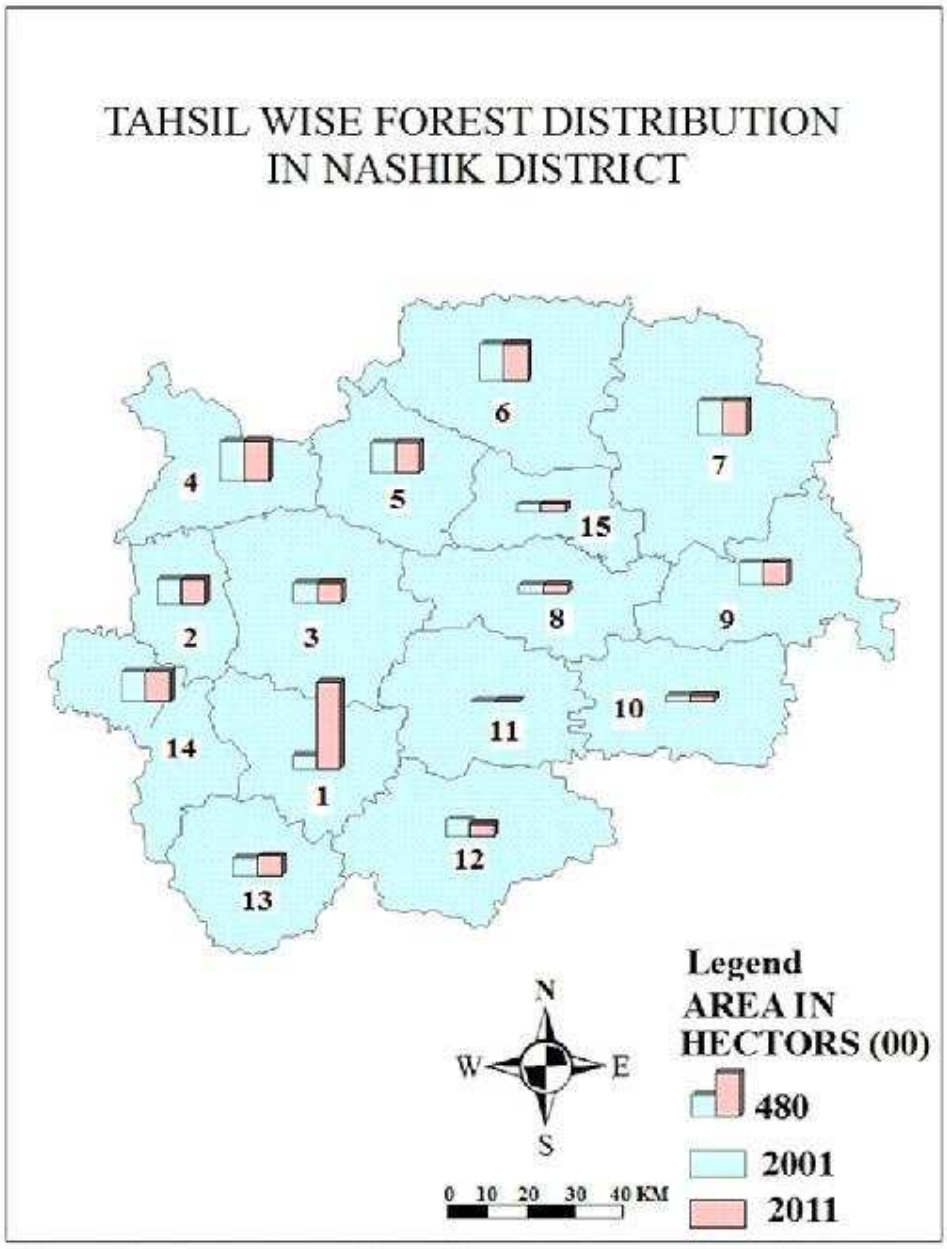
It was found that there are no significant changes in certain tahsils; they are Trimbak, Peth, Surgana, Kalwan, Satana, Malegaon, Nandgaon, Yeola, Niphad, Chandwad, Deola, Dindory, Igatpuri etc. But the tahsils like, Sinner and Nasik shows temporal variation. Moderate forest area group in Sinnar tahsil was found in the decade 2001, while in the decade 2011, it decreased and merged in Low forest area group. On the other hand, Nasik tahsil forest area increasd from low forest area group (2001) to very high forest area group (2011), as shown in Map no. 4.3.



Map No.4.2



Map No.4.1



Map No. 4.3

4.3 Fallow Land in Nasik District –

A Fallow land is defined as 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.

Table: 4.2 General Land use pattern (Fallow land) Area in '00' hectors

No.	Name of Tahsil	2000-01	2010-11
1	Nasik	352.26	206.80
2	Peth	71.00	117.28
3	Dindory	174.33	160.03
4	Surgana	31.06	20.89
5	Kalwan	46.42	22.35
6	Satana	29.18	55.51
7	Malegaon	43.97	40.44
8	Chandwad	46.75	49.38
9	Nandgaon	54.08	40.44
10	Yeola	104.08	141.85
11	Niphad	144.92	142.72
12	Sinnar	122.10	13.34
13	Igatpuri	122.10	66.88
14	Trimbak	68.45	68.45
15	Deola	30.85	29.23
	Total	1401.26	1175.49

(Source: Socio-Economic Abstract, Nasik District 2001 and 2011)

4.3 a Classification of Fallow Land –

According to area Fallow lands are divided into five classes. As shown in Map no. 4.4 and 4.5.It is prepared by table no. 4.2. They are as follows-

1. Very Low Fallow land area (13.34 – 95.13 area in '00' hectors)
2. Low Fallow land area (95.13 – 159.41 area in '00' hectors)
3. Moderate Fallow land area (159.41 – 233.69 area in '00' hectors)
4. High Fallow land area (233.69 - 287.97 area in '00' hectors)
5. Very High Fallow land area (287.97 – 352.26 area in '00' hectors)

1. Very Low Fallow land area (13.34 – 95.13 area in '00' hectors)-

   In both decade the following tahsils observed the Very Low Fallow land area; Trimbak, Surgana, Kalwan, Satana, Deola, Chandwad and Nandgaon, while in Peth it was observed in 2001 and in 2011 Igatpuri and Sinner were merged in this group.

2. Low Fallow land area (95.13 – 159.41 area in '00' hectors)-

   The Low Fallow land area was found in Niphad and Yeola tahsil from 2001 to 2011. In the tahsil like Igatpuri and Sinner Low Fallow land area was observed in 2001 and in Peth tahsil it was observed in 2011.

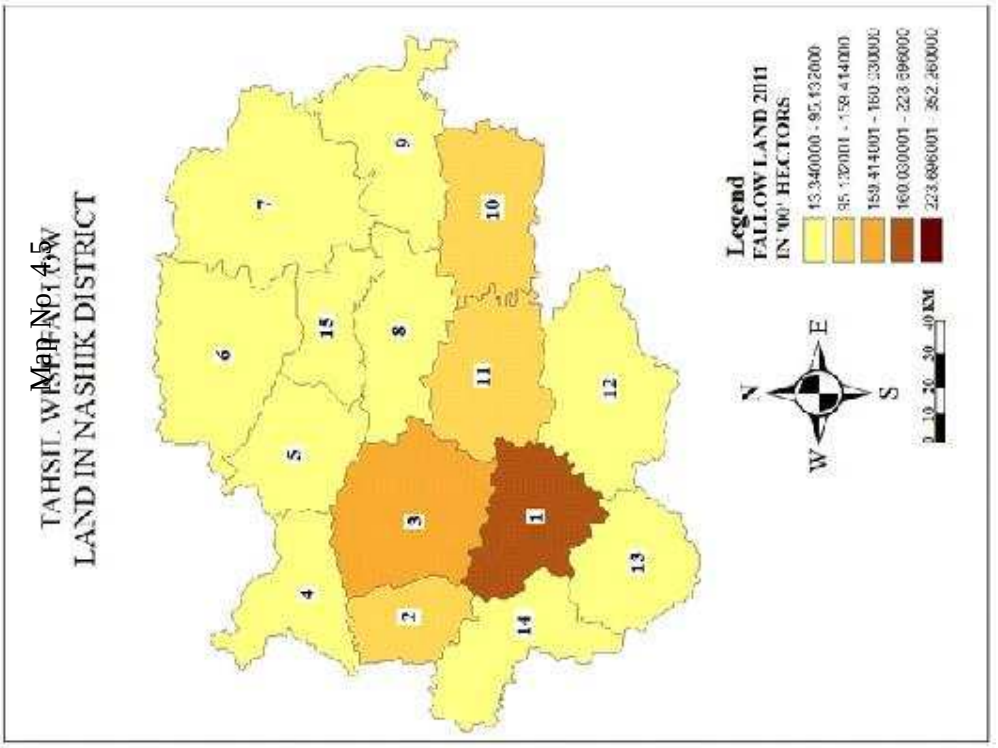
3. Moderate Fallow land area (159.41 – 233.69 area in '00' hectors)-

   This type of density is found in only Dindory tahsil in both the decades.

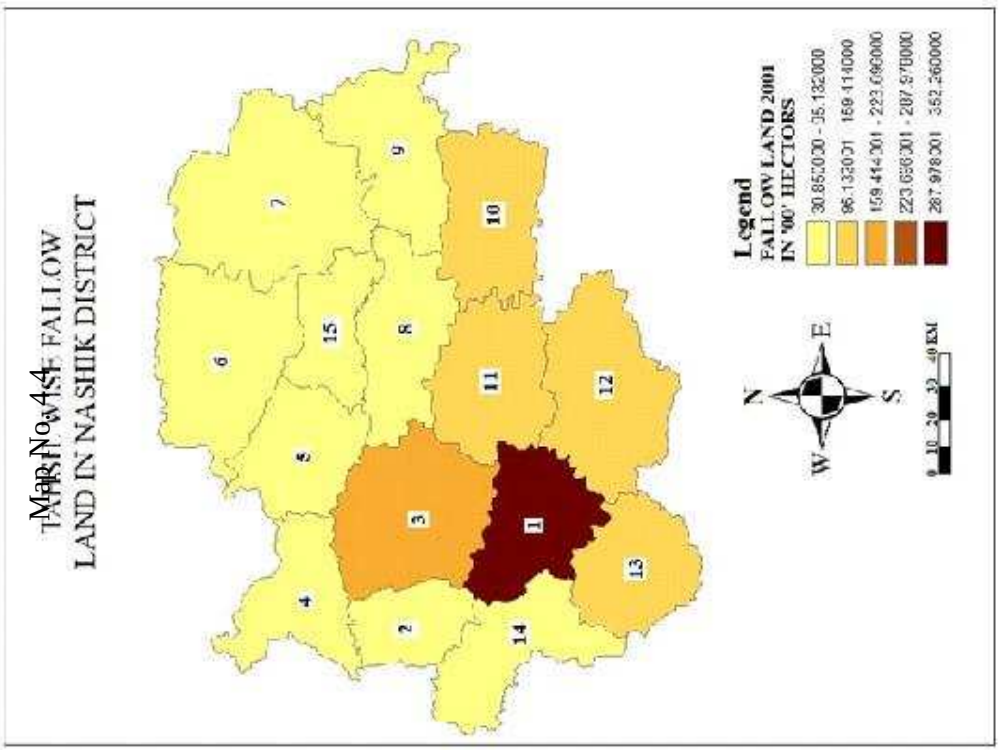
4. High Fallow land area (233.69 – 287.97 area in '00' hectors)- In the decade 2011 it is observed in Nasik tahsil.

5. Very High Fallow land area (287.97 – 352.26 area in '00'

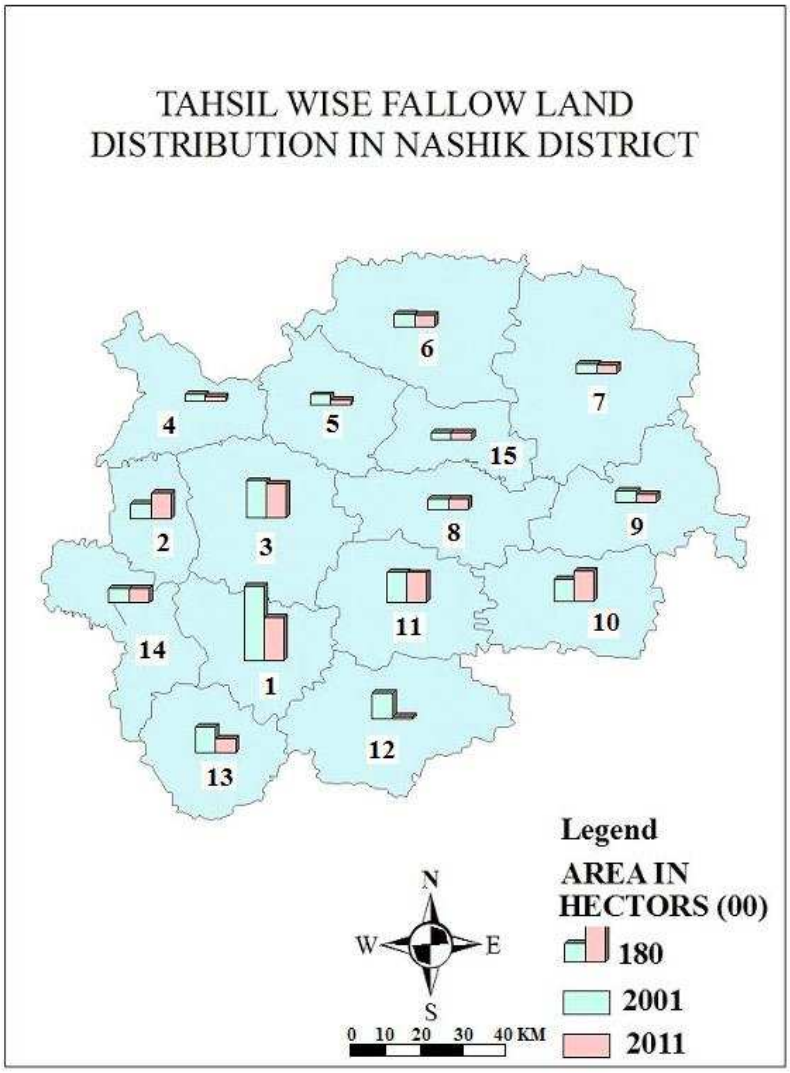
   hectors)-Nasik tahsil hold this kind of density in 2001 decade.



Map No. 4.4



Map No. 4.5



Map No. 4.6

4.3 b Temporal Changes in Fallow land area in the study region-

The study of temporal changes in Fallow land is very important because it increases or decreases agricultural area which affects the production of crops. The tahsils like, Satana, Malegaon, Deola, Chandwad, Trimbak, Dindory and Niphad there are very small changes are observed .While in Peth Fallow land increases very low to low from 2001 to 2011. Also this phenomenon is observed in Yeola tahsil but it merges in same group i.e. in Low Fallow land area. The Fallow land area was decreases in the tahsils from 2001 to 2011 in Nasik (very high to high area of Fallow land) Igatpuri and Sinnar

(low to very low area of Fallow land), Surgana and Kalwan merge in same group i.e. very low area Fallow land, which is shown in Map 4.6

4.4 Area not available for cultivation in Nasik district-

This kind of land is that land which is occupied by buildings, roads, railways, water (e.g. rivers and canals) and other lands used for non-agricultural purposes e.g. recreational land.

4.4 a Classification of area not available for cultivation-

With reference to table no. 4.3, this type of land use is divided into five classes. It is shown in Map 4.7 and 4.8 with respective to decade 2001 and 2011. These classes are as follows-

1. Very low area not available for cultivation (0.100000 to 11.750000 area in '00' hectors)
2. Low area not available for cultivation (11.750000 to 52.940000 area in '00' hectors)
3. Moderate area not available for cultivation (52.940001 to 107.170000 area in '00' hectors)
4. High area not available for cultivation (107.170001 to 142.980000 area in '00' in hectors)
5. Very high area not available for cultivation (142.980001 to 278.990000 area in '00' in hectors)

Table: 4.3 General Land use pattern (Area Not Available for Cultivation) Area in '00' hectors

No.	Name of Tahsil	2000-01	2010-11
1	Nasik	177.53	278.99
2	Peth	34.63	34.63
3	Dindory	51.61	52.94
4	Surgana	38.66	47.28
5	Kalwan	48.01	00.00
6	Satana	214.84	11.75
7	Malegaon	257.47	260.79
8	Chandwad	84.92	86.62
9	Nandgaon	132.14	132.14
10	Yeola	106.92	107.17
11	Niphad	89.60	89.60
12	Sinnar	140.42	142.98
13	Igatpuri	102.04	134.63
14	Trimbak	47.79	49.04
15	Deola	01.22	03.87
	Total	1527.80	1432.43

(Source: Socio-Economic Abstract, Nasik District 2001 and 2011)

1. Very low area not available for cultivation (0.100000 – 11.750000 area in '00' hectors)-

   In this type of classification, Trimbak, Peth, Surgana and Dindory are found in 2001 and 2011 decade. Only Satana is merged in this group in decade 2011.

2. Low area not available for cultivation (11.750001 – 52.940000 area in '00' hectors) –

   Low classification type holds tahsils like Igatpuri, Niphad and Chandwad in the decade 2001 and Trimbak, Peth, Surgana and Dindory in the decade 2011.

3. Moderate area not available for cultivation (52.940001 – 107.170000 area in '00' hectors)-

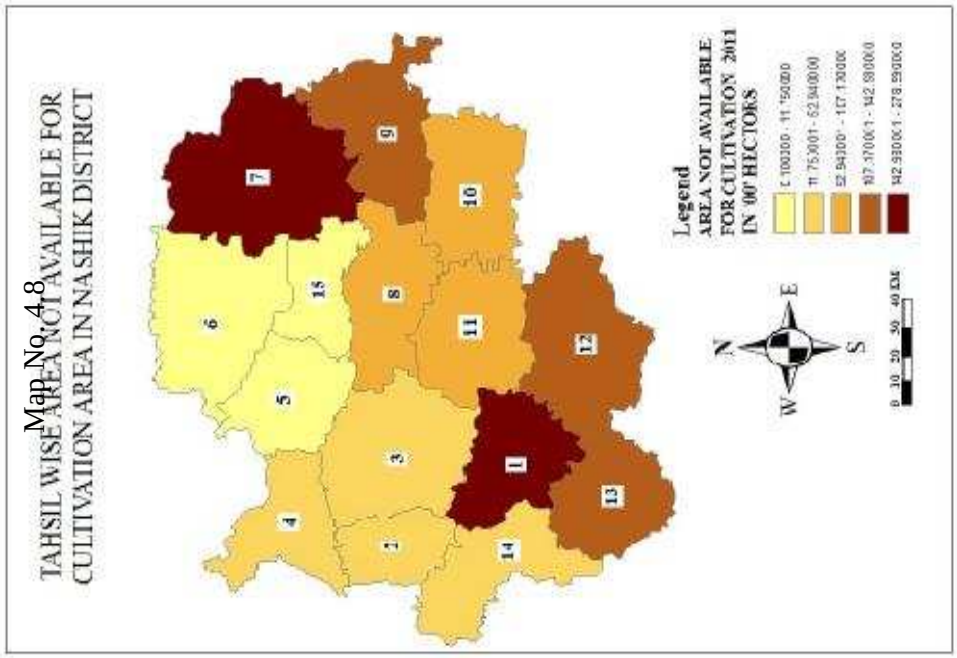
Sinnar, Yeola and Nandgaon tahsils show moderate tendency in the decade 2001, while Chandwad, Niphad and Yeola tahsils are in decade 2011.

4. High area not available for cultivation (107.170001 – 142.980000 area in '00' hectors)-

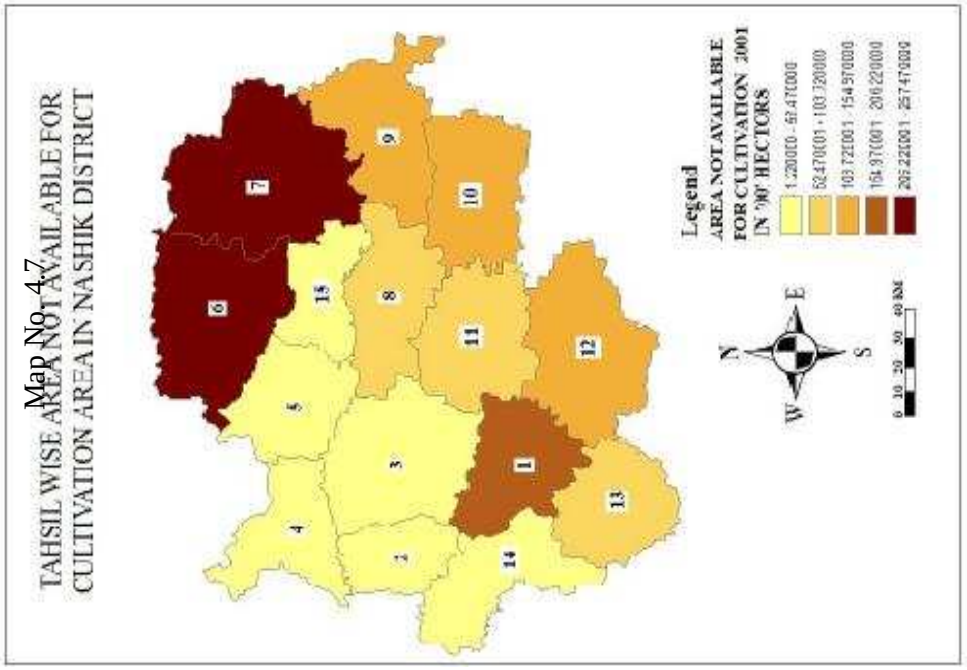
Only one tahsil merged in this group in 2001, namely Nasik. While in the decade of 2011 there were three tahsils known as Igatpuri, Sinnar and Nandgaon are found are found in this type.

5. Very high area not available for cultivation (142.980001 – 278.990000 area in '00' hectors)-

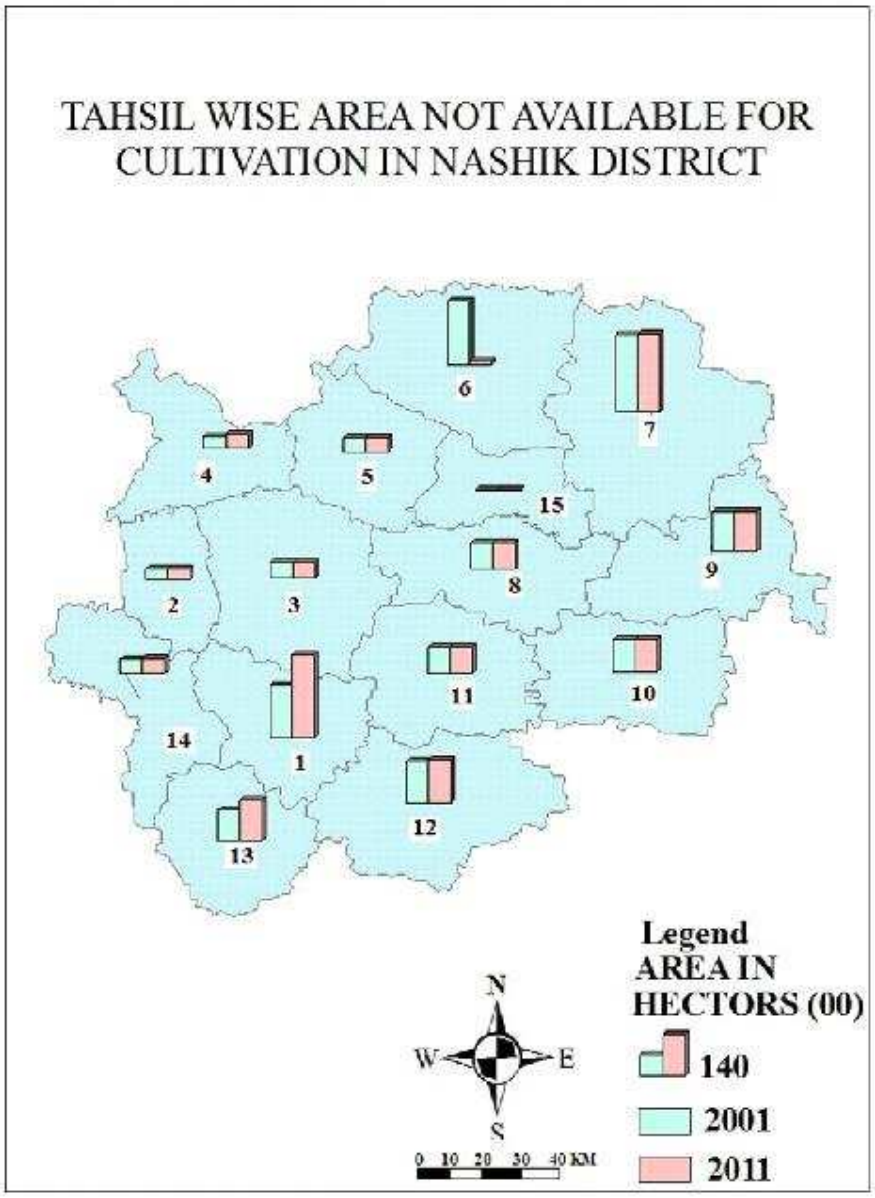
Two tahsils like Satana and Malegaon in 2001 decade and two tahsils like Malegaon and Nasik in 2011 decade show the tendency of area not available for cultivation in largest amount.



Map No. 4.8



Map No. 4.7



Map No. 4.9

4.4 b Temporal changes in area not available for cultivation-

In this district changes for area not available for cultivation are found in the tahsils namely, Satana, Nasik, Igatpuri, Trimbak and Surgana tahsils. The tahsils like Malegaon, Nandgaon, Yeola, Niphad, Sinnar, Dindory, Peth, Deola, Chandwad and Kalwan have not changed or slightly changed with the time. In all tahsils, Deola tahsil shows very small amount of land under non cultivable land. It is shown in Map no. 4.9

4.5 Cultivable waste in Nasik district –

This includes land available for cultivation, whether taken up or not taken up for cultivation for once, but not cultivated during last five years or more in succession including the current year for some reason or the other. Such land may be either fallow or covered with shrubs and jungles which are not put to any use. They may be accessible or in accessible and may be liying in isolated blocks or within cultivated holdings.

4.5 a Classification of cultivable waste land-

According to table no. 4.4 the cultivable waste land is again divided into five types which is shown in Map no. 4.10 and 4.11, they are –

1. very low cultivable waste land (less than 17.164000 area in '00' hectors)
2. low cultivable waste land (17.164001 to 34.328000 area in '00' hectors)
3. Moderate cultivable waste land (34.328001 to 51.492000 area in '00' hectors)
4. High cultivable waste land (51.492001 to 68.656000 area in '00' hectors)
5. Very High cultivable waste land (Above 68.656000 area in '00' hectors)

1. very low cultivable waste land (less than 17.164000 area in '00' hectors)

In the decade 2001 nearly 50 % tahsils out of total shows very low cultivable weste land they are Trimbak Peth, Surgana, Satana, Deola, Chandwad and Yeola while in 2011 only 4 tahsils are merged in this group they are Peth, Surgana, Kalwan, Deola. It means that there is increase in cultivable land.

Table: 4.4 General Land use pattern (Cultivable Waste) Area in '00' hectors

No.	Name of Tahsil	2000-01	2010-11
1	Nasik	85.82	71.38
2	Peth	00.67	00.28
3	Dindory	35.53	37.96
4	Surgana	07.78	09.20
5	Kalwan	33.32	10.19
6	Satana	16.99	20.10
7	Malegaon	44.62	74.24
8	Chandwad	00.00	117.85
9	Nandgaon	49.05	62.26
10	Yeola	00.00	68.88
11	Niphad	33.37	141.37
12	Sinnar	73.40	103.91
13	Igatpuri	60.00	155.27
14	Trimbak	12.79	63.09
15	Deola	02.82	09.76
	Total	456.16	945.74

(Source: Socio-Economic Abstract, Nasik District 2001 and 2011)

1. low cultivable waste land (17.164001 to 34.328000 area in '00' hectors)

   Tahsils like Kalwan and Niphad in 2001 and Satana in 2011 observed in low cultivable waste land group.

2. Moderate cultivable waste land (34.328001 to 51.492000 area in '00' hectors)

   Dindory, Malegaon and Nandgaon tahsils are in 2001 and Dindory tahsil in 2011 are found in this type.

3. High cultivable waste land (51.492001 to 68.656000 area in '00' hectors)

   In the decade 2001 only one tahsil namely Igatpuri and in 2011 Trimbak and Nandgaon tahsils are merged in this type.

4. Very High cultivable waste land (Above 68.656000 area in '00' hectors)

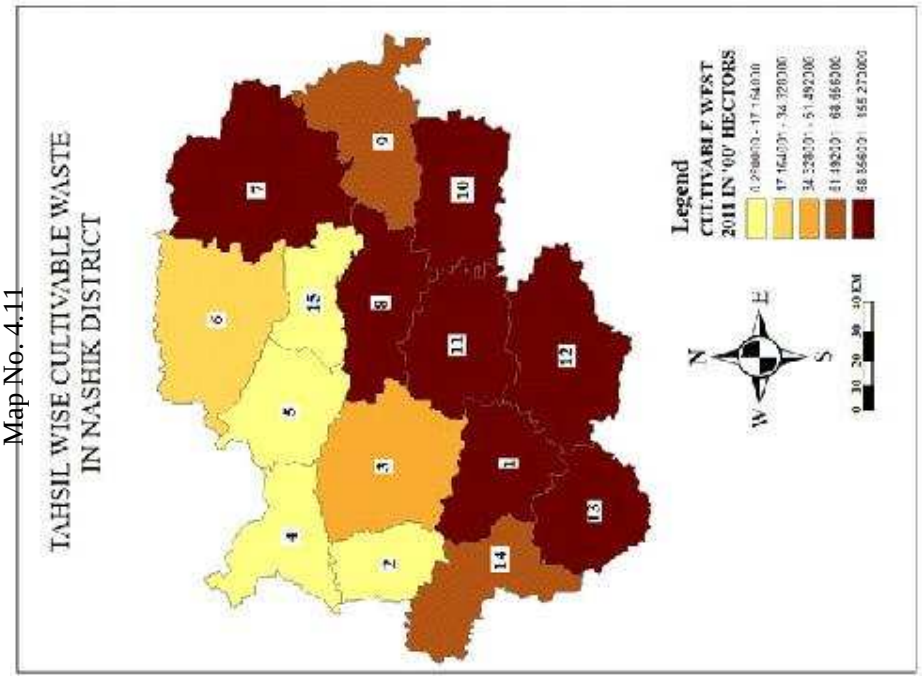
Only two tahsils namely, Nasik and Sinnar merged in this group in both the decade i. e. in 2001 and 2011. While the tahsils like Igatpuri, Niphad, Chandwad, Yeola and Malegaon merged in this group, in the decade 2011.

In 2011 out of total tahsils 50% tahsils are merged in very high cultivable waste land. It means that there is increase in cultivable waste land since 2001 decade.

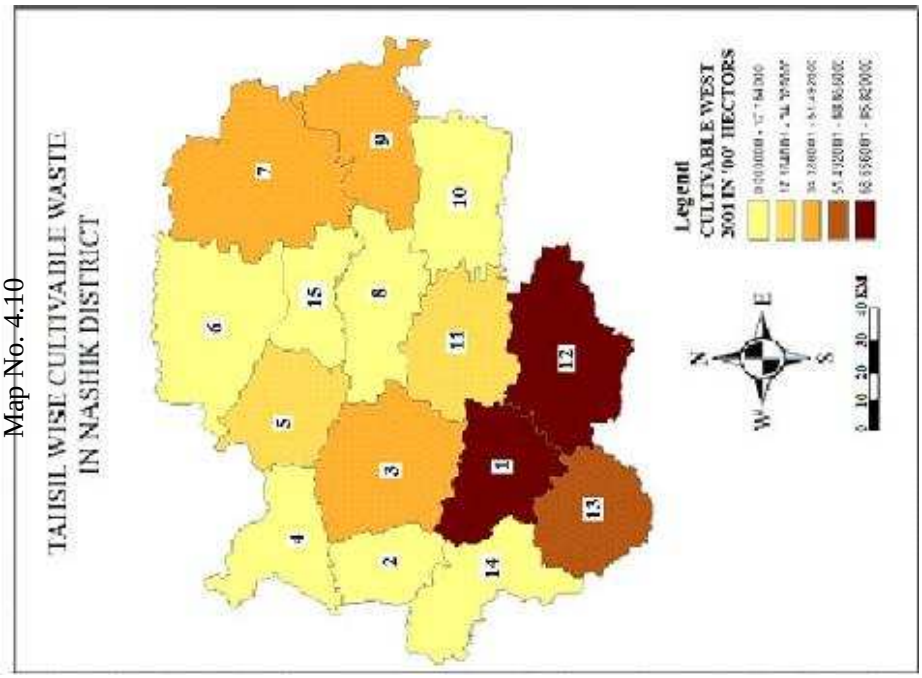
4.5 b Temporal changes in cultivable waste land

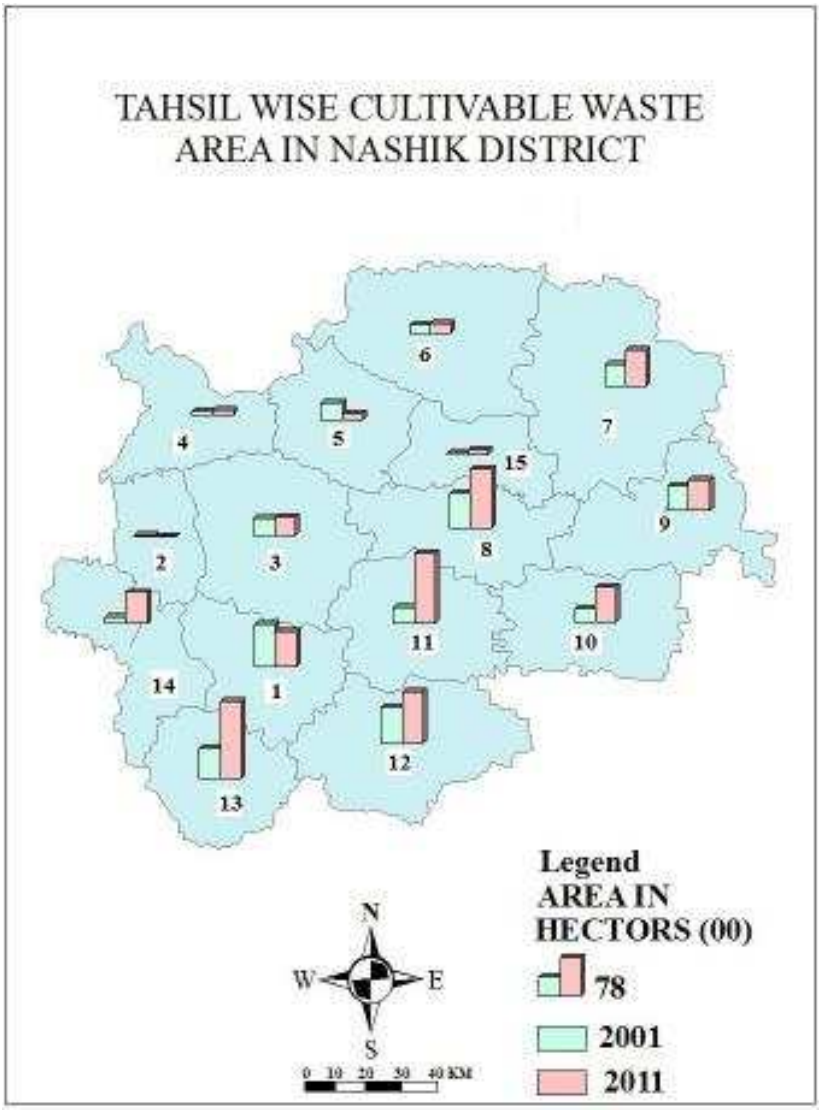
In the Map 3.12 it is observed that there is increase in cultivable waste land from decade 2001 to 2011. These tahsils are Igatpuri, Sinnar, Trimbak, Yeola, Niphad, Chandwad, Nandgaon, Malegaon, Dindory, Deola, Satana, Surgana and Peth. Out of 15 tahsils 13 tahsils show the increasing trend of cultivable waste land. It means that in 2011 decade there is decrease in Net Sown Area. Tahsils like Kalwan and Nasik show the decreasing trend of cultivable land i.e. in 2001, in this tahsils there is higher cultivable waste land and in 2011 decade it reduced.

Map No. 4.11



Map No. 4.10





Map No. 4.12

4.6 Net Sown Area in Nasik district –

This represents the total area sown with crops and orchards. Area sown more than once in the same year is counted only once.

Table: 4.5 General Land use pattern (Net Sown Area) Area in '00' hectors

No.	Name of Tahsil	2000-01	2010-11
1	Nasik	370.40	189.39
2	Peth	195.21	330.77
3	Dindory	629.22	621.90
4	Surgana	314.36	311.80
5	Kalwan	387.99	468.71
6	Satana	707.68	734.86
7	Malegaon	1037.96	657.74
8	Chandwad	621.88	575.78
9	Nandgaon	460.77	343.33
10	Yeola	696.26	534.15
11	Niphad	700.98	486.60
12	Sinnar	777.58	544.24
13	Igatpuri	487.77	380.72
14	Trimbak	363.71	383.78
15	Deola	331.78	295.73
	Total	8063.90	6859.51

(Source: Socio-Economic Abstract, Nasik District 2001 and 2011)

4.6 a Classification of Net Sown Area –

The Net Sown Area is divided into five groups on the basis of table No. 4.5 which is shown in Map No. 4.13 and 4.14 they are as follows

1. very low Net Sown Area (less than 195.210007 area in '00' hectors)
2. low Net Sown Area (195.210008 to 387.989990 area in '00' hectors)
3. Moderate Net Sown Area (387.989991 to 487.769989 area in '00' hectors)
4. High Net Sown Area (487.769990 to 777.580017 area in '00' hectors)
5. Very High Net Sown Area (Above 777.580017 area in '00' hectors)

1. very low Net Sown Area (less than 195.210007 area in ‘00’ hectors) In

   2001 Peth tahsil and Nasik tahsil in 2011 is lie in this group.

2. low Net Sown Area (195.210008 to 387.989990 area in ‘00’ hectors)

   Trimbak, Nasik, Surgana, Kalwan and Deola tahsils contain low Net Sown Area in 2001 while in 2011 Igatpuri, Trimbak, Peth, Surgana, Deola and Nandgaon merge in this group.

3. Moderate Net Sown Area (387.989991 to 487.769989 area in ‘00’ hectors)

   The tahsils like Igatpuri and Nandgaon joined this group in 2001 and Niphad and Kalwan in 2011

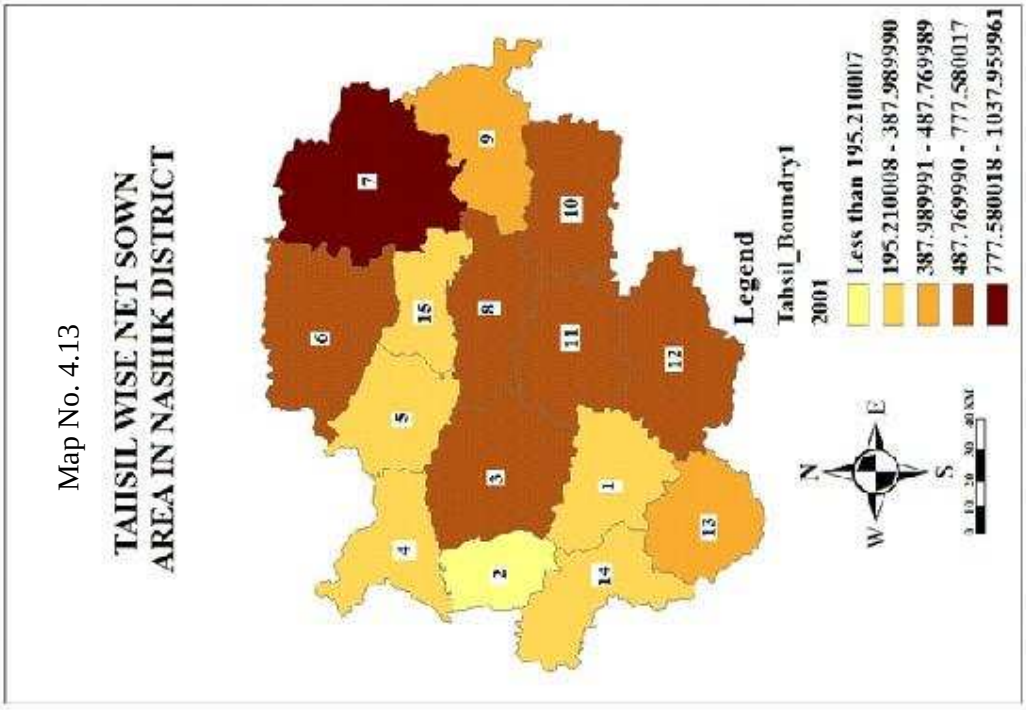
4. High Net Sown Area (487.769990 to 777.580017 area in ‘00’ hectors)

   In this group tahsils like Dindory, Satana, Chandwad, Niphad, Yeola and Sinnar in 2001 and Satana, Malegaon, Dindory, Chandwad, Yeola and Sinnar in 2011 merged. Near about 40% tahsils of Nasik district are found in this group.

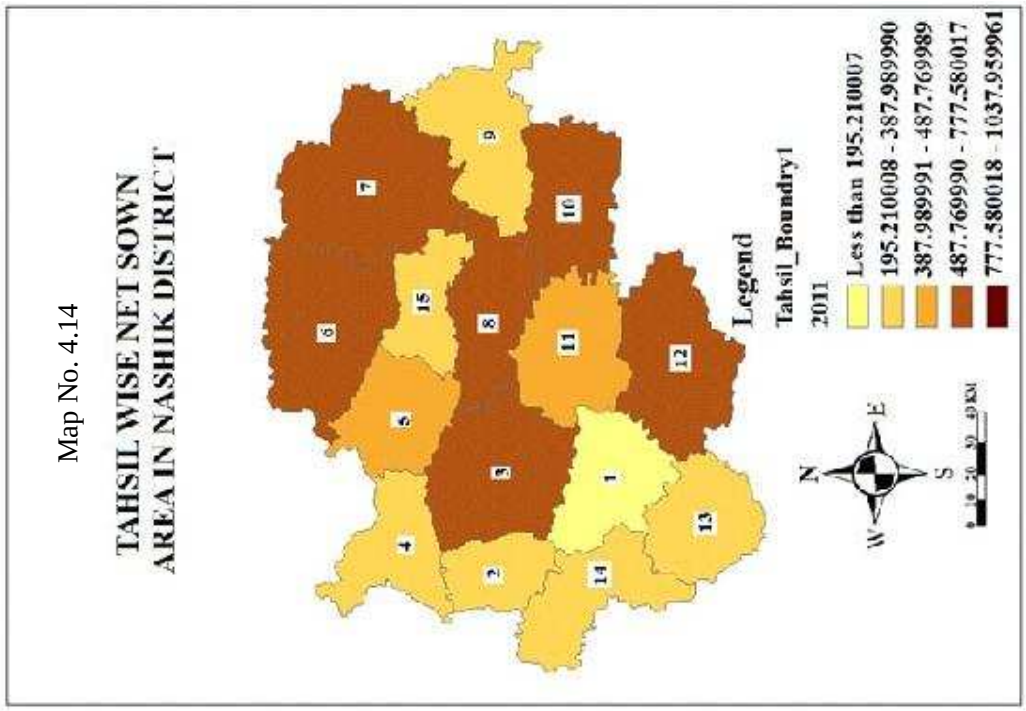
5. Very High Net Sown Area (Above 777.580017 area in ‘00’ hectors)

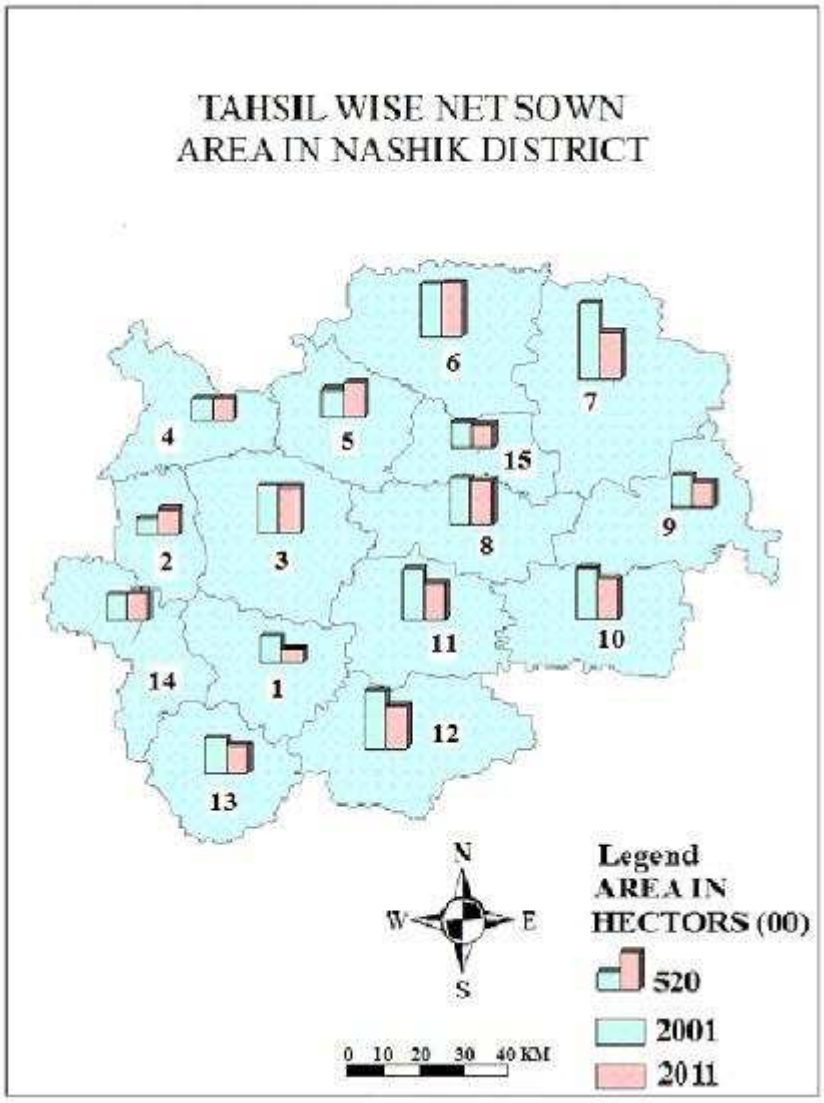
   Only one tahsil namely Malegaon was found in this group in the decade 2001.

Map No. 4.13



Map No. 4.14





Map no. 4.15

4.6 b Temporal changes in Net Sown Area

A positive growth was found in this study in Net sown area from 2001 to 2011 in the tahsils like Trimbak, Peth, Surgana, Kalwan, Dindory and Satana. While Negative growth was found in the tahsils like Malegaon, Nandgaon, Deola, Chandwad, Niphad,

Nasik, Yeola, Sinnar and Igatpuri from the decade 2001 to 2011 which is shown in the Map 4.15.

Chapter- 5

AGRICULTURAL LAND USE PATTERN

5.1 Introduction

Agricultural land use means the extent of the gross cropped area under various crops during the agricultural year. It is essential to evaluate the agricultural land use for the individual crop in order to understand crop pattern and growth. Agricultural land use pattern in any region depends on socio-economic, physical and climatic conditions. Farmer's crop selection and method of production are influenced by behavior of human being, price fluctuations in markets, purchasing power

5.2 Spatial Analysis of Agricultural Land use

69.91 percent population is involved in agricultural activity in study region. Rice, Jowar, Bajara, Wheat, Onion, Grapes and Sugarcane are major crops grown in study region. For the spatial analysis of the crops researcher classified the crop area in five group i) very low area under the crop ii) low area under the crop iii) Moderate area under the crop iv) High area under the crop v) Very high area under the crop

5.3 a Spatial Variation of Rice crop in Nasik District

In the study region 50% tahsils showed low area under rice crop they are Satana, Malegaon, Deola Nandgaon, Chandwad, Niphad, Yeola and Sinnar in 2001 while in 2011 Malegaon, Deola Nandgaon, Chandwad, Niphad and Yeola. The tahsils namely Surgana, Kalwan, Peth, Dindory and Nasik in 2001 and Satana, Kalwan, Peth, Dindory, Nasik and Sinnar in 2011 lies in low area under Rice crop. Tahsil Trimbak in 2001 and Surgana (2011) found in Moderate area under Rice crop. High area under Rice crop is found in the decade 2011 in Trimbak tahsil while in 2001 & 2011 Igatpuri is leading in Rice crop which is merged in very high area under Rice crop as shown in table No. 4.1 and Map No. 5.1 & 5.2

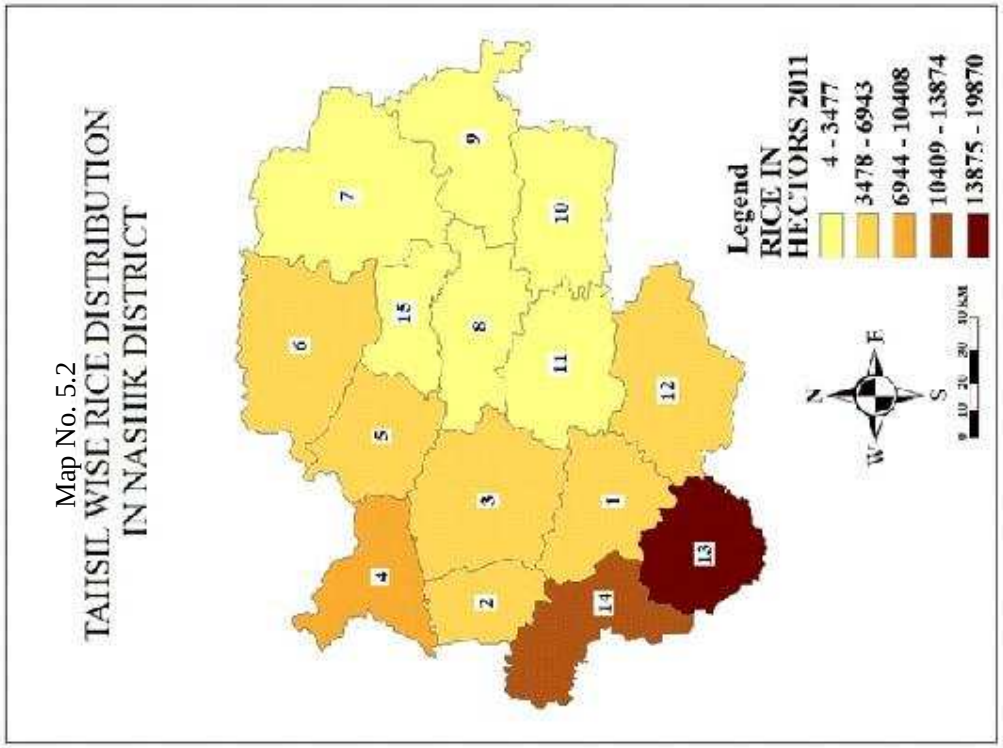
5.3 b Temporal changes in Rice crop in Nasik District

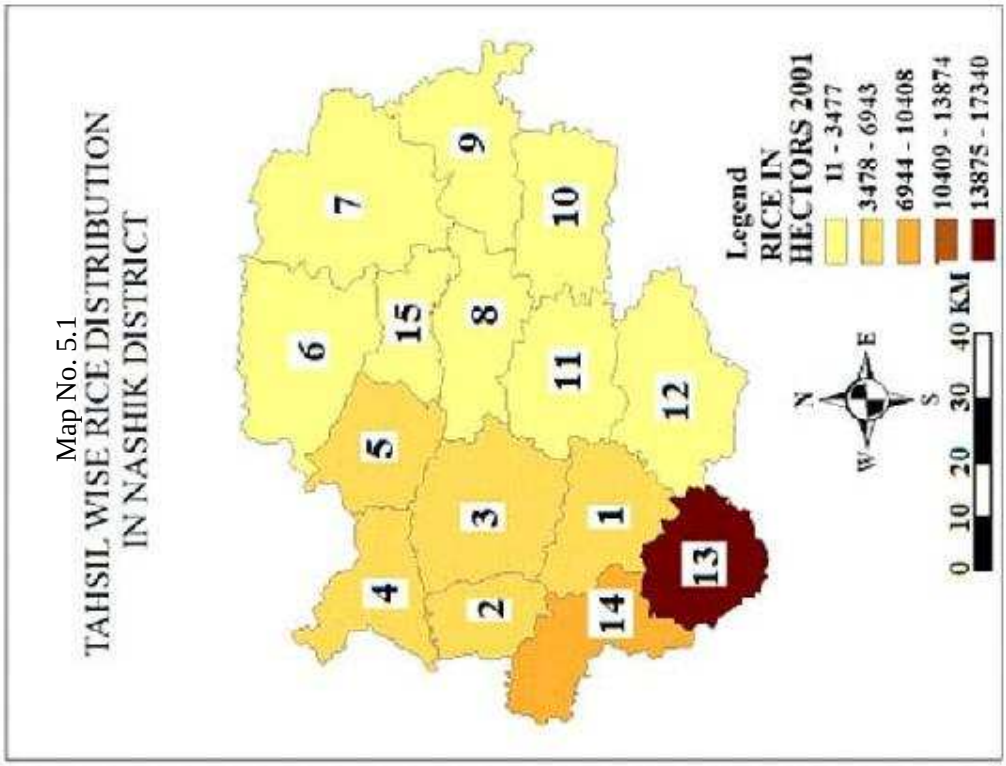
There is increase in the area under Rice in Surgana, Kalwan, Satana, Peth, Dindory, Trimbak, Igatpuri, Nasik and Sinnar tahsil. While in the tahsil Malegaon, Deola, Nandgaon, Chandwad, Yeola and Niphad there is no change in rice crop area (table No. 5.1 and Map No. 5.3).

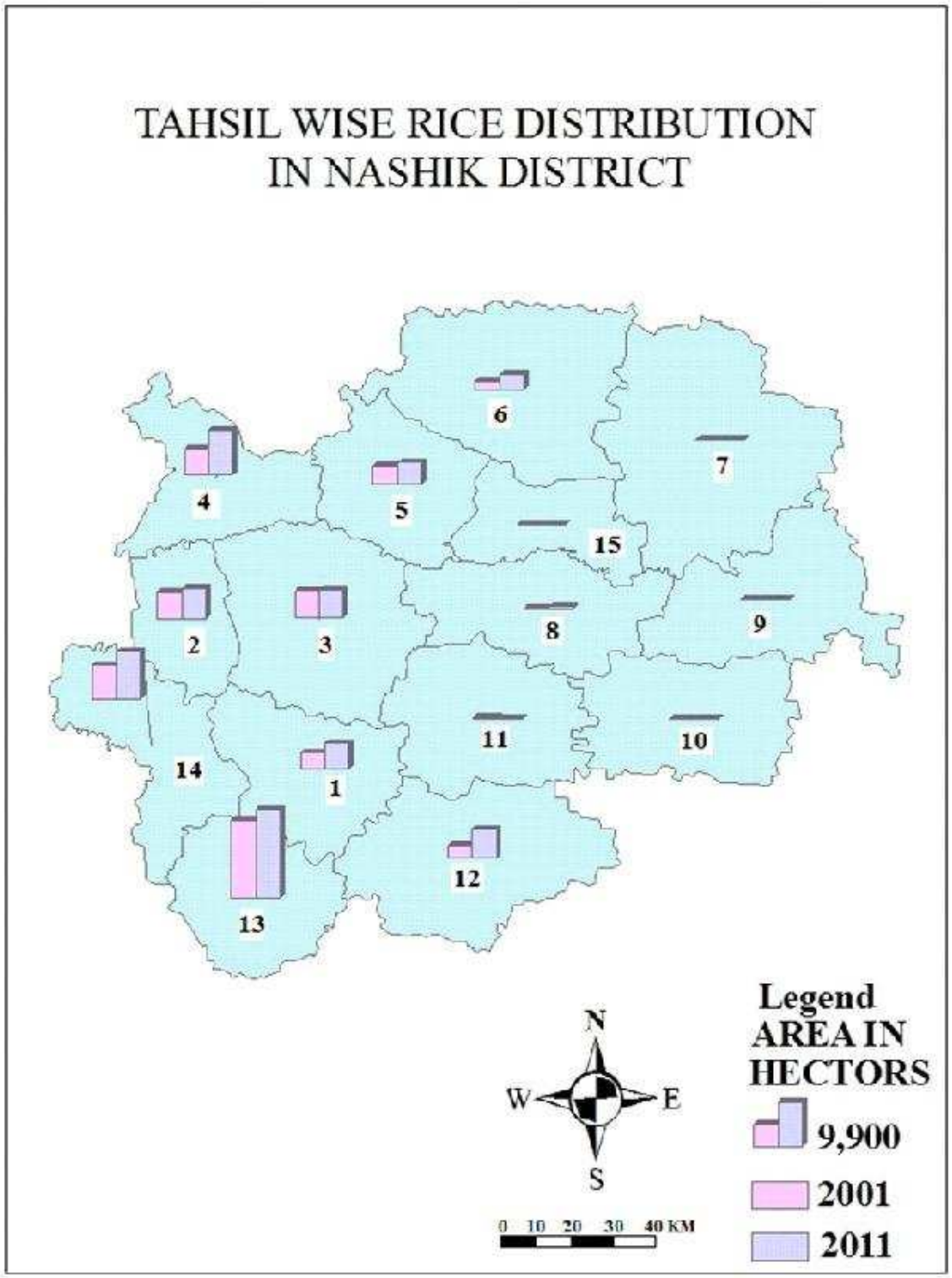
Table 5.1 Rice Area in '00' hectors

No.	Name of Tahsil	2000-01	2010-11
1	Nasik	3589	5770
2	Peth	5644	6670
3	Dindory	6021	6269
4	Surgana	5700	10058
5	Kalwan	3978	4707
6	Satana	1827	3532
7	Malegaon	38	33
8	Chandwad	198	420
9	Nandgaon	55	40
10	Yeola	15	18
11	Niphad	325	140
12	Sinnar	2937	6394
13	Igatpuri	17340	19870
14	Trimbak	7692	10785
15	Deola	11	04
	Total	55355	74652

(Source: Socio-Economic Abstract, Nasik District 2001 and 2011)


Map No. 5.2
TAHSIL WISE RICE DISTRIBUTION
IN NASHIK DISTRICT
Legend
RICE IN
HECTORS 2011
4 - 3477
3478 - 6943
6944 - 10408
10409 - 13874
13875 - 19870
N
S
E
W
10 0 10 20 30 40 KM
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15


Map No. 5.1
TAHSIL WISE RICE DISTRIBUTION
IN NASHIK DISTRICT
Legend
RICE IN
HECTORS 2001
11 - 3477
3478 - 6943
6944 - 10408
10409 - 13874
13875 - 17340
N
S
E
W
0 10 20 30 40 KM
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15


TAHSIL WISE RICE DISTRIBUTION
IN NASHIK DISTRICT
6
7
4
5
15
2
3
8
9
11
10
14
1
12
13
N
W
E
S
0 10 20 30 40 KM
Legend
AREA IN
HECTORS
9,900
2001
2011

Map No. 5.3

5.4 a Spatial Variation of Wheat crop in Nasik District

Table 5.2 Wheat Area in '00' hectors

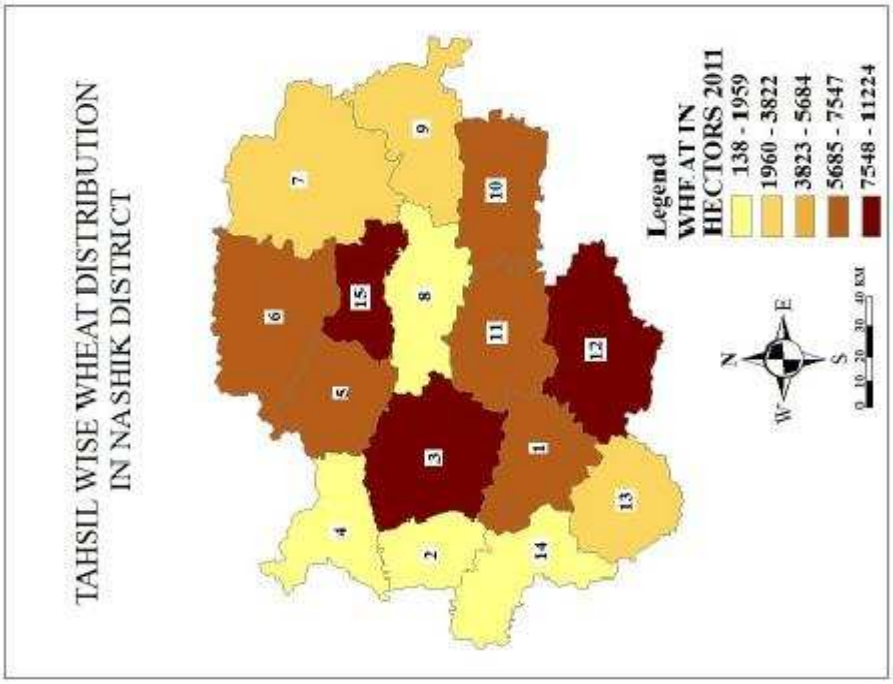
No.	Name of Tahsil	2000-01	2010-11
1	Nasik	3980	6288
2	Peth	321	381
3	Dindory	9410	9481
4	Surgana	410	231
5	Kalwan	2665	6839
6	Satana	1873	5766
7	Malegaon	1470	3723
8	Chandwad	853	1450
9	Nandgaon	470	3064
10	Yeola	1918	6980
11	Niphad	5392	7510
12	Sinnar	3175	11224
13	Igatpuri	1578	2538
14	Trimbak	96	138
15	Deola	1092	8330
	Total	33876	80923

(Source: Socio-Economic Abstract, Nasik District 2001 and 2011)

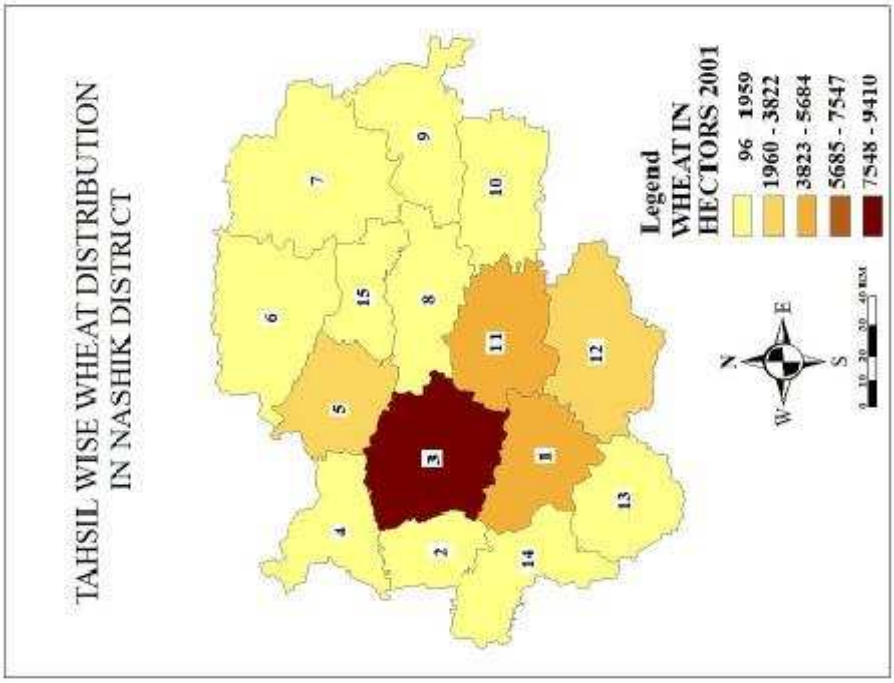
In 2001 around 70 % tahsils in Nasik District are under very low very low area of wheat crop they are Surgana, Peth, Trimbak, Igatpuri, Yeola, Nandgaon, Chandwad, Deola, Satana and Malegaon. In 2011 only four tahsils Trimbak, Peth, Surgana and Chandwad were in very low area under wheat crop. Low area of wheat crop was found in Kalwan and Sinnar tahsil in 2001 and 2011 Igatpuri, Malegaon and Nandgaon tahsil.

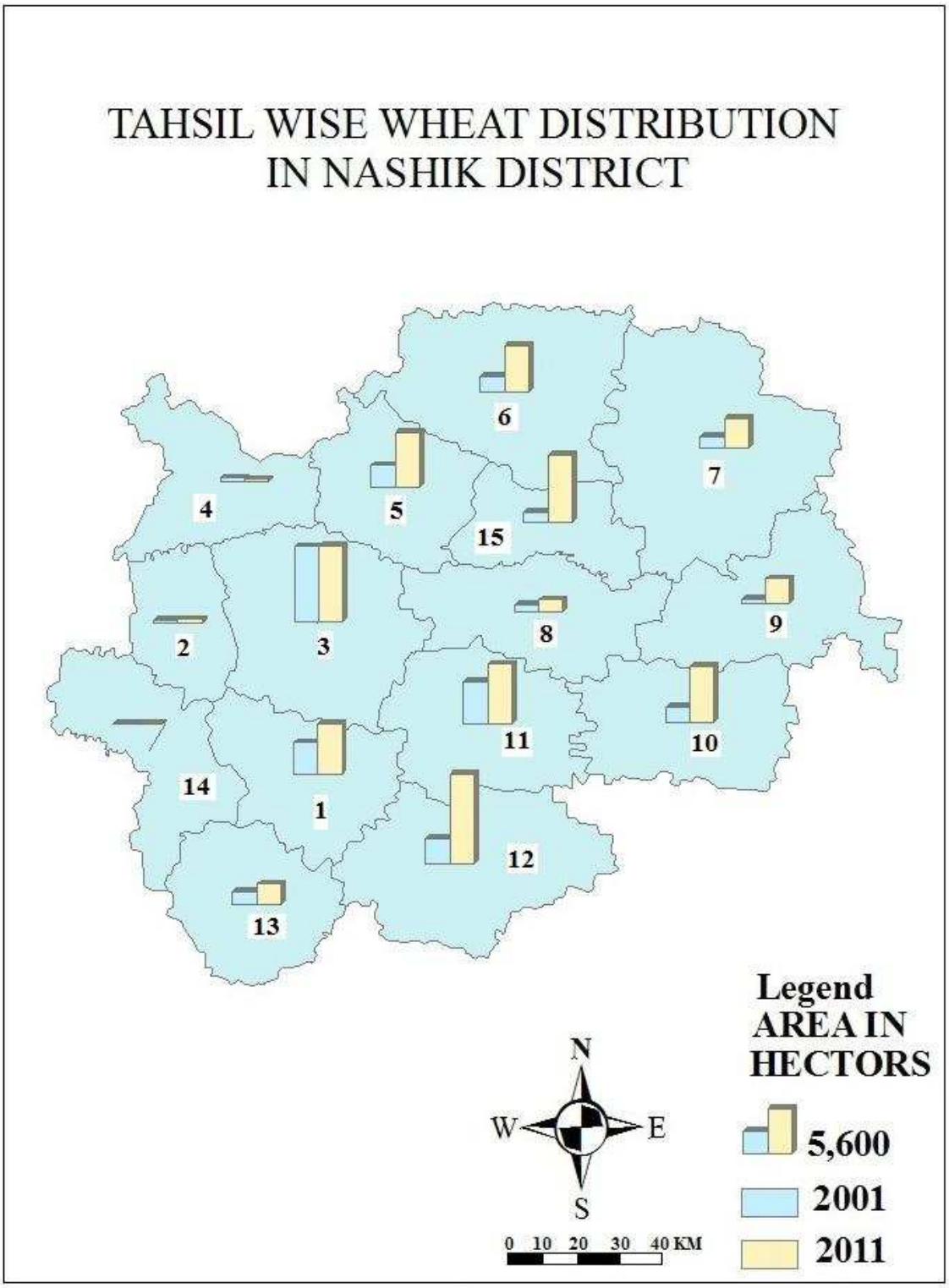
The moderate area under wheat crop is found only in 2001 like the tahsils Nasik and Niphad. High area under wheat crop was found only in 2011 decade in the tahsils namely Nasik, Niphad Yeola, Kalwan and Satana. On the other hand very high wheat area was found in Dindory in 2001 and Deola Dindory and Sinnar in 2011 as shown in table No. 5.2 and Map No. 5.4 & 5.5

Map No. 5.5



Map No. 5.4




TAHSIL WISE WHEAT DISTRIBUTION
IN NASHIK DISTRICT
6
7
4
5
15
9
8
2
3
11
10
14
1
12
13
N
W
E
S
0 10 20 30 40 KM
Legend
AREA IN
HECTORS
5,600
2001
2011

Map No. 5.6

5.4 b Temporal changes in Wheat crop in Nasik District

There is remarkable increase in the area under wheat in the tahsils known as Sinnar Yeola, Deola, Satana, Kalwan, Malegaon, Nandgaon, Nasik and Igatpuri within two decade (2001 & 2011). Whereas there is no change or slight decrease in area under wheat crop in the Trimbak Peth Surgana and Dindory tahsils of Nasik district table No. 5.2 and Map No. 5.6

5.5 a Spatial Variation of Jowar crop in Nasik District

Most of the area under Jowar was found in Dindory and Yeola tahsil in 2001 and Deola in 2011 which is lies in very high area under Jowar crop. The high area under Jowar crop was found in Nandgaon tahsil in 2011. Moderate density of Jowar crop was found in Niphad Chandwad Kalwan and Malegaon in 2001 and Kalwan Malegaon and Yeola in 2011.

Low intensity of crop was found in Surgana, Satana, Nandgaon and Sinnar in 2001, Dindory Nasik and Chandwad in 2011. At the bottom, tahsils like Igatpuri, Trimbak, Nasik, Peth and Deola in 2001where as Surgana, Satana, Peth, Trimbak, Igatpuri, Sinnar and Niphad tahsils found under very low area of Jowar as shown in table No. 5.3 and Map No. 5.7 & 5.8

5.5 b Temporal changes in Jowar crop in Nasik District

Only in few tahsils there was increase in area under Jowar they are Deola, Nandgaon, Kalwan and Nasik in the decade 2001 to 2011 while remaining all tahsils showed negative trend of growth (table No. 5.3 and Map No. 5.9)

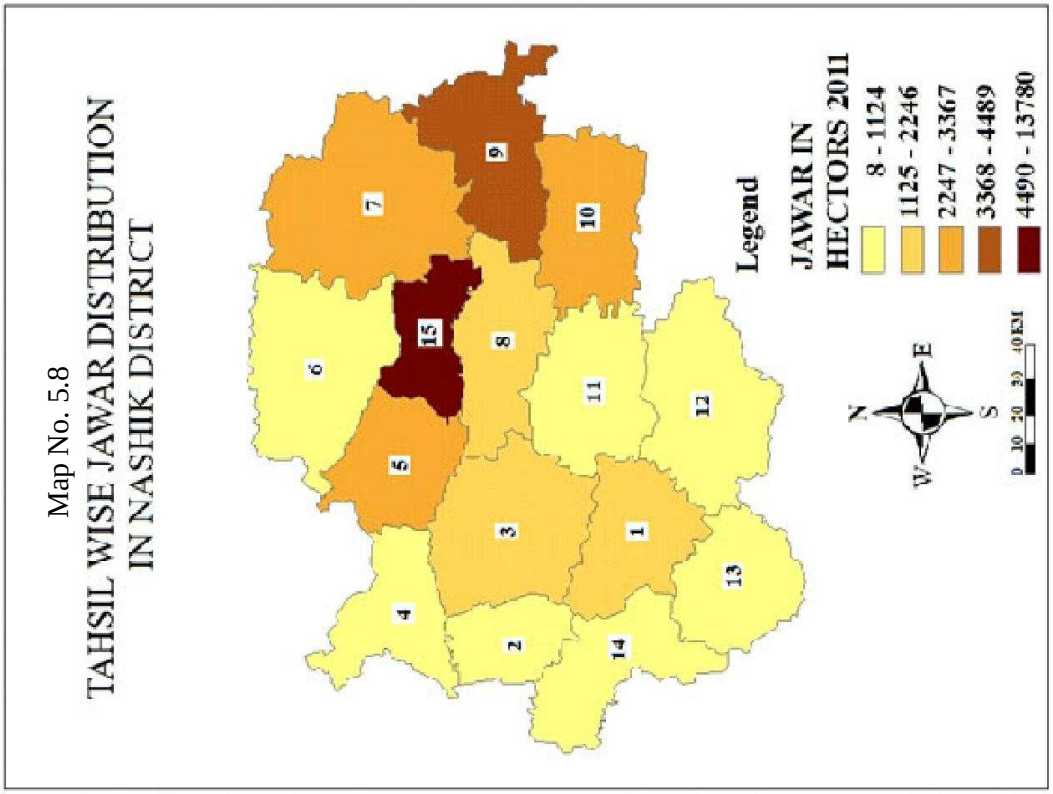
Table 5.3 Jowar Area in ‘00’ hectors

No.	Name of Tahsil	2000-01	2010-11
1	Nasik	340	2241
2	Peth	03	08
3	Dindory	5610	2077
4	Surgana	2030	526
5	Kalwan	2556	2752
6	Satana	1329	291
7	Malegaon	2832	2399
8	Chandwad	3120	1909
9	Nandgaon	1500	3726
10	Yeola	5108	3070
11	Niphad	2305	242
12	Sinnar	1293	1001
13	Igatpuri	725	55
14	Trimbak	18	22
15	Deola	63	13780
	Total	28314	34069

(Source: Socio-Economic Abstract, Nasik District 2001 and 2011)

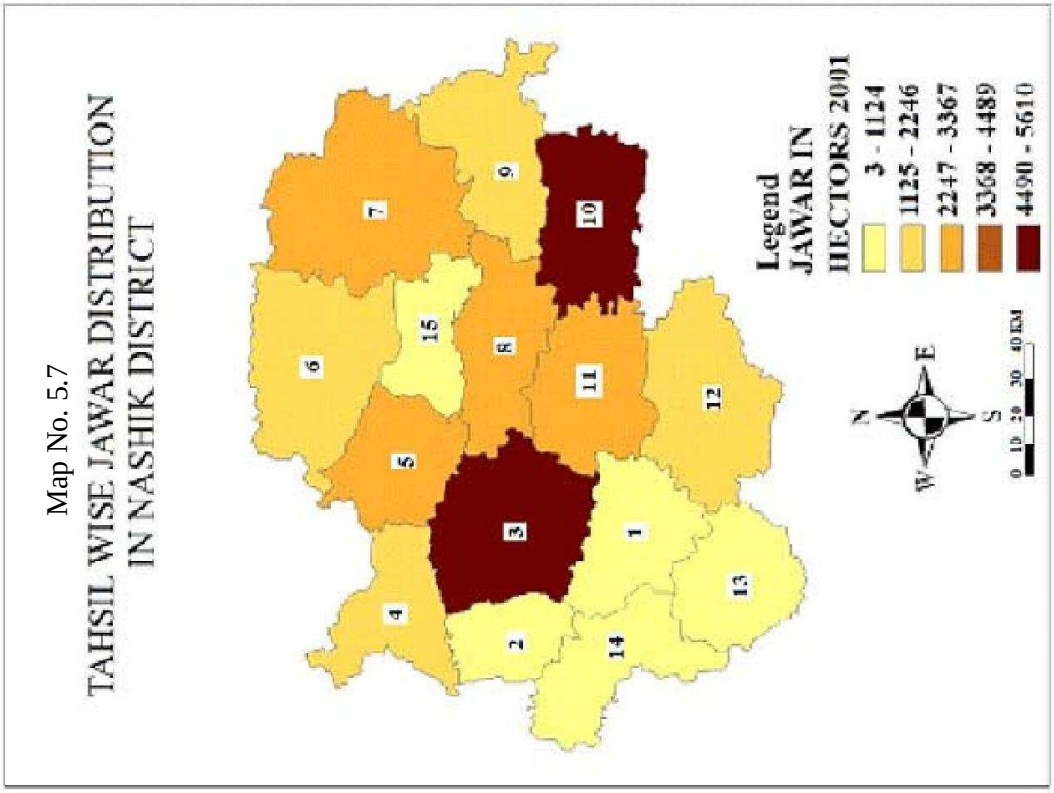
Map No. 5.8

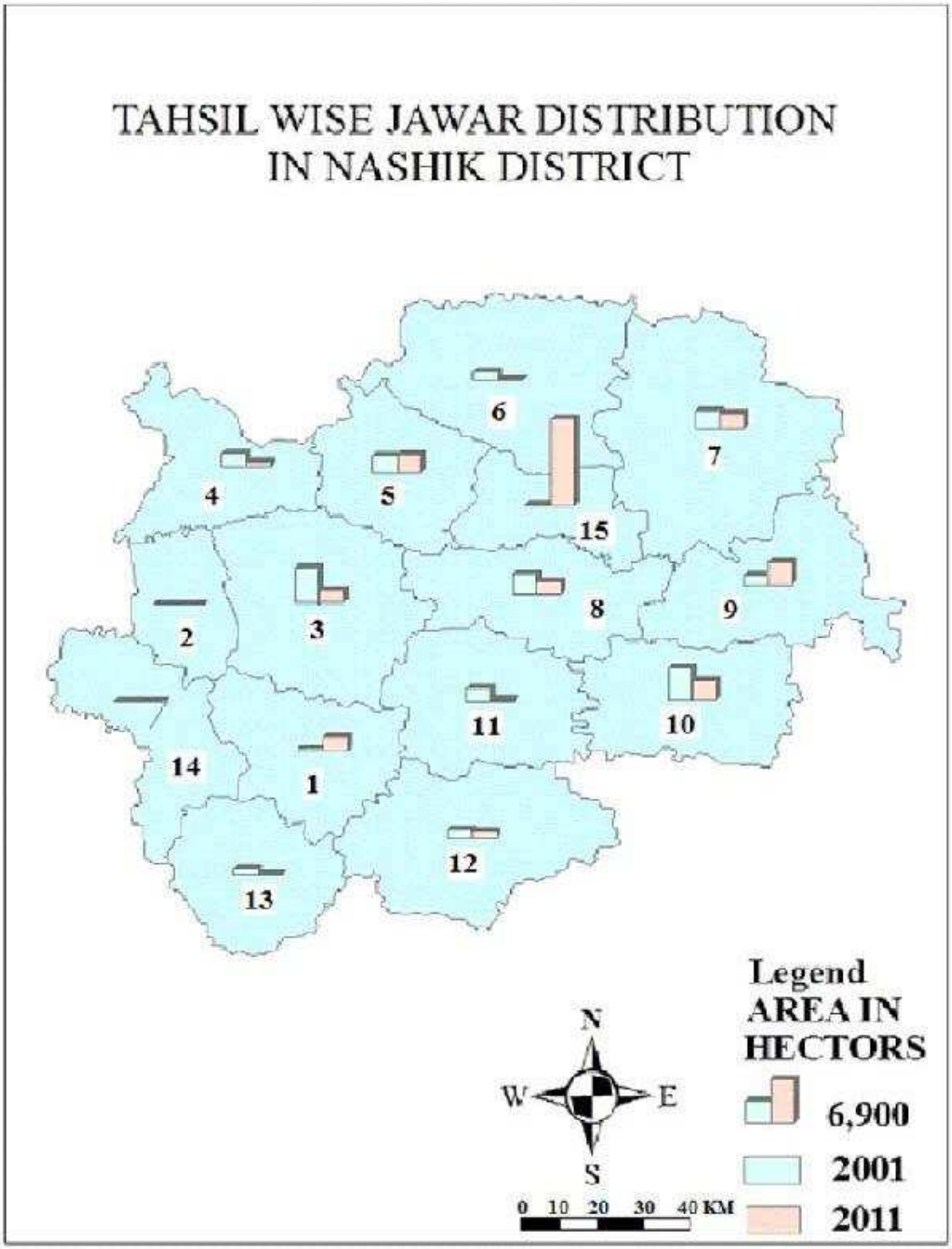
TAHSIL WISE JAWAR DISTRIBUTION IN NASHIK DISTRICT



Map No. 5.7

TAHSIL WISE JAWAR DISTRIBUTION IN NASHIK DISTRICT




TAHSIL WISE JAWAR DISTRIBUTION
IN NASHIK DISTRICT
6
7
4
5
15
8
9
2
3
11
10
14
1
12
13
Legend
AREA IN
HECTORS
6,900
2001
2011
N
W
E
S
0 10 20 30 40 KM

Map No. 5.9

5.6 a Spatial Variation of Bajara crop in Nasik District

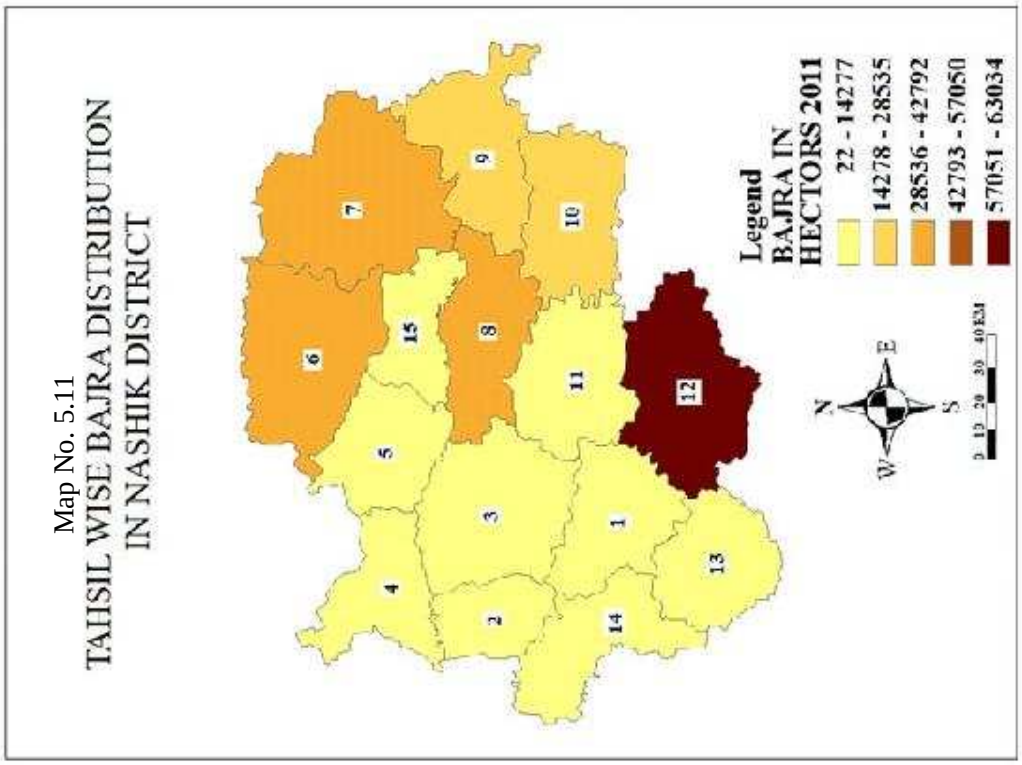
Tahsils like Surgana, Peth, Trimbak, Igatpuri, Nasik, Dindory and Kalwan contain very low area under Bajara crop in both the decade and 2011 there were Niphad and Deola tahsils.

Table 5.4 Bajara Area in '00' hectors

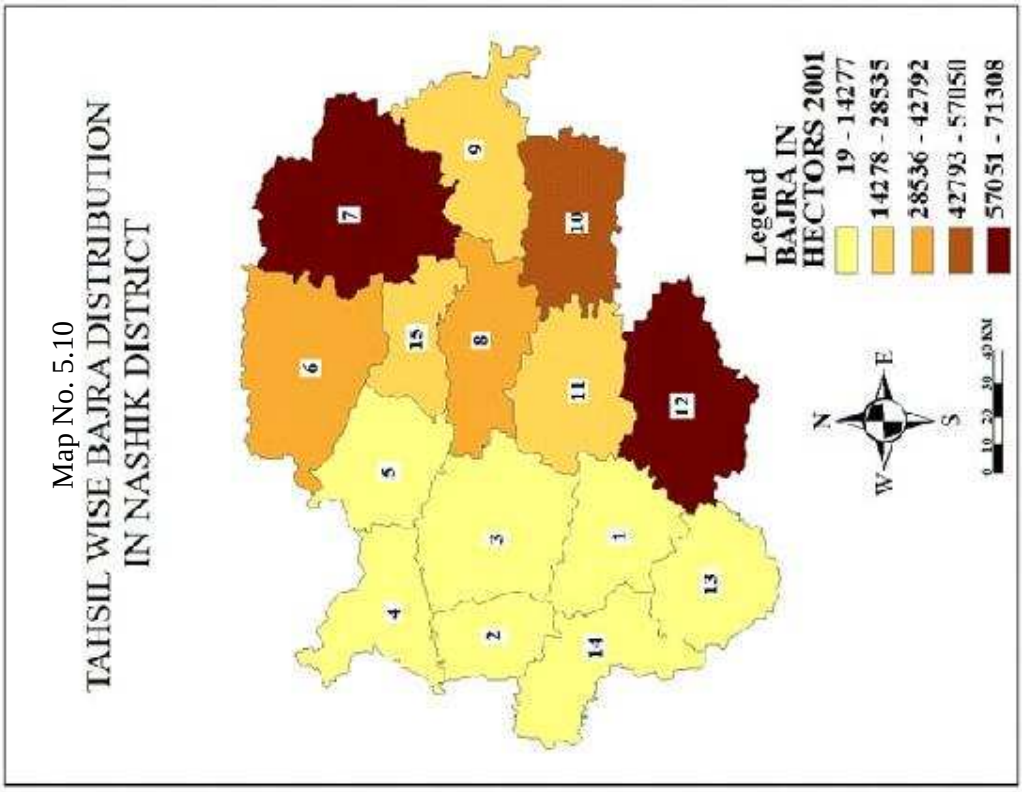
No.	Name of Tahsil	2000-01	2010-11
1	Nasik	1289	349
2	Peth	28	35
3	Dindory	708	1549
4	Surgana	73	42
5	Kalwan	9631	9890
6	Satana	41154	36855
7	Malegaon	71308	35067
8	Chandwad	35720	34169
9	Nandgaon	25000	24986
10	Yeola	48964	19650
11	Niphad	22395	1145
12	Sinnar	60190	63034
13	Igatpuri	19	22
14	Trimbak	35	28
15	Deola	20367	13516
	Total	336685	241110

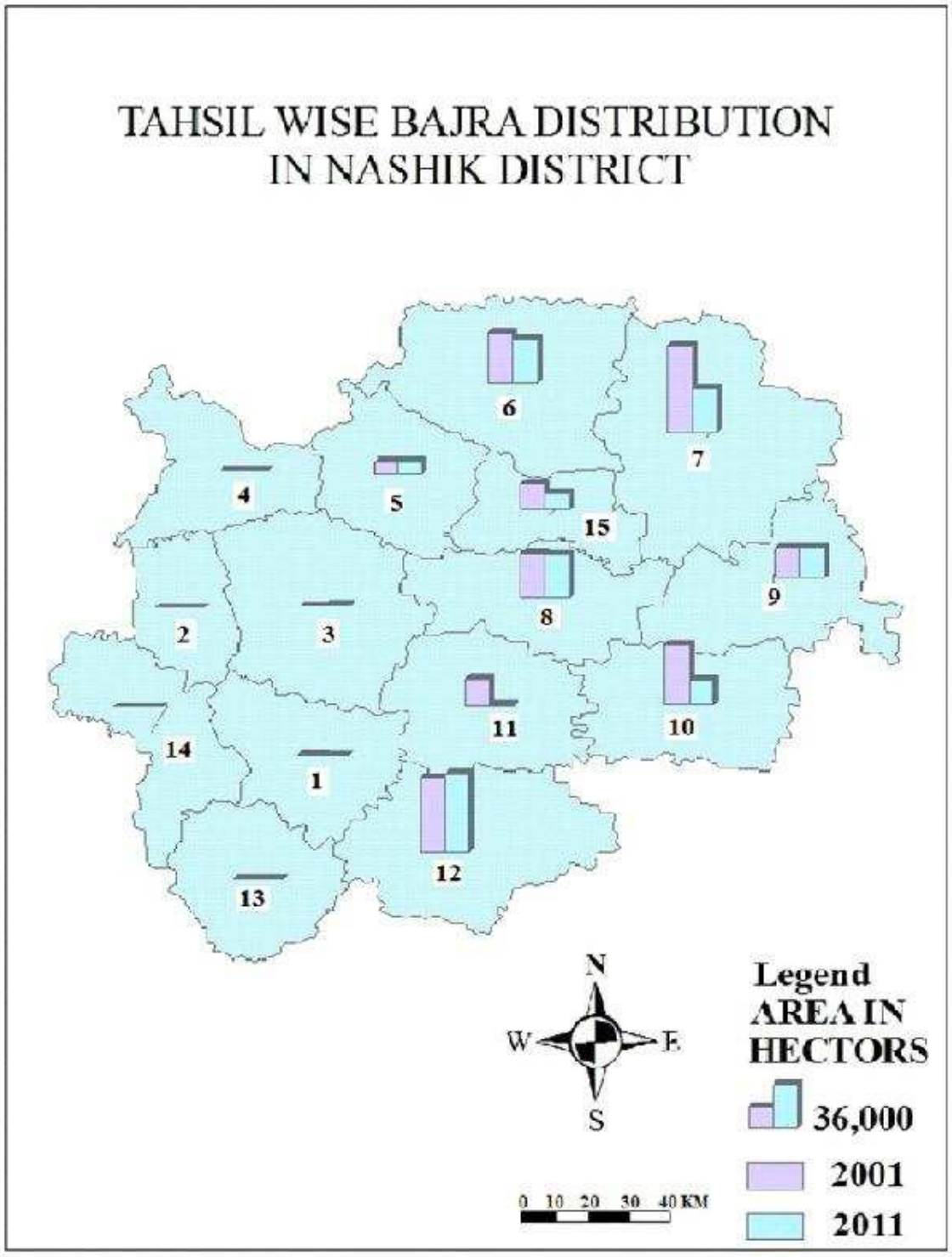
(Source: Socio-Economic Abstract, Nasik District 2001 and 2011)

Map No. 5.11
TAHSIL WISE BAJRA DISTRIBUTION
IN NASHIK DISTRICT



Map No. 5.10
TAHSIL WISE BAJRA DISTRIBUTION
IN NASHIK DISTRICT




TAHSIL WISE BAJRA DISTRIBUTION
IN NASHIK DISTRICT
6
7
4
5
15
9
8
2
3
11
10
14
1
12
13
N
W
E
S
0 10 20 30 40 KM
Legend
AREA IN
HECTORS
36,000
2001
2011

Map No. 5.12

The lower density of Bajara crop is found in Nandgaon (2001 &2011) and Yeola (2011) tahsils. The tahsils like Chandwad and Satana (2001 & 2011) and Malegaon in 2011 hold the Moderate area under Bajara crop. High density of Bajara crop was observed in Yeola tahsil in 2001 while Sinnar (2001 & 2011) and Malegaon (2001) tahsils acquired the stateus of very high area under Bajara crop as shown in table No. 5.4 and Map No. 5.10 & 5.11

5.6 b Temporal changes in Bajara crop in Nasik District

Bajara crop is dominated only in Sinnar tahsil which shows positive trend of growth in 2001 to 2011. Though the area under Bajara crop is higher in Satana, Malegaon, Deola, Chandwad, Yeola and Niphad there is decreasing trend in 2001 to 2011. While in Surgana, Peth, Dindory, Kalwan, Nasik, Trimbak and Igatpuri shows very less area under Bajara crop table No. 5.4 and Map No. 5.12

5.7 a Spatial Variation of Sugarcane crop in Nasik District

In Niphad tahsil there is very high concentration found in 2001 while in 2011 it shows moderate area under sugarcane. In 2001 other than Niphad all tahsils merge in very low area under sugarcane.

In 2011 Dindory tahsil there is very high concentration of sugarcane. Moderate concentration was found in Kalwan tahsil and remaining all tahsils shows very low concentration of sugarcane crop in entire study region in the decade 2011 as shown in table No. 5.5 and Map No. 5.13 & 5.14

5.7 b Temporal changes in Sugarcane crop in Nasik District

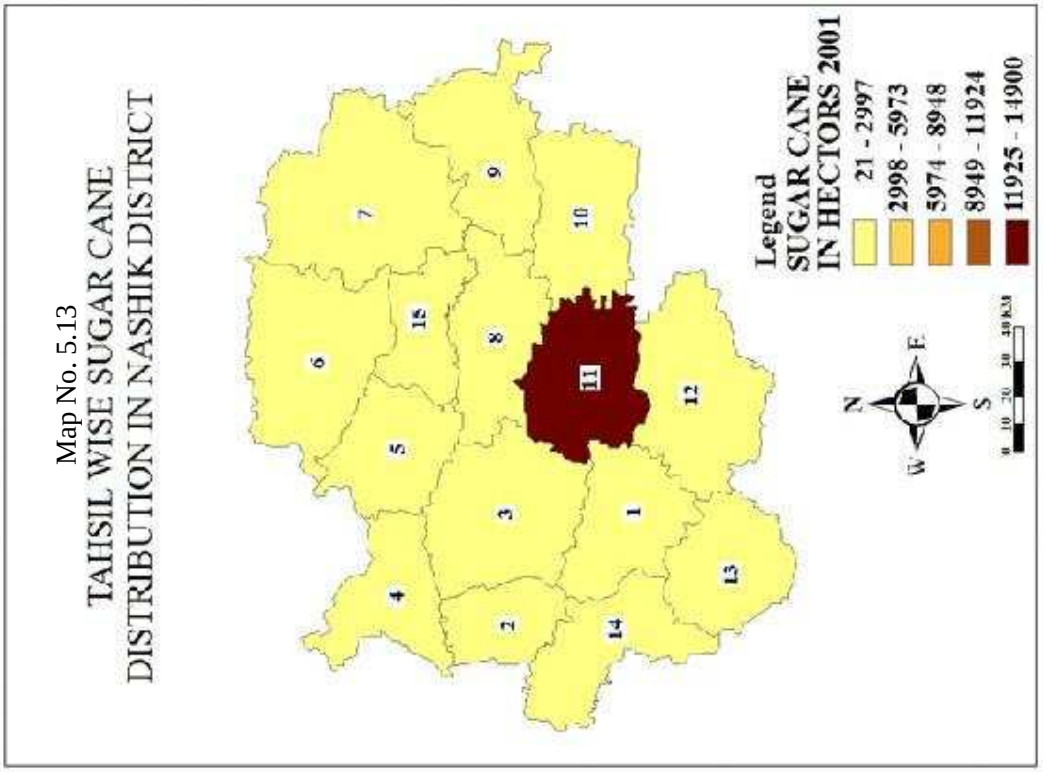
It was found in the study region there increase in the area of sugarcane in the tahsils Satana, Malegaon, Deola, Dindory, Sinnar, Igatpuri and Kalwan (2001 to 2011). The negative trend of growth for sugarcane area was found in Surgana, Peth, Trimbak, Nasik, Nandgaon, Yeola and Niphad (table No. 5.5 and Map No. 5.15)

Table 5.5 Sugarcane Area in '00' hectors

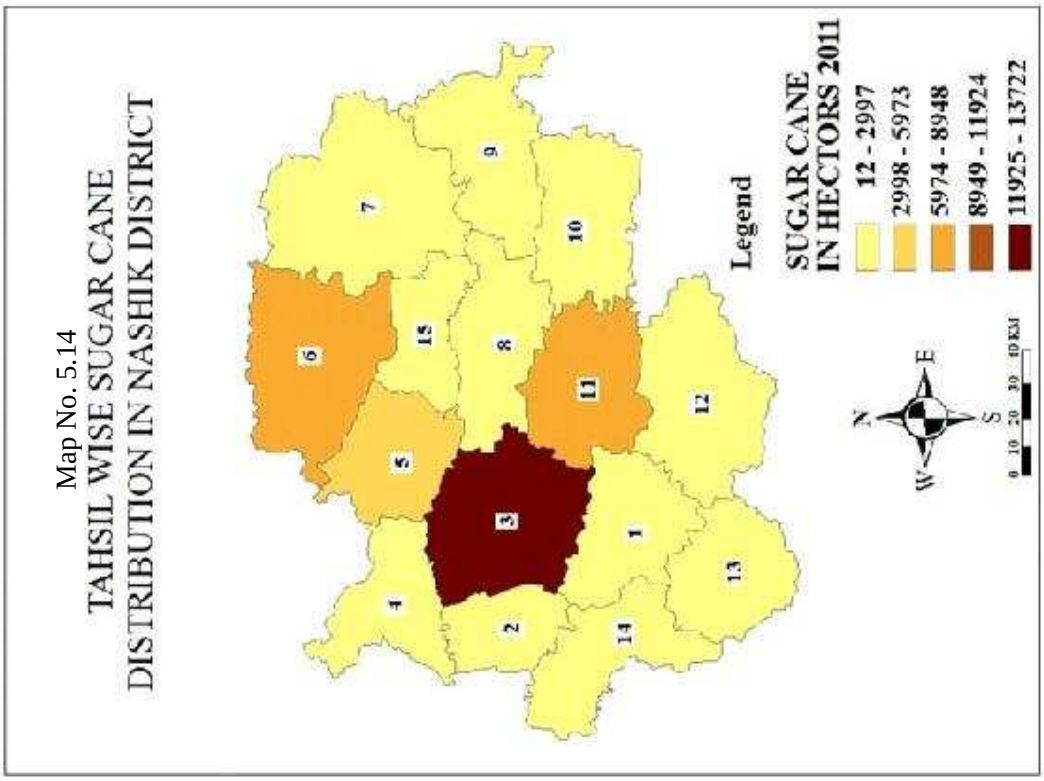
No.	Name of Tahsil	2000-01	2010-11
1	Nasik	2235	1622
2	Peth	79	169
3	Dindory	2860	13722
4	Surgana	22	35
5	Kalwan	1150	4728
6	Satana	2969	6440
7	Malegaon	892	2000
8	Chandwad	253	40
9	Nandgaon	2895	235
10	Yeola	967	56
11	Niphad	14900	8270
12	Sinnar	1485	2122
13	Igatpuri	193	2728
14	Trimbak	21	12
15	Deola	392	1341
	Total	31291	43508

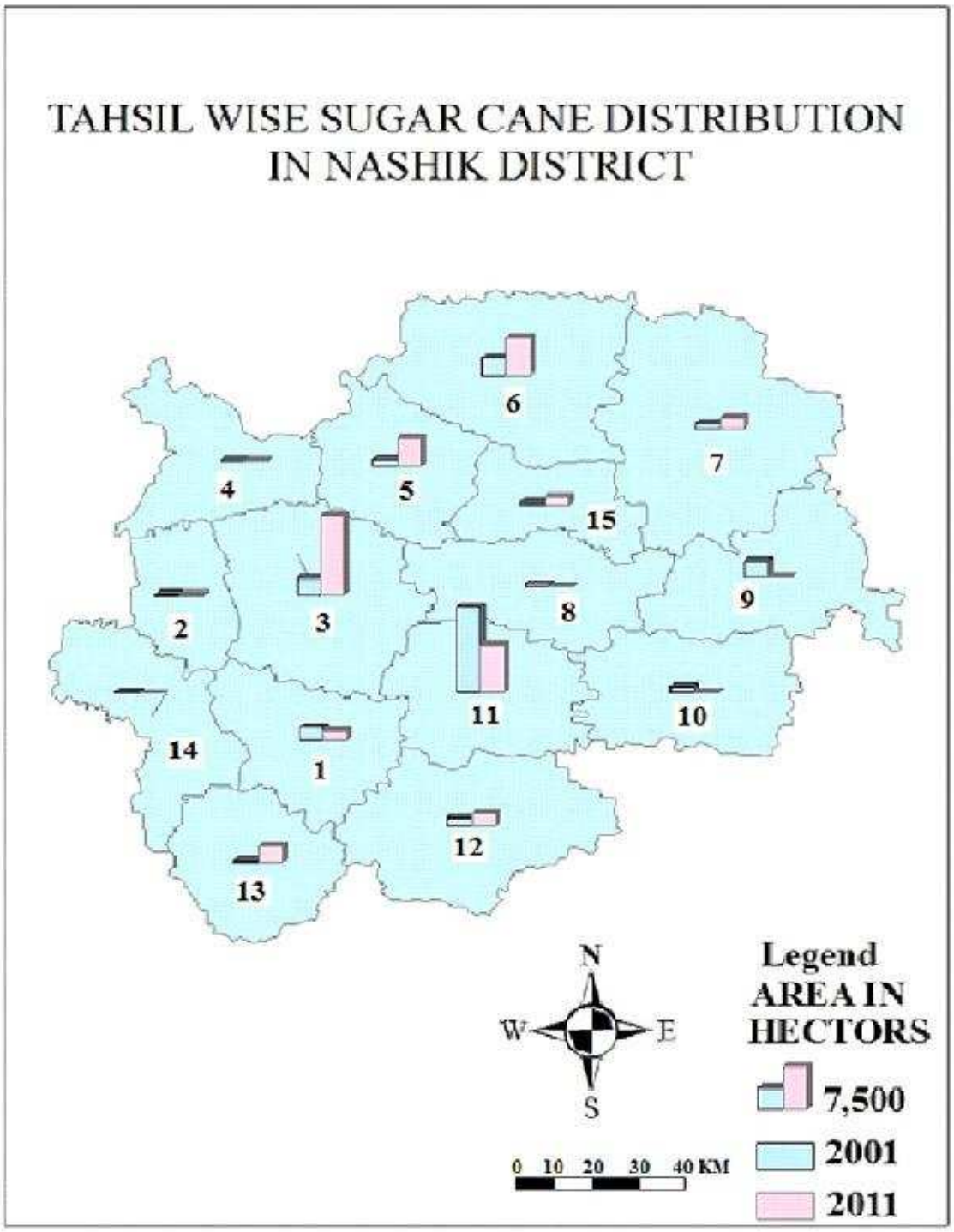
(Source: Socio-Economic Abstract, Nasik District 2001 and 2011)

Map No. 5.13
TAHSIL WISE SUGAR CANE
DISTRIBUTION IN NASHIK DISTRICT



Map No. 5.14
TAHSIL WISE SUGAR CANE
DISTRIBUTION IN NASHIK DISTRICT




TAHSIL WISE SUGAR CANE DISTRIBUTION
IN NASHIK DISTRICT
6
7
4
5
15
9
2
3
8
11
10
14
1
12
13
N
W
E
S
0 10 20 30 40 KM
Legend
AREA IN
HECTORS
7,500
2001
2011

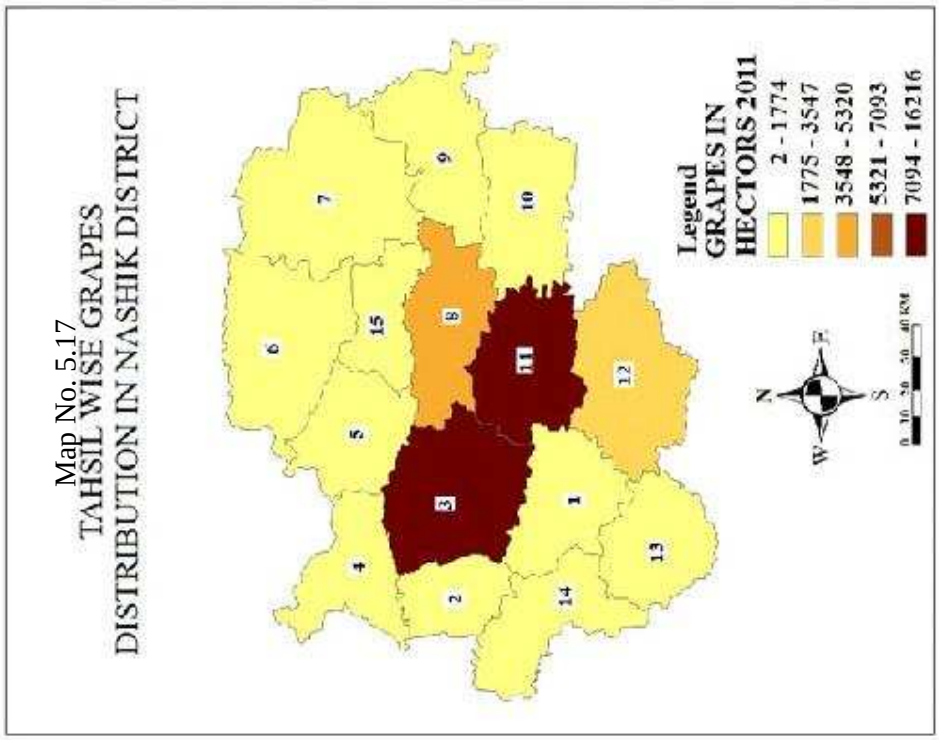
Map No. 5.15

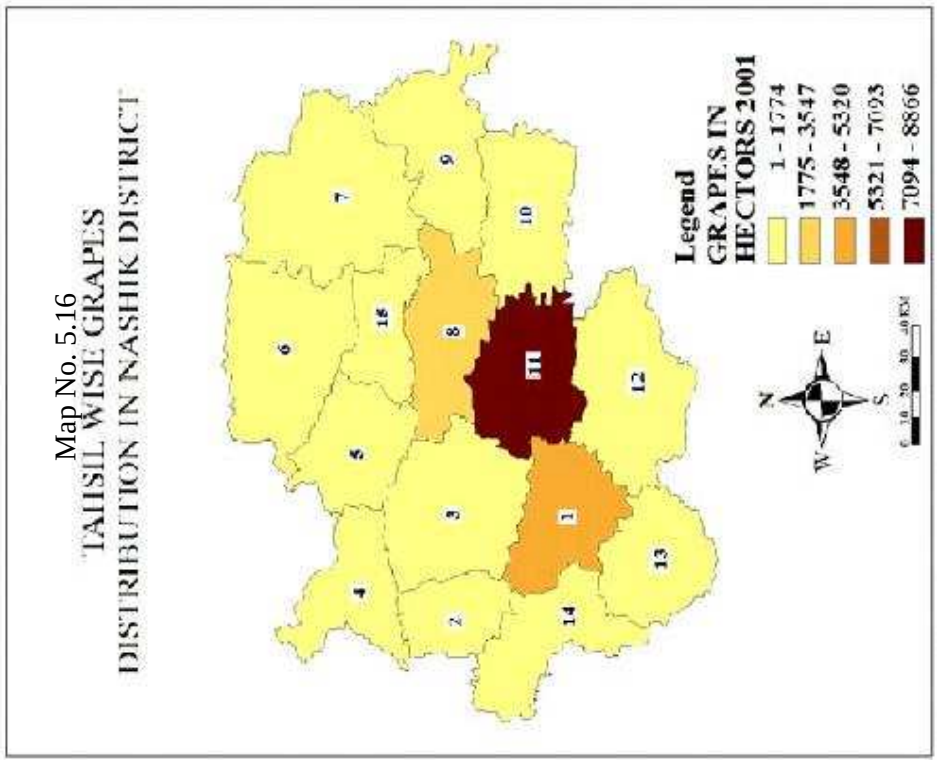
5.8 a Spatial Variation of Grapes crop in Nasik District

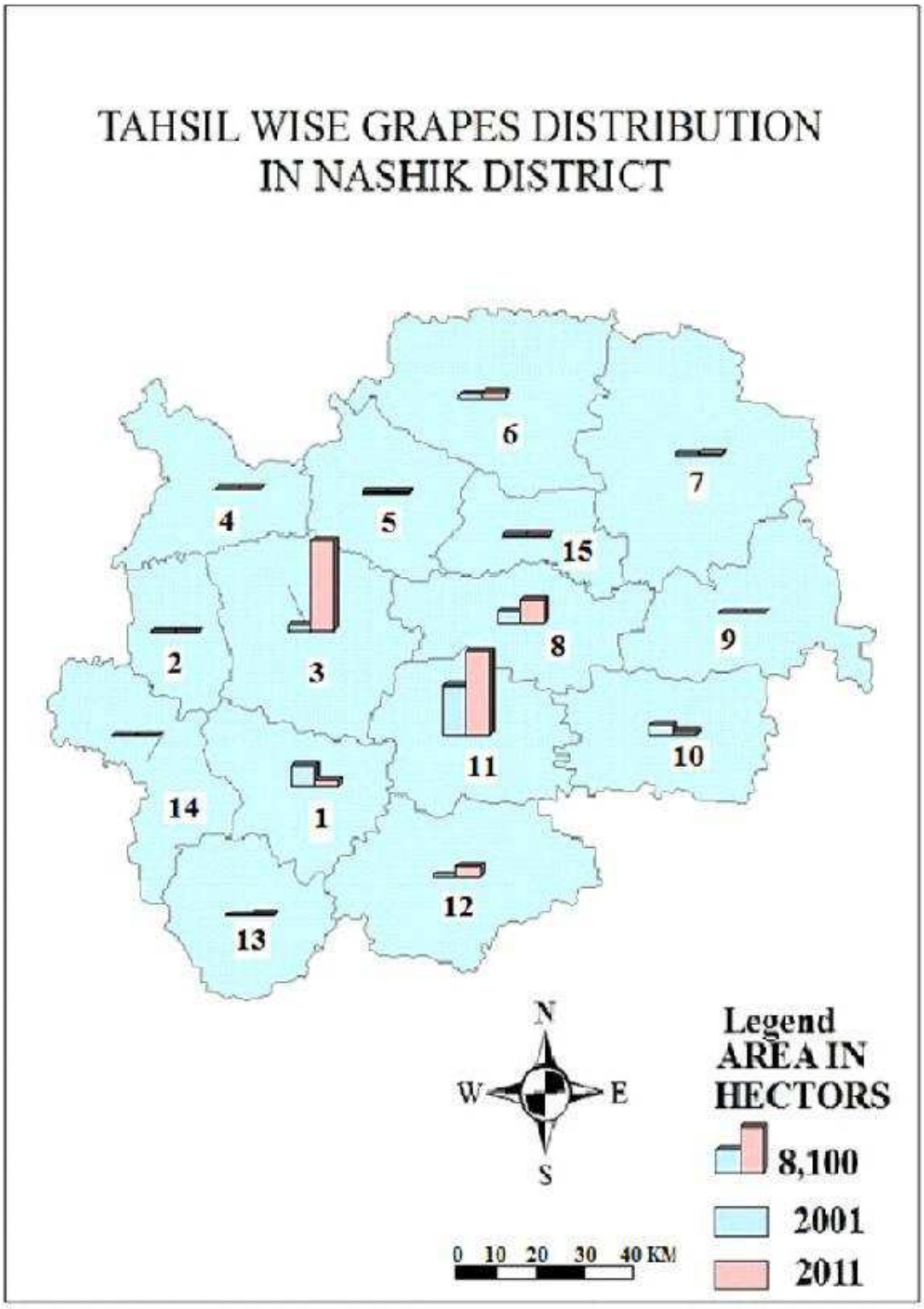
Table 5.6 Grapes Area in '00' hectors

No.	Name of Tahsil	2000-01	2010-11
1	Nasik	3641	1076
2	Peth	02	02
3	Dindory	1074	16216
4	Surgana	12	46
5	Kalwan	198	158
6	Satana	611	1080
7	Malegaon	85	419
8	Chandwad	1880	3950
9	Nandgaon	17	53
10	Yeola	1762	580
11	Niphad	8866	15037
12	Sinnar	394	1900
13	Igatpuri	50	125
14	Trimbak	01	08
15	Deola	84	139
	Total	17027	40779

(Source: Socio-Economic Abstract, Nasik District 2001 and 2011)


Map No. 5.17
TAHSIL WISE GRAPES
DISTRIBUTION IN NASHIK DISTRICT
Legend
GRAPES IN
HECTORS 2011
2 - 1774
1775 - 3547
3548 - 5320
5321 - 7093
7094 - 16216
N
E
W
S
0 10 20 30 40 KM


Map No. 5.16
TAHSIL WISE GRAPES
DISTRIBUTION IN NASHIK DISTRICT
Legend
GRAPES IN
HECTORS 2001
1 - 1774
1775 - 3547
3548 - 5320
5321 - 7093
7094 - 8866
N
E
W
S
0 10 20 30 40 KM


TAHSIL WISE GRAPES DISTRIBUTION
IN NASHIK DISTRICT
6
7
4
5
15
8
9
2
3
11
10
14
1
12
13
N
W
E
S
Legend
AREA IN
HECTORS
8,100
2001
2011
0 10 20 30 40 KM

Map No. 5.18

Niphad tahsil is leading in Grapes cultivation among all the tahsil in Nasik district in both decade (2001 & 2011). In 2011 another tahsil known as Dindory contain very high density of Grapes cultivation. Moderate area under Grapes cultivation was found in Nasik tahsil (2001) and Chandwad in 2011. Tahsil name as Chandwad (2001) and Sinnar (2011) hold low area under Grapes cultivation. On the other hand tahsils like Igatpuri, Trimbak, Peth, Surgana, Kalwan, Satana, Malegaon, Nandgaon, Yeola shows very low area under grapes cultivation as shown in table No. 5.6 and Map No. 5.16 & 5.17

5.8 b Temporal changes in Grapes crop in Nasik District

In the Dindory tahsil crop under Grapes is increase with more than 10 fold with respect to 2001 decade. Also tahsils namely Niphad, Chandwad, Sinnar Malegaon, Igatpuri and Satana there was increase in area under grapes from decade 2001 to 2011. There was decrease in area under grapes in Nasik and Yeola tahsil. While there is no change found in grapes area in tahsils like Trimbak, Peth, Surgana and Kalwan. (Table No. 5.6 and Map No. 5.18)

5.9 a Spatial Variation of Onion crop in Nasik District

Among all the crops area under onion a remarkabl increase is shown in Nasik district. It increased in the decade 2011 as compared to 2001 decade. Very low area under onion crop is found in the tahsils like Igatpuri, Trimbak, Nasik, Peth, Dindory and Surgana in both the decade. In 2001 tahsils namely Sinnar, Kalwan, Deola, Satana, Malegaon shows low density. The moderate, high and very high density was observed only in each tahsil in 2001, they are Yeola Niphad and Chandwad. On the other hand tahsils like Sinnar, Niphad, Yeola, Chandwad, Nandgaon, Deola, Kalwan, Satana and Malegaon hold very high area under onion crop in 2011 is shown as table No. 5.7 and Map No. 5.19 & 5.20

5.9 b Temporal changes in Onion crop in Nasik District

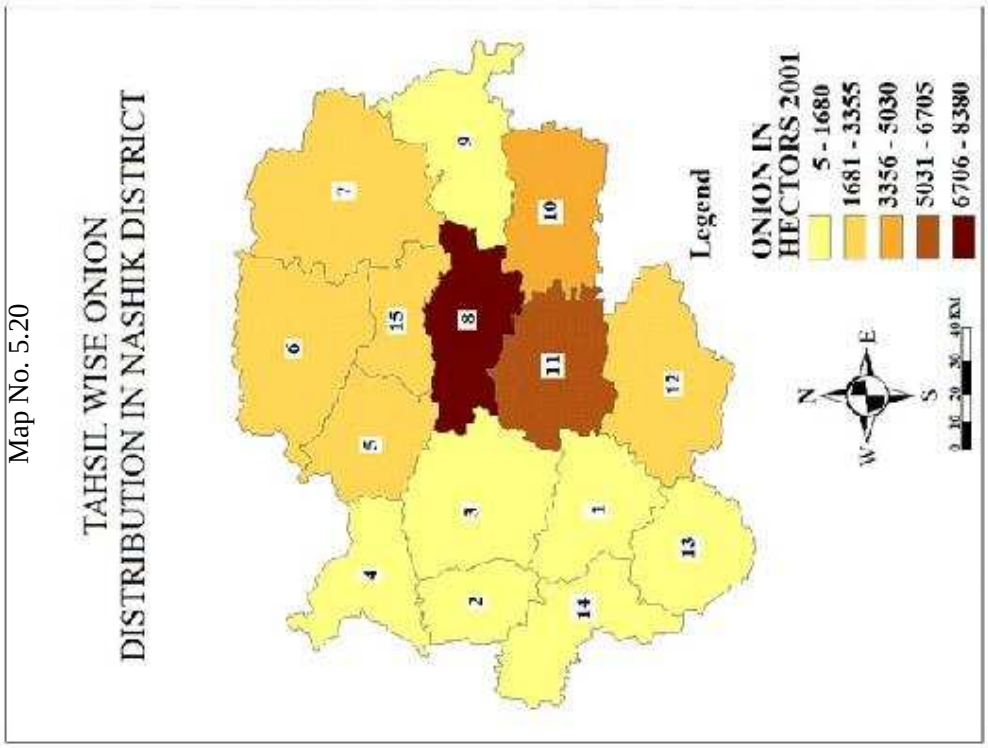
There is remarkable increase in the area under onion crop. It is uplifted up from 5 to 10 fold in the following tahsils Sinnar Niphad, Chandwad, Peth, Kalwan, Satana, Malegaon, Nandgaon and Yeola. The two tahsil known as Nasik and Dindory shows as increasing trend with 2 fold from 2001 to 2011. The area under onion crop is stagnant within two decade in tahsils like Igatpuri, Trimbak, Peth and Surgana. (Table No. 5.7 and Map No. 5.21)

Table 5.7 Onion Area in '00' hectors

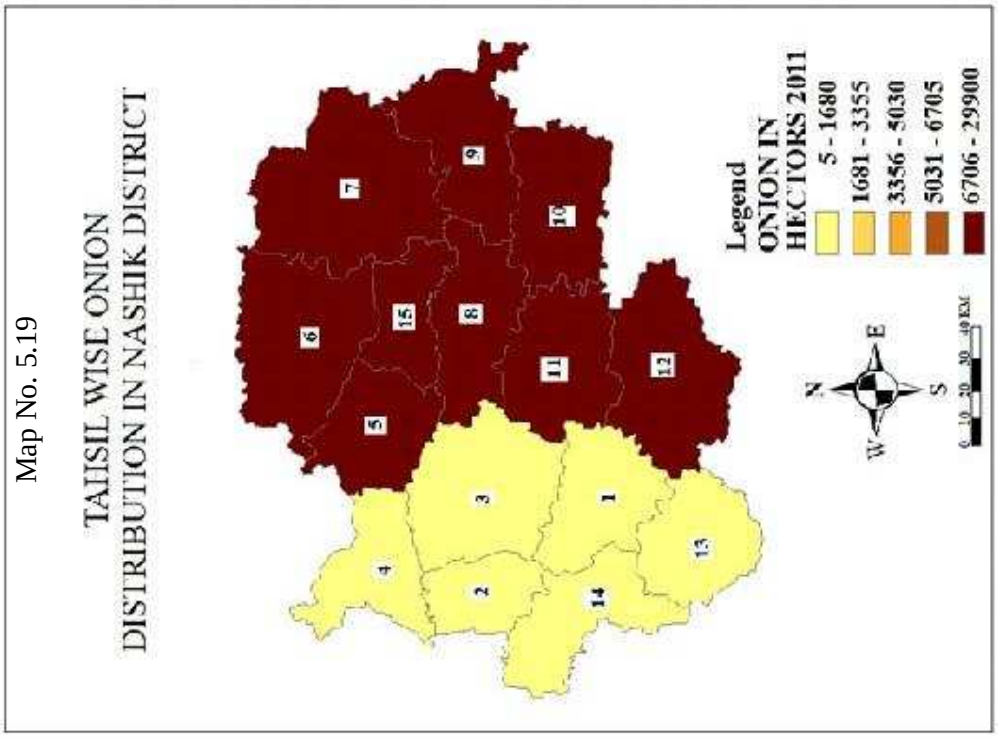
No.	Name of Tahsil	2000-01	2010-11
1	Nasik	718	1612
2	Peth	14	18
3	Dindory	200	1220
4	Surgana	25	32
5	Kalwan	1788	8396
6	Satana	1780	7188
7	Malegaon	2666	7112
8	Chandwad	8380	14860
9	Nandgaon	1400	15320
10	Yeola	4806	29900
11	Niphad	5132	16102
12	Sinnar	3055	10136
13	Igatpuri	331	400
14	Trimbak	5	5
15	Deola	2775	11568
	Total	32861	123846

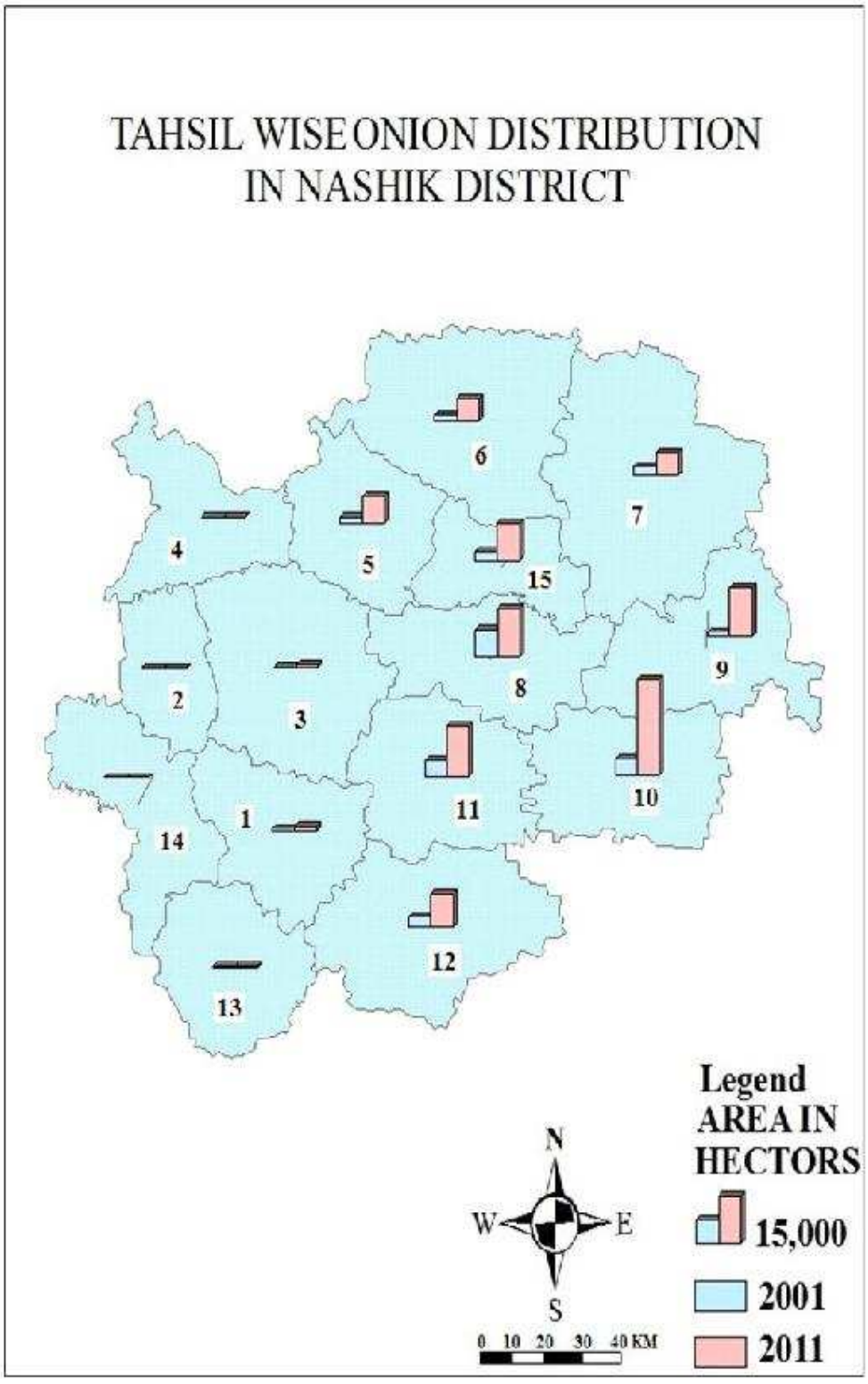
(Source: Socio-Economic Abstract, Nasik District 2001 and 2011)

Map No. 5.20



Map No. 5.19




TAHSIL WISE ONION DISTRIBUTION
IN NASHIK DISTRICT
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
N
W
E
S
0 10 20 30 40 KM
Legend
AREA IN
HECTORS
15,000
2001
2011

Map No. 5.21

Chapter 6

IMPACT OF TRANSPORTATION ON LAND USE OF NASIK DISTRICT

6.1 Spatial variation in Road density in Nasik district

Density of road is very high in Yeola tahsil which shows dense network structure after that Surgana and Dindory tahsil contain high density of road per kilometer. The moderate road density enjoys five tahsils namely Nandgaon, Chandwad, Deola, Peth and Nasik. Low road density was found in Satana, Sinnar and Igatpuri. Lastly very low road density was found in Trimbak, Kalwan and Malegaon tahsil which is shown in table No. 6.1 and Map No. 6.1

6.2 Spatial variation in National Highway density in Nasik district

The length of National highway is large in Nasik tahsil which enjoy very high road density after that Chandwad and Igatpuri shows high road density while Sinnar Niphad, Deola and Malegaon shows moderate road density. Only one tahsil namely Dindory contain low road density and remaining tahsils does not enjoy the national highway as shown in table No. 6.1 and Map No. 6.2

6.3 Spatial variation in State Highway density in Nasik district

In the Trimbak and Nasik tahsil very high concentration of state highway is found. Surgana and Satana tahsils enjoys high density of state highway. While moderate density is found in Kalwan, Deola and Chandwad tahsil. On the other hand low to very low density is found in Peth, Dindory, Niphad, Igatpuri, Sinnar, Yeola, Nandgaon and Malegaon which is shown in table No. 6.1 and Map No. 6.3

6.4 Spatial variation in District Highway density in Nasik district

Most of the district highway is concentrated in Yeola and Dindory tahsils. Moderate density of district highway is found in Nandgaon, Chandwad, Peth and Surgana tahsil. On the other hand low to very low density of district highway is found in Satana, Deola,

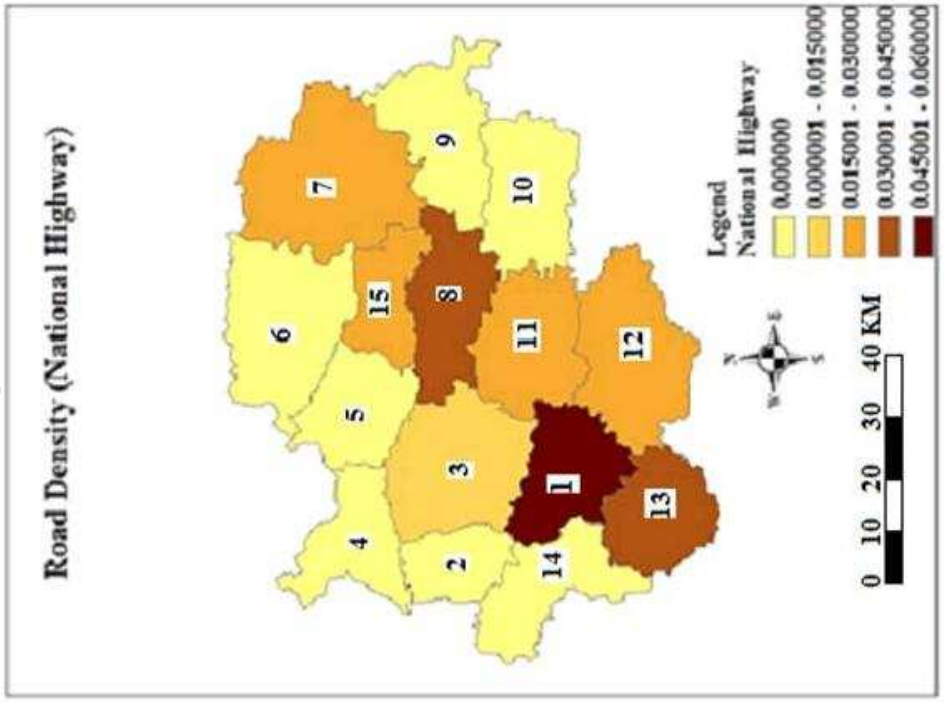
Niphad, Sinnar, Trimbak, Igatpuri, Nasik, Malegaon and Kalwan tahsil which is shown in table No. 6

Table No. 6.1 Tahsil wise Road Density of Nasik District

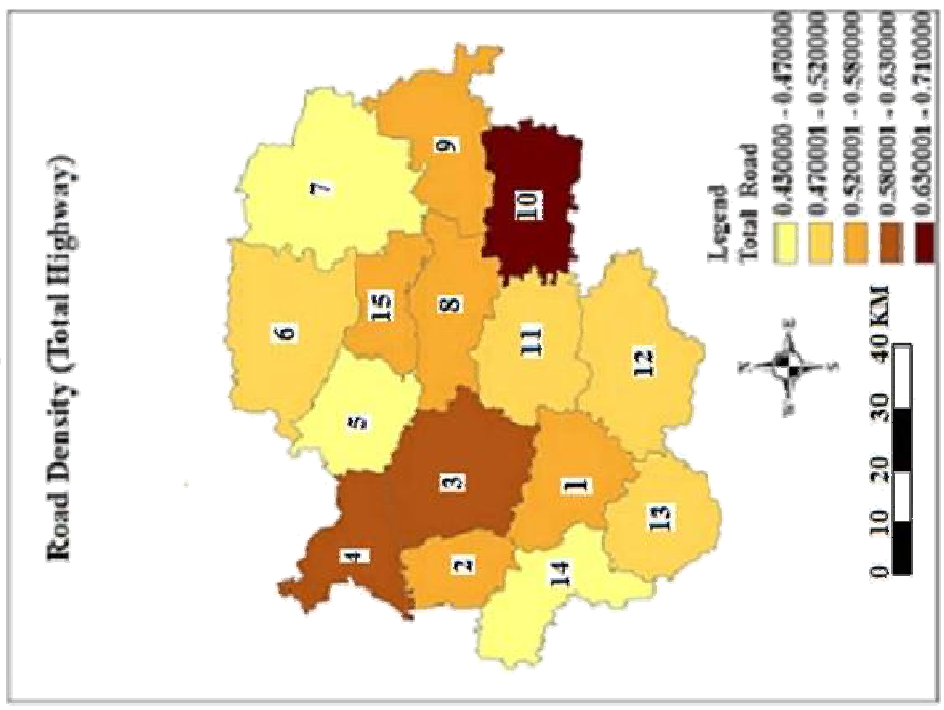
Sr. No.	**Name of**	**Total Area**	**NH**		**SH**		**DH**	
	Tahsil	**in Sq. Km.**	length	Density	length	Density	length	Density
1	Nasik	810.57	45.34	0.056	156.6	0.19	245.7	0.30
2	Peth	560.60	Nil	Nil	73.4	0.13	230.5	0.41
3	Dindory	1342.19	2.70	0.002	184.3	0.14	663.9	0.50
4	Surgana	845.65	Nil	Nil	150.0	0.18	373.2	0.44
5	Kalwan	859.71	Nil	Nil	133.0	0.16	233.8	0.27
6	Satana	1477.83	Nil	Nil	254.9	0.17	515.3	0.35
7	Malegaon	1825.13	42.00	0.023	214.1	0.12	555.6	0.30
8	Chandwad	958.73	34.00	0.035	148.1	0.16	372.6	0.39
9	Nandgaon	1089.82	Nil	Nil	133.8	0.12	452.4	0.42
10	Yeola	1064.47	Nil	Nil	129.4	0.12	628.0	0.59
11	Niphad	1353.65	24.30	0.018	170.6	0.13	500.5	0.37
12	Sinnar	1352.61	34.15	0.025	159.5	0.12	488.7	0.36
13	Igatpuri	846.32	37.88	0.045	121.5	0.14	264.5	0.31
14	Trimbak	884.18	Nil	Nil	175.2	0.20	241.1	0.27
15	Deola	576.94	11.00	0.019	84.15	0.15	210.6	0.37
	Total	15343.86	231.57	0.015	2287.8	0.15	5976.4	0.39

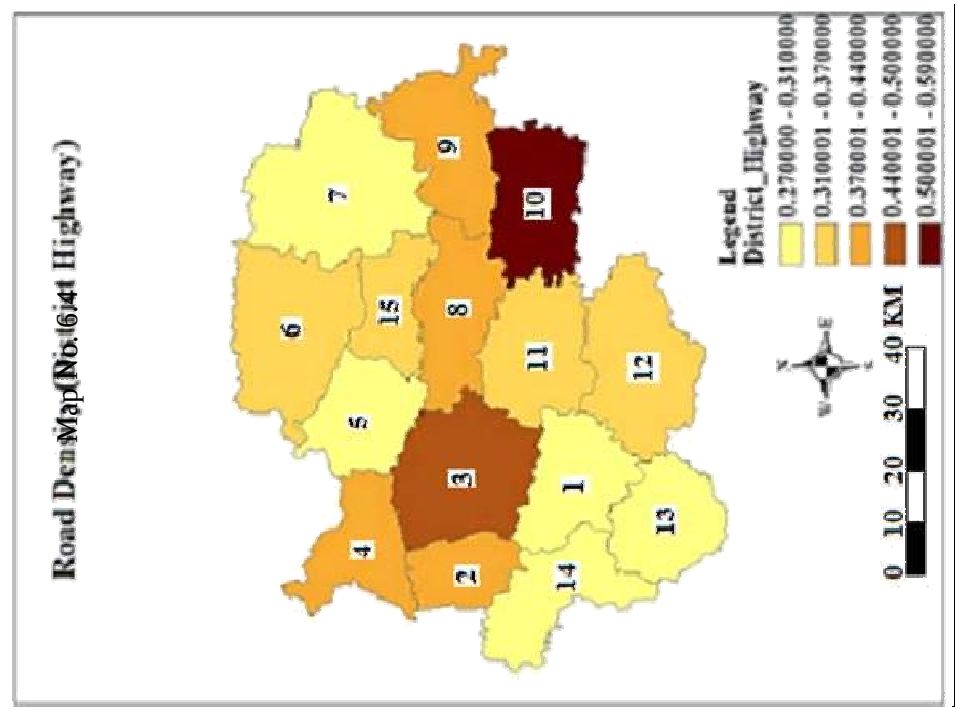
(Source: RTO Nasik Division)

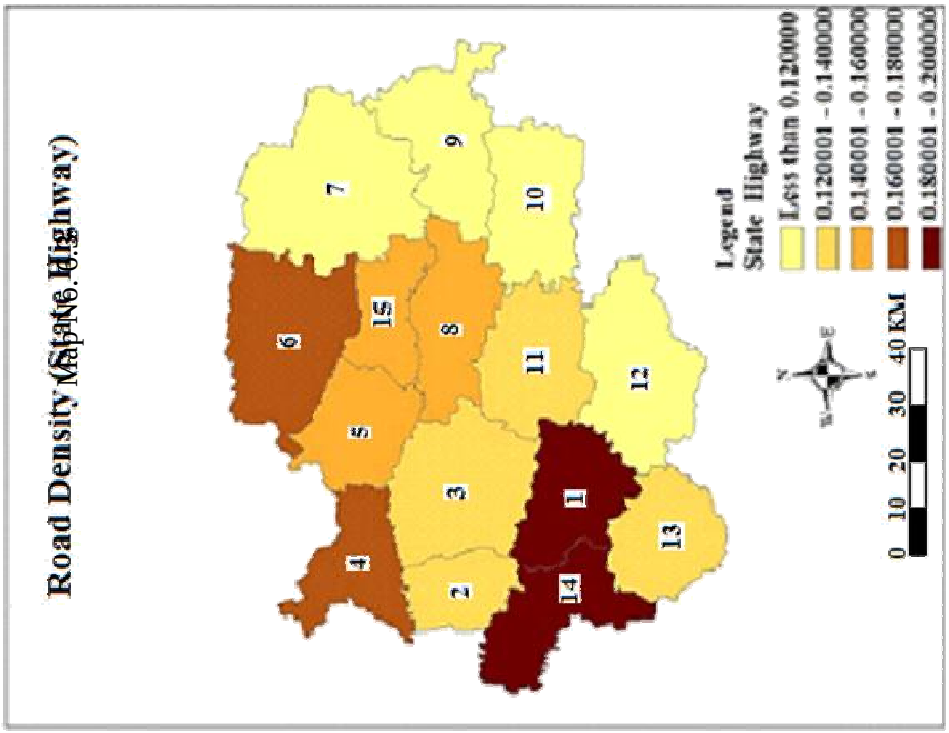
Map No. 6.2



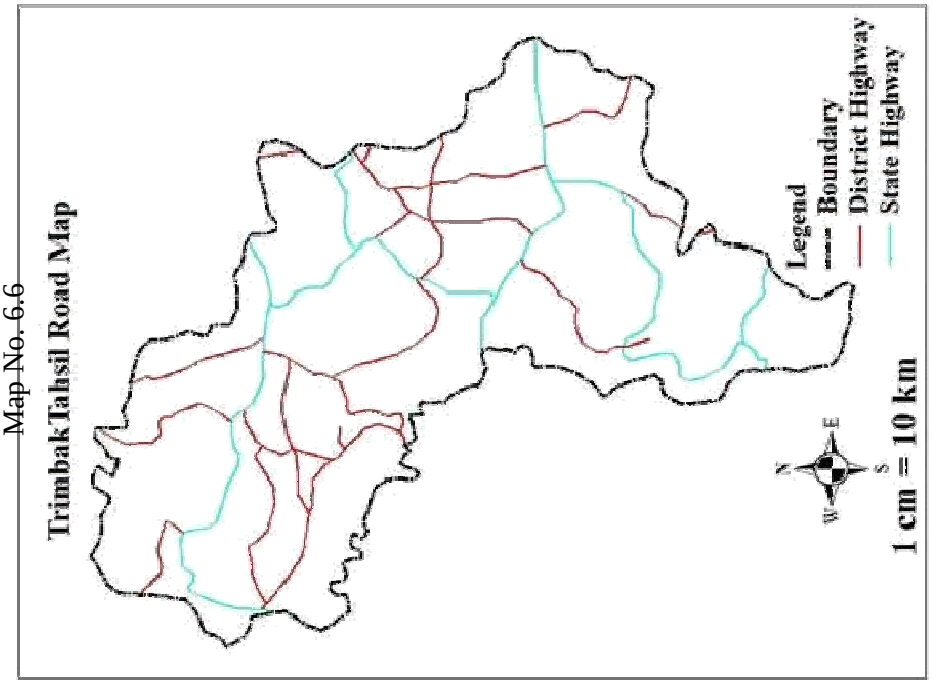
Map No. 6.1 Map No. 6.2



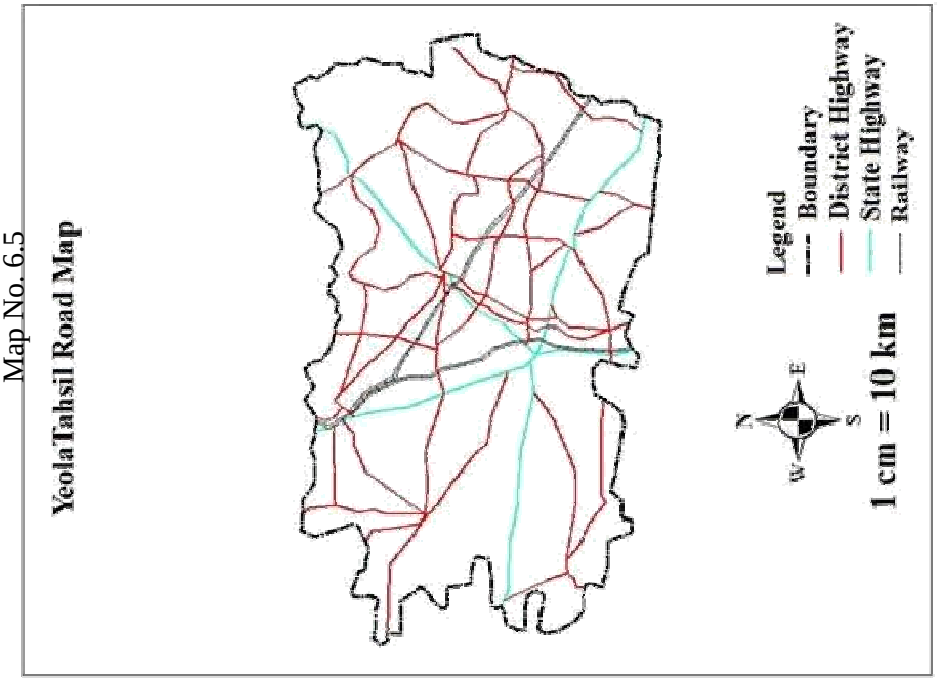

Road Density (State Highway)
Legend
State Highway
Less than 0.120000
0.120001 - 0.140000
0.140001 - 0.160000
0.160001 - 0.180000
0.180001 - 0.200000
0 10 20 30 40 KM
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15


Road Density (National Highway)
Legend
District_Highway
0.270000 - 0.310000
0.310001 - 0.370000
0.370001 - 0.440000
0.440001 - 0.500000
0.500001 - 0.590000
0 10 20 30 40 KM
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

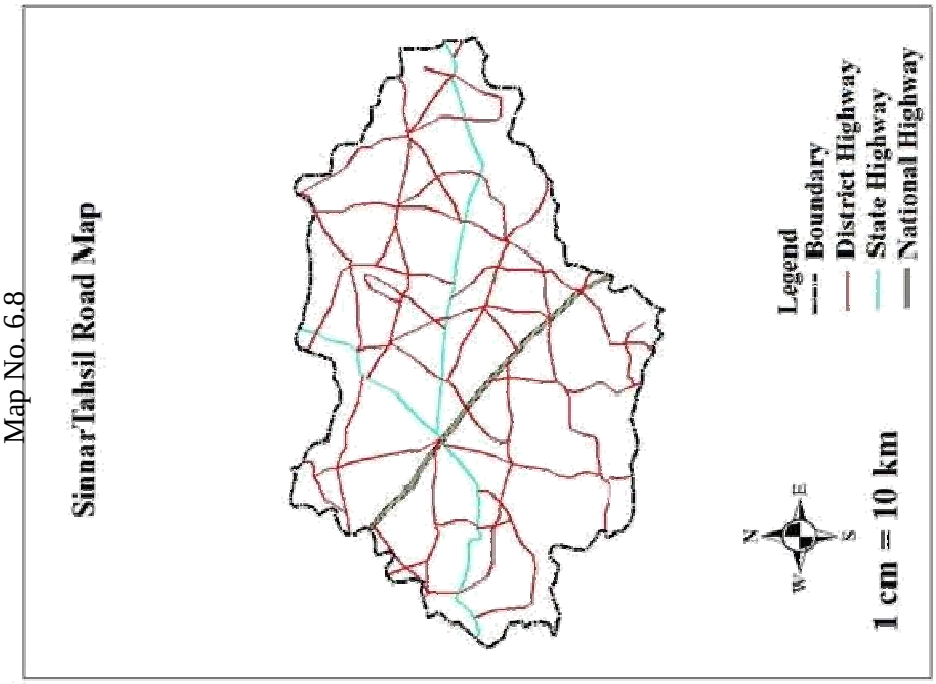
Map No. 6.6



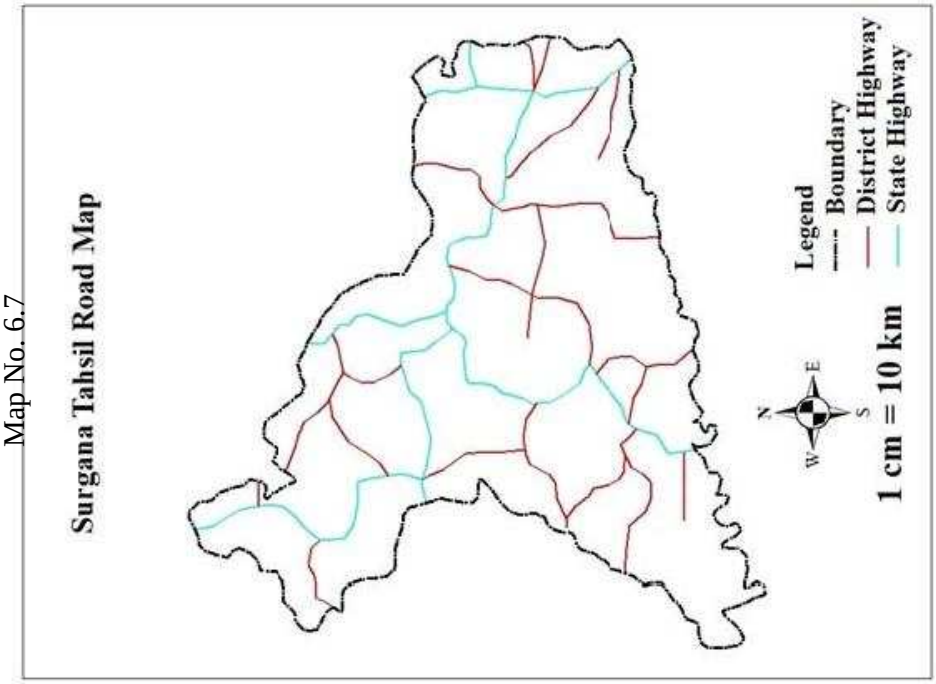
Map No. 6.5



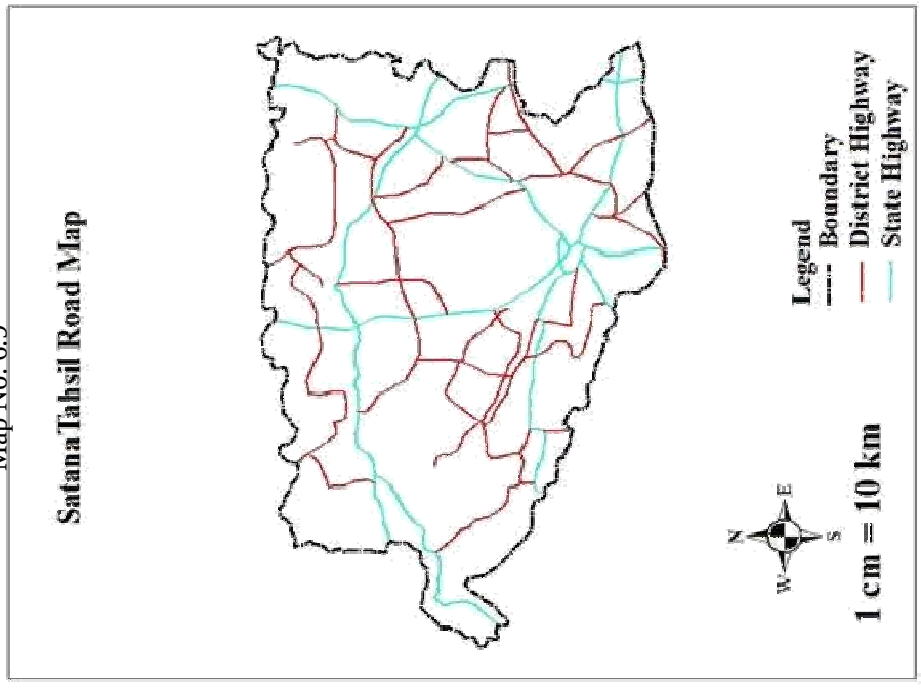
Map No. 6.8



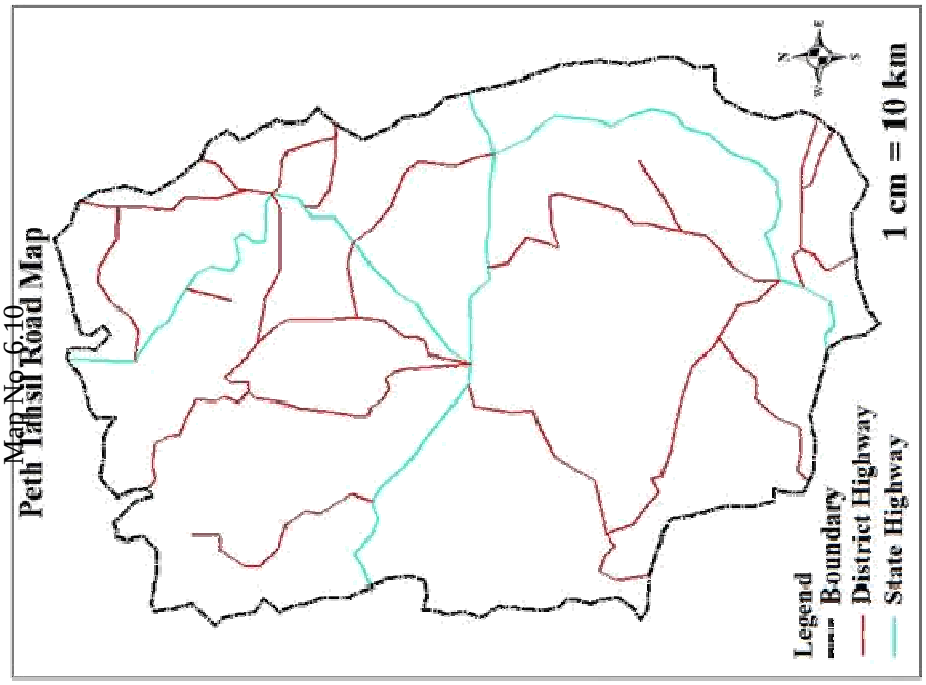
Map No. 6.7



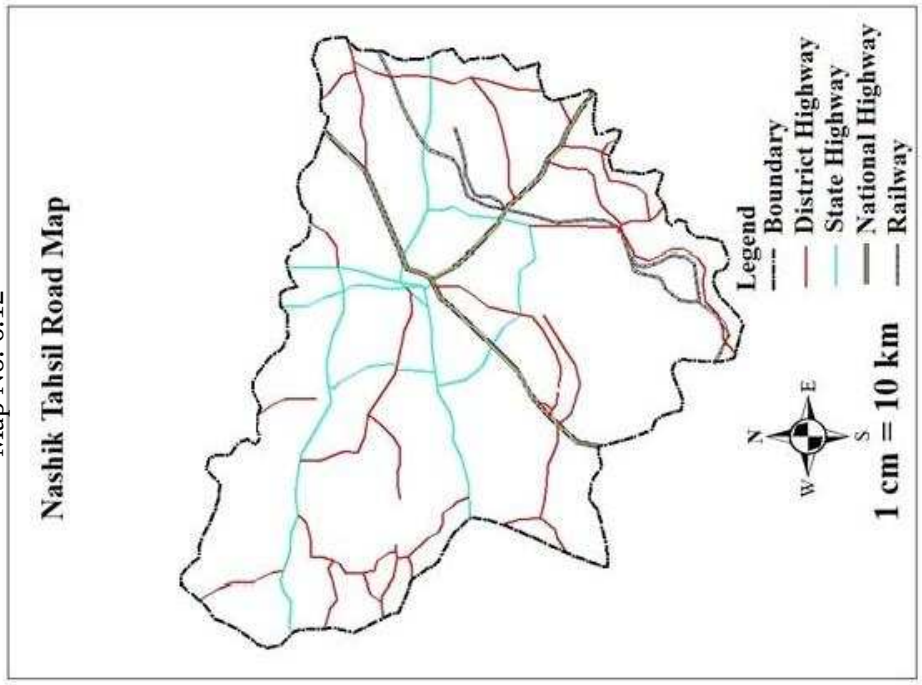
Map No. 6.9



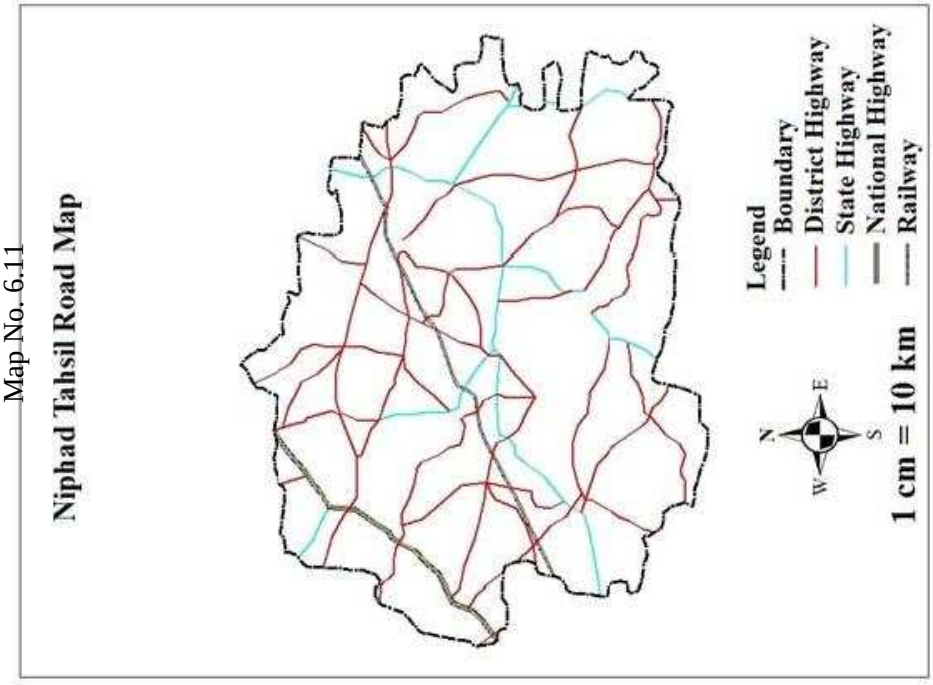
Map No. 6.10



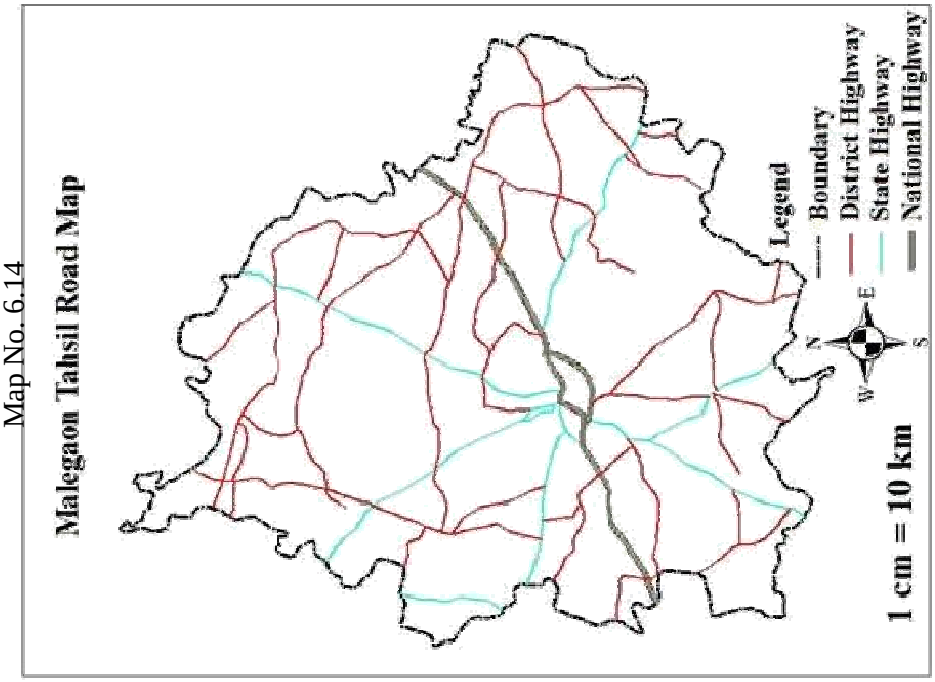
Map No. 6.12



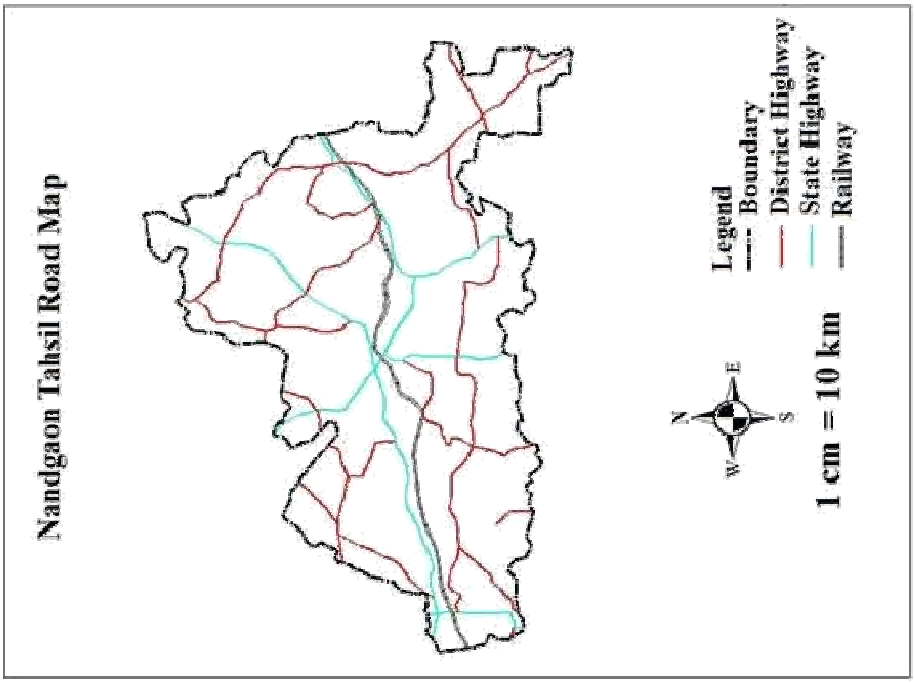
Map No. 6.11



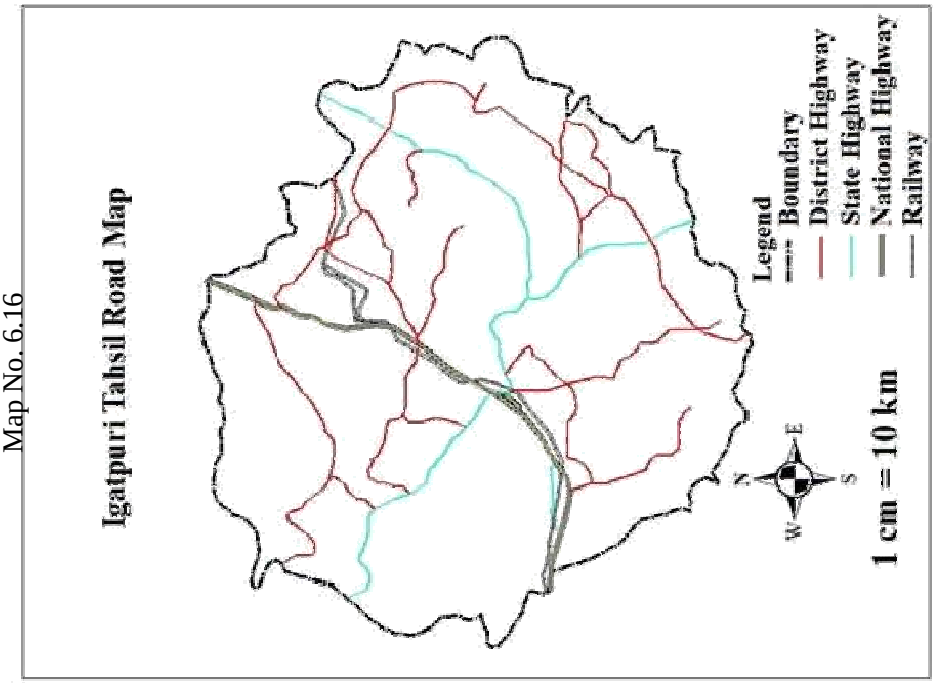
Map No. 6.14



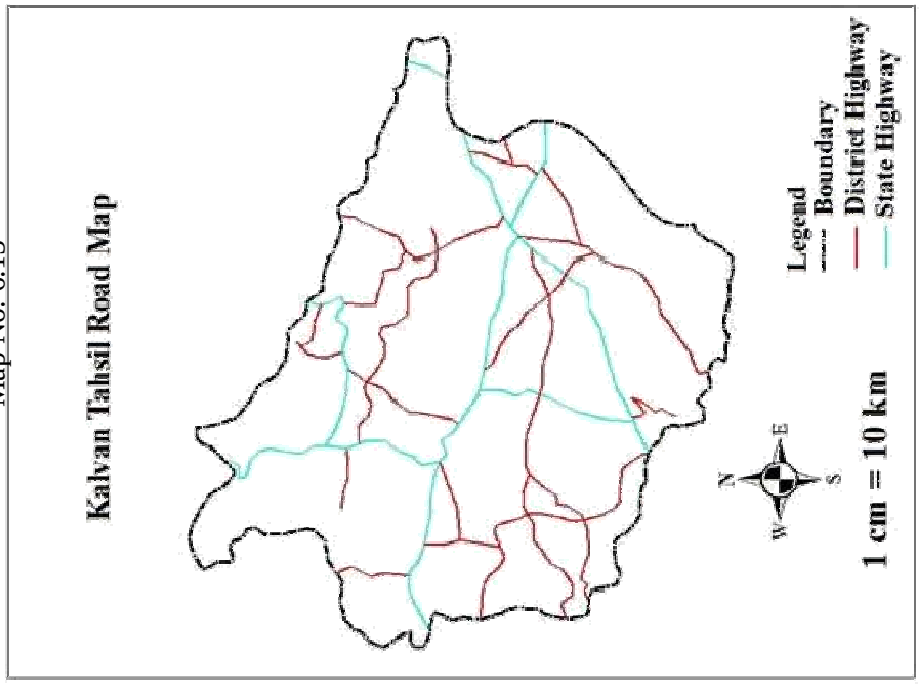
Map No. 6.13



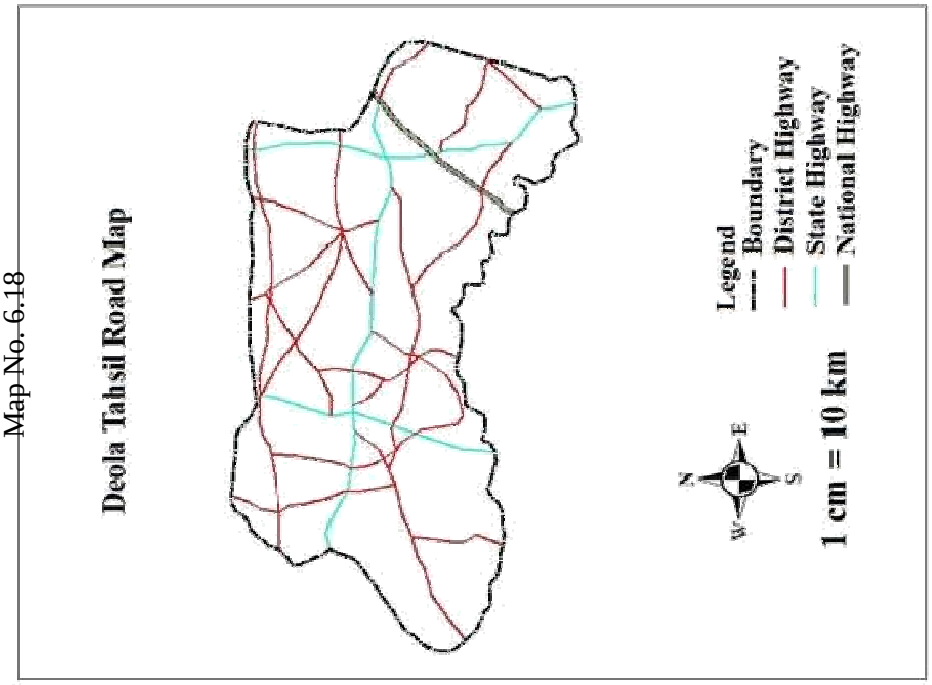
Map No. 6.16



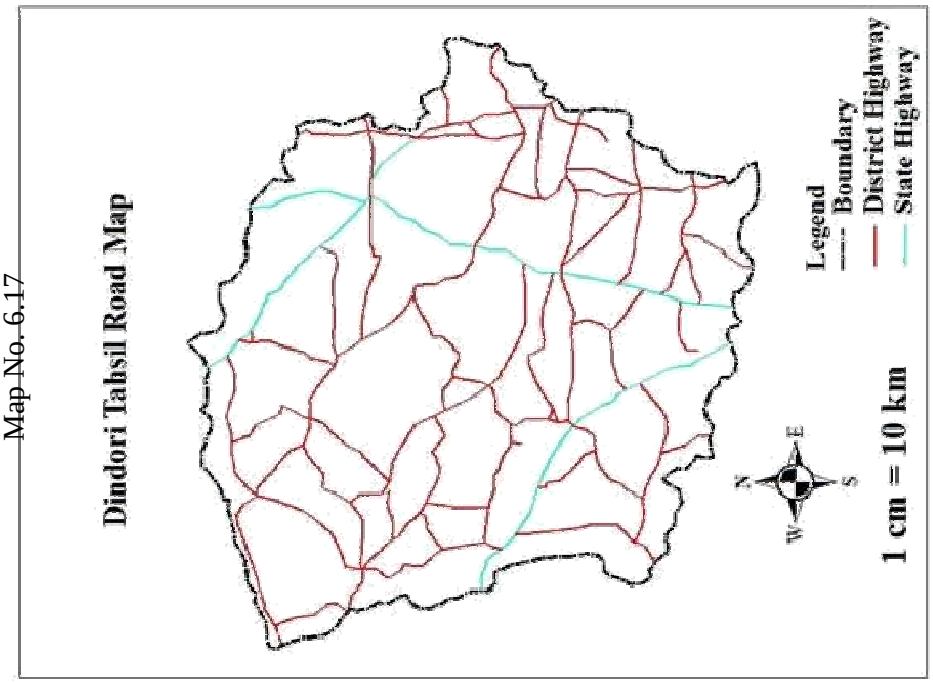
Map No. 6.15

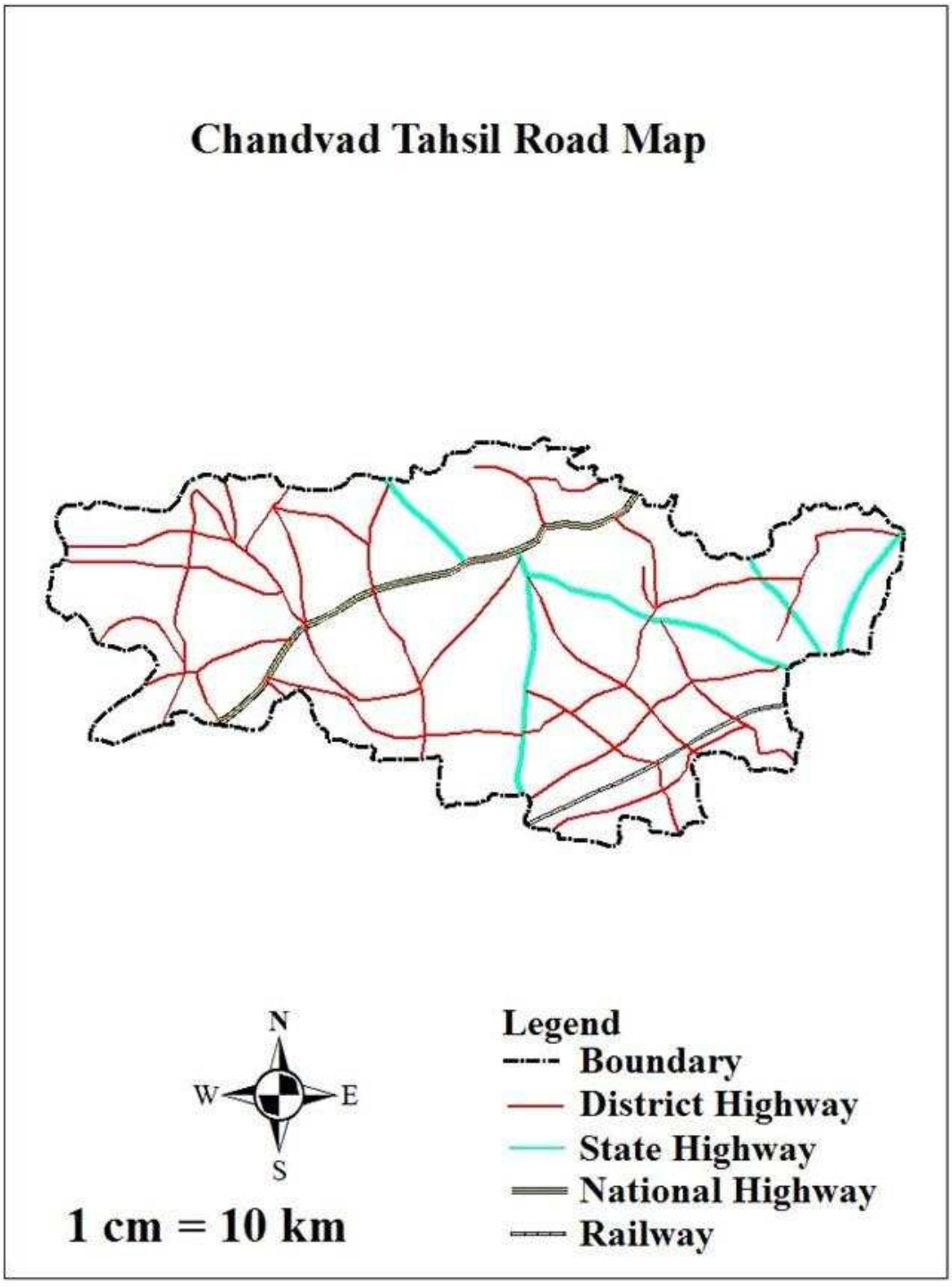


Map No. 6.18



Map No. 6.17




Chandvad Tahsil Road Map
N
W
E
S
1 cm = 10 km
Legend
Boundary
District Highway
State Highway
National Highway
Railway

Map No 6.19

6.5 Impact of Transportation on General Land use Pattern

A) Forest and Transportation

1 National highway and Forest: -

Very high national highway density is found only in Nasik tahsil which contain 0.056 km for each square kilometer of total area of tahsil. If one observes the forest area of Nasik tahsil it was moderate in 2001 and very high in 2011 it means there is increase in forest area it is due to social forestry programme.

High density of national highway is found in Igatpuri tahsil (0.045 km per each square kilometer of total area of tahsil) and Chandwad tahsil (0.035 km per each square kilometer of total area of tahsil). While forest area of Igatpuri is moderate in both the decades (2001 & 2011) because Igatpuri is a hilly area and containing more vegetation cover. The national highway road density is higher as it connects Nasik to Mumbai. Chandwad tahsil contain very low forest area because due to irrigation facility for agricultural activity.

Moderate density of national highway is found in Sinnar (0.025 km per each square kilometer of total area of tahsil), Niphad (0.018 km per each square kilometer of total area of tahsil), Deola (0.019 km per each square kilometer of total area of tahsil) and Malegaon (0.023 km per each square kilometer of total area of tahsil). On the other hand Malegaon tahsil observed very high forest area in both the decade while Deola and Niphad contain very low area of forest to total region. It was found that in Sinnar tahsil there is significant changes in forest area i.e. in 2001 it is moderate and in 2011 it become low area, it mean that decrease in forest area it may be due to construction of industry.

In Dindory very low density of national highway is found. Total length of national highway is 2.70 km in this tahsil which cannot affect the forest area. The tahsils like Peth, Surgana, Kalwan, Satana, Nandgaon, Yeola and Trimbak there is no national highway found.

2 State highway and Forest: -

The very high density of state highway is found in Trimbak (0.20 km per each square kilometer of total area of tahsil) and Nasik (0.19 km per each square kilometer of total area of tahsil). In Trimbak there is no change in forest area in both decade i.e. 2001 & 2011 but Nasik tahsil there is increase in forest area it is due to social forestry program by government and NGO.

High density of state highway is found in Surgana and Satana tahsil they are 0.18 & 0.16 km per each square kilometer of total area of tahsil. In this tahsils both decades shows the higher forest density. It may be due to less agricultural activity i.e. state highway did not affect the forest area in both decade (2001 & 2011).

Moderate density of state highway is found in Kalwan, Deola and Chandwad. It contains 0.16, 0.15 & 0.16 km per each square kilometer of total area of tahsil. If one observes the forest area of Kalwan tahsil it shows the higher density while Deola and Chandwad shows very low density it means that state highway play an important role in this tahsils because agricultural development is depended on transportation.

Lower density of state highway is found in Peth, Dindory, Niphad and Igatpuri tahsils. (0.13, 0.14, 0.13 & 0.14 km per each square kilometer of total area of tahsil) while in Peth, Dindory and Igatpuri there is high to moderate forest area. It says that decrease in state highway density increases in forest area. While in Niphad very low density of forest is found because it is well developed for agricultural activity.

Very low density of state highway is found in Malegaon, Nandgaon, Yeola and Sinnar. (0.12, 012, 0.12 & 0.12 km per each square kilometer of total area of tahsil) The tahsils like Malegaon, Nandgaon and Sinnar hold high to moderate density of forest i.e. higher the forest density lower the state highway density.

3 District highway and Forest: -

The intensity of district highway is very high in Yeola tahsil. (0.59 km per each square kilometer of total area of tahsil) which contain very low forest density it says that

increase in district highway density there is decrease in forest area.

High density of district highway is found in Dindory tahsil. (0.50 km per each square kilometer of total area of tahsil) On the other hand area under forest is moderate it is due to some hilly area is found in Dindory tahsil which is covered with vegetation cover so it shows moderate density of forest.

Moderate density of district highway is found in Nandgaon, Chandwad, Peth and Surgana tahsil (0.42, 0.39, 0.41 and 0.44 km per each square kilometer of total area of tahsil) while in Nandgaon tahsil moderate density of forest is found, in Chandwad low density of forest is found. In the tahsil Peth and Surgana there is found high to very high forest density. There is higher agricultural activity is found due to road development.

Low density of district highway is found in Sinnar, Niphad, Deola and Satana tahsils. (They are 0.36, 0.37, 0.37 and 0.35 km per each square kilometer of total area of tahsil) But Satana tahsil contain very high forest density. On the other hand moderate forest density is found in Sinnar and very low density is found in Niphad and Deola tahsil.

Below 0.31 km per each square kilometer of total area of tahsil i.e. very low density of district highway is found in Trimbak, Igatpuri, Nasik, Kalwan and Malegaon tahsil. In both the decade i.e. 2001 and 2011 there is no change in the forest density except Nasik tahsil which is change moderate to very high forest density which is due to social forestry.

4 Total road density and Forest: -

Very high road density is found in Yeola (0.71 km per each square kilometer of total area of tahsil) while forest density is very low which shows the increasing road density decreasing forest area.

High road density is found in Surgana and Dindory tahsils (0.62 & 0.63 km per each square kilometer of total area of tahsil) but in both the tahsils there is no change in forest density in both decades i.e. 2001and 2011 which remain same

The total road density in between 0.52 km to 0.58 km per each square kilometer of total area of tahsil (Moderate density) is found in Peth, Nasik, Deola, Chandwad and Nandgaon. On the other hand only Nasik tahsil shows the change in forest area i.e. it increased from moderate to very high forest density it is due to social forestry programme.

The low total road density is lying in 0.47 to 0.52 km per each square kilometer of total area of tahsil. In this group Igatpuri, Sinnar, Niphad and Satana tahsils are merged. There is no change in forest density in both the decade i.e. 2001 and 2011 so road was not play role for forest area.

0.43 km to 0.47 km per each square kilometer of total area of tahsil is known for the very low density group for total road, in it the tahsils like Trimbak, Kalwan and Malegaon are merging. The forest area has not changed in these three tahsils during the decade 2001 and 2011.

Lastly one can say that there is no significant change in forest area in the decade 2001 and 2011 due to road but it changes the forest area when they are constructing.

B) Fallow Land and Transportation

1 National highway and Fallow Land: -

Very high national highway density is found in only Nasik tahsil which contain 0.056 km for each square kilometer of total area of tahsil. The fallow land is decrease in 2011 as compare to 2001 i.e. very high to high i.e. it may be due to increase in agricultural area i.e. national highway gives the boost to decreasing fallow land.

High density of national highway is found in Igatpuri tahsil (0.045 km per each square kilometer of total area of tahsil) and Chandwad tahsil (0.035 km per each square kilometer of total area of tahsil). In Igatpuri there is the decreasing trend and fallow land from 2001 to 2011.But in Chandwad there is no change found in fallow land during 2001 to2011.

Moderate density of national highway is found in Sinnar (0.025 km per each

square kilometer of total area of tahsil), Niphad (0.018 km per each square kilometer of total area of tahsil), Deola (0.019 km per each square kilometer of total area of tahsil) and Malegaon (0.023 km per each square kilometer of total area of tahsil). Only in Sinnar there was decrease in fallow land in 2011 with respect to 2001 other i.e. low to very low density & fallow land. On the other hand Niphad, Deola and Malegaon there is no Change found in density &fallow land during 2001 to2011

In Dindory very low density of national highway is found. Total length of national highway is 2.70 km. There is no change found in area a fallow land in Dindory tahsil. So it is not influenced by national highway. The tahsils like Peth, Surgana, Kalwan, Satana, Nandgaon, Yeola and Trimbak there is no national highway found.

2 State highway and Fallow Land: -

The very high density of state highway is found in Trimbak (0.20 km per each square kilometer of total area of tahsil) and Nasik (0.19 km per each square kilometer of total area of tahsil). The area of fallow land changes from very high density in 2001 to High density to 2011. It shows the impact of state highway .The tahsil Trimbak shows no change in fallow land area.

High density of state highway is found in Surgana and Satana tahsil they are 0.18 & 0.16 km per each square kilometer of total area of tahsil. There is no change in the area of fallow land during 2001 to 2011 (very low density) in the Tahsil like Surgana & Satana.

Moderate density of state highway is found in Kalwan, Deola and Chandwad. It contains 0.16, 0.15 & 0.16 km per each square kilometer of total area of tahsil. There is no influence of state highway on fallow land of Kalwan, Deola and Chandwad i.e. it remained very low area of fallow during both the decade 2001 to 2011.

Lower density of state highway is found in Peth, Dindory, Niphad and Igatpuri tahsils. (0.13, 0.14, 0.13 and 0.14 km per each square kilometer of total area of tahsil) There is negative impact of state highway in Peth tahsil. It is found that increase in area

of fallow land in 2001 i.e. very low area of fallow land which changes low area of fallow land in 2011. But in Igatpuri tahsil there is decrease in fallow land area it means low area fallow land (2001) to very low area of fallow land (2011) .While in Dindory and Niphad tahsil there is no change in area of fallow land.

Very low density of state highway is found in Malegaon, Nandgaon, Yeola and Sinnar. (0.12, 012, 0.12 & 0.12 km per each square kilometer of total area of tahsil) In Sinnar tahsil there is change in density of fallow land low to very low. But in tahsils like Malegaon, Nandgaon and Yeola there is no change in fallow land area during 2001 to 2011.

3 District highway and Fallow Land: -

The intensity of district highway is very high in Yeola tahsil. (0.59 km per each square kilometer of total area of tahsil) In Yeola tahsil there is no changes in fallow land area during 2001 to 2011 it contain low density fallow land.

High density of district highway is found in Dindory tahsil. (0.50 km per each square kilometer of total area of tahsil) Moderate density a fallow land found in Dindory tahsil in 2001 to 2011. So there is no influence of district highway on fallow land of Dindory tahsil.

Moderate density of district highway is found in Nandgaon, Chandwad, Peth and Surgana tahsil (0.42, 0.39, 0.41 and 0.44 km per each square kilometer of total area of tahsil) In Peth tahsil there is change in density fallow land from very low (2001) to low (2011). It is found that state highway does not play negative role for changing fallow land pattern. But in Nandgaon, Chandwad and Surgana tahsil there is no changes in density fallow land.

Low density of district highway is found in Sinnar, Niphad, Deola and Satana tahsils. (They are 0.36, 0.37, 0.37 and 0.35 km per each square kilometer of total area of tahsil) The area of fallow land changes low to very low in 2001 to 2011 in Sinnar tahsil. It is due to district highway. In Niphad Deola and Satana there is no change in fallow land.

Below 0.31 km per each square kilometer of total area of tahsil i.e. very low density of district highway is found in Trimbak, Igatpuri, Nasik, Kalwan and Malegaon tahsil. There is slightly change the fallow land in Igatpuri and Nasik tahsil during 2001 to 2011. No change is found in Trimbak, Kalwan and Malegaon tahsil for the fallow land density.

4 Total road density and Fallow Land: -

Very high road density is found in Yeola. (0.71 km per each square kilometer of total area of tahsil) Total road density influence found in Yeola tahsil for change in density of fallow land i.e. it remains immutable.

High road density is found in Surgana and Dindory tahsils. (0.62 & 0.63 km per each square kilometer of total area of tahsil) No change is found in fallow land density for Surgana and Dindory tahsils in 2001 to 2011.

The total road density between 0.52 km to 0.58 km per each square kilometer of total area of tahsil (Moderate density) is found in Peth, Nasik, Deola, Chandwad and Nandgaon. The influence of total road is found in Peth and Nasik tahsil (very low to low and very high to high in 2001 to 2011). While in Deola, Chandwad and Nandgaon there is no change in fallow land.

The low total road density is lying in 0.47 to 0.52 km per each square kilometer of total area of tahsil. In this group Igatpuri, Sinnar, Niphad and Satana tahsils are merged. On the other hand in Igatpuri and Sinnar there is change in fallow land density i.e. low to very low in 2001 to 2011which is influenced by total road. But there is no impact found in Niphad and Satana for fallow land.

0.43 km to 0.47 km per each square kilometer of total area of tahsil is known for the very low density group for total road, in it the tahsils like Trimbak, Kalwan and Malegaon are merging. Very low density of total road is not responsible for fallow land. There is no change in fallow land area in Trimbak, Kalwan and Malegaon tahsil.

C) Area not Available for cultivation and Transportation

1 National highway and Area not Available for cultivation: -

Very high national highway density is found only in Nasik tahsil which contain 0.056 km for each square kilometer of total area of tahsil. It is found that in Nasik tahsil there is increase in area not available for cultivation in 2001 it is high density while in 2011 it increase i.e. it become very high density of area not available for cultivation means that increase in buildup area and roads.

High density of national highway is found in Igatpuri tahsil (0.045 km per each square kilometer of total area of tahsil) and Chandwad tahsil (0.035 km per each square kilometer of total area of tahsil). While area not available for cultivation is in Igatpuri tahsil changes moderate to high density during two decade 2001 to 2011. In Chandwad the density changes from low to moderate during 2001 to 2011 for area not available for cultivation.

Moderate density of national highway is found in Sinnar (0.025 km per each square kilometer of total area of tahsil), Niphad (0.018 km per each square kilometer of total area of tahsil), Deola (0.019 km per each square kilometer of total area of tahsil) and Malegaon (0.023 km per each square kilometer of total area of tahsil). on the other hand density for area not available for cultivation in Sinnar tahsil changes from moderate to high, for Niphad low to moderate, for Malegaon and Deola there is no change found during 2001 to 2011.

In Dindory very low density of national highway is found. Total length of national highway is 2.70 km. In Dindory area under road, railway and building changes is very low to low during 2001 to 2011. The tahsils like Peth, Surgana, Kalwan, Satana, Nandgaon, Yeola and Trimbak there is no national highway found.

2 State highway and Area not Available for cultivation: -

The very high density of state highway is found in Trimbak (0.20 km per each square kilometer of total area of tahsil) and Nasik (0.19 km per each square kilometer of

total area of tahsil). In both the tahsils there is found the influence of state highway, it is changes from very low to low in Trimbak and high to very high density in Nasik tahsil during 2001 to 2011.

High density of state highway is found in Surgana and Satana tahsil they are 0.18 & 0.16 km per each square kilometer of total area of tahsil. In the decade 2001 Surgana tahsil contain very low density of area not available for cultivation in 2001 it changes to low density in 2011. On the other hand there is no change observed in density of area not available for cultivation in Satana tahsil during 2001 to 2011.

Moderate density of state highway is found in Kalwan, Deola and Chandwad. It contains 0.16, 0.15 & 0.16 km per each square kilometer of total area of tahsil. Only in Chandwad tahsil there is change in density of area not available for cultivation lower to moderate in 2001 to 2011. While there is no change found in density in the tahsil Kalwan and Deola during 2001 to 2011.

Lower density of state highway is found in Peth, Dindory, Niphad and Igatpuri tahsils. (0.13, 0.14, 0.13 & 0.14 km per each square kilometer of total area of tahsil) The tahsil like Peth, Dindory, Niphad and Igatpuri shows positive changes in density of area not available for cultivation (Very Low to Low, Low to Moderate and Moderate to High) during 2001 to 2011.

Very low density of state highway is found in Malegaon, Nandgaon, Yeola and Sinnar. (0.12, 012, 0.12 & 0.12 km per each square kilometer of total area of tahsil) In Yeola and Malegaon tahsil the density of area not available for cultivation remains same i.e. moderate and very high during 2001 to 2011. While Nandgaon and Sinnar tahsil it changes moderate to high in the decades 2001 to 2011.

3 District highway and Area not Available for cultivation: -

The intensity of district highway is very high in Yeola tahsil. (0.59 km per each square kilometer of total area of tahsil) There is no found impact of district highway on area not Available for cultivation in Yeola tahsil since 2001.

High density of district highway is found in Dindory tahsil. (0.50 km per each square kilometer of total area of tahsil) In Dindory tahsil there is increase in roads and settlements i.e. it changes the density of area not Available for cultivation, very low to low in 2001 and 2011.

Moderate density of district highway is found in Nandgaon, Chandwad, Peth and Surgana tahsil (0.42, 0.39, 0.41 and 0.44 km per each square kilometer of total area of tahsil) Peth and Surgana tahsil shows very low to low density of area not Available for cultivation since 2001. On the other hand Chandwad tahsil shows Low to moderate and Nandgaon tahsil contain moderate to high density of area not Available for cultivation during 2001 to 2011.

Low density of district highway is found in Sinnar, Niphad, Deola and Satana tahsils. (They are 0.36, 0.37, 0.37 and 0.35 km per each square kilometer of total area of tahsil) there is found negative change in density of area not available for cultivation Satana tahsil while in other tahsil like Niphad and Sinnar shows Low to moderate and moderate to high density of area not available for cultivation. There is no change in density of area not available for cultivation for Deola tahsil it remain very low density of area not available for cultivation.

Below 0.31 km per each square kilometer of total area of tahsil i.e. very low density of district highway is found in Trimbak, Igatpuri, Nasik, Kalwan and Malegaon tahsil. In Kalwan and Malegaon tahsil there is no change in density of area not available for cultivation, it remain very low and very high. The tahsil like Trimbak, Igatpuri and Nasik shows the changes in density of area not available for cultivation it stateus is very low to low, low to high and high to very high during 2001 to 2011.

4 Total road density and Area not Available for cultivation: -

Very high road density is found in Yeola (0.71 km per each square kilometer of total area of tahsil) but in Yeola tahsil there is no change in density of area not available for cultivation it remain moderate density. (2001 to 2011)

High road density is found in Surgana and Dindory tahsils. (0.62 & 0.63 km per each square kilometer of total area of tahsil) In this tahsil density of area not available for cultivation is very low to low from 2001 to 2011.

The total road density in between 0.52 km to 0.58 km per each square kilometer of total area of tahsil (Moderate density) is found in Peth, Nasik, Deola, Chandwad and Nandgaon. The stateus for density of area not available for cultivation in Peth, Nasik, Deola, Chandwad and Nandgaon is it is very low to low, high to very high, very low to low, low to moderate and moderate to high (both decade 2001 & 2011).

The low total road density is lying in 0.47 to 0.52 km per each square kilometer of total area of tahsil. In this group Igatpuri, Sinnar, Niphad and Satana tahsils are merged. In Igatpuri there is dominant positive change found in density of area not available for cultivation i.e. low to high it means that there is increase in road and settlement area. On the other hand Sinnar, Niphad and Satana tahsils are merged in moderate to high, low to moderate and very high to low group for density of area not available for cultivation.

0.43 km to 0.47 km per each square kilometer of total area of tahsil is known for the very low density group for total road, in it the tahsils like Trimbak, Kalwan and Malegaon are merging. Only in tahsil Trimbak there is impact of road which shows change in density very low to low for area not available for cultivation. But in Kalwan and Malegaon there is no changes found in density of area not available for cultivation.

All above explanation show that there is defiantly found the impact of transportation on density of area not available for cultivation. Most of tahsil shows the changes they are Satana, Surgana, Trimbak, Peth, Dindory, Igatpuri, Sinnar, Nandgaon, Niphad, Chandwad and Nasik. But in Igatpuri there is more impact of transportation on density of area not available for cultivation which changes low to very high. On the other hand there is no impact found on density of area not available for cultivation in Kalwan, Deola, Yeola and Malegaon. There is also increase in settlement area which is due to increase in transportation facility.

D) Cultivable Waste and Transportation

1 National highway and Cultivable Waste: -

Very high national highway density is found in only Nasik tahsil which contain 0.056 km for each square kilometer of total area of tahsil. There is no change found in density of cultivable waste in Nasik tahsil. It remains very high during 2001 to 2011 decade.

High density of national highway is found in Igatpuri tahsil (0.045 km per each square kilometer of total area of tahsil) and Chandwad tahsil (0.035 km per each square kilometer of total area of tahsil). The density of cultivable waste in 2011 of Chandwad tahsil is increase four times since 2001. It is very low in 2001 and it becomes very high in 2011. But in Igatpuri there is change in density of cultivable waste from high to very high.

Moderate density of national highway is found in Sinnar (0.025 km per each square kilometer of total area of tahsil), Niphad (0.018 km per each square kilometer of total area of tahsil), Deola (0.019 km per each square kilometer of total area of tahsil) and Malegaon (0.023 km per each square kilometer of total area of tahsil). In tahsil like Sinnar and Malegaon there is no change in density of cultivable waste. (2001 & 2011) But in Niphad and Malegaon tahsil it changes low to high and moderate to very high.

In Dindory very low density of national highway is found. Total length of national highway is 2.70 km in this tahsil density of cultivable waste area is no change in both decades. The tahsils like Peth, Surgana, Kalwan, Satana, Nandgaon, Yeola and Trimbak there is no national highway found.

2 State highway and Cultivable Waste: -

The very high density of state highway is found in Trimbak (0.20 km per each square kilometer of total area of tahsil) and Nasik (0.19 km per each square kilometer of total area of tahsil). There is no change in density of cultivable waste in Nasik tahsil while in Trimbak tahsil it changes three fold i.e. very low to high during the period 2001 to 2011.

High density of state highway is found in Surgana and Satana tahsil they are 0.18 & 0.16 km per each square kilometer of total area of tahsil. On the other hand density of cultivable waste for Satana tahsil the changes is very low to low but in Surgana tahsil there is no change in density of cultivable waste.

Moderate density of state highway is found in Kalwan, Deola and Chandwad. It contains 0.16, 0.15 & 0.16 km per each square kilometer of total area of tahsil. There is positive impact of state highway on density of cultivable waste in Kalwan tahsil which changes from low to very low group i.e. there is decrease in cultivable waste it indicates increase in agriculture area it may be due to fast road transportation or increase in irrigation facility. On the other hand density of cultivable waste increases four fold in Chandwad tahsil i.e. from very low to very high. While in Deola tahsil there is no change in density of cultivable waste.

Lower density of state highway is found in Peth, Dindory, Niphad and Igatpuri tahsils. (0.13, 0.14, 0.13 & 0.14 km per each square kilometer of total area of tahsil) There is no impact of state highway found on density of cultivable waste in Peth and Dindory tahsil. But in Niphad and Igatpuri it is observed low to high density of cultivable waste and high to very high density of cultivable waste.

Very low density of state highway is found in Malegaon, Nandgaon, Yeola and Sinnar. (0.12, 012, 0.12 & 0.12 km per each square kilometer of total area of tahsil) The density of cultivable waste is changes rapidly in Yeola tahsil from very low to very high i.e. decrease in agricultural area. In Malegaon and Nandgaon density of cultivable waste changes from moderate to very high and moderate to high. While in Sinnar there is no change in density of cultivable waste.

3 District highway and Cultivable Waste: -

The intensity of district highway is very high in Yeola tahsil. (0.59 km per each square kilometer of total area of tahsil) The density of cultivable waste in Yeola is very low in 2001 and very high in 2011 which is a huge change. Area of cultivation is decreased from 2001 to 2011.

High density of district highway is found in Dindory tahsil. (0.50 km per each square kilometer of total area of tahsil) There is no change found in density of cultivable waste in Dindory tahsil it remains as it is (Moderate).

Moderate density of district highway is found in Nandgaon, Chandwad, Peth and Surgana tahsil (0.42, 0.39, 0.41 and 0.44 km per each square kilometer of total area of tahsil) Peth and Surgana tahsils hold same position during 2001 to 2011 for density of cultivable waste i.e. very low. There is change in Nandgaon and Chandwad tahsil it is moderate to high density of cultivable waste and very low to very high density of cultivable waste.

Low density of district highway is found in Sinnar, Niphad, Deola and Satana tahsils. (They are 0.36, 0.37, 0.37 and 0.35 km per each square kilometer of total area of tahsil) Sinnar and Deola tahsils hold same position during 2001 to 2011 for density of cultivable waste i.e. very high and very low. While in Niphad and Satana it is low to high density of cultivable waste and very low to low density of cultivable waste changes are observed since 2001.

Below 0.31 km per each square kilometer of total area of tahsil i.e. very low density of district highway is found in Trimbak, Igatpuri, Nasik, Kalwan and Malegaon tahsil. The density of cultivable waste in Kalwan tahsil changes from low to very low group i.e. there is decrease in cultivable waste it indicates increase in agriculture area. On the other hand Trimbak, Igatpuri and Malegaon tahsils shows the change that is very low to high density of cultivable waste, high to very high density of cultivable waste and moderate to very high density of cultivable waste in 2001 to 2011 decades. But in Nasik tahsil there is no change found it remains very high density of cultivable waste during both the decade.

4 Total road density and Cultivable Waste: -

Very high road density is found in Yeola. (0.71 km per each square kilometer of total area of tahsil) The density of cultivable waste in Yeola is very low in 2001 and very high in 2011 which is huge change. Area of cultivation is decreased from 2001 to 2011.

High road density is found in Surgana and Dindory tahsils. (0.62 & 0.63 km per each square kilometer of total area of tahsil) There is no change found in density of cultivable waste in Surgana and Dindory tahsil it remains as it is (very low and moderate).

The total road density between 0.52 km to 0.58 km per each square kilometer of total area of tahsil (Moderate density) is found in Peth, Nasik, Deola, Chandwad and Nandgaon. In Peth, Nasik and Deola tahsil there is no change found it remains very low density of cultivable waste, very high density of cultivable waste and very low density of cultivable waste during both the decades. But in Chandwad and Nandgaon tahsil there is decrease in area of agriculture i.e. very low to very high density of cultivable waste and moderate to high density of cultivable waste since 2001 to 2011.

The low total road density is lying in 0.47 to 0.52 km per each square kilometer of total area of tahsil. In this group Igatpuri, Sinnar, Niphad and Satana tahsils are merged. There is definitely change found in density of cultivable waste, these tahsils are Igatpuri, Niphad and Satana. They show density of cultivable waste as high to very high density of cultivable waste, low to high density of cultivable waste and very low to low density of cultivable waste. In Sinnar tahsil there is no change found it remains very high density of cultivable waste.

0.43 km to 0.47 km per each square kilometer of total area of tahsil is known for the very low density group for total road, in it the tahsils like Trimbak, Kalwan and Malegaon are merging. On the other hand Trimbak and Malegaon tahsils shows the changes they are very low to high density of cultivable waste and moderate to very high density of cultivable waste in 2001 to 2011 decades. The density of cultivable waste in Kalwan tahsil changes low to very low group i.e. there is decrease in cultivable waste it indicates increase in agricultural area.

If there is increase in cultivable waste area it shows that there is no impact of transportation it may be due to scarcity of water or capital. There is positive impact of state highway on density of cultivable waste in Kalwan tahsil which changes low to very low group i.e. there is decrease in cultivable waste it indicates increase in agricultural area it may be due to fast road transportation or increase in irrigation facility. In Sinnar,

Surgana, Peth, Dindory, Nasik and Deola tahsils there is no change found in density of cultivable waste.

E) Net Sown Area and Transportation

1 National highway and Net Sown Area: -

Very high national highway density is found only Nasik tahsil which contain 0.056 km for each square kilometer of total area of tahsil. But the density of net sown area in Nasik tahsil is low to very low duration in 2001 to 2011. It shows decreasing trend may be due to scarcity of water or capital.

High density of national highway is found in Igatpuri tahsil (0.045 km per each square kilometer of total area of tahsil) and Chandwad tahsil (0.035 km per each square kilometer of total area of tahsil). There is no change found in density of net sown area in Igatpuri and Chandwad tahsils it remains as it is (Low and Moderate).

Moderate density of national highway is found in Sinnar (0.025 km per each square kilometer of total area of tahsil), Niphad (0.018 km per each square kilometer of total area of tahsil), Deola (0.019 km per each square kilometer of total area of tahsil) and Malegaon (0.023 km per each square kilometer of total area of tahsil). In Niphad tahsil density of net sown area decreased in three times i.e. high to low density of net sown area. On the other hand decrease in density of net sown area is very high to high and high to moderate in Malegaon and Sinnar tahsil since 2001. There is no change in density of net sown area for Deola tahsil it remains very low in both decades.

In Dindory very low density of national highway is found. Total length of national highway is 2.70 km but the density of net sown area is change moderate to high. The tahsils like Peth, Surgana, Kalwan, Satana, Nandgaon, Yeola and Trimbak there is no national highway found.

2 State highway and Net Sown Area: -

The very high density of state highway is found in Trimbak (0.20 km per each square kilometer of total area of tahsil) and Nasik (0.19 km per each square kilometer of

total area of tahsil). Tahsil Trimbak contains very low density of net sown area in 2001 and changes to low density of net sown area in 2011. On the other hand Nasik tahsil shows low density of net sown area in 2001 and changes very low density of net sown area.

High density of state highway is found in Surgana and Satana tahsil they are 0.18 & 0.16 km per each square kilometer of total area of tahsil. There is no change in density of net sown area in Surgana and Satana tahsil during both the decades.

Moderate density of state highway is found in Kalwan, Deola and Chandwad. It contains 0.16, 0.15 & 0.16 km per each square kilometer of total area of tahsil. Also in these three tahsil there is no change in density of net sown area during both the decades.

Lower density of state highway is found in Peth, Dindory, Niphad and Igatpuri tahsils. (0.13, 0.14, 0.13 & 0.14 km per each square kilometer of total area of tahsil) In Peth and Igatpuri no change is found in density of net sown area during both the decades. But in Niphad there is decrease in density of net sown area i.e. high to low since 2001 and Dindory tahsil shows increase in density of net sown area (moderate to high) during 2001 to 2011.

Very low density of state highway is found in Malegaon, Nandgaon, Sinnar and Yeola. (0.12, 012, 0.12 & 0.12 km per each square kilometer of total area of tahsil) In first three tahsil there is decrease in density of net sown area it is very high to high density of net sown area, low to very low density of net sown area and high to moderate density of net sown area. While in Yeola no change found in density of net sown area during both the decades.

3 District highway and Net Sown Area: -

The intensity of district highway is very high in Yeola tahsil. (0.59 km per each square kilometer of total area of tahsil) In this tahsil same density of net sown area is observed during 2001 to 2011.

High density of district highway is found in Dindory tahsil. (0.50 km per each square kilometer of total area of tahsil) Density of net sown area is fluctuating between moderate to high in 2001 to 2011.

Moderate density of district highway is found in Nandgaon, Chandwad, Peth and Surgana tahsil. (0.42, 0.39, 0.41 and 0.44 km per each square kilometer of total area of tahsil) Tahsil Nandgaon contains low density of net sown area in 2001 and it changes very low density of net sown area. But in Chandwad, Peth and Surgana tahsil no change found in density of net sown area during both the decades.

Low density of district highway is found in Sinnar, Niphad, Deola and Satana tahsils. (They are 0.36, 0.37, 0.37 and 0.35 km per each square kilometer of total area of tahsil) Deola and Satana tahsils shows no change in density of net sown area during both the decades. While in Sinnar and Niphad density of net sown area is changes high to moderate and high to low.

Below 0.31 km per each square kilometer of total area of tahsil i.e. very low density of district highway is found in Trimbak, Igatpuri, Nasik, Kalwan and Malegaon tahsil. There is density changes observed in net sown area in Trimbak, Nasik and Malegaon. While in Igatpuri and Kalwan no change found in density of net sown area during both the decades.

4 Total road density and Net Sown Area: -

Very high road density is found in Yeola. (0.71 km per each square kilometer of total area of tahsil) In this tahsil same density of net sown area is observed during 2001 to 2011.

High road density is found in Surgana and Dindory tahsils. (0.62 & 0.63 km per each square kilometer of total area of tahsil) In Dindory tahsil density of net sown area is fluctuating between moderate to high in 2001 to 2011while in Surgana no change found in density of net sown area during both the decades.

The total road density in between 0.52 km to 0.58 km per each square kilometer of total area of tahsil (Moderate density) is found in Peth, Nasik, Deola, Chandwad and Nandgaon. There is no change in density of net sown area in Peth, Deola and Chandwad tahsils during both the decades. There is density changes observed in net sown area in Nasik and Nandgaon. (Low to very low)

The low total road density is lying in 0.47 to 0.52 km per each square kilometer of total area of tahsil. In this group Igatpuri, Sinnar, Niphad and Satana tahsils are merged. In Sinnar and Niphad density of net sown area is changes high to moderate and high to low in both the decade. On the other hand in Igatpuri and Satana tahsils there is no change found in density of net sown area during both the decades.

0.43 km to 0.47 km per each square kilometer of total area of tahsil is known for the very low density group for total road, in it the tahsils like Trimbak, Kalwan and Malegaon are merging. There is density changes observed in net sown area in Trimbak and Malegaon (very low to low and very high to high) in 2001 to 2011. No change is found in Kalwan for density of net sown area during both the decades.

6.6. Impact of Transportation on Agricultural Land use Pattern

A) Rice Crop and Transportation

1 National highway and Rice Crop: -

Very high national highway density is found in only Nasik tahsil which contain 0.056 km for each square kilometer of total area of tahsil. There is no change found in density of rice crop in Nasik tahsil it remains as it is (Low).

High density of national highway is found in Igatpuri tahsil (0.045 km per each square kilometer of total area of tahsil) and Chandwad tahsil (0.035 km per each square kilometer of total area of tahsil). But in both the tahsil there is no change in area of rice crop in 2001 and 2011.

Moderate density of national highway is found in Sinnar (0.025 km per each square kilometer of total area of tahsil), Niphad (0.018 km per each square kilometer of

total area of tahsil), Deola (0.019 km per each square kilometer of total area of tahsil) and Malegaon (0.023 km per each square kilometer of total area of tahsil). Except Sinnar tahsil there is no change found in area of rice crop. In Sinnar it changes very low density of rice area to low density of rice area in 2001 to 2011.

In Dindory very low density of national highway is found. Total length of national highway is 2.70 km. In this tahsil which cannot affect the rice area. The tahsils like Peth, Surgana, Kalwan, Satana, Nandgaon, Yeola and Trimbak there is no national highway found.

2 State highway and Rice Crop: -

The very high density of state highway is found in Trimbak (0.20 km per each square kilometer of total area of tahsil) and Nasik (0.19 km per each square kilometer of total area of tahsil). In Trimbak tahsil the density of rice crop area is changes moderate to high in 2001 to 2011. In this tahsil, increase in rice crop area by one fold. But in Nasik tahsil there is no change in rice area during 2001 to 2011.

High density of state highway is found in Surgana and Satana tahsil they are 0.18 & 0.16 km per each square kilometer of total area of tahsil. In both the tahsil density of rice crop is changes low to moderate and very low to low in 2001 to 2011.

Moderate density of state highway is found in Kalwan, Deola and Chandwad. It contains 0.16, 0.15 & 0.16 km per each square kilometer of total area of tahsil. In all these tahsil there is no change found in rice crop area in 2001 to 2011.

Lower density of state highway is found in Peth, Dindory, Niphad and Igatpuri tahsils. (0.13, 0.14, 0.13 & 0.14 km per each square kilometer of total area of tahsil) Also in this group there is no change rice area during 2001 to 2011.

Very low density of state highway is found in Malegaon, Nandgaon, Yeola and Sinnar. (0.12, 012, 0.12 & 0.12 km per each square kilometer of total area of tahsil) Only in Sinnar tahsil density of rice crop area is lies between very low to low in both decades, but rest of tahsil in this group is not change with time.

3 District highway and Rice Crop: -

The intensity of district highway is very high in Yeola tahsil. (0.59 km per each square kilometer of total area of tahsil) In this tahsil same density of rice crop area is observed during 2001 to 2011.

High density of district highway is found in Dindory tahsil. (0.50 km per each square kilometer of total area of tahsil) Density of rice crop area in Dindory is not fluctuating it remain low in 2001 to 2011.

Moderate density of district highway is found in Nandgaon, Chandwad, Peth and Surgana tahsil. (0.42, 0.39, 0.41 and 0.44 km per each square kilometer of total area of tahsil) Only tahsil Surgana shows the change in rice area and the rest of tahsil in this group not changes with time for rice cultivation. The change in rice crop area in Surgana tahsil is very low to low in 2001 to 2011.

Low density of district highway is found in Sinnar, Niphad, Deola and Satana tahsils. (They are 0.36, 0.37, 0.37 and 0.35 km per each square kilometer of total area of tahsil) The change is found in Sinnar and Satana tahsil it is very low to low density of rice crop area and very low to low density of rice crop area, rest of tahsil remains as it is for density of rice crop area in decade 2001 to 2011.

Below 0.31 km per each square kilometer of total area of tahsil i.e. very low density of district highway is found in Trimbak, Igatpuri, Nasik, Kalwan and Malegaon tahsil. Except Trimbak tahsil the density of rice crop area remain same during both decades. Density of rice crop area changes moderate to high in Trimbak tahsil.

4 Total road density and Rice Crop: -

Very high road density is found in Yeola. (0.71 km per each square kilometer of total area of tahsil) In this tahsil same density of rice crop area is observed during 2001 to 2011.

High road density is found in Surgana and Dindory tahsils. (0.62 & 0.63 km per each square kilometer of total area of tahsil) In the Surgana tahsil density of rice crop is changes low to moderate in 2001 to 2011. But in Dindory tahsils it remains as it is.

The total road density in between 0.52 km to 0.58 km per each square kilometer of total area of tahsil (Moderate density) is found in Peth, Nasik, Deola, Chandwad and Nandgaon. All these tahsils shows no change in density of rice crop area during 2001 to 2011.

The low total road density is lying in 0.47 to 0.52 km per each square kilometer of total area of tahsil. In this group Igatpuri, Sinnar, Niphad and Satana tahsils are merged. The change is found in Sinnar and Satana tahsil, it is very low density of rice crop area to low density of rice crop area, rest of tahsil remains as it is for density of rice crop area in decade 2001 to 2011.

0.43 km to 0.47 km per each square kilometer of total area of tahsil is known for the very low density group for total road, in it the tahsils like Trimbak, Kalwan and Malegaon are merging. Except Trimbak tahsil the density of rice crop area remain same during both decades. Density of rice crop area changes moderate to high in Trimbak tahsil.

B) Wheat Crop and Transportation

1 National highway and Wheat Crop: -

Very high national highway density is found only in Nasik tahsil which contain 0.056 km for each square kilometer of total area of tahsil. But the density of wheat crop area in Nasik tahsil is moderate to high in duration 2001 to 2011.

High density of national highway is found in Igatpuri tahsil (0.045 km per each square kilometer of total area of tahsil) and Chandwad tahsil (0.035 km per each square kilometer of total area of tahsil). The density of wheat crop area in Chandwad tahsil is remains same during 2001 to 2011. But in Igatpuri there is change in density of wheat crop area from very low to low.

Moderate density of national highway is found in Sinnar (0.025 km per each square kilometer of total area of tahsil), Niphad (0.018 km per each square kilometer of total area of tahsil), Deola (0.019 km per each square kilometer of total area of tahsil) and Malegaon (0.023 km per each square kilometer of total area of tahsil).). In Niphad tahsil density of wheat crop area is increase from moderate to high. There is rapid increase in density of wheat crop area very low to very high, very low to moderate and low to high in Deola, Malegaon and Sinnar tahsil since 2001.

In Dindory very low density of national highway is found. Total length of national highway is 2.70 km. In this tahsil density of wheat crop area remain same. The tahsils like Peth, Surgana, Kalwan, Satana, Nandgaon, Yeola and Trimbak there is no national highway found.

2 State highway and Wheat Crop: -

The very high density of state highway is found in Trimbak (0.20 km per each square kilometer of total area of tahsil) and Nasik (0.19 km per each square kilometer of total area of tahsil). Tahsil Nasik contains moderate density of wheat crop area in 2001 and changes to high density of wheat crop area in 2011. On the other hand Trimbak tahsil shows very low density of wheat crop area in both the decade.

High density of state highway is found in Surgana and Satana tahsil they are 0.18 & 0.16 km per each square kilometer of total area of tahsil. There is no change in density of wheat crop area in Surgana tahsil during both the decades. But density of wheat crop area in Satana changes very low to high during both the decades.

Moderate density of state highway is found in Kalwan, Deola and Chandwad. It contains 0.16, 0.15 & 0.16 km per each square kilometer of total area of tahsil. There is positive impact of state highway on density of wheat crop area in Kalwan tahsil which changes low to very high group i.e. there is decrease in wheat crop area it indicate increase in agriculture area it may be due to fast road transportation or increase in irrigation facility. On the other hand density of wheat crop area increase four fold in Deola tahsil i.e. from very low to very high. While in Chandwad tahsil there is no change in density of wheat crop area.

Lower density of state highway is found in Peth, Dindory, Niphad and Igatpuri tahsils. (0.13, 0.14, 0.13 & 0.14 km per each square kilometer of total area of tahsil) There is no impact of state highway found on density of wheat crop area in Peth and Dindory tahsil. But in Niphad and Igatpuri it is observed there is moderate to high density of wheat crop area and very low to low density of wheat crop area.

Very low density of state highway is found in Malegaon, Nandgaon, Yeola and Sinnar. (0.12, 012, 0.12 & 0.12 km per each square kilometer of total area of tahsil) The density of wheat crop area changes rapidly in Yeola and Sinnar tahsil from very low to high and low to high i.e. decrease in agricultural area. In Malegaon and Nandgaon density of wheat crop area changes from very low to moderate.

3 District highway and Wheat Crop: -

The intensity of district highway is very high in Yeola tahsil. (0.59 km per each square kilometer of total area of tahsil) The density of wheat crop area in Yeola is very low in 2001 and high in 2011 which is a huge change. Area of cultivation increased from 2001 to 2011.

High density of district highway is found in Dindory tahsil. (0.50 km per each square kilometer of total area of tahsil) There is no change found in density of wheat crop area in Dindory tahsil it remains as it is (Very high).

Moderate density of district highway is found in Nandgaon, Chandwad, Peth and Surgana tahsil (0.42, 0.39, 0.41 and 0.44 km per each square kilometer of total area of tahsil) Peth, Surgana and Chandwad tahsils hold same position during 2001 to 2011 for density of wheat crop area i.e. very low. There is change in Nandgaon tahsil, it has very low to moderate density of wheat crop area.

Low density of district highway is found in Sinnar, Niphad, Deola and Satana tahsils. (They are 0.36, 0.37, 0.37 and 0.35 km per each square kilometer of total area of tahsil) Sinnar, Deola and Satana tahsils during 2001 to 2011 holds density of wheat crop area is low to high, very low to very high and very low to very high. While in Niphad it is moderate to high density of wheat crop area changes are observed since 2001.

Below 0.31 km per each square kilometer of total area of tahsil i.e. very low density of district highway is found in Trimbak, Igatpuri, Nasik, Kalwan and Malegaon tahsil. The density of wheat crop area in Kalwan tahsil changes low to high group i.e. there is increase in agriculture area. On the other hand Nasik, Igatpuri and Malegaon tahsils shows the changes they are moderate to high density of wheat crop area, very low to low density of wheat crop area and very low to moderate density of wheat crop area in 2001 to 2011 decades. But in Trimbak tahsil there is no change found it remains very low density of wheat crop area during both the decade.

4 Total road density and Wheat Crop: -

Very high road density is found in Yeola. (0.71 km per each square kilometer of total area of tahsil) The density of wheat crop area in Yeola is very low in 2001 and high in 2011 which is huge change. Area of cultivation increased from 2001 to 2011.

High road density is found in Surgana and Dindory tahsils (0.62 & 0.63 km per each square kilometer of total area of tahsil) There is no change found in density of wheat crop area in Surgana and Dindory tahsil it remains as it is (very low and very high).

The total road density between 0.52 km to 0.58 km per each square kilometer of total area of tahsil (Moderate density) is found in Peth, Nasik, Deola, Chandwad and Nandgaon. In Peth and Chandwad tahsil there is no change found, it remains very low density of wheat crop area during both the decades. But in Nasik, Deola and Nandgaon tahsil there is increase in area of wheat crop i.e. moderate to high density of wheat crop area, very low to very high density of wheat crop area and very low to moderate density of wheat crop area since 2001 to 2011.

The low total road density is lying in 0.47 to 0.52 km per each square kilometer of total area of tahsil. In this group Igatpuri, Sinnar, Niphad and Satana tahsils are merged. There is definitely change found in density of wheat crop area, these tahsils are Igatpuri, Sinnar, Niphad and Satana. They show density of wheat crop area as very low to low density of wheat crop area, low to high density of wheat crop area, moderate to high density of wheat crop area and very low to high density of wheat crop area.

0.43 km to 0.47 km per each square kilometer of total area of tahsil is known for the very low density group for total road, in it the tahsils like Trimbak, Kalwan and Malegaon are merging. On the other hand Kalwan and Malegaon tahsils shows changes that are very low to high density of wheat crop area and very low to moderate density of wheat crop area in 2001 to 2011 decades. The density of wheat crop area in Trimbak tahsil remains the same i.e. very low.

C) Jowar Crop and Transportation

1 National highway and Jowar Crop: -

Very high national highway density is found in only Nasik tahsil which contain 0.056 km for each square kilometer of total area of tahsil. But the density of Jowar crop area in Nasik tahsil is very low to low duration 2001 to 2011.

High density of national highway is found in Igatpuri tahsil (0.045 km per each square kilometer of total area of tahsil) and Chandwad tahsil (0.035 km per each square kilometer of total area of tahsil). There is no change found in density of Jowar crop area in Igatpuri tahsil it remains as it is (very Low). The density of Jowar crop area in Chandwad is moderate in 2001 and low in 2011 it is decreased.

Moderate density of national highway is found in Sinnar (0.025 km per each square kilometer of total area of tahsil), Niphad (0.018 km per each square kilometer of total area of tahsil), Deola (0.019 km per each square kilometer of total area of tahsil) and Malegaon (0.023 km per each square kilometer of total area of tahsil). In Niphad tahsil density of Jowar crop area has decreased twice i.e. moderate to very low. On the other hand decrease in density of Jowar crop area low to very low in Sinnar tahsil since 2001. But rapidly increase in Deola tahsil very low to very high density of Jowar crop area. There is no change in density of Jowar crop area for Malegaon tahsil it remains moderate in both decades.

In Dindory very low density of national highway is found. Total length of national highway is 2.70 km. In Dindory tahsil rapidly decrease in density of Jowar crop area i.e.

very high to low in 2001 to 2011. It was found that there is no national highway in tahsils like like Peth, Surgana, Kalwan, Satana, Nandgaon, Yeola and Trimbak.

2 State highway and Jowar Crop: -

Very high density of state highway is found in Trimbak (0.20 km per each square kilometer of total area of tahsil) and Nasik (0.19 km per each square kilometer of total area of tahsil). Tahsil Trimbak contains very low density of Jowar crop area in 2001 and 2011. On the other hand Nasik tahsil shows very low density of Jowar crop area in 2001 and changes low density of Jowar crop area in 2011.

High density of state highway is found in Surgana and Satana tahsil they are 0.18 & 0.16 km per each square kilometer of total area of tahsil. There is change in density of Jowar crop area in Surgana and Satana tahsil during both the decades it is low to very low.

Moderate density of state highway is found in Kalwan, Deola and Chandwad. It contains 0.16, 0.15 & 0.16 km per each square kilometer of total area of tahsil. Density of Jowar crop area in Chandwad tahsil changes moderate to low during both the decade. On the other hand density of Jowar crop area increased four fold in Deola tahsil i.e. from very low to very high. While in Kalwan tahsil there is no change in density of Jowar crop area.

Lower density of state highway is found in Peth, Dindory, Niphad and Igatpuri tahsils. (0.13, 0.14, 0.13 & 0.14 km per each square kilometer of total area of tahsil) In Peth and Igatpuri tahsil there is no change found in density of Jowar crop area during both decades. But in Niphad and Dindory there is decrease in density of Jowar crop area i.e. moderate to very low and very high to low since 2001.

Very low density of state highway is found in Malegaon, Nandgaon, Yeola and Sinnar. (0.12, 012, 0.12 & 0.12 km per each square kilometer of total area of tahsil) In Yeola and Sinnar tahsils there is decrease in density of Jowar crop area it is very high to moderate density of Jowar crop area and low to very low density of Jowar crop area. But

in Nandgaon density of Jowar crop area increase low to high during 2001 to 2011.While in Malegaon no change was found in density of Jowar crop area during both the decades.

3 District highway and Jowar Crop: -

The intensity of district highway is very high in Yeola tahsil. (0.59 km per each square kilometer of total area of tahsil) The density of Jowar crop area in Yeola is very high in 2001 and moderate in 2011 which is huge change. Area of Jowar is decreased from 2001 to 2011.

High density of district highway is found in Dindory tahsil. (0.50 km per each square kilometer of total area of tahsil) There is negative change found in density of Jowar crop area in Dindory tahsil it is Very high to low.

Moderate density of district highway is found in Nandgaon, Chandwad, Peth and Surgana tahsil (0.42, 0.39, 0.41 and 0.44 km per each square kilometer of total area of tahsil) Peth tahsil hold same position during 2001 to 2011 for density of Jowar crop area i.e. very low. A positive change is found in Nandgaon tahsil, it is low to high density of Jowar crop area. But in Chandwad and Surgana negative change is observed i.e. moderate to low density of Jowar crop area and low to very low density of Jowar crop area in both the decades.

Low density of district highway is found in Sinnar, Niphad, Deola and Satana tahsils. (They are 0.36, 0.37, 0.37 and 0.35 km per each square kilometer of total area of tahsil) Sinnar, Niphad and Satana tahsils during 2001 to 2011 holds density of Jowar crop area is low to very low, moderate to very low and low to very low. While in Deola it is very low to very high density of Jowar crop area changes are observed since 2001.

Below 0.31 km per each square kilometer of total area of tahsil i.e. very low density of district highway is found in Trimbak, Igatpuri, Nasik, Kalwan and Malegaon tahsil. There is no change observed in density of Jowar crop area in Trimbak, Kalwan, Malegaon and Igatpuri. While in Nasik tahsil change is found in density of Jowar crop area it is very low to low during both the decades.

4 Total road density and Jowar Crop: -

Very high road density is found in Yeola. (0.71 km per each square kilometer of total area of tahsil) The density of Jowar crop area in Yeola is very high to moderate in 2001 to 2011.

High road density is found in Surgana and Dindory tahsils. (0.62 & 0.63 km per each square kilometer of total area of tahsil) In both the tahsils negative impact is found i.e. Surgana tahsil density of Jowar crop area is changes from low to very low and in Dindory tahsil rapidly decrease in density of Jowar crop area which is very high to low in both the decades.

The total road density in between 0.52 km to 0.58 km per each square kilometer of total area of tahsil (Moderate density) is found in Peth, Nasik, Deola, Chandwad and Nandgaon. In Peth tahsil there is no change found it remains very low density of Jowar crop area during both the decades. But in Chandwad tahsil there is decrease in area of Jowar crop i.e. moderate to low density of Jowar crop area since 2001 to 2011. While in Nasik, Deola and Nandgaon tahsil increase in density of Jowar crop area it is very low to low, very low to very high and low to high during both the decade.

The low total road density is lying in 0.47 to 0.52 km per each square kilometer of total area of tahsil. In this group Igatpuri, Sinnar, Niphad and Satana tahsils are merged. There is definitely change found in density of Jowar crop area, these tahsils are Sinnar, Niphad and Satana. They shows density of Jowar crop area as low to very low density of Jowar crop area, moderate to very low density of Jowar crop area and low to very low density of Jowar crop area. In Igatpuri tahsil there is no change found it remains very low density of Jowar crop area.

0.43 km to 0.47 km per each square kilometer of total area of tahsil is known for the very low density group for total road, in it the tahsils like Trimbak, Kalwan and Malegaon are merging. On the other hand in Trimbak, Kalwan and Malegaon tahsil there is no change found it remains very low density of Jowar crop area in 2001 to 2011.

D) Bajara Crop and Transportation

1 National highway and Bajara Crop: -

Very high national highway density is found in only Nasik tahsil which contain 0.056 km for each square kilometer of total area of tahsil. But the density of Bajara crop area in Nasik tahsil is not changed it remains very low in duration 2001 to 2011.

High density of national highway is found in Igatpuri tahsil (0.045 km per each square kilometer of total area of tahsil) and Chandwad tahsil (0.035 km per each square kilometer of total area of tahsil). The density of Bajara crop area of Igatpuri tahsil remains same during 2001 to 2011. But in Chandwad there is change in density of Bajara crop area from moderate to low.

Moderate density of national highway is found in Sinnar (0.025 km per each square kilometer of total area of tahsil), Niphad (0.018 km per each square kilometer of total area of tahsil), Deola (0.019 km per each square kilometer of total area of tahsil) and Malegaon (0.023 km per each square kilometer of total area of tahsil). In Deola and Niphad tahsil density of Bajara crop area is decreased from low to very low. There is rapid decrease in density of Bajara crop area by very high to moderate in Malegaon tahsil since 2001. In Sinnar tahsil there is no change in density of Bajara crop area.

In Dindory very low density of national highway is found. Total length of national highway is 2.70 km. In this tahsil density of Bajara crop area remains the same i.e. very low during 2001 to 2011. The tahsils like Peth, Surgana, Kalwan, Satana, Nandgaon, Yeola and Trimbak there is no national highway found.

2 State highway and Bajara Crop: -

The very high density of state highway is found in Trimbak (0.20 km per each square kilometer of total area of tahsil) and Nasik (0.19 km per each square kilometer of total area of tahsil). On the other hand Nasik and Trimbak tahsil shows very low density of Bajara crop area in both the decades.

High density of state highway is found in Surgana and Satana tahsil they are 0.18 & 0.16 km per each square kilometer of total area of tahsil. There is no change in density of Bajara crop area in Surgana and Satana tahsil during both the decades.

Moderate density of state highway is found in Kalwan, Deola and Chandwad. It contains 0.16, 0.15 & 0.16 km per each square kilometer of total area of tahsil. There is no impact of state highway on density of Bajara crop area in Kalwan tahsil which remain very low group. On the other hand density of Bajara crop area decreases in Deola and Chandwad tahsil i.e. from low to very low and moderate to low.

Lower density of state highway is found in Peth, Dindory, Niphad and Igatpuri tahsils. (0.13, 0.14, 0.13 & 0.14 km per each square kilometer of total area of tahsil) There is no impact of state highway found on density of Bajara crop area in Peth, Igatpuri and Dindory tahsil. But in Niphad it observed low to very low density of Bajara crop area.

Very low density of state highway is found in Malegaon, Nandgaon, Yeola and Sinnar. (0.12, 012, 0.12 & 0.12 km per each square kilometer of total area of tahsil) The density of Bajara crop area changes rapidly in Yeola and Malegaon tahsil from high to low and very high to moderate. While in Sinnar and Nandgaon there was no change in density of Bajara crop area during 2001 and 2011.

3 District highway and Bajara Crop: -

The intensity of district highway is very high in Yeola tahsil. (0.59 km per each square kilometer of total area of tahsil) The density of Bajara crop area in Yeola is high in 2001 and low in 2011 which is huge change. Area of Bajara crop decreased from 2001 to 2011.

High density of district highway is found in Dindory tahsil. (0.50 km per each square kilometer of total area of tahsil) There is no change found in density of Bajara crop area in Dindory tahsil it remains as it is (Very low).

Moderate density of district highway is found in Nandgaon, Chandwad, Peth and Surgana tahsil (0.42, 0.39, 0.41 and 0.44 km per each square kilometer of total area

of tahsil) Nandgaon, Surgana and Peth tahsils hold same position during 2001 to 2011 for density of Bajara crop area i.e. low, very low and very low. There is change in Chandwad tahsil; it is moderate to low density of Bajara crop area.

Low density of district highway is found in Sinnar, Niphad, Deola and Satana tahsils. (They are 0.36, 0.37, 0.37 and 0.35 km per each square kilometer of total area of tahsil) While in Niphad and Deola it is low to very low density of Bajara crop area are observed since 2001. There is no change in Sinnar and Satana tahsil; it is very high and moderate density of Bajara crop area.

Below 0.31 km per each square kilometer of total area of tahsil i.e. very low density of district highway is found in Trimbak, Igatpuri, Nasik, Kalwan and Malegaon tahsil. On the other hand Malegaon tahsil shows the change it is very high to moderate density of Bajara crop area in 2001 to 2011 decades. But in Trimbak, Igatpuri, Nasik and Kalwan tahsils there is no change found it remains very low density of Bajara crop area during both the decade.

4 Total road density and Bajara Crop: -

Very high road density is found in Yeola. (0.71 km per each square kilometer of total area of tahsil) The density of Bajara crop area in Yeola is high in 2001 and low in 2011 which is huge change. Area of Bajara crop is decrease from 2001 to 2011.

High road density is found in Surgana and Dindory tahsils (0.62 & 0.63 km per each square kilometer of total area of tahsil) There is no change found in density of Bajara crop area in Surgana and Dindory tahsil it remains as it is (very low).

The total road density in between 0.52 km to 0.58 km per each square kilometer of total area of tahsil (Moderate density) is found in Peth, Nasik, Deola, Chandwad and Nandgaon. In Peth, Nasik and Nandgaon tahsil there is no change found, it remains very low and low density of Bajara crop area during both the decades. But in Deola and Chandwad tahsil there is decrease in area of Bajara crop i.e. low to very low density of Bajara crop area and very moderate to low density of Bajara crop area since 2001 to 2011.

The low total road density is lying in 0.47 to 0.52 km per each square kilometer of total area of tahsil. In this group Igatpuri, Sinnar, Niphad and Satana tahsils are merged. There is definitely change found in density of Bajara crop area in Niphad tahsil it is low to very low. In Igatpuri, Sinnar and Satana tahsils, there is no change found; it remains very low, very high and moderate density of Bajara crop area during both the decades.

0.43 km to 0.47 km per each square kilometer of total area of tahsil is known for the very low density group for total road, in it the tahsils like Trimbak, Kalwan and Malegaon are merging. In Trimbak and Kalwan tahsils, there is no change found; it remains very low, density of Bajara crop area during both the decades. There is definitely change found in density of Bajara crop area in Malegaon tahsil it is very high to moderate.

E) Sugarcane Crop and Transportation

1 National highway and Sugarcane Crop: -

Very high national highway density is found in only Nasik tahsil which contain 0.056 km for each square kilometer of total area of tahsil. There is no change found in density of Sugarcane crop in Nasik tahsil it remains as it is very Low in 2001 to 2011.

High density of national highway is found in Igatpuri tahsil (0.045 km per each square kilometer of total area of tahsil) and Chandwad tahsil (0.035 km per each square kilometer of total area of tahsil). But in both the tahsils there is no change in area of Sugarcane crop in 2001 and 2011.

Moderate density of national highway is found in Sinnar (0.025 km per each square kilometer of total area of tahsil), Niphad (0.018 km per each square kilometer of total area of tahsil), Deola (0.019 km per each square kilometer of total area of tahsil) and Malegaon (0.023 km per each square kilometer of total area of tahsil). Except Niphad tahsil there is no change found in area of Sugarcane crop. In Niphad it changes very high density of Sugarcane area to moderate density of Sugarcane area in 2001 to 2011.

In Dindory very low density of national highway is found. Total length of national highway is 2.70 km. In this tahsil density of Sugarcane area changes from very low to

very high in 2001 to 2011. The tahsils like Peth, Surgana, Kalwan, Satana, Nandgaon, Yeola and Trimbak there is no national highway found.

2 State highway and Sugarcane Crop: -

The very high density of state highway is found in Trimbak (0.20 km per each square kilometer of total area of tahsil) and Nasik (0.19 km per each square kilometer of total area of tahsil). In Trimbak and Nasik tahsil there is no change in Sugarcane area during 2001 to 2011it remains very low.

High density of state highway is found in Surgana and Satana tahsil they are 0.18 & 0.16 km per each square kilometer of total area of tahsil. In Satana tahsil density of Sugarcane crop changes from very low to moderate in 2001 to 2011. On the other hand it remains as it is i.e. very low density of Sugarcane crop in Surgana tahsil since 2001.

Moderate density of state highway is found in Kalwan, Deola and Chandwad. It contains 0.16, 0.15 & 0.16 km per each square kilometer of total area of tahsil. In Deola and Chandwad tahsil there is no change in Sugarcane area during 2001 to 2011 it remains very low. But in Kalwan tahsil it changes very low to low density of Sugarcane crop area.

Lower density of state highway is found in Peth, Dindory, Niphad and Igatpuri tahsils. (0.13, 0.14, 0.13 & 0.14 km per each square kilometer of total area of tahsil) The density of Sugarcane area in Dindory and Niphad tahsil changes very low to very high and very low to moderate during 2001 to 2011. While Peth and Igatpuri tahsil density of Sugarcane area has not changed it remains very low during 2001 to 2011.

Very low density of state highway is found in Malegaon, Nandgaon, Yeola and Sinnar. (0.12, 012, 0.12 & 0.12 km per each square kilometer of total area of tahsil) But all this tahsil in this group is not change for density of Sugarcane area with time.

3 District highway and Sugarcane Crop: -

The intensity of district highway is very high in Yeola tahsil. (0.59 km per each square kilometer of total area of tahsil) In this tahsil same density of Sugarcane crop area is observed during 2001 to 2011.

High density of district highway is found in Dindory tahsil. (0.50 km per each square kilometer of total area of tahsil) Density of Sugarcane crop area in Dindory is fluctuating between very low to very high in 2001 to 2011.

Moderate density of district highway is found in Nandgaon, Chandwad, Peth and Surgana tahsil. (0.42, 0.39, 0.41 and 0.44 km per each square kilometer of total area of tahsil) All these tahsil shows no change in density of Sugarcane crop area during 2001 to 2011 which lies in very low density of Sugarcane crop area.

Low density of district highway is found in Sinnar, Niphad, Deola and Satana tahsils. (They are 0.36, 0.37, 0.37 and 0.35 km per each square kilometer of total area of tahsil) The change is found in Niphad and Satana tahsil it is very high to moderate density of Sugarcane crop area and very low to moderate density of Sugarcane crop area, rest of tahsil remains as it is for density of Sugarcane crop area in decade 2001 to 2011.

Below 0.31 km per each square kilometer of total area of tahsil i.e. very low density of district highway is found in Trimbak, Igatpuri, Nasik, Kalwan and Malegaon tahsil. Except Kalwan tahsil the density of Sugarcane crop area remains same during both decades. Density of Sugarcane crop area changes very low to low in Kalwan tahsil.

4 Total road density and Sugarcane Crop: -

Very high road density is found in Yeola. (0.71 km per each square kilometer of total area of tahsil) In this tahsil same density of Sugarcane crop area is observed during 2001 to 2011.

High road density is found in Surgana and Dindory tahsils (0.62 & 0.63 km per each square kilometer of total area of tahsil) In the Dindory tahsil density of Sugarcane crop changes very low to very high in 2001 to 2011. But in Surgana tahsils it remains as it is.

The total road density in between 0.52 km to 0.58 km per each square kilometer of total area of tahsil (Moderate density) is found in Peth, Nasik, Deola, Chandwad and Nandgaon. All these tahsils shows no change in density of Sugarcane crop area during 2001 to 2011.

The low total road density is lying in 0.47 to 0.52 km per each square kilometer of total area of tahsil. In this group Igatpuri, Sinnar, Niphad and Satana tahsils are merged. The change is found in Niphad and Satana tahsil, it is very high to moderate density of Sugarcane crop area and very low to moderate density of Sugarcane crop area, rest of tahsil remains as it is for density of Sugarcane crop area in decade 2001 to 2011.

0.43 km to 0.47 km per each square kilometer of total area of tahsil is known for the very low density group for total road, in it the tahsils like Trimbak, Kalwan and Malegaon are merging. Except Kalwan tahsil the density of Sugarcane crop area remain same during both decades. Density of Sugarcane crop area changes very low to low in Kalwan tahsil.

F) Grapes Crop and Transportation

1 National highway and Grapes Crop: -

Very high national highway density is found in only Nasik tahsil which contain 0.056 km for each square kilometer of total area of tahsil. But the density of Grapes crop area in Nasik tahsil is moderate to low in duration 2001 to 2011.

High density of national highway is found in Igatpuri tahsil (0.045 km per each square kilometer of total area of tahsil) and Chandwad tahsil (0.035 km per each square kilometer of total area of tahsil). The density of Grapes crop area in Igatpuri tahsil remains same during 2001 to 2011. But in Chandwad there is change in density of Grapes crop area from low to moderate.

Moderate density of national highway is found in Sinnar (0.025 km per each square kilometer of total area of tahsil), Niphad (0.018 km per each square kilometer of total area of tahsil), Deola (0.019 km per each square kilometer of total area of tahsil) and Malegaon (0.023 km per each square kilometer of total area of tahsil). In Sinnar tahsil density of Grapes crop area increases from very low to low. There is no change in density of Grapes crop area in Deola, Malegaon and Niphad tahsil since 2001.

In Dindory very low density of national highway is found. Total length of national highway is 2.70 km. In this tahsil density of Grapes crop area increases in very low to very high. The tahsils like Peth, Surgana, Kalwan, Satana, Nandgaon, Yeola and Trimbak there is no national highway found.

2 State highway and Grapes Crop: -

The very high density of state highway is found in Trimbak (0.20 km per each square kilometer of total area of tahsil) and Nasik (0.19 km per each square kilometer of total area of tahsil). Tahsil Nasik contains moderate density of Grapes crop area in 2001 and changes to low density of Grapes crop area in 2011. On the other hand, density of Grapes crop area of Trimbak tahsil remains constant in both the decade.

High density of state highway is found in Surgana and Satana tahsil they are 0.18 & 0.16 km per each square kilometer of total area of tahsil. There is no change in density of Grapes crop area in Surgana and Satana tahsil during both the decades.

Moderate density of state highway is found in Kalwan, Deola and Chandwad. It contains 0.16, 0.15 & 0.16 km per each square kilometer of total area of tahsil. There is positive impact of state highway on density of Grapes crop area in Chandwad tahsil which changes low to moderate group i.e. there is increase in Grapes crop area it indicate increase in agricultural area it may be due to fast road transportation. While in Kalwan and Deola tahsil there is no change in density of Grapes crop area it remains very low in both the decades.

Lower density of state highway is found in Peth, Dindory, Niphad and Igatpuri tahsils. (0.13, 0.14, 0.13 & 0.14 km per each square kilometer of total area of tahsil)

There is no impact of state highway found on density of Grapes crop area in Peth, Niphad and Igatpuri tahsil it remains as it is (very low, very high and very low). But in Dindory tahsil it is observed as very low to very high density of Grapes crop area during 2001 to 2011.

Very low density of state highway is found in Malegaon, Nandgaon, Yeola and Sinnar. (0.12, 012, 0.12 & 0.12 km per each square kilometer of total area of tahsil) The density of Grapes crop area changes in Sinnar tahsil from very low to low. In Yeola, Malegaon and Nandgaon density of Grapes crop area there is no change in both decades.

3 District highway and Grapes Crop: -

The intensity of district highway is very high in Yeola tahsil. (0.59 km per each square kilometer of total area of tahsil) The density of Grapes crop area in Yeola is very low in 2001 and 2011.

High density of district highway is found in Dindory tahsil. (0.50 km per each square kilometer of total area of tahsil) There is change in density of Grapes crop area in Dindory tahsil as it is very low to Very high.

Moderate density of district highway is found in Nandgaon, Chandwad, Peth and Surgana tahsil (0.42, 0.39, 0.41 and 0.44 km per each square kilometer of total area of tahsil) Nandgaon, Peth and Surgana tahsils hold same position during 2001 to 2011 for density of Grapes crop area i.e. very low. Change is found in Chandwad tahsil, it is low to moderate density of Grapes crop area.

Low density of district highway is found in Sinnar, Niphad, Deola and Satana tahsils. (They are 0.36, 0.37, 0.37 and 0.35 km per each square kilometer of total area of tahsil) Niphad, Deola and Satana tahsils during 2001 to 2011 holds the same density of Grapes crop area which is very high, low and very low. While in Sinnar it is very low to low density of Grapes crop area change is observed since 2001.

Below 0.31 km per each square kilometer of total area of tahsil i.e. very low density of district highway is found in Trimbak, Igatpuri, Nasik, Kalwan and Malegaon

tahsil. The density of Grapes crop area in Nasik tahsil changes moderate to low during 2001 to 2011. But in Trimbak, Igatpuri, Kalwan and Malegaon tahsil there is no change found it remains very low density of Grapes crop area during both the decade.

4 Total road density and Grapes Crop: -

Very high road density is found in Yeola. (0.71 km per each square kilometer of total area of tahsil) The density of Grapes crop area in Yeola is very low in 2001 and 2011.

High road density is found in Surgana and Dindory tahsils. (0.62 & 0.63 km per each square kilometer of total area of tahsil) There is no change found in density of Grapes crop area in Surgana tahsil it remains as it is (very low). But change is observed in Dindory tahsil it is very low to very high during 2001 to 2011.

The total road density in between 0.52 km to 0.58 km per each square kilometer of total area of tahsil (Moderate density) is found in Peth, Nasik, Deola, Chandwad and Nandgaon. In Peth, Deola and Nandgaon tahsil there is no change found, it remains very low density of Grapes crop area during both the decades. But in Nasik and Chandwad tahsils there is change in area of Grapes crop i.e. moderate to low density of Grapes crop area, low to moderate density of Grapes crop area since 2001.

The low total road density is lying in 0.47 to 0.52 km per each square kilometer of total area of tahsil. In this group Igatpuri, Sinnar, Niphad and Satana tahsils are merged. There is definitely change found in density of Grapes crop area in tahsil Sinnar it is very low to low density of Grapes crop area. While in Igatpuri, Niphad and Satana there is no change in density of Grapes crop area it remain very low, very high and very low in 2001 to 2011.

0.43 km to 0.47 km per each square kilometer of total area of tahsil is known for the very low density group for total road, in it the tahsils like Trimbak, Kalwan and Malegaon are merging. There is no change in density of Grapes crop area in Trimbak, Kalwan and Malegaon tahsil it remains the same i.e. very low.

G) Onion Crop and Transportation

1 National highway and Onion Crop: -

Very high national highway density is found in only Nasik tahsil which contain 0.056 km for each square kilometer of total area of tahsil. There is no change in the density of Onion crop area in Nasik tahsil it remains very low in duration 2001 to 2011.

High density of national highway is found in Igatpuri tahsil (0.045 km per each square kilometer of total area of tahsil) and Chandwad tahsil (0.035 km per each square kilometer of total area of tahsil). The density of Onion crop area of Igatpuri and Chandwad tahsil remains same during 2001 to 2011.

Moderate density of national highway is found in Sinnar (0.025 km per each square kilometer of total area of tahsil), Niphad (0.018 km per each square kilometer of total area of tahsil), Deola (0.019 km per each square kilometer of total area of tahsil) and Malegaon (0.023 km per each square kilometer of total area of tahsil). In Sinnar, Deola Niphad and Malegaon tahsils density of Onion crop area is increased from low to high, high to very high and low to very high .

In Dindory very low density of national highway is found. Total length of national highway is 2.70 km. In this tahsil density of Onion crop area is remain same i.e. very low during 2001 to 2011. The tahsils like Peth, Surgana, Kalwan, Satana, Nandgaon, Yeola and Trimbak there is no national highway found.

2 State highway and Onion Crop: -

The very high density of state highway is found in Trimbak (0.20 km per each square kilometer of total area of tahsil) and Nasik (0.19 km per each square kilometer of total area of tahsil). On the other hand Nasik and Trimbak tahsil shows very low density of Onion crop area in both the decades.

High density of state highway is found in Surgana and Satana tahsil they are 0.18 & 0.16 km per each square kilometer of total area of tahsil. There is no change in

density of Onion crop area in Surgana tahsil during both the decades. On the other hand Satana tahsil shows very low to very high density of Onion crop area in both the decades.

Moderate density of state highway is found in Kalwan, Deola and Chandwad. It contains 0.16, 0.15 & 0.16 km per each square kilometer of total area of tahsil. There is no impact of state highway on density of Onion crop area in Chandwad tahsil which remain very high group. On the other hand density of Onion crop area in Deola and Kalwan tahsil changes from very low to very high and low to very high.

Lower density of state highway is found in Peth, Dindory, Niphad and Igatpuri tahsils. (0.13, 0.14, 0.13 & 0.14 km per each square kilometer of total area of tahsil) There is no impact of state highway found on density of Onion crop area in Peth, Igatpuri and Dindory tahsil. But in Niphad it observed high to very high density of Onion crop area.

Very low density of state highway is found in Malegaon, Nandgaon, Yeola and Sinnar. (0.12, 012, 0.12 & 0.12 km per each square kilometer of total area of tahsil) The density of Onion crop area changes rapidly in Nandgaon, Yeola, Sinnar and Malegaon tahsil from very low to very high, moderate to high, low to high and low to very high during 2001 and 2011.

3 District highway and Onion Crop: -

The intensity of district highway is very high in Yeola tahsil. (0.59 km per each square kilometer of total area of tahsil) The density of Onion crop area in Yeola is moderate in 2001 and very high in 2011 which is huge change. Area of Onion crop is increases from 2001 to 2011.

High density of district highway is found in Dindory tahsil. (0.50 km per each square kilometer of total area of tahsil) There is no change found in density of Onion crop area in Dindory tahsil it remains as it is (Very low).

Moderate density of district highway is found in Nandgaon, Chandwad, Peth and Surgana tahsil (0.42, 0.39, 0.41 and 0.44 km per each square kilometer of total area

of tahsil) Chandwad, Surgana and Peth tahsils hold same position during 2001 to 2011 for density of Onion crop area i.e. very low. There is change in Nandgaon tahsil, it is very low to very high density of Onion crop area.

Low density of district highway is found in Sinnar, Niphad, Deola and Satana tahsils. (They are 0.36, 0.37, 0.37 and 0.35 km per each square kilometer of total area of tahsil) While in Sinnar, Niphad, Deola and Satana it is low to very high, high to very high, low to very high and low to very high density of Onion crop area are observed since 2001.

Below 0.31 km per each square kilometer of total area of tahsil i.e. very low density of district highway is found in Trimbak, Igatpuri, Nasik, Kalwan and Malegaon tahsil. On the other hand Kalwan and Malegaon tahsil shows the change it is low to very high density of Onion crop area in 2001 to 2011 decades. But in Trimbak, Igatpuri and Nasik tahsils there is no change found it remains very low density of Onion crop area during both the decade.

4 Total road density and Onion Crop: -

Very high road density is found in Yeola. (0.71 km per each square kilometer of total area of tahsil) The density of Onion crop area in Yeola was moderate in 2001 and high in 2011

High road density is found in Surgana and Dindory tahsils (0.62 & 0.63 km per each square kilometer of total area of tahsil) There is no change found in density of Onion crop area in Surgana and Dindory tahsil it remains as it is (very low).

The total road density in between 0.52 km to 0.58 km per each square kilometer of total area of tahsil (Moderate density) is found in Peth, Nasik, Deola, Chandwad and Nandgaon. In Peth, Nasik and Chandwad tahsil there is no change found, it remains very low, very low and very high density of Onion crop area during both the decades. But in Deola and Nandgaon tahsil there is increase in area of Onion crop i.e. low to very high density of Onion crop area and very low to very high density of Onion crop area since 2001 to 2011.

The low total road density is lying in 0.47 to 0.52 km per each square kilometer of total area of tahsil. In this group Igatpuri, Sinnar, Niphad and Satana tahsils are merged. There is definitely change found in density of Onion crop area in Niphad, Sinnar and Satana tahsils it is high to very high, low to very high and low to very high. In Igatpuri tahsil, there is no change found; it remains very low density of Onion crop area during both the decades.

0.43 km to 0.47 km per each square kilometer of total area of tahsil is known for the very low density group for total road, in it the tahsils like Trimbak, Kalwan and Malegaon are merging. In Malegaon and Kalwan tahsils, there is change found; they are low to very high density of Onion crop area during both the decades. There is no change found in density of Onion crop area in Trimbak tahsil it is very low.

Transportation, as the service of moving commodities between places, plays a unique role in a fully competitive capitalist space-economy. The commodity of transportation is consumed as a part of virtually every economic transaction, linking the production and consumption of a commodity; demand for transportation is derived from spatial configurations rather than being fixed by socially necessary techniques and real wages; and the circulation time taken in transportation is a deduction from capitalists' profits. The impact of circulation time on profits may be calculated precisely. The derived nature of the demand for transportation adds a level of uncertainty to the impact of cost-reducing technical change on profit rates. Given this, cost-reducing and time-reducing technical change in the transportation commodity is one of the few ways of ensuring an increased rate of profit for capitalists, ceteris paribus. The public nature of transportation improvements and the high investments in fixed capital that are required help to explain the central role of the state in capitalism in the improvement of transportation and thus in underwriting capital accumulation.

In the study region temporal changes in Fallow land is very important because it increases or decreases agricultural area which affects the production of crops. The tahsils like, Satana, Malegaon, Deola, Chandwad, Trimbak, Dindory and Niphad there are very

small changes are observed. It leads to increase intensity of agriculture production. Out of 15 tahsils 13 tahsils show the increasing trend of cultivable waste land. It means there is increase in land use for non agriculture. It is mainly founds in Igatpuri, Sinnar, Trimbak, Yeola, Niphad, Chandwad, Nandgaon, Malegaon, Dindory, Deola, Satana, Surgana and Peth. In this study area there is found positive growth in Net sown area from 2001 to 2011 in the tahsils like Trimbak, Peth, Surgana, Kalwan, Dindory and Satana.

There is increase in the area under Rice in Surgana, Kalwan, Satana, Peth, Dindory, Trimbak, Igatpuri, Nasik and Sinnar tahsil. There is remarkable increase in area under wheat in the tahsils known as Sinnar Yeola, Deola, Satana, Kalwan, Malegaon, Nandgaon, Nasik and Igatpuri within two decade (2001 & 2011). Only in few tahsils there are increases in area under Jowar they are Deola, Nandgaon, Kalwan and Nasik in the decade 2001 to 2011 while remaining all tahsils shows negative trend of growth. Though the area under Bajara crop is higher in Satana, Malegaon, Deola, Chandwad, Yeola and Niphad there is found decreasing trend in 2001 to 2011. While in Surgana, Peth, Dindory, Kalwan, Nasik, Trimbak and Igatpuri shows very less area under Bajara crop. In the study region there is found increase in the area of sugarcane in the tahsils Satana, Malegaon, Deola, Dindory, Sinnar, Igatpuri and Kalwan (2001 to 2011). In the Dindory tahsil crop under Grapes is increase with more than 10 fold with respect to 2001 decade. Also tahsils name as Niphad, Chandwad, Sinnar Malegaon, Igatpuri and Satana there is increase in area under grapes from decade 2001 to 2011.Above all explanation leads the spatio-temporal changes with respect to capitalism.

Chapter 7

IMPACT OF TRANSPORTATION CASE STUDY OF SURGANA, IGATPURI, DINDORI AND TRIMBAK TAHSILS

7.1 Introduction

The case studies of sample villages demonstrate the impact of the growth of transport network on the communities in the selected spatial area of research. As mentioned in the earlier chapter, researcher has chosen some villages so as to compare and contrast the effects of these networks in terms of change in landuse pattern and also assessing changes in life chances of individuals and communities of these regions. These case studies include narratives of various individuals belonging to disparate castee, class, religion and ethnic groups/communities. After all development is not equitably shared. As the secondary literature and findings from my research suggest that the impact is highest amongst the lower middle class pesantry, researcher has chosen small farmers from these villages. These farmers belong to Maratha, OBC, S.C , Kokana tribe, Mahadev Koli tribe and Mahadev Thakur tribe group whose village population is up to 2000 according to 2011 census. With these factors taken into consideration the researcher employed the simple random sampling method for selection of the case study villages from four tahsil which is predominantly tribal - these are Umbarpada, Galpada and Harantekadi from Surgana tahsil, Kaluste, Bhavli Bk and Adsare Kh from Igatpuri tahsil, Joranpada, Kokangaon and Sadrale Dindori tahsil and Rohile, Hirdi and Kharshet from Trimbak tahsil. Researcher has presented the case studies as individual cases and village level analysis.

A. Individual Case Study

Case study 1

Eaknath Gaikwad is 40 years old. Who belongs to the Hindu Kokana Scheduled castee. He lives in Umbarpada village in Surgana tahsil. Umbarpada village which is 43 km away from Surgana. His wife Kudabai is 35 years old. Both are illiterate.

They have one son Manoj who is 18 years old and is studying in 11th standard and one daughter named Anjali 16 years old studying in 9th standard. This family's main occupation is agriculture. They have small plot of agricultural land measuring 2 acres which is registered in Eaknath's name. In this small piece of land Eknath is able to raise rice and that too only in rainy season. Other than rainy season they offer their labour as wage labourers in others field and at best earn Rs 200 per day.

This family's annual income is Rs 48000 per annum. They have a small two room house in field. The wall of this house are made up of mud and roof is covered by grass. Only rice is grown in there field. The distance of field from main road is 8 km. This field road is cart track. The condition of the major access road before the year 2000 was that it was unmetalled. This unmetalled road changed into metalled road in the year 2009. But after that there is no change in cropping pattern in Eaknath's field. This is because there is no capital for other crop production. Also there is no irrigation source for his field.

In tribal areas Government of India has implemented Pradhan Mantri Gram Sadak Yojana. In this ambitious project played Yeomen service to connect small villages with each others as well as with tahsil places. In this 4 tribal tahsils this scheme ways implemented with high spirit which resulted visible improvement of road conditions. Due to road network means of surface transport has improved under the scheme of Govt. of Maharashtra. Metallic road are also re-enforced. Previously this family was engaged in cultivation of Land mainly of Rice. But due to this family is enjoy the road for travel to other area for wages. It is observed that there is need of labour force in the field in surrounding villages because there is demand of vegatable frout grain in market like Nasik and Mumbai also the demand of this agriculture products is higher in Gujarat state and this state is near from Nasik city. Nasik is well conacted to Mumbai and Gujarat state by highway this leads to change in landuse pattern and labour pattern in the case study region. This leads to increase in income of family. The increase in income play an important role in changing life style. This family use mobile, T.V., Gas etc aminities.

Eaknath also told that most of his friend go to others village for agriculture

wages and got good earning there economic situtation is change. Farmers from other village send vehicles for recive the labours. It is due to quality of the road is improve. He told that number of two wheeler and four wheeler have increased in last 5 year. Few male from his village are shifted to Mumbai and Nasik area for other work like wages, unskilled workers in industry etc. it means that transport not only play role for changing agriculture land use pattern but also change occupation structure.

Case study 2

Ranu Jadhav is 75 years old. Who is Hindu Kokana Scheduled castee. He live in Galpada village in Surgana tahsil. Galpada village is 37 km from Surgana. His wife Hirabai is 70 years old. Both are illiterate. They have two sons name Somanath and Daulat (45 and 42 years old) both are educated upto 10^{th}. There wife Nirmala (40 year old) and Pramila (37 year old) are educated upto 8^{th}. Ranu Jadhav has two grandsons (son of his son) name Charu 10 year old studies in 4^{th} standard and Raju 6 year old. He also has three granddaughters (daughters of his son) name Rani, Moni and Soni 13, 11 and 5 year old, they go to primary school. Ranu Jadhav‘s main occupation is agriculture. They have plot of agriculture land measuring 4.5 acres which is registered in Ranu Jadhav’s name. In this field, he grow rice and vegetable like tomato, bringle etc crop production. They have a well which is used for irrigation .

This family‘s annual income is Rs 65000. They have small three room house in field. The wall of this house is made up of mud and roof is covered by grass. In his field since time they grow rice crop. The distance of field from main road is 2 km. This field road is cart track. Condition of major road before 2000 A.D is unmetalled. This unmetalled road change into metalled road in 2008 A.D. After this there is change in cropping pattern of Ranu Jadhav’s field. Now a days he grow vegetables because the market for vegetable is increased due to improvement of road towards Mumbai and Nasik. He say that tarkari (Vegetable truck) reach market place with in 2 to 5 hours. Also mentioned that day by day the demand for vegetable is increasing and most of this village farmer are engaged in vegetable farming. Since last five year there is increase in the income of villagers. It leads to change in life style of villagers like they use two and four wheeler,

T.V. Mobile, they construct the houses of R.C.C structure etc. They import the agriculture labour from surrounding region. Also says that in past due to lack of transport facilities transportation of fertilizer, raw material & harvested crop was difficult task as the condition of road use to deteriorated in monsoon. So it was a obstacle for the development of agricultural product in this area. But now it has changed since last five years, the agriculture shops of fertilizer, raw material are easily available. The facility of privatet transportation is now easily available due to metalled road.

Case study 3

Pandurang Jadhav is police patil 42 years old. Who is Hindu Kokana Scheduled caste. He lives in Harantekadi village in Surgana tahsil. Harantekadi village is 27 km from Surgana. His wife Bhimabai is 38 years old. Both are educated 12^{th} and 10^{th} standard. They have two son name as Jitendra 22 years old studied upto S.Y.B.A. standard, Danaraj is second son 18 years old studying in F.Y.B.Sc. and two daughters name Sunita 15 years old studying in 9^{th} standard, second daughter Gita13 years old studying in 6^{th} standard . This family‘s main occupation is agriculture. They have plot of agriculture land measuring 10 acres which is registered in Pandurang Jadhav’s name. In this field, he grow rice, Wheat, Udid. They have a well which is used for irrigation.

This family‘s annual income is Rs 94000. They have three room house in Village. The wall of this house is made up of bricks and roof is covered by tin. In his field since time they grow rice crop only. The distance of field from main road is 1 km. This field road is cart track. Condition of major road before 2000 A.D was unmetalled. This unmetalled road changed into metalled road in 2009 A.D. After that there is change in cropping pattern they grow wheat and Udid also in the field. This is because there is small capital available for other crop production. Also there is irrigation source for his field. But the main thing is that condition of road is good for transport agriculture goods to the market place that is impact of road enjoyed by Pandurang Jadhav for changing agriculture land use pattern.

He also says that his some friend take the production of frout, onion, vegetable it increases the income of the farmers also he say that they enjoy the transportation

system for selling their agricultural product in Nasik and Mumbai market center. Due to transport system, farmers easily get fertilizers, insecticide, pesticide, manual laboursa to the farm at the time of growing and harvesting of the crops. So there is increase in the income of villagers. It leads to change in life style of villagers like they use two and four wheeler, T.V. Mobile, they construct the houses of R.C.C structure etc. They import the agriculture labour from surrounding region. Also says that in past due to lack of transport facilities transportation of fertilizer, raw material & harvested crop was difficult task as the condition of road use to deteriorate in monsoon. So it was an obstacle for the development of agricultural product in this area. But now it was change since last four to five years, the agriculture shops of fertilizer, raw material are easily available. The facility of private transportation is now easily available due to metalled road.

Case study 4

Sakharam Ghate is 48 years old. Who is Hindu Mahadev Koli Scheduled caste. He lives in Kaluste village in Igatpuri tahsil. Kaluste village is 27 km from Igatpuri. His wife Suman is 32 years old. Both are illiterate. They have three sons Tanaji 18 years old studying in 10^{th} standard, Shivaji 16 years old studying in 9^{th} standard and Gajanan 10 years old studying in 3^{rd} standard. This family‘s main occupation is agriculture. They have small plot of agriculture land measuring 1.5 acres which is registered in Sakharam Ghate name. In this field, he grow rice crop only in rainy season. Other than rainy season they go to wages in others field and get Rs 175 per day.

This family‘s annual income is Rs 32000. They have small two room house in their field. The wall of this house is made up of mud and roof is covered by grass. In his field since time they grow rice crop only. The distance of field from main road is 6 km. This field road is cart track. Condition of major road before 2000 A.D was unmetalled. This unmetalled road changed into metalled road in 2008 A.D. But after that there is no change in cropping pattern of Sakharam Ghate field. This is because there is no capital for other crop production. Also there is no irrigation source for his field.

This family is not yet developed as compared to the other farmers family of his village. Because he say that other people in his village grows different crop according to

season. They have well irrigation source throughout the year. Their crop pattern are vegetable like Tomato, Brinjal, Lady-fingers, and Cucumbers and cukerbetas in monsoon season etc. due to good networking of road the frequent visits of the family members to taluka plaece it has increased general awareness of modern farming fertilizers, insecticides, pesticides. This is due to Pradhan Mantri Gram Sadak Yojana many villages are connected with Tar roads and it becaome very easy and assessable to meet their relatives in emergency and crisis time. His family has suffered due to unavailability capital as well as irrigation source. So they did not enjoy the transportation facility.

Case study 5

Vasat Tadpade is 28 years old. Who is Hindu Mahadev Koli Scheduled Tribes. He lives in Sare Kh village in Igatpuri tahsil. Adsare Kh village is 78 km from Igatpuri. His wife Kamal is 24 years old. Both are illiterate. They have one son Veelin 5 years old and one daughter Vina 3 years old. This family‘s main occupation is agriculture. They have small plot of agriculture land measuring 1 acres which is registered in Vasat Tadpade’s name. In this field, he grow rice crop production only in rainy season. Other than rainy season they go for wages in others field and get Rs 150 per day.

This family‘s annual income is Rs 36000. They have small one room house in field. The wall of this house is made up of mud and roof is covered by grass. In his field since time they grow rice crop only. The distance of field from main road is 12 km. This field road is cart track. Condition of major road before 2000 A.D is unmetalled. This unmetalled road changed into metalled road in 2008 A.D. But after that there is no change in cropping pattern in Vasat Tadpade’s field. This is because there is no capital for other crop production. Also there is no irrigation source for his field. This rice production is used for only house not for sale.

This family is marginal farmer having less land holding in comparison to other families from that tribe. Due to less land holding, this family is not in a position to keep basic logistic and infrastructure like Bullock-Cart, Ploughs, Triller, Tractors. So they are farming by indigenous methods. They have also slightly changed the crop pattern. Previously the family was engaged in Kharip-Crop pattern and cultivating crops with

Rice, Paddy's for their personal consumptions. Only three months of monsoon were self employment generating and remaining moths of the year they were hardly engaged with extra agricultural activities. Now, due to change of crop pattern in the village the big farmers are developing vegetable farms, horticultural farms and many marginal families are seeking jobs with prominent farmers. Working in grape garden or vegetable tomato farms labourer generally use to get 200-300 Rs. Per day. This family member is having two potential labours and use to get around 500 Rs. Per day after working in vegetable farms or Horticulture gardens.

Case study 6

Shivanta Alivle is 30 years old. Who is Hindu Mahadev Thakur Scheduled caste. She live in Bhavli Bk village in Igatpuri tahsil. Bhavli Bk village is 56 km from Igatpuri. She is illiterate. Her husband is no more She has one son name as Vishal 5 years old and one daughter Swati 12 years old studying in 5^{th} standard. This family's main occupation is agriculture. They have small plot of agricultural land measuring 1.5 acres which is registered in Shivanta Alivle husband name (Ramesh). In this field, She grows rice only in rainy season. Other than rainy season they go to wages in others field and get Rs 120 per day.

This family's annual income is Rs 28000. They have small one room house in the field. The wall of this house is made up of mud and roof is covered by grass. In her field since time they grow rice crop only. The distance of field from main road is 6 km. This field road is cart track. Condition of major road before 2000 A.D was unmetalled. This unmetalled road changed into metalled road in 2002 A.D. But after that there is no change in cropping pattern of Shivanta Alivle field. This is because there is no capital for other crop production. Also there is no irrigation source for her field. This rice production is used for only house not for sale.

This family is marginal farmer having less land holding in comparison to other families from that tribe. They have no support of her husband and other family member. So this lady suffer due to this. Due to less man power she cannot take crop production effectively. Because of this there is no change in cropping pattern. To increase the income

of this family she goes to work in other field. She also told that cropping pattern of the other farmers have changed due to Pradhan Mantri Gram Sadak Yojana, many villages are connected with Tar roads. She also told that few years back the agriculture activities were only confined for the Kharip-season. But now activities has been extended to Rugby-season. In Rugby the farmer grows Nuts (Harbara), peas, which have also changed their food habits Social Communication Due to Pradhan Mantri Gram Sadak Yojana.

Case study 7

Hiraman Buare is 32 years old. Who is Hindu Kokna Scheduled Tribes. He lives in Sadrale village in Dindori tahsil. Sadrale village is 37 km from Dindori. He is illiterate and studied upto 9^{th}. His wife Hausabai 29 studied upto 7^{th} has one son Pundalik 6 years old studying in 1^{st} standard This family's main occupation is agriculture. They have plot of agriculture land measuring 9 acres which is registered in Hiraman Buare's name. In this field, He grows rice and vegetables like tomato, Ghavda Brinjal etc. For the irrigation purpose they have well

This family's annual income is Rs 110000. They have three room house in village. The wall of this house is made up of brick and roof is covered by tin. In his field since time they grow rice and vegetable crops. The distance of field from main road is 5 km. This field road is cart track. Condition of major road before 2000 A.D was unmetalled. This unmetalled road changed into metalled road in 2013 A.D. But after that there is no change in cropping pattern of Hiraman Buare field. This is because already they have capital for other crop production. Also there is irrigation source for his field. This crop production is used for sale. In this case study road impact is not found on agriculture land use pattern because before good condition of road they grow same crop as today.

This family is progressive family in connection with agricultural activities. The crop pattern of the family has not changed considerable as their farm is 5 Km away from Motorable road. Previously they were engaged in cultivation of rice, *Varli, Nachni,* for their food consumption. But now they have changed their crop patterns to vegetables like tomato, brinjals, bitter gourds, lady-finger, also in monsoon season they use to cultivate cucumbers and pumpkins. This area has become supplier of green vegetables

Peth Surgana & Nasik. Due to road network transportation of vegetable has become very easy and fast with the help of mini doors meta doors and small trucks. Few youths of this villages have also started business of transportation and many youth become drivers & cleaners of the transport vehicles. Transportation of fertilizer, insecticides, pesticides, also become very easy due to construction of small village roads under the scheme of Pradhan Mantri Gram Sadak Yojana. Previously the family members were also engaged as a labourers of big farms but now they have developed self sustain system of their own farm.

Case study 8

Janabai Gavali is 41 years old. Who is Hindu Kokna Scheduled caste. She lives in Joranpada village in Dindori tahsil. Joranpada village is 19 km from Dindori. She is illiterate. Her husband is no more. She has one son name as Balu 22 years old studied upto 7^{th} standard and his wife name Puspa 19 years old studied upto 5^{th} standard. This family‘s main occupation is agriculture. They have plot of agriculture land measuring 4.5 acres which is registered in Janabai Gavali’s name. In this field, She grows rice only in rainy season past few years.

This family‘s annual income is Rs 1,39,000. They have three room house in field. The wall of this house is made up of brick and roof is covered by tin. In his field since time they grow rice crop only. The distance of field from main road is 7 km. This field road is cart track. Condition of major road before 2000 A.D was unmetalled. This unmetalled road change into metalled road in 2012 A.D. But after that there is change in cropping pattern of Janabai Gavali field. This is because there is avalibality of capital for other crop production. Also there is well irrigation source for her field.

This is a well to do family having good holding of land and having progressive attitude. They have changed their crop pattern. Indigenously this family was engaged in cultivation of Rice and Paddy but due to change in Scenario they have changed their crop pattern for vegetable like Tomato, Brinjal, Lady-fingers, and Cucumbers and cukerbetas in monsoon season etc. due to good networking of road the frequent visits of the family members to taluka plaece it has increased general awareness of modern farming

fertilizers, insecticides, pesticides. In villages also agro based fertilizers and insecticides are available and seed-centers are come up with modern techniques. This family has also done their soil testing to adjust the crops as per the ecological requirement. Due to cultivation of vegetables and daily supply to adjoining towns and cities this family members are having daily work on their farm just like spraying, viding, thinning. Due to cultivation of vegetables this family becomes self sustained in the manner of financial independence. Few years back the agriculture activities were only confined for the Kharip-season. But now activities has been extended to Rugby-season. In Rugby the family grows Nuts (Harbara), peas, which have also changed their food habits.Social Communication: Due to Pradhan Mantri Gram Sadak Yojana many villages are connected with Tar roads and it becaome very easy and asessable to meet their relatives in emergency and crisis time. This family also belongs to Motor-Cycle and which is a chief and simple way of conveyance for the family members. Even females of the house also use By-Cycle to attend family social functions.

B. Village level Case Study

1 Occupation Stateus

Table No. 7.1 Occupation Stateus

Sr. No.	Occupation / Villages	Agriculture (Percent)	Agriculture + Service (Percent)
1	Umbarpada	90	10
2	Galpada	90	10
3	Harantekadi	100	00
4	Kaluste	80	20
5	Bhavli Bk	100	00
6	Adsare Kh	80	20
7	Joranpada	100	00
8	Kokangaon	100	00
9	Sadrale	100	00
10	Rohile	100	00
11	Hirdi	100	00
12	Kharshet	100	00

(Source: Computed by Researcher)

Occupation structure is indicator of development. It is also indicator of standard of living and it gives the idea to income group. In present study researcher consider occupation such as Agriculture and Service with Agriculture.

It found that in study region only four villages contain service with agriculture they are Umbarpada Galpada, Kaluste and Adsare Kh contain 10 to 20 percent people. Remaining villages are holding agriculture occupation. It means that most of the tribal people are related to agriculture. (Table No. 7.1)

2 Family Size

Family size is one of the important factors of society. It shows the development, stateus in society and standard of living. In the present case study it is observed that most of the villages are merge in 3 to 5 person family group it ranges 40 to 100 percentage. On the other hand 6 to 10 persons family group is found in villages like Galpada (50 %), Harantekadi (40%), Kaluste (48%), Adsare Kh (60%), Rohile (32%) and Hirdi (22%). While upto 2 persons family group is observed in only three villages Kokangaon (13.88%), Joranpada (38 %) and Sadrale (42.12 %). In this case study there is not observed family group above 10 persons. (Table No. 7.2)

Table No. 7.2 Family Size

Sr. No.	Famile Size / Villages	Upto 2 (Percent)	3 to 5 (Percent)	6 to 10 (Percent)	Above 10 (Percent)
1	Umbarpada	00	100	00	00
2	Galpada	00	50	50	00
3	Harantekadi	00	60	40	00
4	Kaluste	00	52	48	00
5	Bhavli Bk	00	100	00	00
6	Adsare Kh	00	40	60	00
7	Joranpada	38	62	00	00
8	Kokangaon	13.88	86.12	00	00
9	Sadrale	42.12	57.88	00	00
10	Rohile	00	68	32	00
11	Hirdi	00	78	22	00
12	Kharshet	00	100	00	00

(Source: Computed by Researcher)

3 Educational stateus

Literacy is a qualitative attribute of population which is fairly reliable index of the socio-economic development of an area. Literacy affects the urbanization, industrialization, communication and commerce which are indispensable to the advancement of nation in the present day world. Thus the literacy is essential for the socio-economic development and demographic growth of a country. A literate person is able 'both to read and write a letter' according to Indian census.

Education is an important variables affecting demographic behavior concerning growth of population, participation in labour force, income structure etc. In the present case study it is observed that in all villages there is found illiterate person it ranges in 17.96% to 75% that is illiteracy is the main problems in this tribal group. Hirdi and Rohile is the village who having highest literacy i.e. 75% and 71.44 % .on the other hand Kharshet is a village where lower illiteracy rate is found i.e. 17.96 %. Most of the people of case study villages are educated up to 5^{th} to 10^{th} standard which is up to 55.55 %. 1^{st} to 4^{th} standard educated people are in 2^{nd} position in the case study villages it lays 10% to 28.68 %. Education up to Graduate and Post Graduate is less in percentage averagely it is 4.97 % it shows in table No. 7.3

Table No. 7.3 Educational stateus

Sr. No	Education level/ Villages	1 to 4 (Percent)	5 to 10 (Percent)	11 to 12 (Percent)	Graduate (Percent)	Post Graduate (Percent)	Illiterate (Percent)
1	Umbarpada	10	35	2.5	12.5	2.5	37.5
2	Galpada	18	28	16	8	2	28
3	Harantekadi	13	33	10	4	1.5	38.5
4	Kaluste	11.53	40.27	13.32	7.00	00	27.88
5	Bhavli Bk	5.55	55.55	8.33	2.77	00	27.8
6	Adsare Kh	13.5	38.5	15	6	00	27
7	Joranpada	15.48	37.25	12.8	2.34	00	32.13
8	Kokangaon	17.56	36.81	13.13	2.3	00	30.2
9	Sadrale	28.68	32.93	16.49	00	00	45.12
10	Rohile	4.76	9.52	9.52	4.76	00	71.44
11	Hirdi	2.5	7.5	10	2.5	2.5	75
12	Kharshet	12.82	41.02	20.51	5.13	2.56	17.96

(Source: Computed by Researcher)

4 Cropping Pattern

Table No. 7.4 shows cropping Pattern of case study villages in it cropping pattern is observed and 2011. Rice is dominant crop all over tribal area of case study villages. In case study region there pattern after 2009 – 10, these crops are wheat, vegetable and fruit. Which is found in villages Harantekadi, Adsare Kh, Kokangaon, Sadrale, Rohile, Hirdi and Kharshet

Table No. 7.4 Cropping Pattern

Sr. No	Villages	2011			2010			2009			
		Crop	Area (Acre)	No. of Family (%)	Crop	Area (Acre)	No. of Family (%)	Crop	Area (Acre)	No. of Family (%)	Cro
1	Umbarpada	Rice	1	80	Rice	1	100	Rice	1	100	R
	Vegetable	2	20	Vegetable		2	20	-	-	-	-
2	Galpada	Rice	1	100	Rice	1	100	Rice	1	100	R
	Nagli	0.5	30	Nagli	0.5	30	Nagli	0.5	30	-	-
	Vegetable	2	65	Vegetable		2	65	-	-	-	-
3	Harantekadi	Rice	1	100	Rice	1	100	Rice	1	100	R
	Nagli	0.3	24	Nagli	0.3	24	Nagli	0.3	24	Nagli	0.
	Wheat	1	18	Jowar	0.5	12	-	-	-	-	-
4	Kaluste	Rice	1	100	Rice	1	100	Rice	1	100	R
5	Bhavli Bk	Rice	1	100	Rice	1	100	Rice	1	100	R
6	Adsare Kh	Rice	1	100	Rice	1	100	Rice	1	100	R
	Onion	1	13	Onion	1	10	-	-	-	-	-
	Wheat	1	10	-	-	-	-	-	-	-	-
7	Joranpada	Rice	1	100	Rice	1	100	Rice	1	100	R

Table No. 7.5 Cropping Pattern

Sr. No	Villages	2011			2010			2009			
		Crop	Area (Acre)	No. of Family (%)	Crop	Area (Acre)	No. of Family (%)	Crop	Area (Acre)	No. of Family (%)	Cro
8	Kokangaon	Rice	1	100	Rice	1	100	Rice	1	100	Ri
		Fruits	1.5	13	Fruits	1.5	13	Fruits	1.5	13	-
9	Sadrale	Wheat	3	62.80	Wheat	1	72.67	Wheat	1	53.12	Wh
			1	37.2	Rice	2	56.12	Rice	2	45.85	Ri
		Rice	2	56.12	-	-	-	-	-	-	-
		Vegetable	2	7.58	-	-	-	-	-	-	-
10	Rohile	Rice	1	100	Rice	1	100	Rice	1	100	Ri
		Wheat	1.5	25	Wheat	1.5	28	Nagli	0.5	13	
11	Hirdi	Rice	1	100	Rice	1	100	Rice	1	100	Ri
		Vegetable	2	26	Vegetable	2	21	-	-	-	-
12	Kharshet	Rice	1	100	Rice	1	100	Rice	1	100	Ri
		Wheat	2	32	Udidh	0.5	100	Udidh	0.5	63	Ud

(Source: Computed by Researcher)

5 Total Agricultural areas Per Family

Agriculture is primary occupation of society. Agricultural area per family is important factor which influence the production and income of the family.

Table No. 7.5 Total Agricultural areas Per Family

Sr. No.	Area (Acre)/ Village	Below 1 (Percent)	1 to 2 (Percent)	2 to 5 (Percent)	5 to 10 (Percent)	Above 10 (Percent)
1	Umbarpada	00	40	50	10	00
2	Galpada	00	90	00	10	00
3	Harantekadi	00	30	50	20	00
4	Kaluste	42	58	00	00	00
5	Bhavli Bk	50	20	30	00	00
6	Adsare Kh	10	90	00	00	00
7	Joranpada	17.45	74.22	8.33	00	00
8	Kokangaon	00	72.29	27.71	00	00
9	Sadrale	00	18.36	80	1.64	00
10	Rohile	12	73	15	00	00
11	Hirdi	00	20	50	20	10
12	Kharshet	00	30	60	10	00

(Source: Computed by Researcher)

Lower agricultural land per family shows lower production and income vice a visa. Most of the families of case study villages hold 1 to 2 acre land (18.36 % to 90 %). The villages like Kaluste, Bhavli Bk, Adsare Kh, Joranpada and Rohile contain below 1 acre area for family it percentages are 42, 50, 10, 17.45 and 12. The agriculture area 2 to 5 acre is observed in villages Umbarpada (50%) Harantekadi (50%), Bhavli Bk (30%), Joranpada (8.33%), Kokangaon (27.71%) Sadrale (80%) Rohile (15%), Hirdi (50%) and Kharshet (60%). On the other hand only six villages namely Umbarpada (10%), Galpada (10%), Harantekadi (20%), Sadrale (1.64%), Hirdi (20%) and Kharshet (10%). While in Hirdi village observed above 10 acre agriculture land in 10% family. (Table No. 7.5)

6 Total Annual Agriculture incomes Per Family

Table No. 7.6 Total Annual Agriculture income Per Family

Sr. No.	Income (Rupee)/ Village	Below 50000 (Percent)	50000 to 100000 (Percent)	100000 to 200000 (Percent)	Above 200000 (Percent)
1	Umbarpada	100	00	00	00
2	Galpada	100	00	00	00
3	Harantekadi	100	00	00	00
4	Kaluste	100	00	00	00
5	Bhavli Bk	100	00	00	00
6	Adsare Kh	100	00	00	00
7	Joranpada	100	00	00	00
8	Kokangaon	100	00	00	00
9	Sadrale	12.62	67.34	20.04	00
10	Rohile	100	00	00	00
11	Hirdi	100	00	00	00
12	Kharshet	100	00	00	00

(Source: Computed by Researcher)

Income shows the stateus in society also income play an important role in development of family and society. The growth of family also depends upon income structure. If the primary activity is dominant in any region then income group belongs to low in nature. For the purpose of study researcher divided the income in 4 groups they are Above 2,00,000; 1,00,000 to 2,00,000; 50,000 to 1,00,000 and below 50,000. In this case study villages except Sadrale village all villages merge in low income group i.e. below 50,000. In village Sadrale most of the people merge in 50000 to 100000 income group i.e. 67.34 %. 20.04% people of same village merge in 100000 to 200000 income group. There is no family who hold income above 200000 rupee per year. (Table No. 7.6)

7 Agriculture field distance from main road

Table No. 7.7 Agricultural field distance from main road

Sr. No.	Distance from main road (Km) / Village	Less than 1 (Percent)	1 to 5 (Percent)	6 to 10 (Percent)
1	Umbarpada	100	00	00
2	Galpada	100	00	00
3	Harantekadi	00	100	00
4	Kaluste	00	00	100
5	Bhavli Bk	00	00	100
6	Adsare Kh	00	00	100
7	Joranpada	00	00	100
8	Kokangaon	00	00	100
9	Sadrale	00	00	100
10	Rohile	100	00	00
11	Hirdi	100	00	00
12	Kharshet	00	00	100

(Source: Computed by Researcher)

Main theme of the thesis is role of transportation on agriculture land use pattern. So researcher collected data like agriculture field distance from main road. In it he observed that agricultural field distance from main road is less than 1 Km for the villages like Umbarpada, Galpada, Rohile and Hirdi farmers.

On the other hand 6 to 10 Km. agricultural field distance from main road enjoyed by villages like Kaluste, Bhavli Bk, Adsare Kh, Joranpada, Kokangaon, Sadrale and Kharshet. Only one village known as Harantekadi enjoys the agricultural field distance from main road is 1 to 5 Km. (Table No. 7.7)

8 Road Condition before 2000 and Changes in Road Condition

Table No. 7.8 Road Condition before 2000 and Changes in Road Condition

Sr. No.	Road condition before 2000/ Villages	Unmetalled (Percent)	Metalled (Percent)	Good condition of Road Year (Mateled)
1	Umbarpada	100	00	2009
2	Galpada	100	00	2008
3	Harantekadi	100	00	2009
4	Kaluste	100	00	2008
5	Bhavli Bk	100	00	2002
6	Adsare Kh	100	00	2009
7	Joranpada	100	00	2012
8	Kokangaon	100	00	2011
9	Sadrale	100	00	2013
10	Rohile	100	00	2004
11	Hirdi	100	00	2005
12	Kharshet	100	00	2008

(Source: Computed by Researcher)

Condition of road is important for effective and fast transportation of agricultural goods. But in case study villages it is observed that all twelve villages road is unmetalled before year 2000. It is also observed that most of metalled road constructed in between years 2008 to 2013. Has this had any effect? (Table No. 7.8)

9 Impact of road on Crop and its Production

Table No. 7.9 shows impact of road on Crop and its Production in case study villages in which only on Hirdi village slightly impact found. While in rest of villages there is no found impact of road on crop and it production is found.

Table No. 7.9 Impact of road on Crop and its Production

Sr. No.	Villages	Impact Factor
1	Umbarpada	Impact found
2	Galpada	Impact found
3	Harantekadi	No impact found
4	Kaluste	No impact found
5	Bhavli Bk	No impact found
6	Adsare Kh	No impact found
7	Joranpada	No impact found
8	Kokangaon	Impact found
9	Sadrale	Impact found
10	Rohile	Impact found
11	Hirdi	Impact found
12	Kharshet	Impact found

(Source: Computed by Researcher)

It is found that there is no change in cropping pattern since year 2000. In Umbarpada, Galpada, Harantekadi, Adsare Kh, Kokangaon, Sadrale, Rohile, Hirdi and Kharshet villages contain different cropping pattern i.e. Wheat and Vegetable. Otherwise Rice is dominant crop which is grow in rainy seasons rest of the season is dry so dry land farming is observed in this case study villages. It is also observed that most of metaled road constructed in between years 2008 to 2013 which play an important role for changing agricultural cropping pattern so one can say that there is impact of transportation on agricultural land use in tribal area of Nasik district. The impact of transportation on agricultural land use is only observed in developed area i.e. urban and semi urban area and other than tribal population area.

Socio-Economic Impact:

Following are the observations and inferences drawn after studying the village level case studies;

1) In tribal areas Government of India has implemented Pradhan Mantri Gram Sadak Yojana. In this ambitious project played Yeomen service to connect small villages with each others as well as with tahsil places. In this 4 tribal tahsils this scheme ways implemented with high spirit which resulted visible improvement of road conditions. Due to road network means of surface transport has improved under the scheme of Govt. of Maharashtra. Metallic road are also re-enforced. This is the main reason of changing crop pattern of the villages which were selected as sample surveys,

2) Change in crop pattern- Tahsil Trambak, Dindori, Peth, Surgana is a heliterian of western ghat of Sahyadri. The annual rainfall of this area average more than 100 each. In past Marathas, other backward castee. Schedule castee & Schedule tribe people who were engaged in farming activities was having in to cultivate grains for their self consumption. Due to lack of transport facilities transportation of fertilizer, raw material & harvested crop was difficult task as the condition of road use to detorial in monsoon. So it was a obstacle for the development of agricultural product in this area. Following are the main cardinal factor regarding land use in reference of agricultural development.

   (i) Good roads are required to transport fertilizers, insecticide, pesticide, manual laboursa to the farm at the time of growing and harvesting of the crops.

   (ii) Good roads are required to transport perishable vegetable, fruits, and green leafy vegetables, to the adjoining market as soon as possible.

   (iii) Harvested crop like rice, varli, nachni, needs to be transported to the market as transportation price is also main constitution of the cereal crops.

   (iv) Due to good network of roads lot of potential treats are open for unemployed youth like drivers, cleaners, mechanics, puncture removers, and extra agricultural activities. Due to good road condition movements of village youth are increased and travel to tahsil place for various jobs

like shop labours, hotel labours, building and contruction labours. Due to this road network diversification of labour force from agricultural activities to secondary activities is been transformes. Due to this diversification in rural area there is acute shortage of agricultural labour. As per the demand supply, the number of supply of agriculture labours is less and farmers have to pay minimum 200-300 Rs. per day for 7 hrs. of agricultural labour. Diversification of unemployed youth is due to good surface transport communication is a land mark of Indian economy.

3) In women agricultural labours pattern has also changed drastically. In last decade women labour force was having only seasonal work in Kharip season which is confined in monsoon. Generally, women worker was engaged in their own family farming but now the pattern has been changed for 3 months they are engaged in the self farming activities after that they use to grow as a contract labours in the vegetable farms, grape gardens. Due to road connectivity farmers have changed their pattern. Supply of vegetables to Nasik, Thane & Mumbai Metro-Politian. Vegetable farming requires lot of labour force and especially women are engaged in vegetable harvesting. Women are also getting about 200-300 Rs. Perday for 7 Hrs.

(b) Due to good communication mean even the women from villages use to go as a construction labour, small scale industry labour in adjoining area where small scale industries are coming up. Dindori Tahsil declared as industrial zone. Again labour force will be diversified to different horizon. Due to effective transport mean movement of masses have increased and new channels of employments are generated. So it resulted in temporalry displacement of labour classes.

(4) Increase in numbers of Motor vehicles: Due to good connectivity of road and good condition of motor roads farmers have changed labour farming to mechanic farming. Use of tractors, cultivators, rotavetors, mechanized flow are used for mechanize farming. In past decade only big farmers are tractor user and engaged in mechanical farming, but now many medium and small farmers are now using

tractors for agricultural activities. Due to improved road condition many villagers has purchased motor cycles. About 50% houses use motor cycle as a primary mean of transportation. This has resulted that many people are not depending on public transportation. In above mention villages frequency of buses was twice or thrice daily, that was only mean of transportation and public convenience but due to motor cycles movements of public have become free.

(5) Development of Clandestine transport: Many unemployed youths have purchased diesel vehicles like Mahindra Bolero, Mahindra Commander, Tata Sumo, Chevrolet Tavera, and engaged in transportation of passengers from villages to tahsils. This new group of transporters is developed and it also becomes a medium type business for unemployed youth. Now they are engaged in transporting passengers and few activities without permission of transportation department. Even vegetables, milk, poultry product, are also transported with the mean of above mentioned vehicles.

(6) Development of Small Business Activities along the road side: Due to improvement of road conditions, increased of vehicle population, movement of public, temporalry displacement of labour classes has given support to development of business activities on road. Due to these business activities youth agricultural labour diversified to this new business labour class. Business Activities like Petrol Pumps, Hotels, Dhabas, Shopping complex, Garages are coming on the road sides. So rural agricultural youth are also engaged in activities like Drivers, Mechanics, Petrol Pump Operator, Hotel Waiters, Hotel Managers this new fields are open so indirectly, it is affecting on labour supply for the agricultural activities.

(7) Social Equality: Due to development of roads and good means of transportation has increased movements of masses and due to frequent contacts the gap between various castee religion community and creeds is dimensionally reduced. People are very close due to business entrance social entrance and professional entrance which is foundation stone of modernization and bridge the gap of communal

disparity. Due to increase in business, professional, personal activities, and interest of the society, the walls of isolation have been demolished. The roads have not joined the geography of the villages but also minds of the people. Due to transportation people are also engaged in social activities and attending functions of their relatives with high esteem and spirits.

(8) Economical Impacts: The recent trend of land prices in the country is a special indication of growth of Indian economy. As per the international survey the appreciation of real estate in India even in Rural area has increased by many times and of the important reason of appreciation of rural land is a development of road networks. In above mentioned villages abrupt survey was conducted and discussed agricultural land price. 5 years back barrel land was costing around 50,000 to 1 lakh Rs. Per Acre but after 5 years same land is costing 5-7 lakh Rs. Per Acres. The land adjoining to road is costing around 10-15 lakhs Per Acre. The network of road has not only changed the agricultural land use but also the prices of the villages where survey was conducted.

Chapter 8

OBSERVATIONS AND CONCLUSIONS

Nasik district comprises 13 Tahsils before 2000, after 2001 there is 15 tahsils like Nasik, Peth, Surgana, Trimbak, Igatpuri, Sinner, Niphad, Dindory, Kalwan, Satana, Malegaon, Chandwad, Nandgaon and Yeola. Nasik district covers 5.05% area of Maharashtra

According to relief this district classified into five categories:

1. Area under 300 to 450 meter height: 3980 square km area comes under this group and covers 25.63 % area of the district.
2. Area under 450 to 650 meter height: 4889 square km area comes under this section and covers 31.48 % area of the district.
3. Area under 600 to 750 meter height: 4066 square km. area comes under this group and covers 26.18 % area of the district.
4. Area under 750 to 900 meter height: 1989 square km. area comes under this group and covers 12.81 % area.
5. Area above 900 meter height: 606 square km. area (3.9%) comes under this group.

The district is drained by two major rivers the Girna and the Godavari and their tributaries the watershed between these being the Satmalas range. Apart from these there are a number of small Konkan Rivers draining westwards into the Arabian Sea.

May is the hottest month with the mean daily maximum temperature is 40.6Ú c. at Malegaon and 37.4Ú c. at Nasik. The heat is increase in the height of summer and on same days the maximum temperature may goes above 46Ú c. in the eastern part of the district with comparatively lower elevation. Night temperature during June is slightly higher than May.

The average annual rainfall in the district is 1035.5 mm. In the narrow strip of the district to the close proximity of the Western Ghats the rainfall is very much heavier than the rest of the district. On an average, the rainfall in this narrow strip is increasing from 2365.6 mm. at Peth in the north and 3012.5 mm. at Igatpuri in the south. In the plateau region to the east of the Western Ghats the Rainfall is generally decreases from the west towards the east, with some local variations due to topography.

Five soil types are observed in the district these are I) Laterite soil, II) Radish Brown soil of hill slope (Trap), III) Deep Black soil (Valleys), VI) Medium Black soil (Plains) and V) Coarse Shallow soils (High level).

The forest in the district falls into three different types, viz. 1) Deciduous forest tending towards monster type, found in western and north-western parts of the district. 2) The Evergreen type forest observed along the terraces of the Western Ghats and 3) The Dry deciduous forest. The total forest area in the district is 928.9 square km. situated below the ghat region. The remaining forest cover observed on the ghat tract with three distinct ranges of hills running in an easterly direction.

As per 2001 census, the population of the Nasik district is 4987923 persons. It accounts for 5.15 percent in the Maharashtra state. The density of population in the area under study is 321 persons per square km. 20.5 percent working population to total has engaged in agricultural activity and rest is involved in household industry, trade and transport in the area under study.

Density of population in the Nasik District is increasing since 1951 from 92 persons per sq. km. to 321 persons in 2001. The interesting fact regarding the density of population increased 3.5 times during 50 years. The population growth is almost constant (nearby 29 percent per decade) but the population density in the district increased rapidly.

In 1961, there was a 78.6 percent worker out of the total population while 52 percent people were the cultivators, and 19.6 percent was agricultural labour. The occupational structure is changed from 1961 to 2001. The percentage of various categories

of occupational structure rapidly decreases in 2001. Total workers are observed 34.7 percent, while total cultivators are 13.3 and agricultural labours are only 7.2 percent

The total cultivators was 965970 persons (72.7 %) in 1961, 380339 (58.8%) in 1971, 380600 (56.2%) in 1981, 685923 (64.2%) in 1991 and 664400 (64.9%) in 2001, shows that the cultivators are decreasing 13.9 percent between 1961 to 1971, 2.6 percent between 1971 to 1981, but the 8 percent cultivators increased between 1981 to 1991 and 0.7 percent increased between 1991 to 2001 in the study area

The agricultural labour in percent decreased considerably during study period by 8 percent from 1981 to 1991 and 0.7 percent in 1991 to 2001. The percentage of agricultural labour to total population decreased from 1961 to 2001

The Nasik district is predominantly agricultural in nature. More than 60 percent working population is engaged in agricultural activity. The percentage of farm workers to total workers is observed 91.2 percent in 1961, it decrease up to the 20.5 (70.7 %) percent in 1971, in 1981 it was increased 6.7 percent (77.4%) but in 1991 and 2001 the percentage of farm workers to total workers goes on decreased by 13.8 and 4.6 percent.

In 1961 the percentage of farm workers to total population was 71.6. In 2001 the percentage of farm workers to total population is only 20.5 and it decreased by 51.1 percent.

In 1961 Well and cannel irrigation extends over 43748 hectors. It is rapidly increased up to 170800 hector in 2001.

Five types of roadways appear in the district, namely National Highway (NH), State Highway (SH), Major District Highway (MDR), Other District Highway (ODR) and Village Road or Kachcha Roads (VR).

There are no found of significant changes in the tahsils of forest area. They are Trimbak, Peth, Surgana, Kalwan, Satana, Malegaon, Nandgaon, Yeola, Niphad, Chandwad, Deola, Dindory, Igatpuri etc. But the tahsils like, Sinner and Nasik show the

temporal variation. Moderate forest area group in Sinnar tahsil found in the decade 2001, while in the decade 2011, it decreases and merge in Low forest area group. On the other hand, Nasik tahsil forest area increase from low forest area group (2001) to very high forest area group (2011).

The study of temporal changes in Fallow land is very important because it increases or decreases agricultural area which affects the production of crops. The tahsils like, Satana, Malegaon, Deola, Chandwad, Trimbak, Dindory and Niphad there are very small changes are observed .While in Peth Fallow land increases very low to low from 2001 to 2011. Also this phenomenon is observed in Yeola tahsil but it merges in same group i.e. in Low Fallow land area. The Fallow land area is decreases in the tahsils from 2001 to 2011 in Nasik (very high to high area of Fallow land) Igatpuri and Sinnar (low to very low area of Fallow land), Surgana and Kalwan merge in same group i.e. very low area Fallow land.

In this district changes for area not available for cultivation are found in the tahsils namely, Satana, Nasik, Igatpuri, Trimbak and Surgana tahsils. The tahsils like Malegaon, Nandgaon, Yeola, Niphad, Sinnar, Dindory, Peth, Deola, Chandwad and Kalwan are not changed or slightly changed with the time. In all tahsils, Deola tahsil shows very small amount of land is under non cultivable land.

It is observed that there is increase in cultivable waste land from decade 2001 to 2011. These tahsils are Igatpuri, Sinnar, Trimbak, Yeola, Niphad, Chandwad, Nandgaon, Malegaon, Dindory, Deola, Satana, Surgana and Peth. Out of 15 tahsils 13 tahsils show the increasing trend of cultivable waste land. It means that in 2011 decade there is decrease in Net Sown Area. Tahsils like Kalwan and Nasik show the decreasing trend of cultivable land i.e. in 2001, in this tahsils there is higher cultivable waste land and in 2011 decade it reduced.

In this study area there is found positive growth in Net sown area from 2001 to 2011 in the tahsils like Trimbak, Peth, Surgana, Kalwan, Dindory and Satana. On the other hand Negative growth is found in the tahsils like Malegaon, Nandgaon, Deola,

Chandwad, Niphad, Nasik, Yeola, Sinnar and Igatpuri between the decades 2001 to 2011.

There is increase the area under Rice in Surgana, Kalwan, Satana, Peth, Dindory, Trimbak, Igatpuri, Nasik and Sinnar tahsil. While in the tahsil Malegaon, Deola, Nandgaon, Chandwad, Yeola and Niphad there is no found the changes in rice crop.

There is remarkable increase area under wheat in the tahsils known as Sinnar Yeola, Deola, Satana, Kalwan, Malegaon, Nandgaon, Nasik and Igatpuri within two decade (2001 & 2011). Whereas there is no change or slightly decrease in area under wheat crop in the Trimbak Peth Surgana and Dindory tahsils of Nasik district.

Only in few tahsils there are increases in area under Jowar they are Deola, Nandgaon, Kalwan and Nasik in the decade 2001 to 2011 while remaining all tahsils shows negative trend of growth.

Bajara crop is dominated in only Sinnar tahsil which shows positive trend of growth in 2001 to 2011. Though the area under Bajara crop is higher in Satana, Malegaon, Deola, Chandwad, Yeola and Niphad there is found decreasing trend in 2001 to 2011. While in Surgana, Peth, Dindory, Kalwan, Nasik, Trimbak and Igatpuri shows very less area under Bajara crop.

In the study region there is found increase in the area of sugarcane in the tahsils Satana, Malegaon, Deola, Dindory, Sinnar, Igatpuri and Kalwan (2001 to 2011). The negative trend of growth for sugarcane area is found in Surgana, Peth, Trimbak, Nasik, Nandgaon, Yeola and Niphad.

In the Dindory tahsil crop under Grapes is increase with more than 10 fold with respect to 2001 decade. Also tahsils name as Niphad, Chandwad, Sinnar Malegaon, Igatpuri and Satana there is increase in area under grapes from decade 2001 to 2011. There is decrease area under grapes in Nasik, Yeola tahsil. While there is no change found in grapes area in tahsils known as Trimbak, Peth, Surgana and Kalwan.

There is remarkable increase in the area under onion crop. It is uplifted upto 5 to 10 fold in the following tahsils Sinnar Niphad, Chandwad, Peth, Kalwan, Satana, Malegaon, Nandgaon and Yeola. There are two tahsil know as Nasik and Dindory shows the increasing trend with 2 fold from 2001 to 2011. The area under onion crop is stagnant with in two decade in the tahsil Igatpuri, Trimbak and, Peth and Surgana.

Road density is very high in Yeola tahsil after that Surgana and Dindory tahsil. While very low density of road is found in Trimbak, Kalwan and Malegaon tahsil. The national highway mainly concentrated in Nasik tahsil after that Igatpuri and Chandwad tahsil. The higher density of state highway is found in Trimbak and Nasik tahsil. On the other hand district highway density is mainly very high in Yeola and Dindory tahsil.

There are no found significant changes in forest area in decade 2001 and 2011 due to road but it changes the forest area when they are constructing.

In Nasik, Igatpuri and Sinnar tahsil fallow land area is decrease during 2001 to 2011 it is due to higher density of national highway i.e. there is increasing agricultural area.

The area not available for cultivation is increase in Nasik, Igatpuri, Chandwad, Sinnar and Niphad due to more density of national highway. In Chandwad, Trimbak and Nasik tahsil area not available for cultivation (Buildup and Road construction) is increase due to state highway. There is slightly change observed in area not available for cultivation in Dindory, Peth Surgana, Chandwad and Nandgaon tahsil due to density of district highway.

Total road density is affect to Surgana, Dindory, Peth, Nasik, Deola, Chandwad and Nandgaon because there is change in area not available for cultivation (i.e. change in Buildup and Road area). Above explanation say that tahsil like Nasik, Chandwad and Dindory shows the positive change i.e. increases in density of area not available for cultivation.

There is increase density of cultivable waste in Chandwad, Igatpuri, Trimbak, Satana, Yeola and Nandgaon tahsils shows that there is no impact of transportation it may due to scarcity of water or capital. There is positive impact of state highway on density of cultivable waste in Kalwan tahsil which changes low to very low group i.e. there is decrease in cultivable waste it indicate increase in agriculture area it may due to fast road transportation or increase in irrigation facility. In Sinnar, Surgana, Peth, Dindory, Nasik and Deola tahsils there is no change found in density of cultivable waste.

There is not found influence of national highway because there is decrease net sown area in the tahsils like Nasik, Niphad, Malegaon and Sinnar. But in Trimbak and Dindory tahsil positive change is observed because density of state and district highway is higher.

Density of rice crop is increase in Sinnar, Trimbak, Surgana and Satana. All these tahsils contain very high to moderate density of different roads types. These are affected to rice crop. It is due to transport facility is provide linkage to markets and rice mill.

The tahsils like Nasik, Igatpuri, Niphad, Deola, Malegaon, Sinnar, Trimbak, Kalwan, Satana, Nandgaon and Yeola shows the increase in the density of wheat crop up to three folds. Increase in the wheat crop area shows the increase demand of wheat in market. Market is developed according to transportation facility. It is observed that in all these tahsils transportation facility is improve.

Only in Nasik and Deola tahsil there is increase in density of Jowar crop area. But the tahsils like Chandwad, Sinnar, Niphad, Dindory, Surgana, Satana and Yeola there is decrease in area of Jowar crop. Jowar crop is not a cash crop. Instead of this crop there is increase in area of onion, Sugarcane and Grapes due to improve in transportation facilities.

Most of tahsils in Nasik district shows the decreasing trend in the density of Bajara crop. Like Jowar, Bajara crop is also not give the profit. So the tahsils like Sinnar, Deola, Niphad, Malegaon and Yeola shows the negative change in Bajara crop.

The crops like Sugarcane, Grapes and Onion are the cash crop it gives the more profit to the farmers. Most of the tahsils in Nasik district does not shows the change in density of Sugarcane, Grapes and Onion crops area, it remains very low to very high density. But remaining tahsils shows the increase in area of Sugarcane, Grapes and Onion crops. On the other hand in Niphad tahsil there is decrease in Sugarcane crop but Onion crop area is increase. There is increase in market of Onion. Due to batter transportation facility found in this tahsil. So one can say that change in cropping pattern is the function of improvement of transportation network.

observations and inferences of case studies

It is found that there is no change in cropping pattern since year 2000. In Umbarpada, Galpada, Harantekadi, Adsare Kh, Kokangaon, Sadrale, Rohile, Hirdi and Kharshet villages contain different cropping pattern i.e. Wheat and Vegetable. Otherwise Rice is dominant crop which is grow in rainy seasons rest of the season is dry so dry land farming is observed in this case study villages. It is also observed that most of metaled road constructed in between years 2008 to 2013 which play an important role for changing agricultural cropping pattern so one can say that there is impact of transportation on agricultural land use in tribal area of Nasik district. The impact of transportation on agricultural land use is only observed in developed area i.e. urban and semi urban area and other than tribal population area.

1) In tribal areas Government of India has implemented Pradhan Mantri Gram Sadak Yojana. In this ambitious project played Yeomen service to connect small villages with each others as well as with tahsil places. In this 4 tribal tahsils this scheme ways implemented with high spirit which resulted visible improvement of road conditions. Due to road network means of surface transport has improved under the scheme of Govt. of Maharashtra. Metallic road are also re-enforced. This is the main reason of changing crop pattern of the villages which were selected as sample surveys,

2) Change in crop pattern- Tahsil Trambak, Dindori, Peth, Surgana is a heliterian of western ghat of Sahyadri. The annual rainfall of this area average more than 100 each. In past

Marathas, other backward castee. Schedule castee & Schedule tribe people who were engaged in farming activities was having in to cultivate grains for their self consumption. Due to lack of transport facilities transportation of fertilizer, raw material & harvested crop was difficult task as the condition of road use to detorial in monsoon. So it was a obstacle for the development of agricultural product in this area. Following are the main cardinal factor regarding land use in reference of agricultural development.

(i) Good roads are required to transport fertilizers, insecticide, pesticide, manual laboursa to the farm at the time of growing and harvesting of the crops.

(ii) Good roads are required to transport perishable vegetable, fruits, and green leafy vegetables, to the adjoining market as soon as possible.

(iii) Harvested crop like rice, varli, nachni, needs to be transported to the market as transportation price is also main constitution of the cereal crops.

(iv) Due to good network of roads lot of potential treats are open for unemployed youth like drivers, cleaners, mechanics, puncture removers, and extra agricultural activities. Due to good road condition movements of village youth are increased and travel to tahsil place for various jobs like shop labours, hotel labours, building and contruction labours. Due to this road network diversification of labour force from agricultural activities to secondary activities is been transformes. Due to this diversification in rural area there is acute shortage of agricultural labour. As per the demand supply, the number of supply of agriculture labours is less and farmers have to pay minimum 200-300 Rs. per day for 7 hrs. of agricultural labour. Diversification of unemployed youth is due to good surface transport communication is a land mark of Indian economy.

3) In women agricultural labours pattern has also changed drastically. In last decade women labour force was having only seasonal work in Kharip season which is confined in monsoon. Generally, women worker was engaged in their own family farming but now the pattern has been changed for 3 months they are engaged in the self farming activities

after that they use to grow as a contract labours in the vegetable farms, grape gardens. Due to road connectivity farmers have changed their pattern. Supply of vegetables to Nasik, Thane & Mumbai Metro-Politian. Vegetable farming requires lot of labour force and especially women are engaged in vegetable harvesting. Women are also getting about 200-300 Rs. perday for 7 Hrs.

(b) Due to good communication mean even the women from villages use to go as a construction labour, small scale industry labour in adjoining area where small scale industries are coming up. Dindori Tahsil declared as industrial zone. Again labour force will be diversified to different horizon. Due to effective transport mean movement of masses have increased and new channels of employments are generated. So it resulted in temporalry displacement of labour classes.

(4) Increase in numbers of Motor vehicles: Due to good connectivity of road and good condition of motor roads farmers have changed labour farming to mechanic farming. Use of tractors, cultivators, rotavetors, mechanized flow are used for mechanize farming. In past decade only big farmers are tractor user and engaged in mechanical farming, but now many medium and small farmers are now using tractors for agricultural activities. Due to improved road condition many villagers has purchased motor cycles. About 50% houses use motor cycle as a primary mean of transportation. This has resulted that many people are not depending on public transportation. In above mention villages frequency of buses was twice or thrice daily, that was only mean of transportation and public convenience but due to motor cycles movements of public have become free.

(5) Development of Clandestine transport: Many unemployed youths have purchased diesel vehicles like Mahindra Bolero, Mahindra Commander, Tata Sumo, Chevrolet Tavera, and engaged in transportation of passengers from villages to tahsils. This new group of transporters is developed and it also becomes a medium type business for unemployed youth. Now they are engaged in transporting passengers and few activities without permission of transportation department. Even vegetables, milk, poultry product, are also transported with the mean of above mentioned vehicles.

(6) Development of Small Business Activities along the road side: Due to improvement of road conditions, increased of vehicle population, movement of public, temporalry displacement of labour classes has given support to development of business activities on road. Due to these business activities youth agricultural labour diversified to this new business labour class. Business Activities like Petrol Pumps, Hotels, Dhabas, Shopping complex, Garages are coming on the road sides. So rural agricultural youth are also engaged in activities like Drivers, Mechanics, Petrol Pump Operator, Hotel Waiters, Hotel Managers this new fields are open so indirectly, it is affecting on labour supply for the agricultural activities.

(7) Social Equality: Due to development of roads and good means of transportation has increased movements of masses and due to frequent contacts the gap between various castee religion community and creeds is dimensionally reduced. People are very close due to business entrance social entrance and professional entrance which is foundation stone of modernization and bridge the gap of communal disparity. Due to increase in business, professional, personal activities, and interest of the society, the walls of isolation have been demolished. The roads have not joined the geography of the villages but also minds of the people. Due to transportation people are also engaged in social activities and attending functions of their relatives with high esteem and spirits.

(8) Economical Impacts: The recent trend of land prices in the country is a special indication of growth of Indian economy. As per the international survey the appreciation of real estate in India even in Rural area has increased by many times and of the important reason of appreciation of rural land is a development of road networks. In above mentioned villages abrupt survey was conducted and discussed agricultural land price. 5 years back barrel land was costing around 50,000 to 1 lakh Rs. Per Acre but after 5 years same land is costing 5-7 lakh Rs. Per Acres. The land adjoining to road is costing around 10-15 lakhs Per Acre. The network of road has not only changed the agricultural land use but also the prices of the

villages where survey was conducted.

REFERENCES AND BIBLIOGRAPHY

1. Ahlvin, R.G. and G.M. Hammitt. (1975), "Load-supporting capability of low-volume roads", Transportation Research Board, Special Report 160, Washington DC.
2. Ahmad, A. and Siddiqui, M.F. (1967): "Crop Association Pattern in the Luni Basin", Geographical Review of India, Kolkata, Vol. 14, Pp. 69-80.
3. Alba, R.D. and Logan, J.R. 1992: Analyzing locational attainments: constructing
4. Alex T. Visser, Cesar Augusto V. de Queiroz, Barry Moser, and Leonard Moser.(1979), "A Preliminary Evaluation of Paved and Unpaved Road Performance in Brazil", Transportation Research Record No.702, National Research Council, Washington D.C
5. Alexander, J.W. (1965): "Economic Geography", Prentice Hall, New Jersey.
6. Alexander, K.C. (1975): "Some Characteristics of the Agrarian Social Structure of Tamil Nadu ", Economic and Political Weekly, April 19, pp 664-771.
7. Alfredo Sanchez Vicente and Clara Zamorano Martin (2006), "Geographic Information System"
8. Ali, Mohammad (1978): "Studies in Agricultural Geography". Rajesh Publication, New Delhi.
9. Ali, Mohammad (1978): "Studies in Agricultural Geography". Rajesh Publication, New Delhi.
10. Ali, Mohammad (1979): "Dynamics of Agricultural Development in India". (Ed.), Concept Publising Co., New Delhi.
11. Amitava Mitra and Debarti Mitra (2010) , "The Role of Transport in the Economic Development of Arunachal Pradesh" Social Growth-Half Yearly Journal, Vol. I (1), Pp. 23.28.

12. Amsden, A.H., Kochanowicz, J. and Taylor, L. 1994: The Market Meets its Match:

13. Analysis of Accessibility as Indicator of Pot4ential Land Use Changes and of Induced Impacts on the Environment: Application to the Pyrenean Area of France and Spain," Transportation Research Record 1983, Transportation Research Board (www.trb.org), pp. 24-32.

14. Anne Vernez Moudon, et al. (2003), Strategies and Tools to Implement Transportation-Efficient Development: A Reference Manual, Washington State Department of ransportation, WA-RD 574.1

15. Archondo-Callao. (1999), "Roads Economic Decision Model (RED) for Economic Evaluation of Low Volume Roads", Sub-Saharan Africa Transport Policy Program Note No. 18 World Bank, Washington, D.C.

16. Australian Urban and Regional Development Review (1994): Australian Cities and Regions: A National Approach, Canberra: Department of Housing and Regional Development.

17. Bairoch, P. 1988: Cities and Economic Development: From the Dawn of History to the Present, Chicago: University of Chicago Press.

18. Barker T. and Lewney, R. (1993). Cambridge Econometrics, submission to the Standing Advisory Committee on Trunk Road Assessment. UK

19. Behavior, Victoria Transport Policy Institute (www.vtpi.org); at ww.vtpi.org/ landtravel.pdf; originally published as "Evaluating Transportation Land Use Impacts," World Transport Policy & Practice, Vol. 1, No. 4, 1995 pp. 9-16;

20. Behra Manaranjan in his paper on (2011) "Block Level Planning for Transport Development - A case study of Backward Block (Khunta) of Orissa" Social Growth-Half Yearly Journal, Vol. II (1), Pp. 17-24

21. Belousov (1964) "Transportation and the formation of Economic Regions", Journal of Soviet Geography Volume 5 issue 9 Pp 19 - 23

22. Bell, M. 1995: Internal Migration in Australia 1986–91: Overview Report, Bureau of Immigration, Multicultural and Population Research, Canberra: Australian Government Publishing Service.

23. Bhagabati, A.K. (1989): "Spatial Pattern of Land Utilization in Nalbari District, Assam". Geographical Review of India, Kolkata,Vol. 5, No. 1, Pp. 70-77.

24. Bharadwaj O. P. (1964) The national Geographical Journal of India. 10, 2.

25. Blaikie, P. M. (1971): "Spatial Organization of Agriculture in Some North Indian Villages", Transactions, Institute of British Geographers, Vol. 52, Pp. 5- 14.

26. Boarnet Marlon and Crane Randall (2001), "The Influence of Land Use on Travel Behavior: A Specification and Estimation Strategies," Transportation Research A, Vol. 35, No. 9 (www.elsevier.com/locate/tra), November 2001, pp. 823-845.

27. Borse Pagar, and Suryawanshi (2008), "Spatial pattern & level of Agricultural evelopment in the Nasik District, Maharashtra", Maharashtra Bhugolshastra Sanshodhan Patrika, Vol.23 (1), Pp 60-70

28. Brecher, J. and Costello, T. 1994: Global Village or Global Pillage, Boston: South End

29. Buck, J. L. (1937): " Land Utilization of China", Council of Economic and Cultural Affairs, New York.

30. Burchell Robert, et al (1998), The Costs of Sprawl – Revisited, TCRP Report 39, Transportation Research Board (www.trb.org). This report includes a detailed review of literature on the effects of land use patterns on personal travel behavior.

31. Cambridge Systematics (1994), The Effects of Land Use and Travel Demand Management Strategies on Commuting Behavior, Travel Model Improvement Program, USDOT (www.bts.gov/tmip).

32. Chandana R.C (2011), "Regional Planning and Development", Kalyani Publication, Ludhiana, Pp.189-227.

33. Chatterjee, B. N., Milti, S. and Mandal, B.K. (1997): "Cropping System Theory and Practice", Oxford and IBM Publishing Company, New Delhi.

34. Chatterjee, S. P. (1952): "Land Utilization Survey of Howrah District", Geographical Review of India Kolkata, Kolkata, Vol. 14, No. 3.

35. Chauhan, R. B. S. (1973): "Land Utilization In Nagla Bhagat- A Vindhyan Foothill Village". The Deccan Geographer, Vol. 11, No. 1and 2, Pp. 33-45.

36. Couclelis H and Gale N 1986 Space and spaces Geografiska Annaler 68B 1-12

37. Cronon, W. 1991, Nature's metropolis: Chicago and the Great West, New York

38. CRRI (1990). "National Workshop on Rural Roads Project- Development of Rural Road Infrastructure (UN-ESCAP), Base Paper", Central Road Research Institute, New Delhi-110020, India, 15-16 October, 1990.

39. Das M.M. (1990) Agriculture Land use and cropping pattern Balak, Ram and Joshi D.C. (1984) Land-use Soil Relationship in Arid Zone. The Deccan Geographer Vol-XXII

40. Das, M. M. (1984): "Agricultural Land use and Cropping Pattern in Assam". National Geographer of India, Varanasi, Vol. No. 4.

41. Datye, V. S. (1984): "Spatial Analysis of Agricultural Landuse in Poona District", Unpublished Ph.D. Thesis. University of Pune, Pune.

42. Datye, V. S. and Gupte, S.C. (1984) : "Association between Agricultural Land use and Physico-socio-economic Phenomena: A Multivariate Approach", Transactions, Institute of Indian Geographers, Pune, Vol. 6, No.2, July.

43. Dev, S. M. (2006), "Agricultural Labour and Wages since 1950", Encyclopedia of India (vol. 1) edited by Stanley Wolpert, pp. 17–20,

44. David Forkenbrock, Sondip K. Mathur and Lisa A. Schweitzer (2001), Transportation Investment Policy and Urban Land Use Patterns, University of Iowa Public Policy Center (www.uiowa.edu).

45. Debasis Das (1985), "Relation between transport Factor and Agricultural Land use- A case Study Birbhum district in West Bangal" Transactions, Institute of Indian Geographers, Pune, Vol. 7, No.2, July.

46. Degaonkar C.K. (1998), "Transport development in karnataka- A Regional analysis in readings in transport geography-A regional perspective Devika publications New Delhi.

47. DETR (1999). Transport and the Economy, Standing Advisory Committee on Trunk Road Assessment. UK.

48. Dhir M.P, Lal N.B. and Mital K. (1987). "The Development of Low Volume Roads in India", Transportation Research Record No.1106, National Research Council, Washington, D.C., pp 235-246.

49. Douglass Lee (1992), An Efficient Transportation and Land Use System, Volpe National Transportation Research Center

50. Friedland, W. H. "The End of Rural Society and the Future of Rural Sociology." Rural Sociology (1982) 47(4): 589-608.

51. Gajre and Shahapurkar (2011), "Spatio-Temporal analysis of land use efficiency in Nanded District: A Geographical Review", Social Growth-Half Yearly Journal, Vol. II (2), Pp.62.65.

52. Gauthier, Howard L. (1970), "Geography, Transport and Regional Development", Economic Geography, Vol. 46 No.4: 612-619.

53. Gazetteer of the Bombay Presidency (1883), Nasik District Volume No.19.Pp.5-7.

54. Gupta, N. I. (1967): "Land Utilization in Udaipur Plateau". Unpublished Ph.D. Thesis, University of Udaipur, Udaipur.

55. Gulati, A. (2006), "Agricultural Growth and Diversification since 1991", Encyclopedia of India (vol. 1) edited by Stanley Wolpert, pp. 14–17

56. Harvey D 1961 Aspects of agricultural and rural change in Kent, 1800-1900 Unpublished PhD thesis, University of Cambridge

57. Harvey David (2001), Megacities: Lecture 4 , Twynstra Gudde Management Consultants, 2001 Pp 19

58. Harvey David (2001), Megacities: Lecture 4 , Twynstra Gudde Management Consultants, 2001 Pp 22

59. Harvey David (2001), Megacities: Lecture 4 , Twynstra Gudde Management Consultants, 2001 Pp 32

60. Held, David, et al. 1999. Global Transformations. Stanford: Stanford University Press.

61. Held, David, et al., eds. 2003. The Global Transformation Reader. Cambridge, UK: Polity Press.

62. Held, David. 2004. The Global Covenant. Cambridge, UK: Polity Press. Inglehart, Ronald, ed. 2003. Mass Values and Social Change: Findings from the Values Survey. Boston: Brill Academic.

63. Hettner, A. (1947): "Allgemein Geographie des Menchen (General Geography of the Humans)", I, Stuttgart Kolhammer, pp. 1.

64. Hoyle B.S. (1973), " Transport and Development" The Macmillan Press Ltd., U.K.

65. Husain, Majid (1996) : "Systematic Agricultural Geography", Rawat Publications, New Delhi.

66. Hussan M. (1999) Systematic Agriculture Geography. Rawat Publication

67. Indian Roads Congress Special Publication.(2002)."Rural Roads Manual SP:20, 2002",IRC Publication, New Delhi.

individual-level regression models using aggregate data. Sociological Methods and Research, 20, 367–97.

68. IRC (2001). "Road Development Plan VISION 2021", Indian Roads Congress, New Delhi.

69. IRC (2005). "Rural Road Development Plan: Vision 2025-Draft Document", Indian Roads Congress, New Delhi.

70. Kapadnis N. R. (1991) Spatial analysis of agriculture land-use in relation to environmental factors in Nasik District; Unpublished Ph.D. thesis submitted to A.P.S. University , Rewa (M.P.)

71. Karmarkar, P. R. (1981): "Agricultural Landuse of the Western Districts of Upland Maharashtra", Unpublished Ph.D. Thesis, University of Pune, Pune.

72. Kashid P. B. (2005) A agricultural Land Use in Solapur District ; A Geographical Analysis .M Phil dissertation submitted to Nanded University

73. Keith Bartholomew and Reid Ewing (2009), 'Land Use-Transportation Scenarios and Future Vehicle Travel and Land Consumption: A Meta-Analysis,' Journal of the American Planning Association, Vol. 75, No. 1, winter 2009

74. Kendall, M. C. (1939):"The Geographical Distribution of Crop Productivity in England", the Journal of the Royal Stateistical Society, Vol. 101 (New Series),

75. Kumar Jainendra (1986): "Landuse Analysis-A Case Study of Nalanda District, Bihar", Inter-India Publications, New Delhi.

76. Kuzmyak Richard J. and Pratt Richard H. (2003), Land Use and Site Design: Traveler Response to Transport System Changes, Chapter 15, Report 95, Transit Cooperative Research Program; Transportation Research Board

77. Litman Todd (2005), Land Use Impacts on Transport: How Land Use Factors Affect Travel

78. Mahajan S.K. in his article (2012) "Road Transport and Regional Planning in Himachal Pradesh" Social Growth-Half Yearly Journal, Vol. I (1), Pp. 85-88.

79. Majid Hussain (2004) Agriculture Geography , Rawat Publication Managers' Association.

80. McKinnon, A. (1995). The Contribution of Road Construction to Economic Development, Transport and Environment workshop on roads and the Economy. UK Government.

81. Mir Mohi-Ud. Din, G.H. (1986): "Saffron Cultivation in the Kashmir Valley-A Case Study of Wasura Village: Saffron Cultivation And Its Role in Socio-Economic. Development". Annals of the National Association of Geographers, India, Vol. 6, No. 2, Pp. 40-47.

82. Mishra, S. (2006c) Suicide Mortality Rates across States of India, 1975-2001: A Stateistical Note, Economic and Political Weekly, Vol. 41, No. 16, pp. 1566-1569.

83. Mohammad Shafi (2006) Agriculture Geography. Pearson Education Monthly Review, 50 (5), 11–22.

84. Moore Terry and Thorsnes Paul (1994), The Transportation/Land Use Connection, Planning Advisory Service Report 448/449, American Planning Association (www.planning.org).

85. Mukherjee, S. N. (1967): "Agricultural Planning in Howrah". Geographical Review of India, Kolkata, 29/2.

86. Murphy, Denis J. (2007), People, Plants and Genes: The Story of Crops and Humanity, Oxford University Press Pp 178

87. Nayak D.K. and Singh Surendra (1987) "Assessment of Transport Development in Northeast India" Institute of Indian Geographers, Pune, Vol. 9, No.1, July.

88. Ogburn, W.F. (1937): Social Characteristics of Cities, Chicago: The International City

89. Oyebanji, A. O. (2003). Principles of Land Use Economics. Lagos: CEPDM. Rallis, T. (1988). City Transport in Developed and Developing Countries. London: The Macmillan Press Limited.

90. Panitch, L. (1998): The state in a changing world: social-democratizing global capitalism? Monthly review Issue 50 Vol. 5 Pp. 11-22

91. Patil S.L. (1988) A Study of changing cropping with special reference to horticulture in Sangola taluka,, unpublished M.Phil dissertation submitted to Shivaji University, Kolhapur. Press. Restructuring the Economies of Eastern Europe, Cambridge (MA): Harvard University

92. Sanches Thomas W. and Brenman Marc (2007), The Right To Transportation: Moving To Equity,Planners Press (www.planning.org).

93. Shafi, M. (1966): "Techniques of Rural Landuse Planning With Reference to India", Geographer, Aligarh, Vol. 13.

94. Sharma S. K. and Bhargava Archana,(2010)"The Study of Transport Facilities and Market Centers in Madhya Pradesh" Annals of the National Association of Geographers, India, Vol. 4, No. 1, Pp. 55-59.

95. Singh Jasbir and Dhillon S. S. (1997): "Agricultural Geography" Mc Graw Mill Publishing co. Ltd. New Delhi.

96. Smith Adam, (1759) Glasgow Edition of the Works and Correspondence Vol. 1 The Theory of Moral Sentiments ". The Online Library of Liberty. Retrieved 2010-01-31.

97. Thoman R. S. and Corbin P.B. (1974), "The Geography of Economic Activity", McGraw Hill Press Ltd. New York

98. Thube Dattatraya Tukaram (2006) "Performance Based Maintenance Management for Rural Roads" unpublished Ph.D. Thesis Department of Civil Engineering of the Indian Institute of Technology Roorkee, Roorkee

99. Visher S.S 1932 Social Geography Social Force 10. 351 - 54

100. Vyalij, Pralhad Yashwant (2012) Agricultural landuse in Nasik district unpublished Ph.D. Thesis Tilak Maharashtra Vidyapeeth

101. Wacher, T. (1971). Public Transport and Land Use – A Strategy for London. The Chartered Surveyor, July 1971.

102. Weitz Raanan (1971) Rural Development in a changing worls The MIT Press; First Edition edition (July 15, 1971)

103. Wheeler Stanton (1973) Bureaucracy and the Public Basic book, New York.

104. Yago, G. (1983). The Sociology of Transportation. Annual Review of Sociology, 9,171-190.