"IMPINGEMENT OF URBANIZATION ON CULTIVATORS IN THE KHED CIRCLE OF PUNE DISTRICT (M.S.)"

A DISSERTATION SUBMITTED BY

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FORM A

DECLARATION BY THE RESEARCH STUDENT

I hereby declare that the dissertation entitled **"IMPINGEMENT OF URBANIZATION ON CULTIVATORS IN THE KHED CIRCLE OF PUNE DISTRICT (M.S.)"** completed and written by me has not previously formed the basis for the award of any degree or similar title of this or any other university or examining body.

Place: Akole **Signature of the Research Student**

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CERTIFICATE

This is to certify that the dissertation entitled **"IMPINGEMENT OF URBANIZATION ON CULTIVATORS IN THE KHED CIRCLE OF PUNE DISTRICT (M.S.)"** which is being submitted here with for the award of the **Master of Philosophy (M.Phil.)** in **Geography** of **Tilak Maharashtra Vidyapeeth, Pune** is the result of original research work completed by **Mrs. Minal Kishor Sonawane** under my supervision and guidance. To the best of my knowledge and belief the work incorporated in this dissertation has not formed the basis for the award of any degree or similar title of this or any other university or examining body upon her.

Place: Akole **Signature of the Research Guide**

Date: **(Dr. Vijay Shivaji Bhagat)**

CONTENTS

Title	Page No.
Acknowledgements	I
List of tables	III
List of figures	IV
Abstract	VI
Chapter-I	
Introduction	1-14
1.0 General	1
1.1 Applications of advanced techniques in urban studies	3
1.2 Hypothesis	5
1.3 Objectives	5
1.4 Study area	5
1.5 Previous literature	9
1.6 Methodology	11
1.7 Arrangement of the text	13
1.8 Resume`	14
Chapter-II	
Physiographic Characteristics	15-27
2.0 General	15
2.1 Relief	15
2.2 Slope	16
2.3 Drainage	18
2.4 Soil	20
2.4.1 Clay soil	20
2.4.1.1 Deep moderately well drained clayey soil	20
2.4.1.2 Shallow well drained clayey soil	20
2.4.2 Loam soil	21
2.4.3 Calcareous soil	21
2.5 Climate	22

2.6 Land use/land cover 23
2.7 Change in net sown area 25
2.8 Resume` 27

Chapter-III

Socio-economic Profile 28-53
3.0 General 28
3.1 Population characteristics 28
3.1.1 Total population 30
3.1.2 Distribution of population 31
3.1.3 Distribution of cultivator 32
3.1.4 Distribution of human power 32
3.1.5 Distribution of male power 34
3.1.6 Distribution of female power 35
3.1.7 Distribution of landless labourers 37
3.1.8 Sex ratio 39
3.1.9 Literacy 40
3.2 Cropping pattern 41
3.2.1 *Kharif* season 42
3.2.2 *Rabbi* season 49
3.3 Resume` 53

Chapter-IV

Transformation and impingement 54-73
4.0 General 54
4.1 Changes in number of cultivators 54
4.2 Causes of changes in number cultivators 56
4.2.1 Change in the agriculture land 56
4.2.2 Change in cropping pattern 57
4.2.2.1 Cropping pattern in *Kharif* 58
4.2.2.2 Cropping pattern in *Rabbi* 59
4.2.3 Change in occupational structure 61
4.2.3.1 Household industry workers 61

4.2.3.1 Total other workers 63
4.2.4 Change in size of land holding 65
4.3 Farmers' views on land transformations 67
4.3.1 Agriculture land ownership 68
4.3.2 Source of ownership transformations 70
4.3.3 Occupation preference of cultivators 71
4.3.4 Cultivators' preference for secondary occupation 72
4.4 Resume` 73

Chapter-V

Overviews and conclusions 74-78
5.0 General 74
5.1 Overviews 75
5.2 Applicability of the study 77
5.3 Limitations of the study 78
5.4 Conclusions 78

Abbreviations 79-80
References 81-86
Appendices 87-90
1 Village wise TGA and NSA distribution (Census 1991 – 2011) 87
2 Questionnaires 88

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LIST OF TABLES

Caption	Page
2.1 Distribution of slope	17
2.2 Distribution of soil	21
2.3 Land use/land cover	23
3.1 Population structure	29
3.2 Cropping pattern (1991-2011)	41
4.1 Cropping pattern 1991-2011 (*Kharip*)	58
4.2 Cropping pattern 1991-2011 (*Rabbi*)	60
4.3 Literacy correlation with total household workers	63
4.4 Literacy correlation with total other workers	65
4.5 Cultivators and cultivable land classes distribution (1991 - 2011)	65
4.6 Random sample selection for interview	68
4.7 Farmers' views on land transformations	68

LIST OF FIGURES

Caption	Page
1.1 Location map	7
1.2 Location of villages and road network map	8
1.3 Schematic preparation of data analysis	13
2.1 Digital elevation model	16
2.2 Slop classes	17
2.3 Slope map	18
2.4 Drainage map	19
2.5 Soil map	22
2.6 Land use/land cover map	25
2.7 Change in net sown area	26
3.1 Total population	30
3.2 Distribution of population	31
3.3 Distribution of cultivators	33
3.4 Distribution of human power	34
3.5 Distribution of male power	36
3.6 Distribution of female power	37
3.7 Distribution of landless labourers	38
3.8 Sex ratio	39
3.9 Literacy	40
3.10 *Bajra*	43
3.11 Rice	44
3.12 Maize	45
3.13 Total pulses	46
3.14 Total oil seeds	47
3.15 Total cash crops	48
3.16 Fodder crops	49
3.17 *Jowa*r	50
3.18 Wheat	51
3.19 Onion	52

4.1 Changes in number of cultivators 55
4.2 Change in the agriculture land 57
4.3 Cropping pattern 1991-2011 (*Kharif*) 59
4.4 Cropping pattern 1991-2011 (*Rabbi)* 60
4.5 Household industry workers 62
4.6 Total other workers 64
4.7 Distribution of cultivators 66
4.8 Distribution of cultivated area (1991-2011) 67
4.9 Agriculture land ownership 69
4.10 Source of ownership transformations 70
4.11 Occupation preferences of cultivators 71
4.12 Cultivators' preference for secondary occupation 72

ABSTRACT

Urbanization is the process of transformation of rural society into urban society. Impingement of urbanization directly related to the change in land use and economical activities in villages near to the cities through changes in settlement pattern, constructions, travelling networks, markets, industrial zones, administrations, etc. These transformations of agricultural setup into urban setup are changing the number of cultivators and their activities in the fringe areas of cities. Therefore, the major objectives of the study are to analyse the relationship between land transformation from agriculture to non-agricultural purpose and its relationship with changes in number of cultivators with their causes.

Satellite datasets acquired by Landast-7 ETM+ and Landsat-8 OLI & TIRS have been used to detect the land transformations with the help of GIS software. Population and agricultural census data has been analysis in SPSS database software to detect their correlations. The physiographic setup, population characteristics, land use, cropping pattern, etc. have been analysed to understand their relationships with farmers in the study area.

The population of the study area is 91,904 (2011) with main cultivators (21.89%), main agriculture labours (5.73%), other main workers (16%) and main workers in household industry (1.22%). *Bajara* and Rice are the major crops in *Kharif* season and *Jowar*, Wheat and Onion are in *Rabbi* season. However, farmers give preferance to cash crops, flower crops, oil seeds, etc. with growth in urban centres and industrial areas. The agricultural lands in the region are converting into non-agricultural use for industrialization, networking facilities, resources storage and supply, etc. rapidly. The size of agricultural land holding in the region is small. About

67.84% cultivators show land holding less than 0.5 ha. Cultivators with large land holding are converting into small holding with fast rate. The ownership of agricultural land is changing from main cultivators to marginal and others observed in all sample villages. Therefore, the number of landless labours and household industry workers are increased in the villages like Pacharnewadi, Rakshewadi, Padali and Chas (2011). However, distribution of population shows different trends in changes happened in reviewed period. The changes in density of cultivators are classified into four caragories i.e. negative, marginal, moderate and positive changes.

Further, selected farmers from sampled villages have been interviews to collect the farmers' views on land transformation in non-agricultural use with simultaneous conversions in economic activities and population structure and their willingness. The changes in population characteristics show positive as well as negative relationships with occupational transformations. The educated and skilled young generation of workers (male and female) have wilfully transferred to non-agricultural economical activities like industry including household industry and other sectors. Some of the cultivators have adopted secondary business like dairy farming, poultry to secure their income. Thus, urbanization shows the impact on farmers in all respect including land use, land holdings, occupation structure, population structure, willingness, etc. Therefore, the analyses, descriptions, overviews, findings of the present study show that the objectives outlined for present study are achieved, satisfactorily. The hypothesis, "the land transformations from agriculture to non-agricultural use shows notable impact on cultivators in the process of urbanization" is accepted.

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CHAPTER I

INTRODUCTION

1.0 General

Urbanization is the increasing population with built-up land. The urban expansions i.e. horizontal and vertical are linked to industrialization and modernization. Urbanization begins from the core area of the settlement and propagates to the fringes. It is dynamic process of changes in size, shape, socio-economic activities, culture, amenities, etc. (Keeley 2011). The United Nations reports show that the share of world urban population was increased from 37.3% (1975) to 52.1% (2011). The rapid rate of urbanization was recorded in India i.e. 0.62 % (mid-19th century) and 1.15 % (2012) as well as the world i.e. 1.51 % (2012) (UNESA 2012). Further, United Nations projected that about 27 mega-cities from developing countries will be emerged by the end of 2025. India is a leading country for industrialization, urbanization, market, etc. since last few decades (Roberts 2006). The rapid growth of cities like Chicago in the late 19th century, Tokyo in the mid-20th and Mumbai in the 21st century largely related to rural-urban migration (Wang and Meng 1999). The industrial revolution in the 18th century caused urbanization in some countries like United States and England. Reported causes of urbanization in India are government services, migration from Pakistan after partition, industrial revolution with economic opportunities, infrastructure facilities and growth of private sector (Rosato *et al.* 2010).

Urbanization is transformation of rural society into urban society (Nagendra 2001). Improved road and market networks are important elements provide access to primary products i.e. agricultural outputs, dairy products, minor forests products, row

materials to the industries, labour force, etc. from remote areas. The impingement of urban growth directly related to change in land use (Paül and Tonts 2005) and indirectly with economical activities, culture, social structure and human mobility (Maithani *et al.* 2010). Small scales activities of rural areas change into big industries with time and space (Dang *et al*. 2002). Industrialization, centralized economic sources, amenities, markets are forcing (Briggs *et al.* 1997) rural dwellers to migrate to urban area in search better future standard of living (Amin *et al*. 2012).

Urbanization in developing countries like India are facing the problems like overcrowding, slums, pollution, illegal constructions, overload on water supply and electricity, etc. The standard of living of population in these urban centers is poor quality (Prados 2005) and inequalities are observed in distribution of the basic amenities (Huang *et al.* 2009).

Agriculture is backbone of Indian economy from ancient period (Agrawal *et al*. 2005). In developing countries, agriculture sector is the most important for economic growth (Yuan 2009). In India the agricultural sector employee's labour force was 80.2% in 1991, 58.02% in 2001 and 54.61% in 2011 (Census of India 2011). Agricultural sector and other economic sectors are synchronised with each other. Any minor change in agricultural sector cause of imbalance in other adjoining and depending economic sectors. Due to the process of urban growth there is a tremendous flexibility occurred in the ratio of agricultural land and number of cultivators (Evans *et al*. 2011). Number of cultivators are changing due the impingement of urbanization in the fringe area (Fulong 2002 and Rosato *et al.* 2010). Therefore, urbanization is changing the interface of traditional agriculture and pattern of economic activity (Dijst *et al*. 2005).

This study performed to understand and predict the trends of land transformation with respect to cultivators. The number of cultivators undulating due to the reflection of urbanization in suburb (Shao *et al.* 2008). These undulations are in the form of 1] rising number of cultivators, 2] falling number of cultivators and 3] irregular pattern of change into number of cultivators (Zhao and Kinfu 2005). Agricultural land changed into non-agricultural land around urban areas due to directly and indirectly impact on the size of land holdings as well as fluctuation in the number of cultivators (Haase and Nuissl 2010).

The reported studies in last some decades show satisfactory result about transformations in agricultural lands into urban with their amenities, prices, land structure, etc. using conventional as well as modern techniques. However, the focus was given on transformation of land from agriculture to urban and the farmers are neglected. Therefore, the present study is avail to understand the impact of agricultural land transformation on farmers' community.

1.1 Applications of advanced techniques in urban studies

Many studies in the fields of urban studies, ecological sciences, natural resources, ecology, geography and geology have used advanced techniques i.e. remote sensing, cartographic and statistical techniques and various data sources efficiently, timely and cost effectively (Dymond *et al.* 1996, Nagendra and Gadgil 1999, Malik and Husain 2006). This data is more useful to accumulate reliable information about complex and remote areas (Apan 1997, Li *et al.* 2009). The outturns of the study can become the undercoat source of information for the planning, management and applications which concerned with the administration of local as well as regional level

(Nagendra 2001, Zomer *et al.* 2002). It can save the energies, money and time of various governmental and non-governmental organizations (Bhagat 2009).

Remote sensing and GIS techniques are useful for land use/land cover classification and finding its relation with agricultural land, urban area, water management, etc. (Gong *et al.* 2004). Landsat-7 ETM+ and Landsat-8 OLI and TIRS datasets have the capacity of identification and classification of land surface at good accuracy level (Gong *et al.* 2004, Ramsey 2004). Statistical, multivariate techniques like regression, correlation, and trend surface analysis, principal component analysis, etc. as well as cartographic presentation of graphs, charts has become an explanatory tool to expose the hidden resolutions. These resolutions are used to fill the gap between problems related to urban planning and their impact on relevant economic sectors.

The relationship between soil wetness index and NDVI has been stated by Adegoke and Carleton (2002). Wang *et al.* (2004) have reported the essence used of NDVI to estimate temperature vegetation dryness index. Bhagat (2009) has used NDVI and soil wetness index for the detection of potential areas for afforestation with the help of remotely sensed data. However, the acquired data i.e. agriculture land use, cropping pattern, population characteristics especially related to occupation and size of land holding are correlated to each other. This data have used to find out the causes of change in the number of cultivators. Also Landsat-7 ETM+ and Landsat-8 OLI & TIRS dataset have been used for the land use/land cover classification. The MS-Excel 2010 and SPSS 17.0 software help to create some reliable statistical and cartographic analytical outputs. The ILWIS 3.4 Academic, has been used for different kinds of RS and GIS analyses in the study.

1.2 Hypothesis

The study area is located near to the industries and urbanized centres. The process of urbanization shows tremendous changes in agro-based activities and farmers. Land transformations from agricultural use to non-agricultural use shows impact on size of land holding, land prices, occupation structure, cropping pattern, etc. Therefore, the hypothesis for present study can be outlined as ‘‘the land transformations from agriculture to non-agricultural use shows notable impact on cultivators in the process of urbanization”.

1.3 Objectives

Land use transformations from agricultural to urban use in suburbs, fringe area shows unanimous patterns. The cultivators are influenced during this process of transformation in all respect. Therefore, following objectives are outlined to understand the relationship of land transformation on cultivators.

1. To study the physiographic and socio-economic profile of the study area.
2. To study the relationship between land transformation from agriculture to non-agricultural use and cultivators.
3. To determine the causes of changes agriculture and cultivators.

1.4 Study area

The ‘Khed Revenues Circle’ (Figure 1.1) of Khed Tahsil, Pune district is suburb zone of Pune urban area. About 24255 ha geographical area distributed within 34 villages. It situated between 18° 44’ 40” N to 19° 00’ 00’’ N Latitudes and 73° 46’ 00’’ E to 73° 58’ 00” E Longitudes. An altitude varies from 480 to 1120 meters. The western part of the study area is situated relatively higher level and quite badly

dissected. The south-eastern portion, except few hillocks show comparatively uniform surface. The basin slopes are towards north-east to south-east. Bhima and Bhama are the main rivers originated Sahyadri Mountain. Eastern part of these basins have fertile deep soils. *Bajra,* wheat, gram and *jowar* are major crops in the region. Rice is also observed in upper part of these basins in narrow tracks along with streams.

This region can be classified into the climatic class, 'hot semi-arid climate (BSh)' with average temperatures ranging from 20° to 28° C. From March onwards is a period of continuous rise in temperature and May is the hottest month of the year. An individual day temperature occasionally rises to 44^{o} C. With the onset of the south-west monsoon there is sudden drop in temperature and the lowest mean temperature records in the month of December (11^{o} C). The distribution of rainfall is uneven and generally decreases from west to east. It receives annual rainfall about 722 mm.

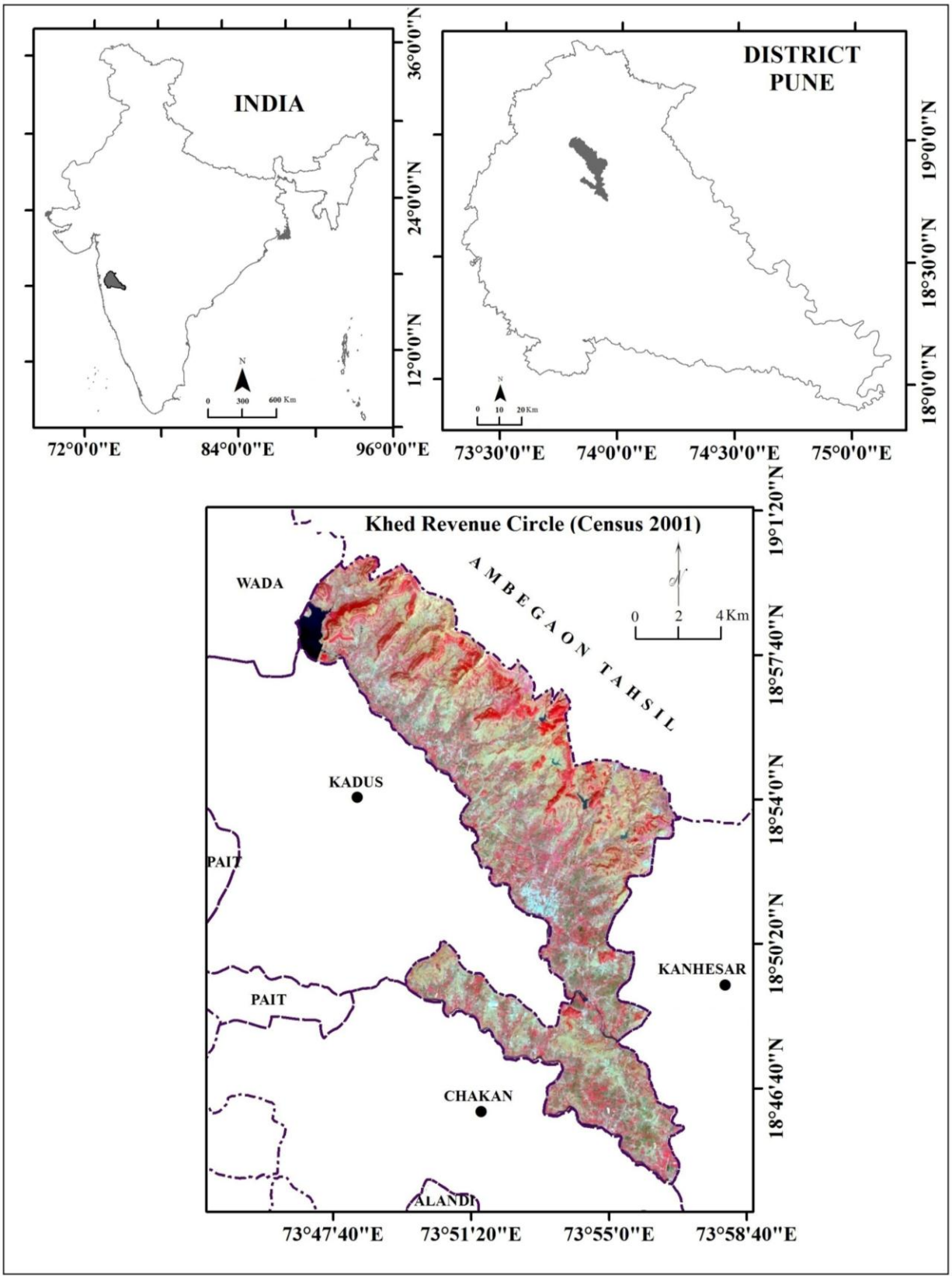

Figure 1.1 Location map

Figure 1.2 Location of villages and road network map

1.5 Previous literature

Urbanization is a global phenomenon shows fast growth and impact in most of the developing countries. Transformations of land use from agriculture to industrial and urban use have been studied by many scholars, researchers to understand the problems, trends, potentials use, etc. The urban population in developing countries was 40% between 1900 and 1975. Predictions show volume of urban population about 60% of the world's population in 2025 (Estruch *et al.* 2008). Amin *et al*. (2012) stated that the urbanization is an inevitable part of economic development. This study provides a visual portrayal of growth and trends of transformations with impact on landscape. They have used early date land use/land cover map of town planning on 1:15,000. Stralberg *et al*. (1999) have used various geo-statistical methods to examine spatial structure of urbanization. A set of chaparral-vegetated points across an urbanized landscape in the Santa Monica Mountains of southern California was surveyed in 1997. Results of spatial covariance models as well as trended non-spatial models shows changes and affected of land use change on population in the region. Amarsaikhan *et al.* (2009) have compared the changes occurred in the main urban land cover classes of Ulaanbaatar city, Mongolia. Multi-temporal remote sensing and geographical information system (GIS) data sets along with census data were used for the analyses. Dang *et al.* (2008) have studied the geometric characteristics of urban change and urban impact along with calculations of distance decay index, distribution of the gravitational field and established spatial cluster system for the megalopolis in china. They have concluded that the distribution of urban gravitational field is the manifestation of regional unbalanced development. Shen (2000) has explained the rural industrial development in Beijing suburban area. The spatial pattern of rural industrial development has influenced by location factors that reflect market forces

and government policies. The result shows significant influence of market forces on spatial pattern of rural industrialization in national capital region.

Yuan (2009) has investigated urban growth dynamics from regional to local scales in the Twin cities metropolitan area and demonstrates impact of policies on growth of metropolitan based on zonal analysis. Wu (2002) has developed a stochastic cellular automata model based on simulation from observed sequential land use data and rural-urban land conversions in the city of Guangzhou, China. Shao *et al*. (2007) stated that farmers are traditionally family-centred in their thinking and behaviour and passionately attached to their lands. The land is transferred under the household responsibility system (HRS) which is underlying driving forces affecting rural land transfer in china.

Chankrajang (2012) has assessed the impacts of urbanization on rural agricultural land with labour structural transformation from agriculture to non-agriculture. Nurden *et al.* (2010) have explained the negative approach towards agricultural activities in fringing zones of urban centres. Gallent and Shaw (2007) have discussed the effects of urbanization on multiple cropping patterns in coastal districts of India. The results show that the area under non-agriculture use is higher in coastal districts. They have calculated the infrastructure index based on eleven indicators. Mallick (2006) has stated that the impact of urbanization leads to increase in surface temperature in urban area mainly due to alteration of natural surfaces. He has explored the potential of multispectral satellite data to retrieve bio-physical parameters for estimating land surface temperature. Huang *et al*. (2008) have explained the complexity of urban expansion requires an analysis of the factors influencing the spatial and temporal processes of rural–urban land conversion. GIS

coupled with a logistic regression model and exponential smoothing techniques are used for exploring the effects of various factors on land use change.

Agrawal *et al*. (2005) have studied environmental problems caused by over population and rapid urbanization process in the metropolitan cities of India. They have concluded that environmental and social parameters of the Indian metropolitan cities are exploited. Chen and Huang (1998) have established the indices of environmental quality measures and developed an ecological system model to simulate the interrelationships between urban development and environmental quality of the Taipei metropolitan region. Gerald *et al*. (2009) have mapped land use/land cover changes in Freetown, Sierra Leone. Special attention was given to the change detection of agricultural land to other land use in the region. Major conversions have occurred between agricultural lands, grasslands, evergreen forest, built-up areas and barren land. Kuemmerle *et al*. (2009) have studied changes in land use patterns in Eastern Europe and classification is based on remote sensing approaches. Fitted linear regression models show relationship between field size and Landsat-based image texture.

Therefore, the previous studies have discussed the impact of urbanization on land use/land cover and environmental parameters. The present study deals with the impact of urbanization on agriculture land and cultivators.

1.6 Methodology

During the last few decades statistical, cartographic and geo-informatics approaches have importance in geo-spatial analysis, environmental analysis, decision making for development planning, land management, etc. Some of the studies have used multi-spectral remotely sensed data for special analysis for land cover change

detection. Statistical techniques like correlation and cartographic techniques have used for analyses of data acquired from different sources, remote sensing images and field check data. The data related to cropping pattern and land holdings is procured from Agricultural department of tahsil office, Khed (1991, 2001 and 2011). Information regarding land holders about land size, land ownership, occupation, etc. is collected in interviews conducted with farmers from selected four villages.

The data of total population, number of main, marginal cultivators, landless labourers, industrial and other workers was collected from district census hand-book (1991, 2001 and 2011). This was analysed in SPSS 17.0 database software to estimate the correlations between different variables like industrial worker, other worker and literacy. Various cartographic techniques, charts and graphs are helpful to explore the interpretations trends in variable like cropping pattern and number of cultivator.

Remote sensing data acquired by Landast-7 ETM+, Landsat-8 OLI and TIRS satellites was used for preparation of land use/land cover map using indices i.e. NDVI and NDWI. These datasets have been compiled, merged and loaded in the GIS image processing software ILWIS 3.4 Academic. The Survey of Indian (SOI) topographical maps at the scale, 1:50000 (47 E/16, 47 F/13 and 47 F/14) have been used for preparation of maps like physiographic, drainage, etc. GPS (Global Positioning System) has used to gather the ground truth information. The detailed discussion of methodology, techniques and data used in the present study is given in the next chapters.

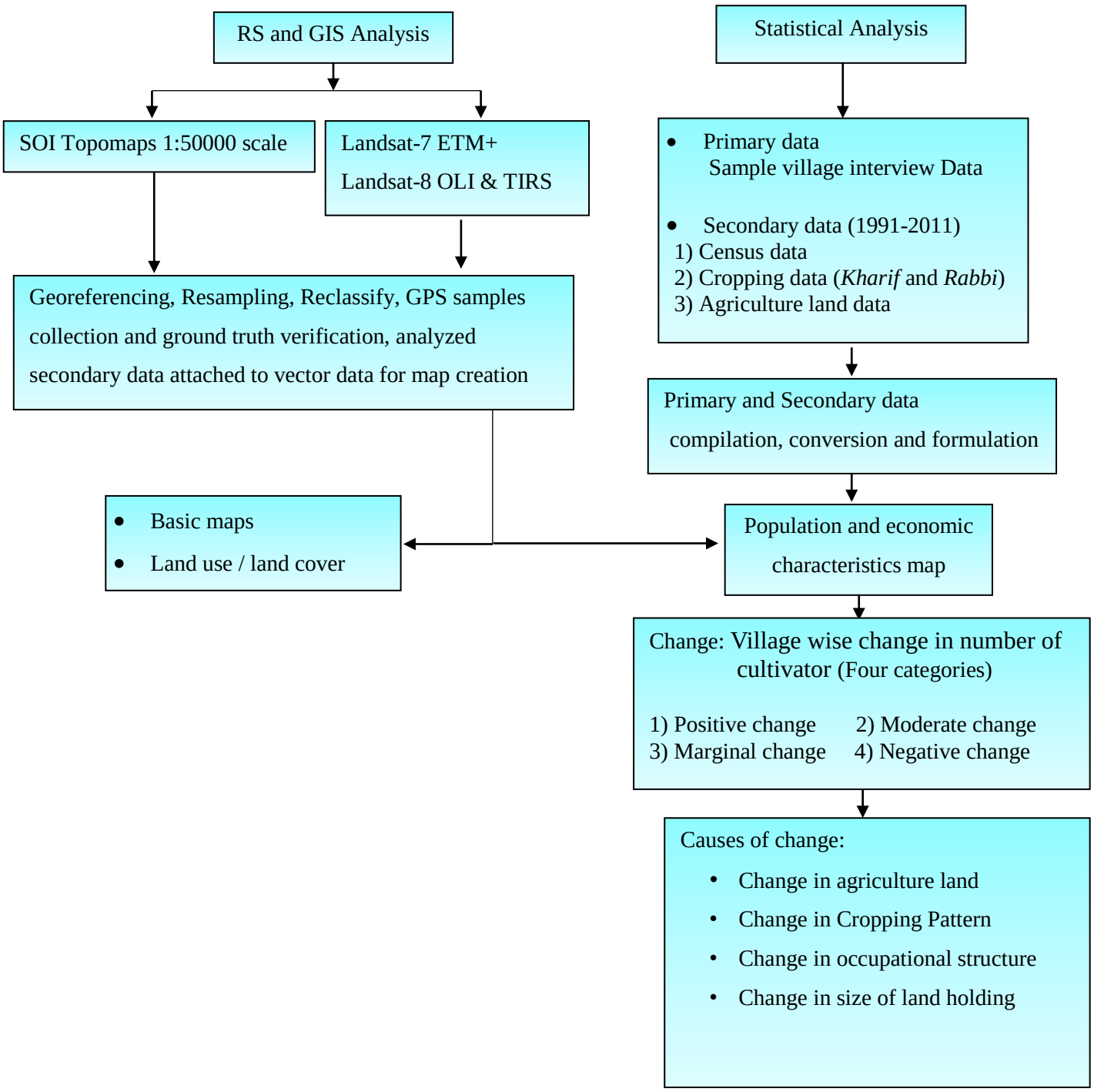

Figure 1.2 Schematic preparation of data analysis

1.7 Arrangement of the text

The analyses of the present study are discussed into five chapters. The first chapter deals with the introduction to the study. Survey of previous literature is given

in this chapter to highlight the spatial correlation of urbanization and land use changes with agricultural and socio-economic parameters. The hypothesis, objectives and methodology used in the study also explained in this chapter. The physiographic and socio-economic set-up of the study area in relation to urbanization is discussed in the second and third chapter, respectively. Fourth chapter deals with estimations of dynamics of change and impingement of urbanization on farmers in the study area. Findings and conclusions are given in the last chapter. The relevant references and appendices are given at the end of the thesis.

1.8 Resume`

Urbanization is a vital process in the competition between under developed and developing region. Urbanized regions have different divisions like industrial, residential, administrative, navigational network, markets, etc. Surrounding areas of city like suburbs, fringe affected in the process of transformation. The people of this area adopt living style, behaviours, socio-economic structure from urban zone. Agricultural land of this area changes into non-agricultural lands. Moreover, the number of cultivators changed into non-agricultural activities. Therefore, the objective to analysis the linkages between urban land transformation and change in number of cultivators is designed for this study. The data regarding land holding, cropping pattern, number of cultivators, etc. is collected. This data is analysed and results are reported in the next chapters to achieve the objectives of the study. The detailed physiographic characteristics of the study area are discussed to make informative base for impingement of urbanisation on cultivators in the next chapters.

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CHAPTER II

PHYSIOGRAPHIC CHARACTERISTICS

2.0 General

Land unit has unique identity for physiographic structure, climatic variability, ecosystem as well as socio-eco-cultural setup. The height of the region varies from 480 meter at south-east to 1120 meter at north-west side. Therefore, slope direction is north-west to south-east. Bhima and Bhama rivers are flowing from north-west to south-east direction. In study area have three soil types i.e. clay soil, loam soil and calcareous fine soil. This region is classified into the climatic class, 'hot semi-arid climate (BSh)'. The climatic variables temperature, rainfall, humidity, wind speed and direction etc. are discussed below. Photographic elements of the region are studied to set background to assess the impact of land transformations from agricultural use to urban based non-agricultural use.

2.1 Relief

Digital Elevation Model (DEM) has been prepared based on Survey of India toposheet and Cartosat-1 satellite image 2009 data (1 degree) in GIS software to show elevation, landforms, drainage pattern, etc. Elevation varies from 480 meter at south-east side to 1120 meter at north-west (Figure 2.1). The hilly area is shown in north-west part and direction of vallies north to south. The slope direction is also north-west to south-east. Therefore, in south-east and central part of the study area distributed agricultural land, settlement, road network and small industries in large scale. The distribution of population and farmers also concentrated in this area.

Figure 2.1 Digital elevation model

2.2 Slope

The map is prepared based on countors from SOI maps and classifed into different classes (Table 2.1). This is integral part of most soil erosion prediction models (Liu *et al.* 2007). The major slope direction in the region is north-west to

south-east (Figure 2.3). Precipitous and extra steep slopes are observed in north-west part in hilly zones coures about 11.02 % area of 18559 hectares (Figure 2.2). Land with slopes from 12° to 90° is more susceptible from soil erosion. Therefore, soil layer in this area is thin and sparse vegetation. South-west and middle part in the region show moderate to gentle slope (0° to 3°) estimated 57.13 % area (Table 2.1) with well drained loamy and calcareous soils. It is more suitable land for agricultural and other economic activities compaired to north-west part. Therefore, in this region inhabited farmers, industrial and other workers.

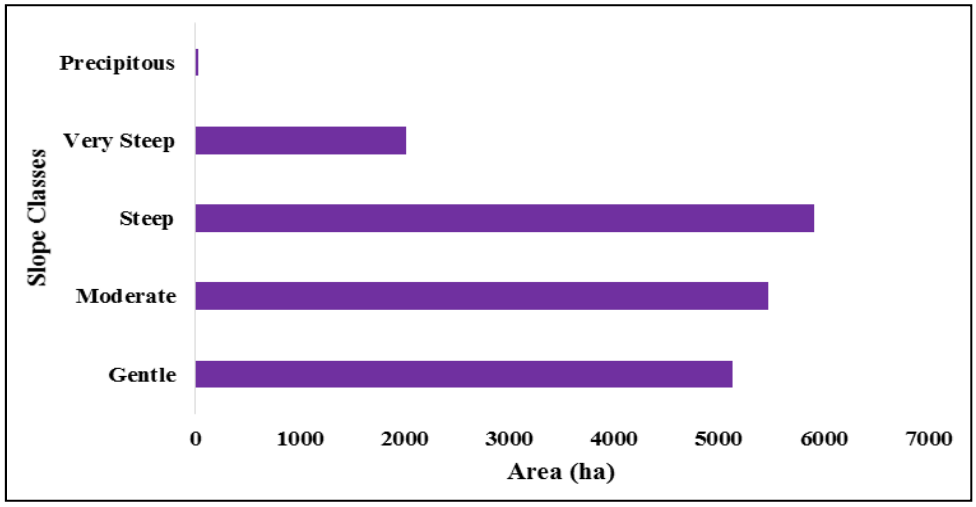

Figure 2.2 Slope classes

Table 2.1 Distribution of slope

Sr. No.	Slope classes	Degree	Area (ha)	Percentage
1	Gentle	0 to 1	5133.34	27.66
2	Moderate	1 to 3	5469.87	29.47
3	Steep	3 to 12	5909.98	31.84
4	Very Steep	12 to 30	2016.22	10.86
5	Precipitous	30 to 90	29.53	0.16
Total			**18559**	**100**

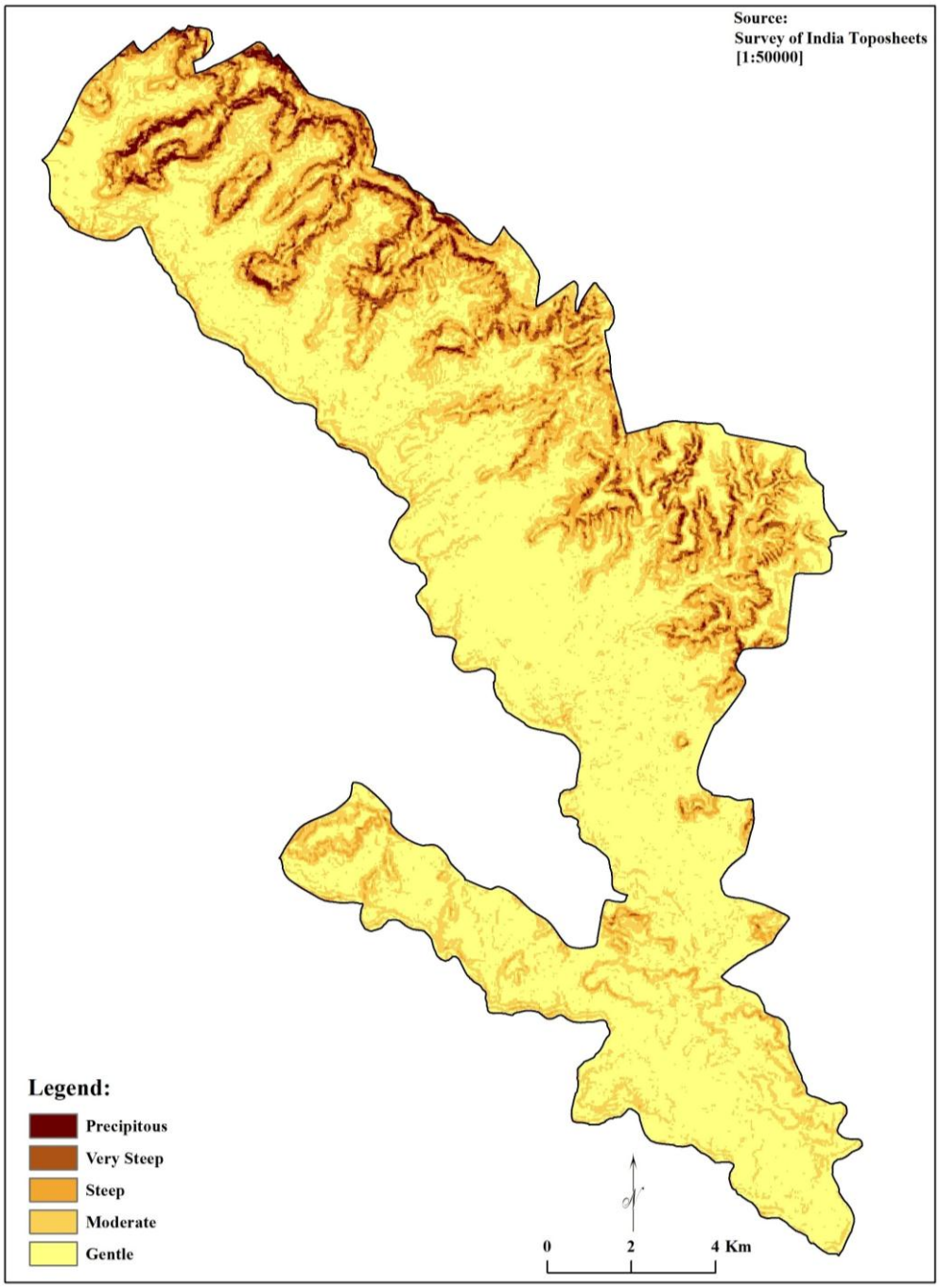

Figure 2.3 Slope map

2.3 Drainage

Stream networks are established according to rock, geological structures, elevation, slopes, climatic parameter, etc. (Vemu and Udayabhaskar 2010). Bhima and Bhama are major rivers in the region flowing north-west to south-east direction (Figure 2.4). They are non-perennial rivers but have floods frequently in month of

June to September i.e. monsoon period. One major dam at west, three small dams, some K.T. weirs and canals are supplying water for irrigation, industry and domestic activities. Therefore, distribution of population and agricultural activities have centralized near these water bodies and farmers taking different crops like, *bajra*, maize, *jowar*, Wheat, etc. in both *Kharif* and *Rabbi* season.

Figure 2.4 Drainage map

2.4 Soil

The aspect and slope can control the movement of water and material in the region results into spatial differences of soil properties (Said and Sohair 2011). In a forest ecosystem, soil properties are also influenced by vegetation composition. Said and Sohair (2011) reported that higher pH, exchangeable Ca and Mg, lower organic carbon, available N and K, extractable Zn in the depositional areas of foot hill zones. Information about soil properties is based on map procured from Soil Survey of India. There are three soil types i.e. clay soil, loam soil and calcareous fine soil (Figure 2.5).

2.4.1 Clay soil

Clay soil is fine grained that have metal oxides an organic matter. Geologic clay deposits are composed of phyllosilicate minerals. Clay soil has more water holding capacities. In study area clay soil is classified into two classes like, deep moderately and shallow well drained clayey soil.

2.4.1.1 Deep moderately well drained clayey soil

Deep moderately well drained clayey soil is distributed in upper parts of Bhima and Bhama river basins. This soil covers 2602.085 hectare (14 %) area on gentle slope of the region (Table 2.2). The cash crops like, sugarcane, groundnut, soyabean, etc. are major crops in the region.

2.4.1.2 Shallow well drained clayey soil

Shallow well drained clayey soil is distributed in north-west part with cover 3253.609 hectare (17.50 %) area in the region (Table 2.2). This soil is found on moderate and steep slopes therefore, it is less suitable for growth of crops except Rice.

2.4.2 Loam soil

Loam soil has more amounts of sand and silt and lesser amount of clay [40% sand, 40% silt and 20% clay]. Loam soils have more nutrients, moisture and humus. It has better drainage and infiltration capacities for water and air, and easier to till. Very shallow well drained loamy soils are distributed middle part and upper part of the Bhama River on 48.81 percent of the study area (Table 2.2) on gentle to moderate slopes. Loams soil hold up to 0.18 inches of water per inch of soil depth. Therefore, it is less suitable for agricultural activities.

2.4.3 Calcareous soil

Calcareous soil is mostly or partly composed of calcium carbonate. Calcareous soils are relatively alkaline, and they have high pH. Coarse soil holds total of 0.05 inches of water per inch of soil depth. Deep moderately well drained strongly calcareous fine soil distributed over south-west part of the study area and covered 19.69 % area. Deep moderately well drained strongly calcareous fine soil distributed over gentle slope.

Table 2.2 Distribution of soil

Sr. No.	Soil types	Area (ha)	Percentage
1	Very shallow well drained loamy soil	9073.032	48.81
2	Clay soil	5855.694	31.50
2.1	Deep moderately well drained clayey soil	2602.085	14.00
2.2	Shallow well drained clayey soil	3253.609	17.50
3	Deep moderate well drained strongly calcareous fine soil	3659.048	19.69
	Total	**18588**	**100**

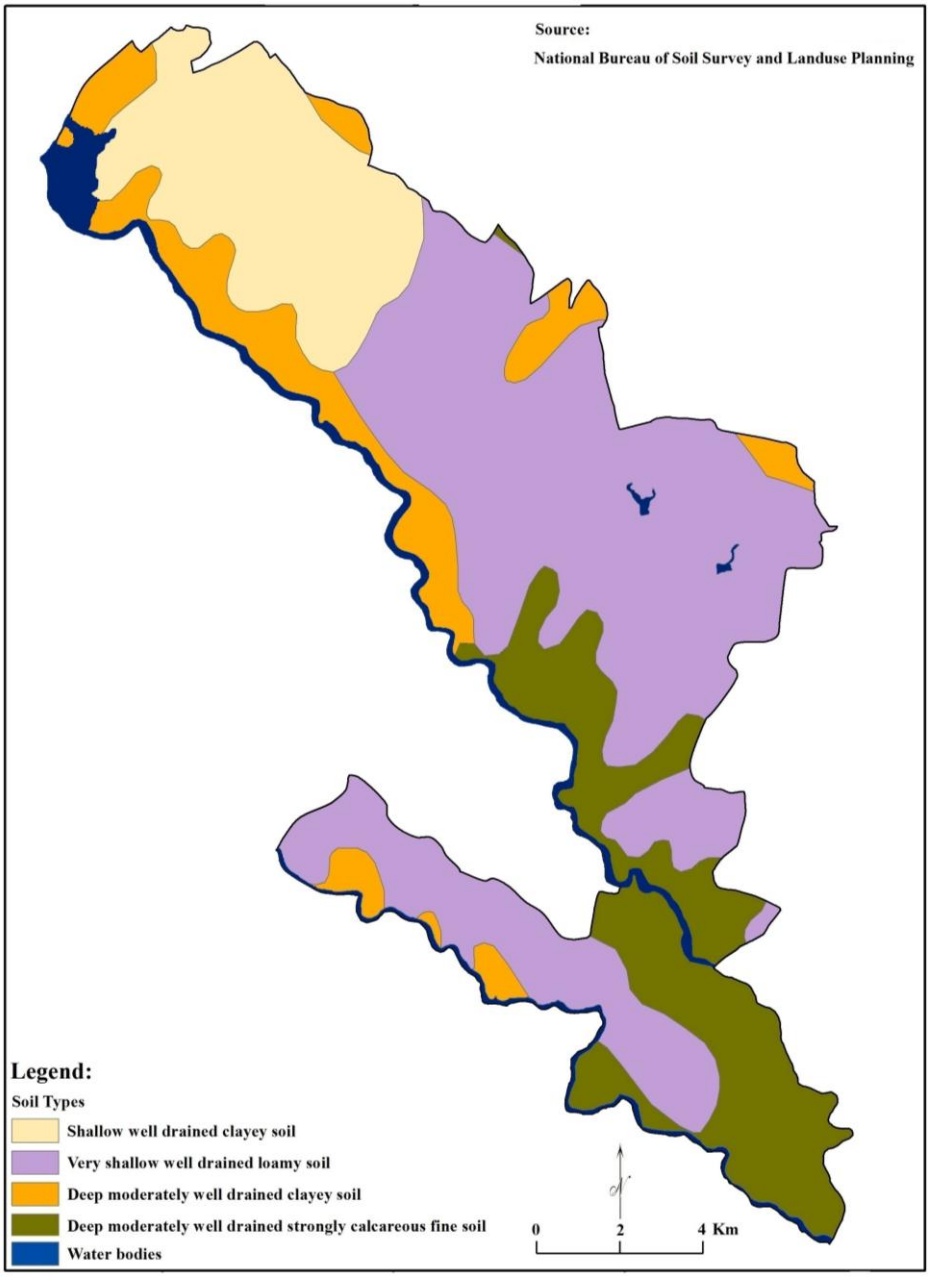

Figure 2.5 Soil map

2.5 Climate

The climate of the district is generally dry and invigorating with three seasons i.e. the cold season is started from November to February, hot season from March to May and monsoon season from June to October. The study area can be classified into the climatic class, 'hot semi-arid climate (BSh)' with average temperatures ranging from 20° to 28° C. From March monthly temperature continuously rises with hottest

month May. An individual day temperature occasionally rises to 44° C. After the end of September, temperature increases slightly which known as 'October heat'. The mean temperature records lowest in December (11° C). Study area receiving high rainfall is during the south-west monsoon season with annual average about 722 mm and uneven distributions. Thunderstorms occur in the pre- and post-monsoon months. The air is generally dry except in the month of June to September. The monsoon period is humid. The wind speed is more on the hill tops and the sky is heavily clouded to overcast. Wind blow from west with moderate speed in the summer season. After the end of May, wind blow predominantly from south-west direction.

2.6 Land use/land cover

A land use/land cover analysis gives the idea about the distribution of natural resources as well as human activities. The land-use/land-cover in the region classified into the categories like water bodies, dense forest, sparse vegetation, agriculture, open scrub, settlement, barren land and fallow land for the year of 1992, 2001 and 2013 (Figure 2.6) according to Level-I classification criteria of National Remote Sensing Centre (NRSC).

Table 2.3 Land use/land cover

Sr. No.	Land use class	Landsat5-TM [1992] in %	Landsat7-ETM+ [2001] in %	Landsat8-OLI&TIRS [2013] in %
1	Water bodies	1.04	2.70	2.48
2	Barren land	1.06	7.61	7.59
3	Dense forest	9.91	6.74	7.84
4	sparse vegetation	8.74	8.15	8.46
5	Open Scrub	5.48	11.09	9.00
6	Open/ Rocky	19.12	10.70	8.87
7	Settlement	4.06	14.38	17.38
8	Agriculture	29.93	16.70	15.36
9	Fallow land	20.66	21.91	23.02
	Total	**100**	**100**	**100**

Turker and Derenyi (2000) reported that forest land destruction and land grabbing are increasing due to the impingement of manmade activities in urban areas. The changes in land transformation from agricultural land to urbanized activities are clearly observed in this region. Agricultural land was 29.93% in 1992 but it is decreased in 2001 (16.70%) and 2013 (15.36%). The area under settlement was 4.06% in 1992 but it is tremendously increased in 2001 (14.38%) and 2013 (17.38%) due to impact of surrounding Chakan, Kadus and Rajgurunagar urban area. Water bodies' area (2.70%) and barren land (7.61%) have increased hugely after 1992 due to construction of dam in north-west part. Dense forest (7.84%), sparse vegetation (8.46%) and fallow land (23.02%) are slightly increased after 2001. The open scrub land increased in 2001 (11.09%) but again decreased in 2013 (9%). The area under rocky land decreased, it was 19.12% in 1992, 10.70% in 2001 and 8.87% in 2013(Table 2.3). The agricultural, open and rocky land is converted into the settlement, industry and navigation network. Therefore, agricultural activities have changed into non-agricultural activities and their impact has occurred on farmers.

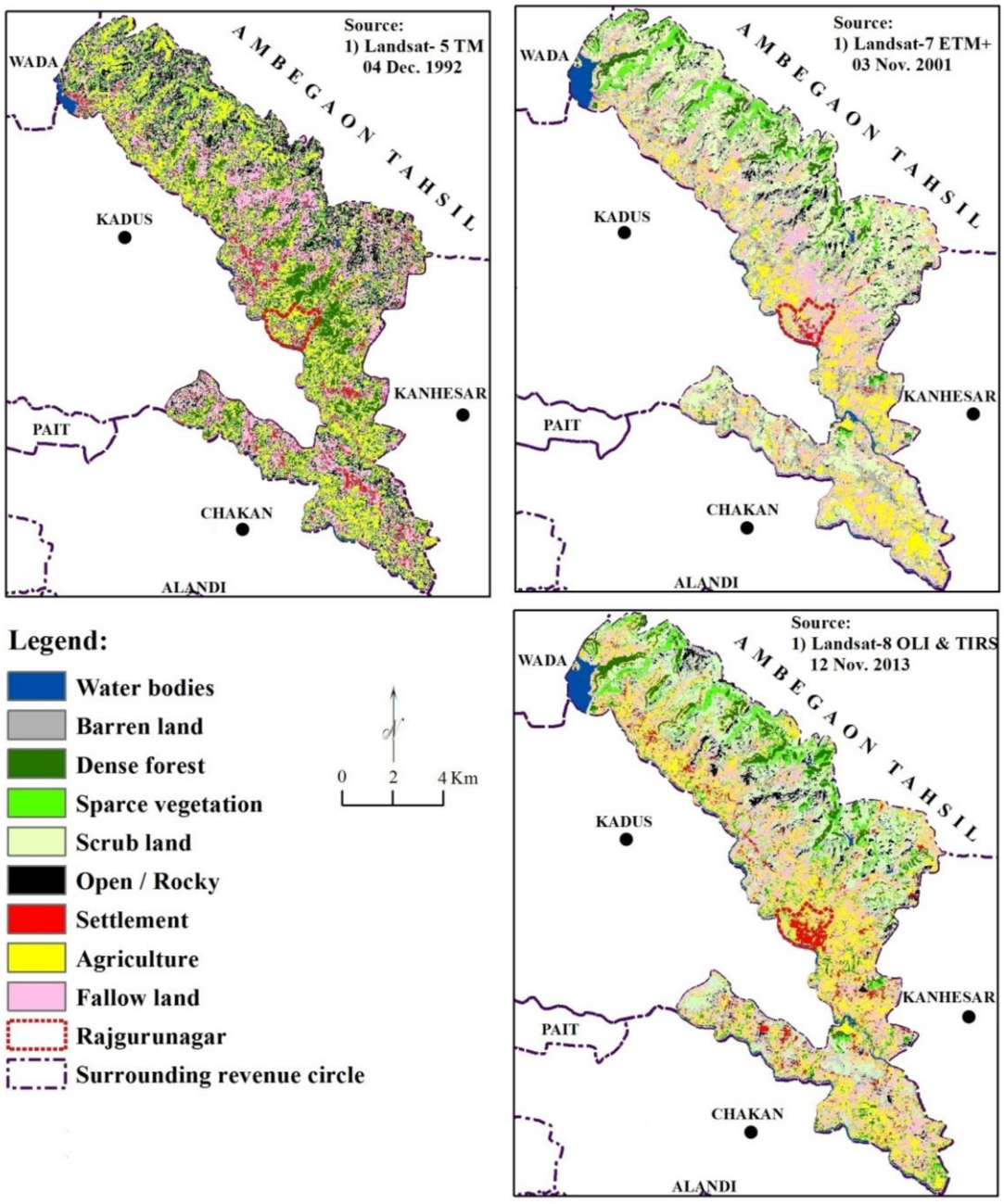

Figure 2.6 Land use/land cover map

2.7 Change in net sown area

The change of net sown area with total geographical area (TGA) was very high in 1991 (66.56%). The highest net sown area is observed in Satkarsthal in 1991 (95.01%) and rapidly decreased after 2001 (Figure 2.7). Non-agricultural activities are

increasing. In 2001 and 2011, the high NSA is shown in Kohinkarwadi (94.15%) and Butewadi (72.17%). Chas shows very less proportion of NSA 2011(8.06%).

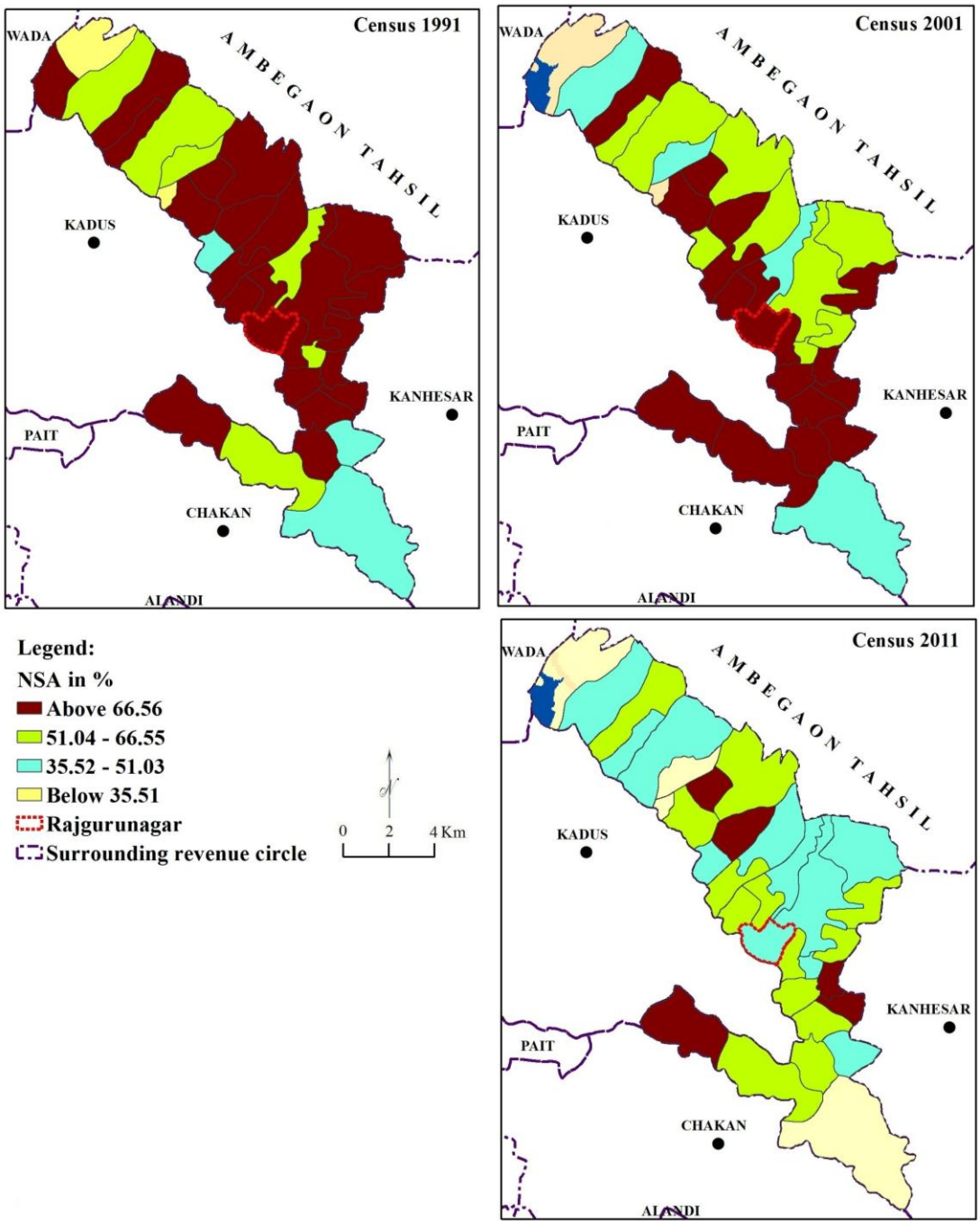

Figure 2.7 Change in net sown area

2.8 Resume`

The elevation and slope are decreasing from north-east to south-east and slope is nearly gentle category. The River Bhima and Bhama both are flowing throughout north-west to south-east direction. There are one major and four small dam, some K.T. weirs and canal supplying the water for irrigation, industry and domestic activities. There are three types of soil i.e. clay soil, loam soil and calcareous fine soil. The study area has a hot semi-arid climate bordering with tropical wet and dry. Agricultural land has decreased and it is converted into settlement and fallow land. Hence, these studies concentrated to explore the impact of urbanization on agriculture land and farmers activities. The detailed study of socio-economic elements has proposed in the third chapter.

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CHAPTER - III

SOCIO-ECONOMIC PROFILE

3.0 General

The development of any region depends on factors like natural resources, road network, population characteristics, social elements, economic activities, standard of living, etc. Population characteristics include distributions population, cultivators, landless labourers, sex ratio, literacy, etc. Economic factors are covers economic activities, workers in different sectors, cropping patterns and economic conditions of the people, etc. Total population of the study area is 91,904 (2011). It has been observed that the number of people, cultivators, landless labourers, literacy, etc. is increased in last two decades i.e. 1991 to 2011. However, sex ratio is decreased. Net sown area (NSA) is also decreased with the growth of urban area. In the study area, *bajra*, rice and maize are major crops in *Kharif* season and *jowar*, wheat and onion crops are in *Rabbi*.

3.1 Population characteristics

Population characteristics include distribution of population, cultivator, literacy, sex ratio, etc. Total population of the study area is 91,904 (2011). Southern part of the study area shows highest density of population. It is recordable that total population of Scheduled Castes is decreased from 2001. The number of main cultivators has decreased and it converted into industry and other workers (Table 3.1).

Table 3.1 Population structure

Sr. No.	Characteristics of population	Census 1991 (%)			Census 2001 (%)			Census 2011 (%)		
		Pune	Khed	Study area	Pune	Khed	Study area	Pune	Khed	Study area
1	Total male	51.72	51.64	51.08	52.11	51.90	51.27	52.22	52.85	51.46
2	Total female	48.28	48.36	48.92	47.89	48.10	48.73	47.78	47.15	48.54
3	Total SC population	16.17	16.13	16.38	13.40	14.70	13.61	11.72	12.46	11.09
4	Total ST population	11.41	11.32	3.41	10.53	3.88	3.98	12.52	6.76	4.70
5	Under 6 years population	3.91	4.20	5.11	3.62	11.15	5.27	3.70	10.95	6.50
6	Total literate population	59.56	59.20	62.79	69.68	61.82	65.34	76.06	70.70	72.82
7	Total illiterate population	60.38	61.18	37.21	30.32	38.18	34.66	23.94	29.30	27.18
8	Total worker	37.08	37.43	44.85	40.85	50.68	50.48	42.94	49.47	49.20
9	Total non-worker	11.64	12.22	52.23	59.15	49.32	49.52	39.78	45.26	50.80
10	Main worker	5.19	5.18	41.94	36.58	43.51	44.50	8.83	20.40	44.84
11	Main cultivators	0.56	0.53	27.53	9.81	25.53	25.63	3.88	5.87	21.89
12	Main agricultural labors	5.55	5.53	5.26	3.84	4.87	5.10	0.96	0.97	5.73
13	Main household industries	33.85	34.01	0.66	0.84	0.83	1.13	26.12	18.02	1.22
14	Main other workers	3.24	3.41	3.68	22.08	12.28	12.64	3.16	4.22	16.00
15	Marginal worker	59.68	59.16	2.91	4.27	7.16	5.98	0.58	1.20	4.37
16	Marginal cultivators	NA	NA	NA	1.16	2.80	2.82	0.51	1.00	1.41
17	Marginal agricultural labors	NA	NA	NA	1.34	2.71	1.44	0.16	0.19	0.90
18	Marginal household industries	NA	NA	NA	0.24	0.35	0.41	1.91	1.82	0.25
19	Marginal other workers	NA	NA	NA	1.53	1.31	1.31	57.06	50.53	1.80
Source: District census handbook, Pune (1991-2011).										

3.1.1 Total population

Total population of the study area is 91,904 (2011) increased from 60,286 in 1991 and 78,494 in 2001. Rajgurunagar is tahsil headquarter has maximum population, 25146 and lowest in Kohinkarwadi, 574 (Figure 3.1). The southern part of the study area shows impact of surrounding urban centres like Pune, Chakan, Alandi, Kadus, etc. with big villages in size of population than the north-west region.

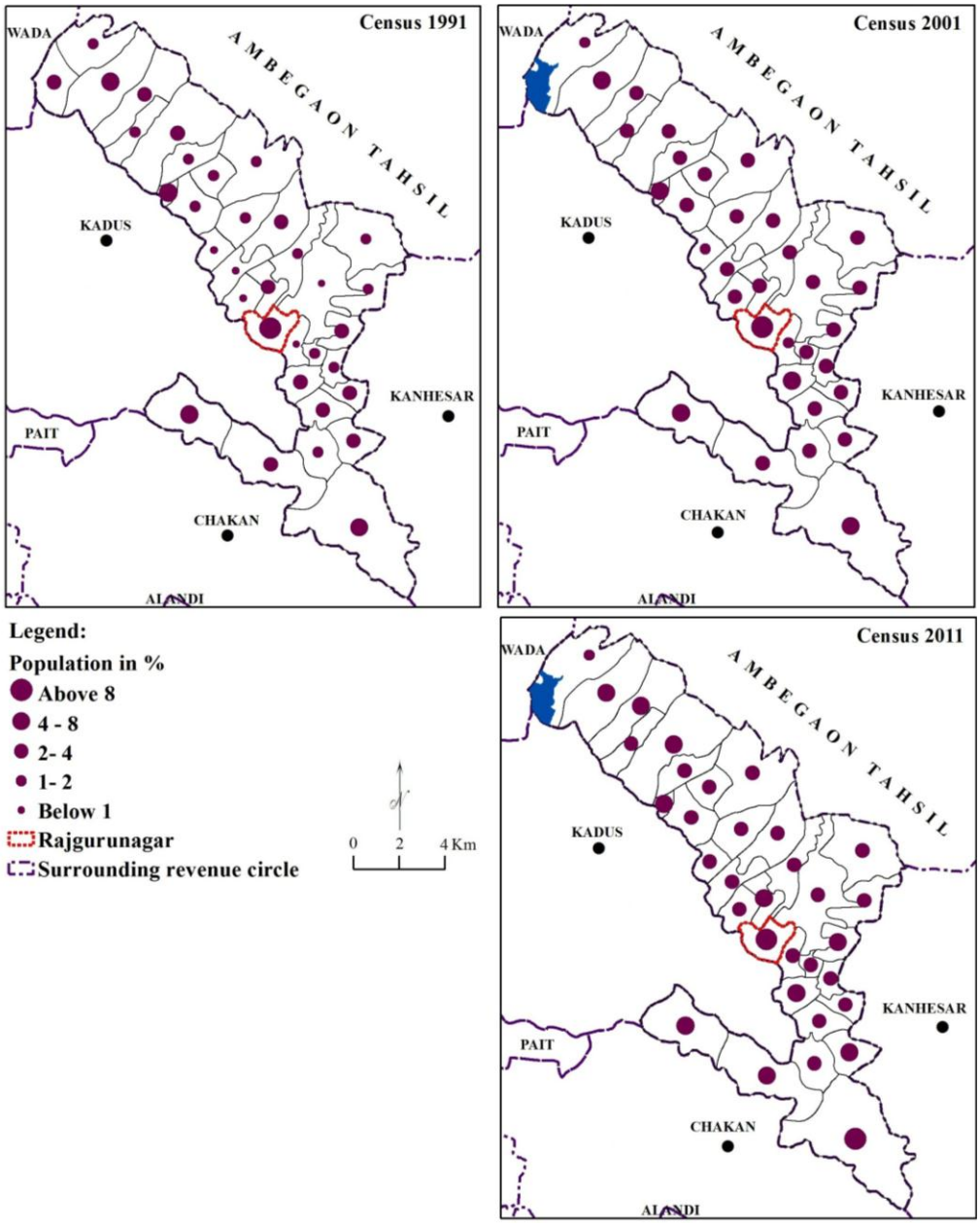

Figure 3.1 Total population

3.1.2 Distribution of population

Urban centres like Kadus, Chakan and Rajgurunagar, etc. are influencing population densities in southern part of the study area. Therefore, the highest density of population shows in the villages like Rakshewadi and Pacharnewadi located near to the Rajgurunagar. Mirjewadi village shows minimum population density i.e. 285 in 2011. More than half of the study area shows population density less than 349. These villages are located far away from urban centres and population is engaged in agricultural activities (Figure 3.2).

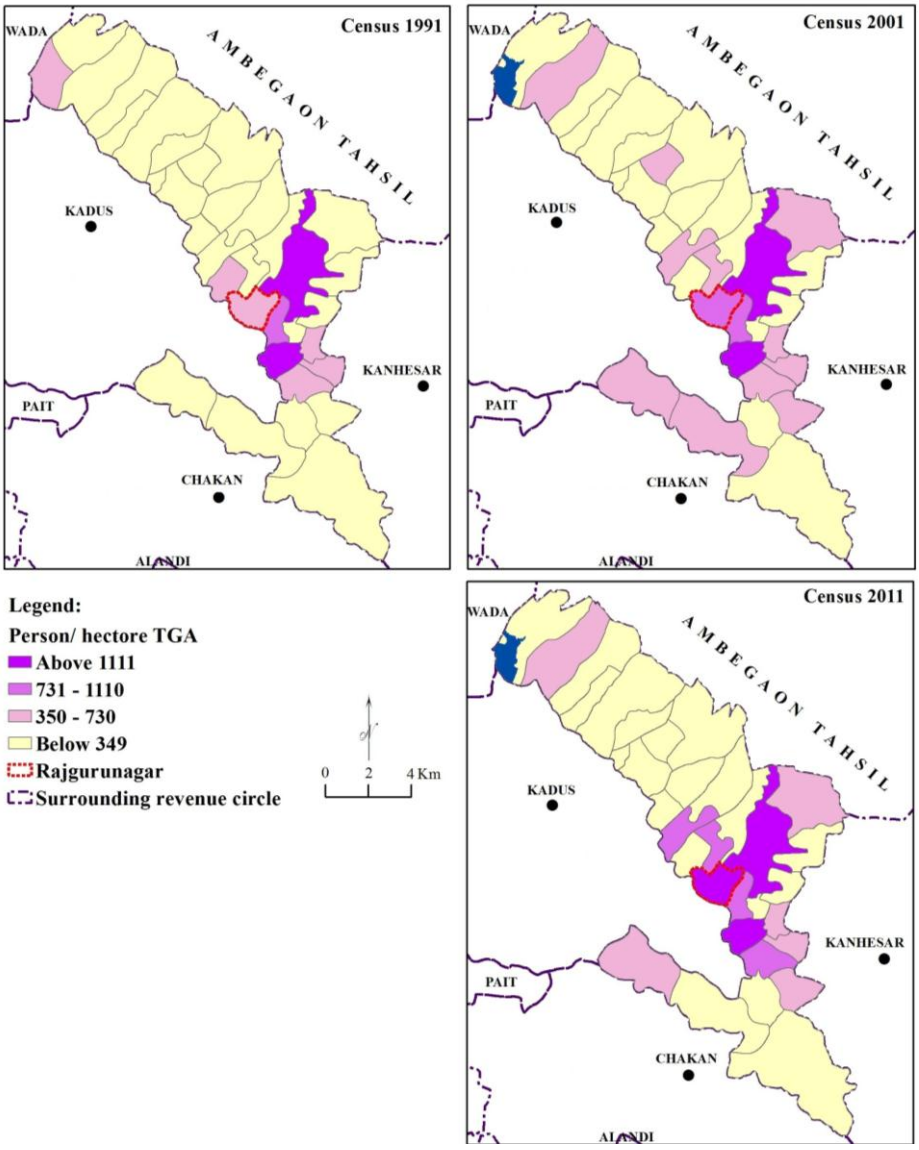

Figure 3.2 Distribution of population

3.1.3 Distribution of cultivator

Basically cultivators are depending on agricultural lands for their all needs. Therefore, cultivators' density was calculated and plotted in the village map to their distributions. It gives information of population pressure on agricultural lands as well as human resources available for agriculture. The relationship of cultivator with agricultural lands was estimated as the ratio of number of cultivator with NSA in the village. The highest density of cultivators estimated in two villages i.e. Pacharnewadi and Rakshewadi whereas from 2001 the village like Kalus, Rakshewadi, Dhorewadi and Pacharnewadi show more densities. In 2011, the highest cultivators density observed in Kalus (1382) and the lowest in Pangri (59) (Figure 3.3).

$$\textbf{Cultivator density} = \frac{\textbf{TC}}{\textbf{NSA}} \times \textbf{100} \qquad \text{(Eq. 3.1)}$$

Whereas,

TC = Total number of cultivators (male and female).

NSA = Net Sown Area (in hectares).

3.1.4 Distribution of human power

Human power is calculated with the help of relationship between total number of population dependant on agricultural i.e. cultivators, landless laborers and marginal workers in the village with NSA (Eq. 3.2) and plotted on the map. In 1991, the highest human power was observed in Dhorewadi with increasing trend from 1991 to 2011(Figure 3.4). The human power density shows this increasing trend in the villages near to the urban centres like Rajgurunagar.

$$\textbf{Human power density} = \frac{\textbf{PA}}{\textbf{NSA}} \times \textbf{100} \qquad \text{(Eq. 3.2)}$$

Whereas,

PA= total number of working population dependant on agricultural i.e. cultivators, landless laborers and marginal workers.

NSA= Net Sown Area (in hectares).

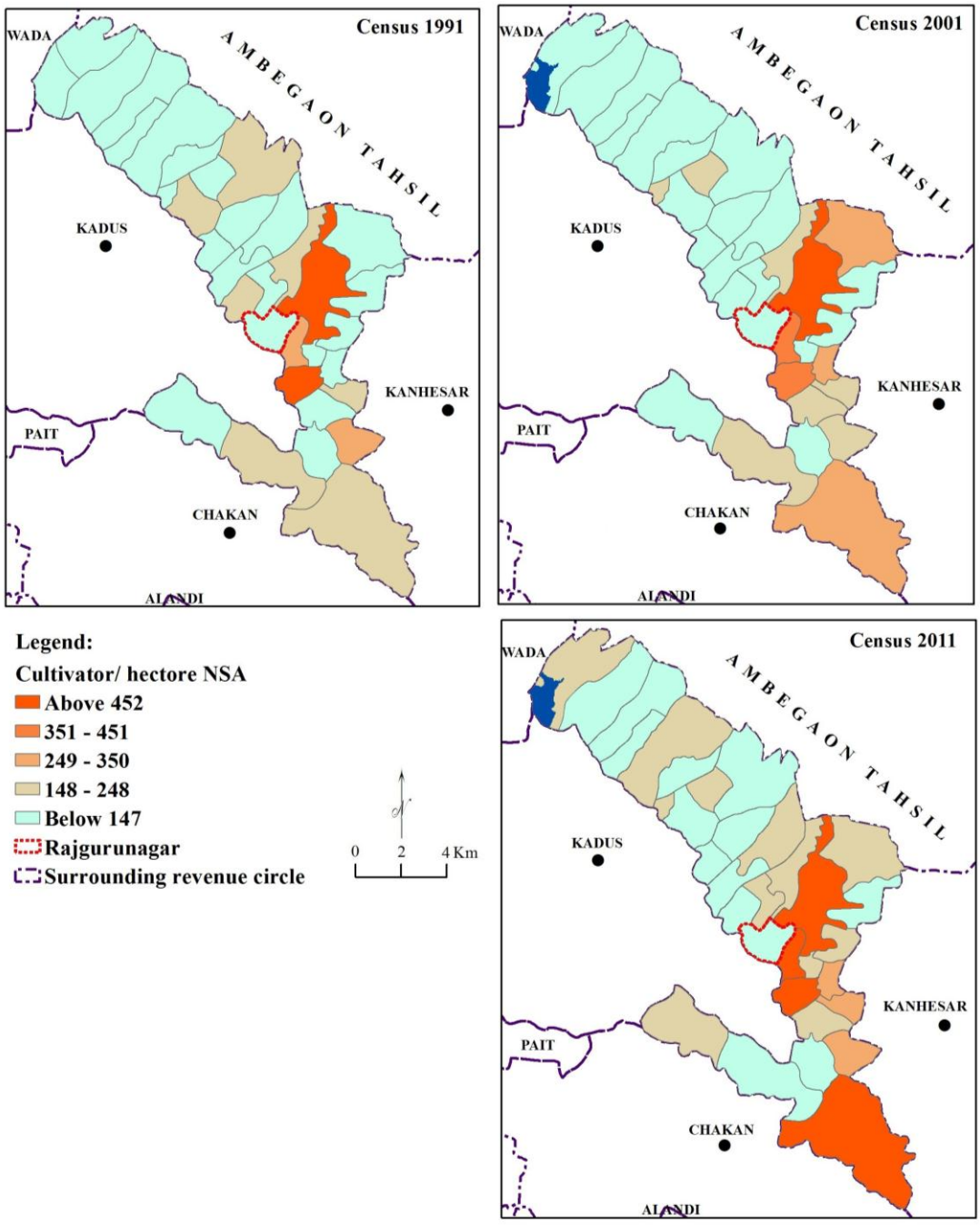

Figure 3.3 Distribution of cultivators

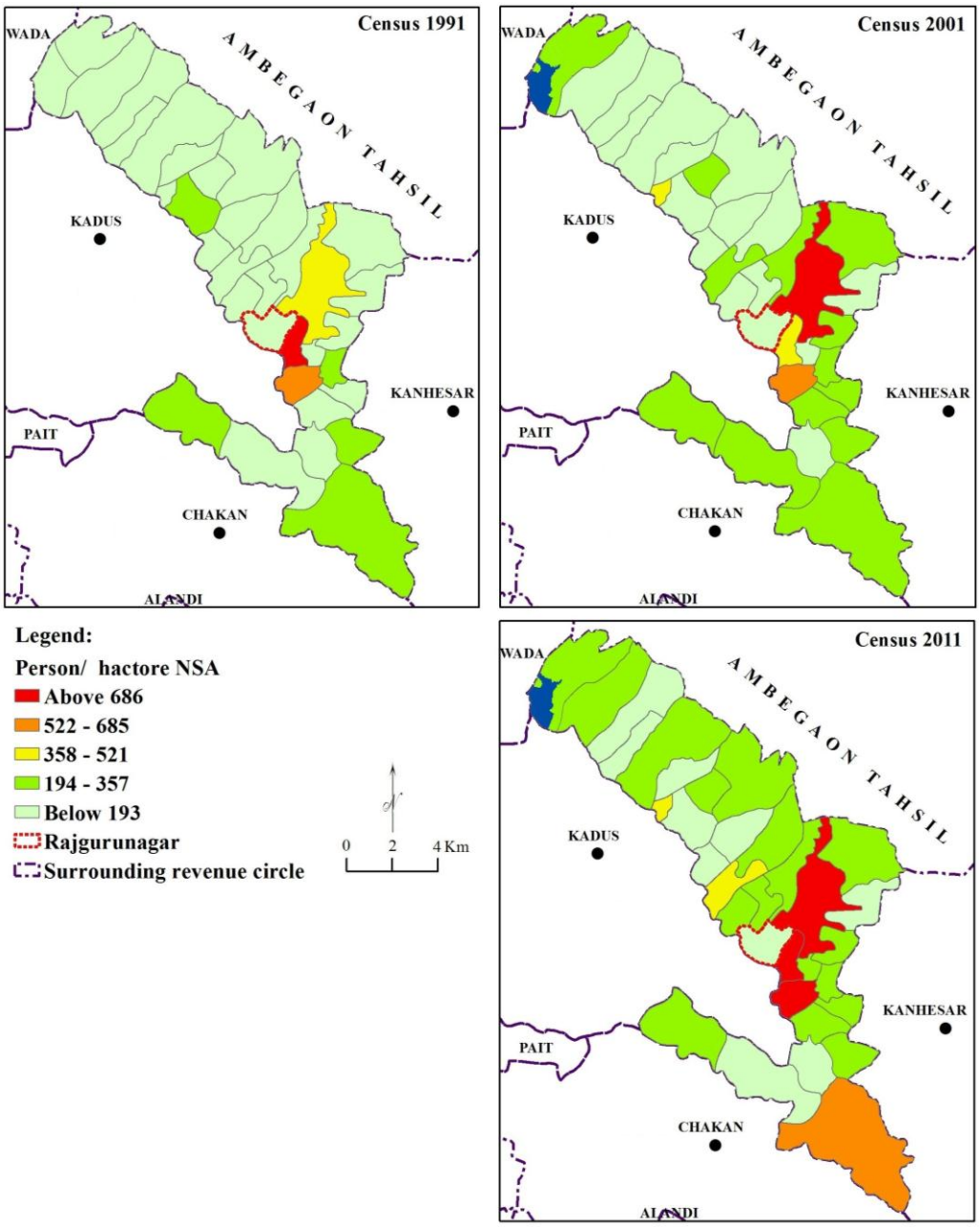

Figure 3.4 Distribution of human power

3.1.5 Distribution of male power

Male human power density is calculated as the ratio of total number of male working in agriculture to NSA (eq. 3.3). The male workers engaged in agriculture activities of this region are less in number than the females. Village Rakshewadi and

Pacharnewadi have more male human power (1991 to 2011) as agriculture plays an important role (Figure 3.5).

$$\textbf{Male power density} = \frac{\textbf{MA}}{\textbf{NSA}} \times \textbf{100} \qquad \text{(Eq. 3.3)}$$

Whereas,

MA= total number of male working in agriculture (cultivators, landless labourers and marginal workers)

NSA= Net Sown Area (in hectares).

3.1.6 Distribution of female power

Female human power was estimated using the density females engaged in agriculture with NSA (eq. 3.4). Female human power is increased from 1991 to 2011 in the villages i.e. Pacharnewadi and Rakshewadi near to urban centre, Rajgurunagar however, Akharwadi shows negative trend (Figure 3.6). In study area, female shows more dependency on agriculture than the male in 2011.

$$\textbf{Female power density} = \frac{\textbf{FA}}{\textbf{NSA}} \times \textbf{100} \qquad \text{(Eq. 3.4)}$$

Whereas,

FA= total number of female working in agriculture (cultivators, landless labourers and marginal workers)

NSA= Net Sown Area (in hectares).

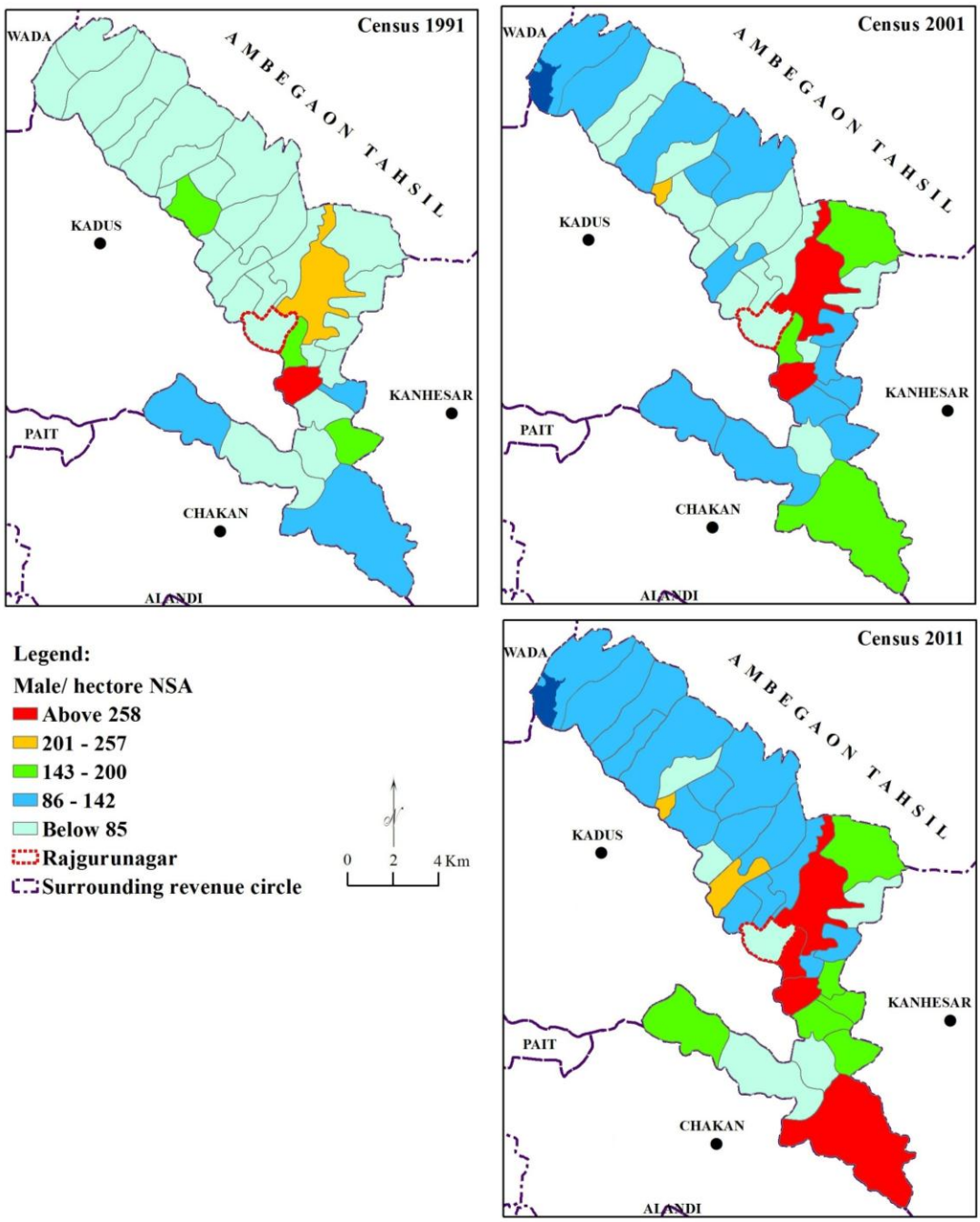

Figure 3.5 Distribution of male power

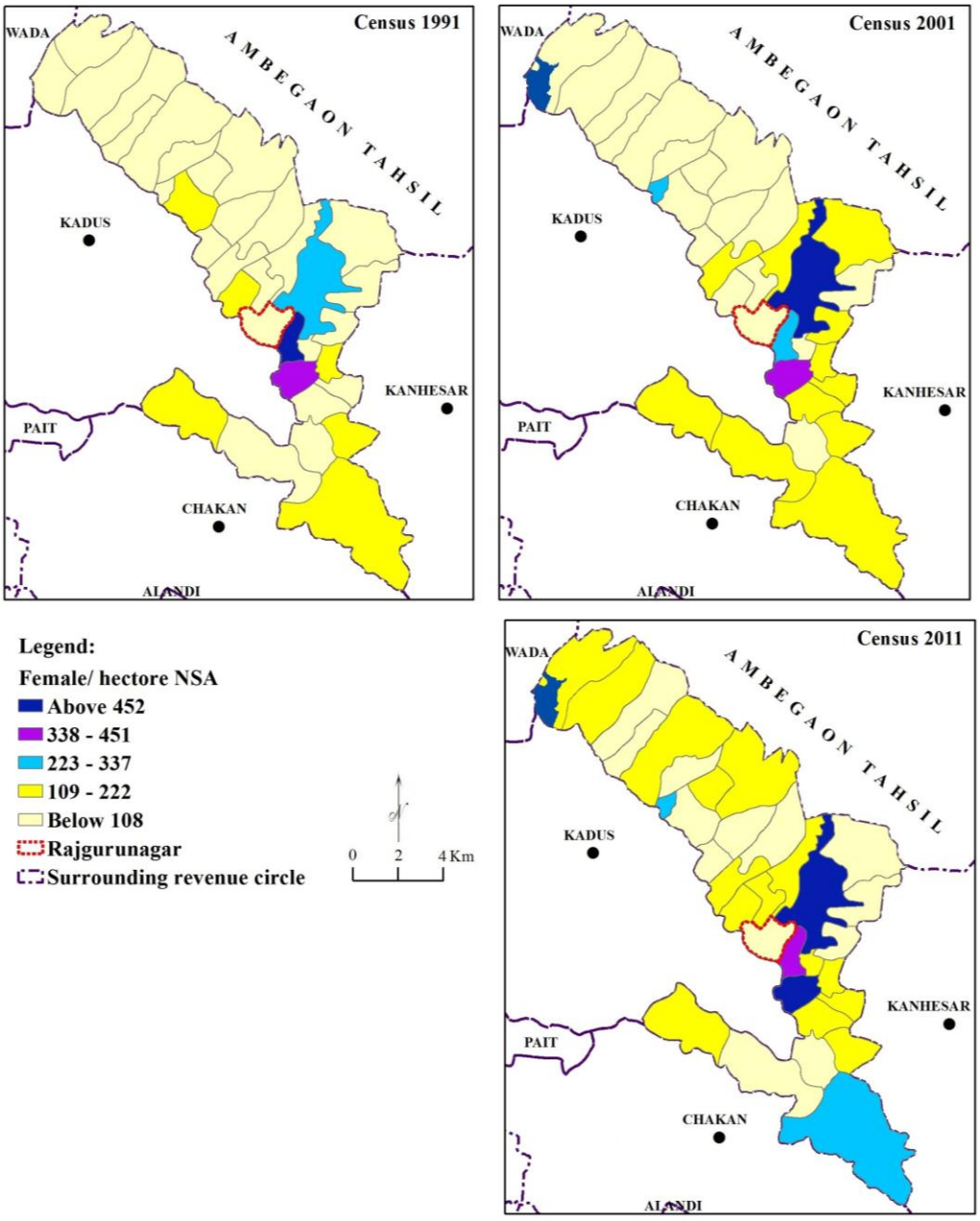

Figure 3.6 Distribution of female power

3.1.7 Distribution of landless labourers

Landless labourers density was calculated and plotted on map to show the distribution. It is ratio of total landless labourres with NSA (Eq. 3.5). It indicates dependancy of landless labourers on agriculture and source of labours to agricultural activities. The proportion of landless labours is less in 1991 and 2001 but increases in

villages like Pacharnewadi, Rakshewadi, Padali and Chas in 2011 (Figure 3.7). However, these villages are located near to the urban centers and have apportunties of employment to this labour force.

$$\textbf{Landless Labourers density} = \frac{\textbf{TLA}}{\textbf{NSA}} \times \textbf{100} \qquad \text{(Eq. 3.5)}$$

Whereas,

TLA= Total landless labourers in agriculture (Male and Female) in the Village

NSA = Net Sown Area (in hectares).

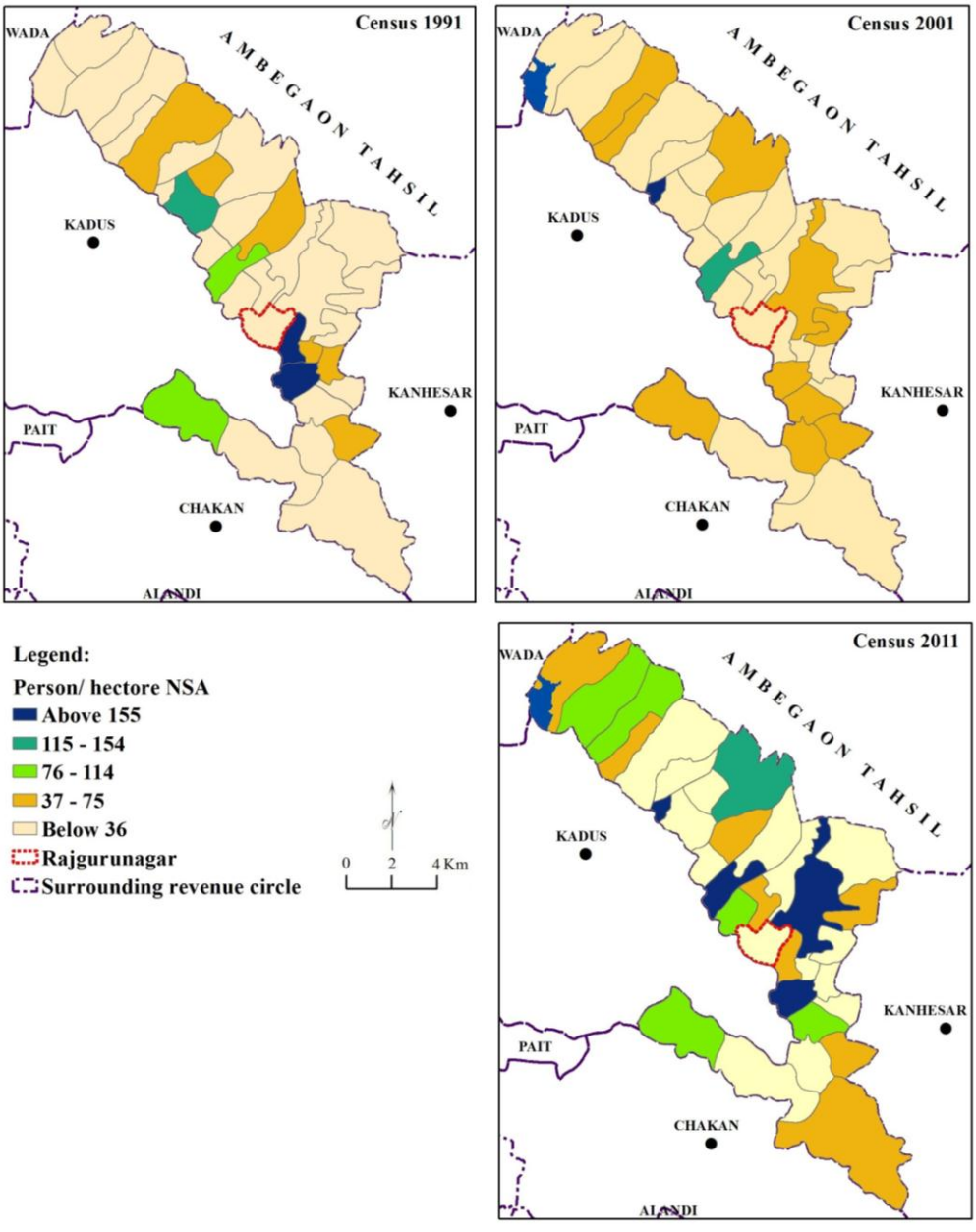

Figure 3.7 Distribution of landless labourers

3.1.8 Sex ratio

Sex ratio is the proportion of female population with male population. It was estimated more in northern part of the study area 1991 and decreased in southern part according to the change in cultural as well as social status. This decreasing trends observed in the villages near to urban centres like Chakan, Kadus and Rajgurunagar. In 2011, Mokhal (1041) village shows the highest sex ratio and Pangri (857) shows the lowest (Figure 3.8).

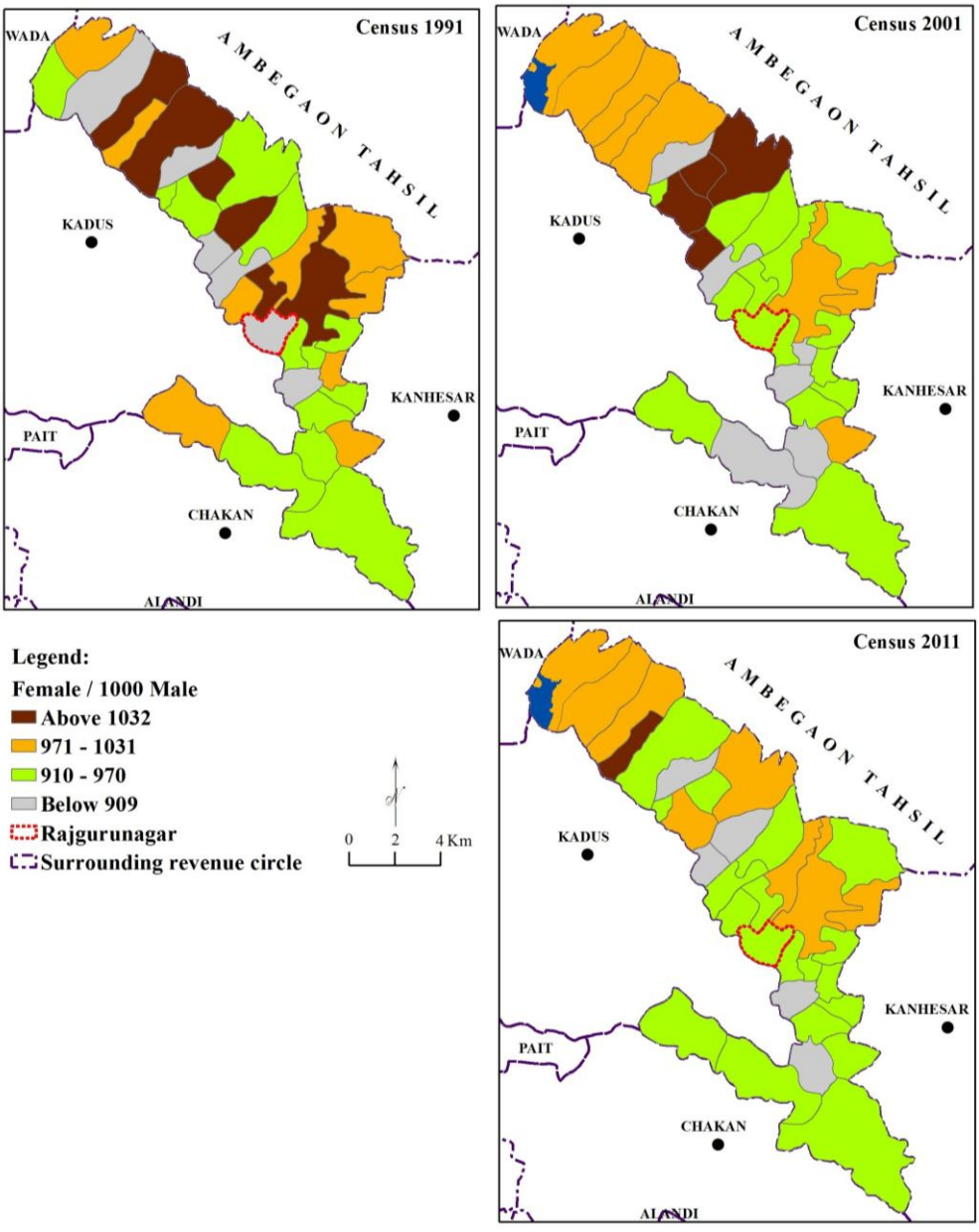

Figure 3.8 Sex ratio

3.1.9 Literacy

The enormous changes have been estimated in literacy rate from 1991 to 2011. In 1991, only Rajgurunagar was shown more literacy (74.54%), but after 2001, it is increased rapidly with increasing education facilities. More than 80% area shows literacy more than 65.65% in 2011. Rajgurunagar (80.28%) and Satkarsthal (78.86%) show the highest literacy and Jaidwadi (55.09%) shows minimum literacy (2011) (Figure 3.9).

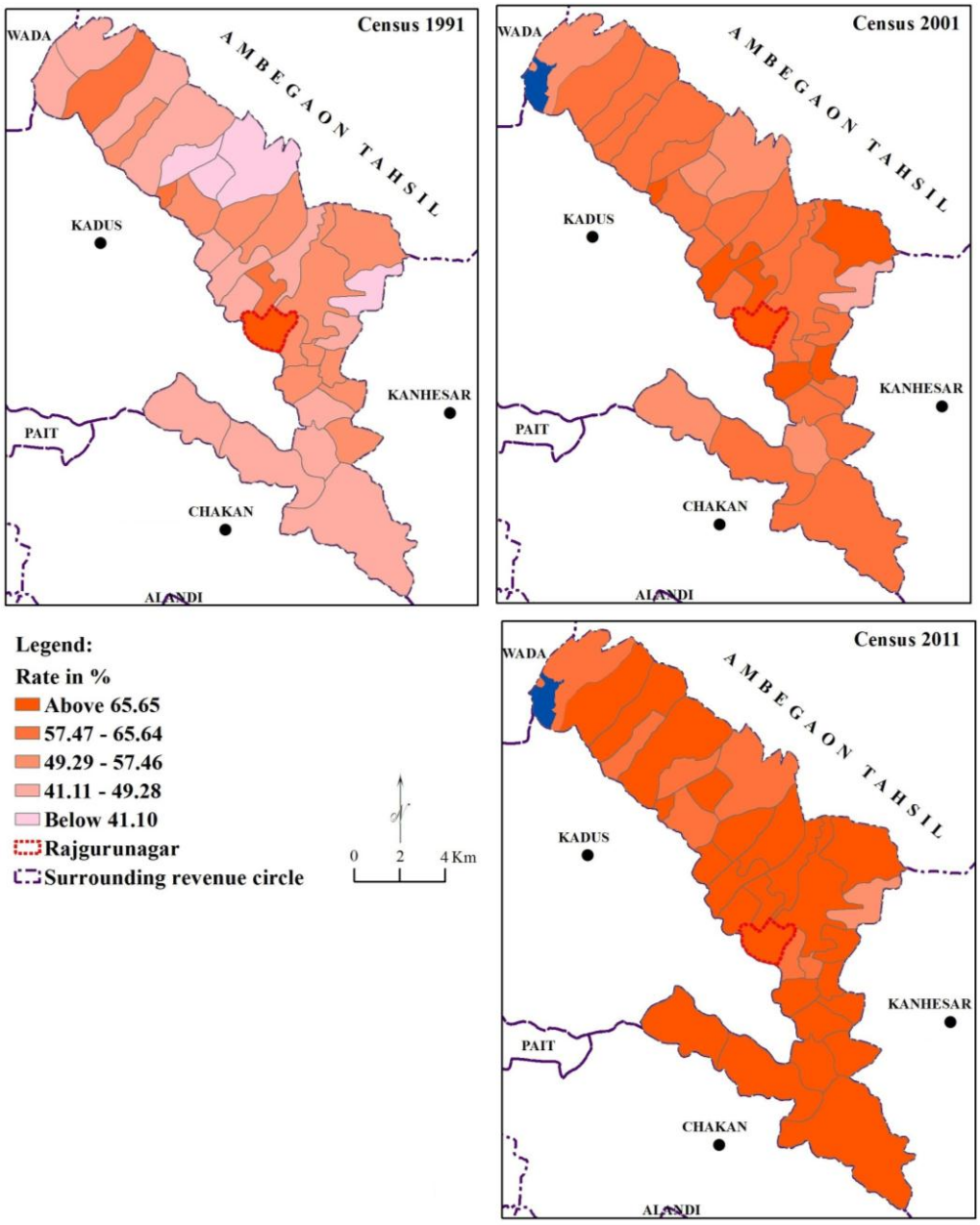

Figure 3.9 Literacy

3.2 Cropping pattern

Deep black soils with good water holding capacity are distributed in the eastern part of study region near to the Bhima and Bhama rivers. These soils are fertile than other soils like, red soil, clayey soil, etc. These soils are suitable for *Rabbi* and *Kharif* crops. Wheat, gram, *jowar*, maize, *bajra*, etc. are major crops in this area. The agricultural lands in the study area is converting into non-agricultural use in influence of urbanization and therefore, the cropping pattern in *Kharif* and *Rabbi* season has changed from 2001. In *Kharif* season, the area under total cereal crops and total pulses is decreased and area under total oil seeds, total cash crops and fodder crops is increased. The area under *jowar* and potato is also increased and wheat, maize and onion crops are decreased in *Rabbi* season. Total flower and total spices are also decreased in the study area. The more changes of cropping pattern are observed in the villages near to urban centres. The area under total cereals and total oil seeds is converted into the cash crop and flower (Table 3.2).

Table 3.2 Cropping pattern (1991-2011)

Census Years	**1991 (in %)**		**2001 (in %)**		**2011 (in %)**	
Crops	*Kharif*	*Rabbi*	*Kharif*	*Rabbi*	*Kharif*	*Rabbi*
Bajra	15.51	-	15.96	-	16.74	-
Rice	11.08	-	11.15	-	10.56	-
Jowar	-	24.55	-	26.75	-	28.66
Wheat	-	6.19	-	0.39	-	5.22
Maize	8.99	8.90	8.99	8.45	8.75	7.57
Other Cereals	1.20	1.57	0.90	0.60	0.66	0.04
Total Cereals	36.78	41.16	37.01	41.27	36.71	41.49
Ghewada	4.87	-	4.62	-	4.27	-
Wal	3.97	-	3.60	-	3.36	-
Pawata	2.74	-	2.63	-	2.40	-
Other Pulses	0.75	-	0.50	-	0.40	-

Total Pulses	12.32	4.91	11.35	4.09	10.43	3.44
Groundnut	15.82	-	15.89	-	16.93	-
Soyabeen	7.89	-	8.49	-	8.26	-
Other Oilseeds	0.66	-	0.39	-	0.34	-
Total Oilseeds	24.37	-	24.76	-	25.54	-
Onion	-	25.00	-	5.87	-	5.60
Potato	6.99	6.11	7.06	26.14	7.41	26.93
Vegetables	4.49	-	4.69	-	4.64	-
Other Chas crops	0.73	8.03	0.67	8.21	0.34	8.30
Total Cash crops	12.21	39.14	12.42	40.22	12.65	40.82
Total Animal Fodder Crops	13.04	9.74	13.23	10.14	13.58	10.43
Total Flower Crops	1.20	3.00	1.17	2.40	1.04	1.97
Total Spices Crops	0.06	2.06	0.06	1.87	0.07	1.84
Source: Khed Agriculture Department						

3.2.1 *Kharif* season

Bajra and rice are major crops in *Kharif* season in the region. The area under *bajra* has increased after 1991. Village, Kalus shows 24.05 % lands under *bajra*, Kalechiwadi shows 22.85% agricultural lands, Kadadhe shows 20.92% lands under *bajra* in 2011. On the other hand, western part of the region shows less area under *bajra* than rice in the villages like Akharwadi about 10.14% (Figure 3.10). In 2011, Kalus shows 16.94%, Varchi Bhamburwadi shows 14.50% and Kadadhe shows 14.04% NSA under rice (Figure 3.11). After 2001, the cropping area under maize and pulses decreased. The village Kalus shows 11.95% and Dhorewadi 15.38% area under maize and pulses crop in 2011. Some other villages have less area under maize is less than 5.34% (Figure 3.12) and area under pulses is less than 7.92% (Figure 3.13). Oil seeds is covered more area in Papalwadi (36.26%), Akharwadi (35.94%), Arudewadi (34.32%) lands and Takalkarwadi (33.53%) lands in 2011 compare to 1991 and 2001.

Very less area covered in village Pacharnewadi (16.67%) in 2011 (Figure 3.14). The area under cash crops and fodder crops is increased in study area after 2001. In 2011 cash crops covered more area in Rajgurunagar, Waki Bk, Kharpudi Bk and Manjarewadi (Figure 3.15). The more area under fodder is observed in the villages, Dhorewadi (23.08%) and Rakshewadi (22.35%) in 2011(Figure 3.16). The less area under fodder crops are shown in the villages, like Kaman (9.44%) and Kalus (8.62%).

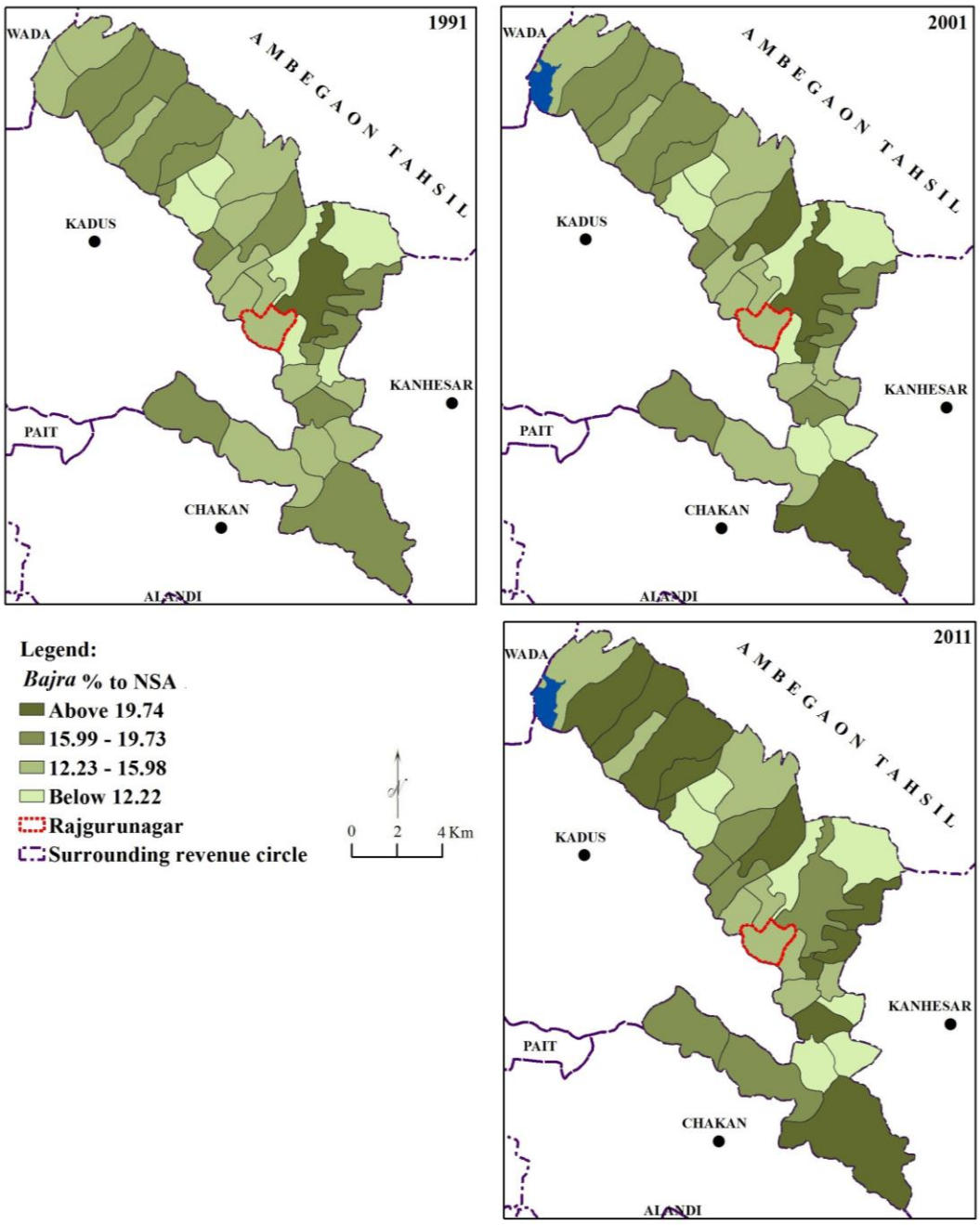

Figure 3.10 ***Bajra***

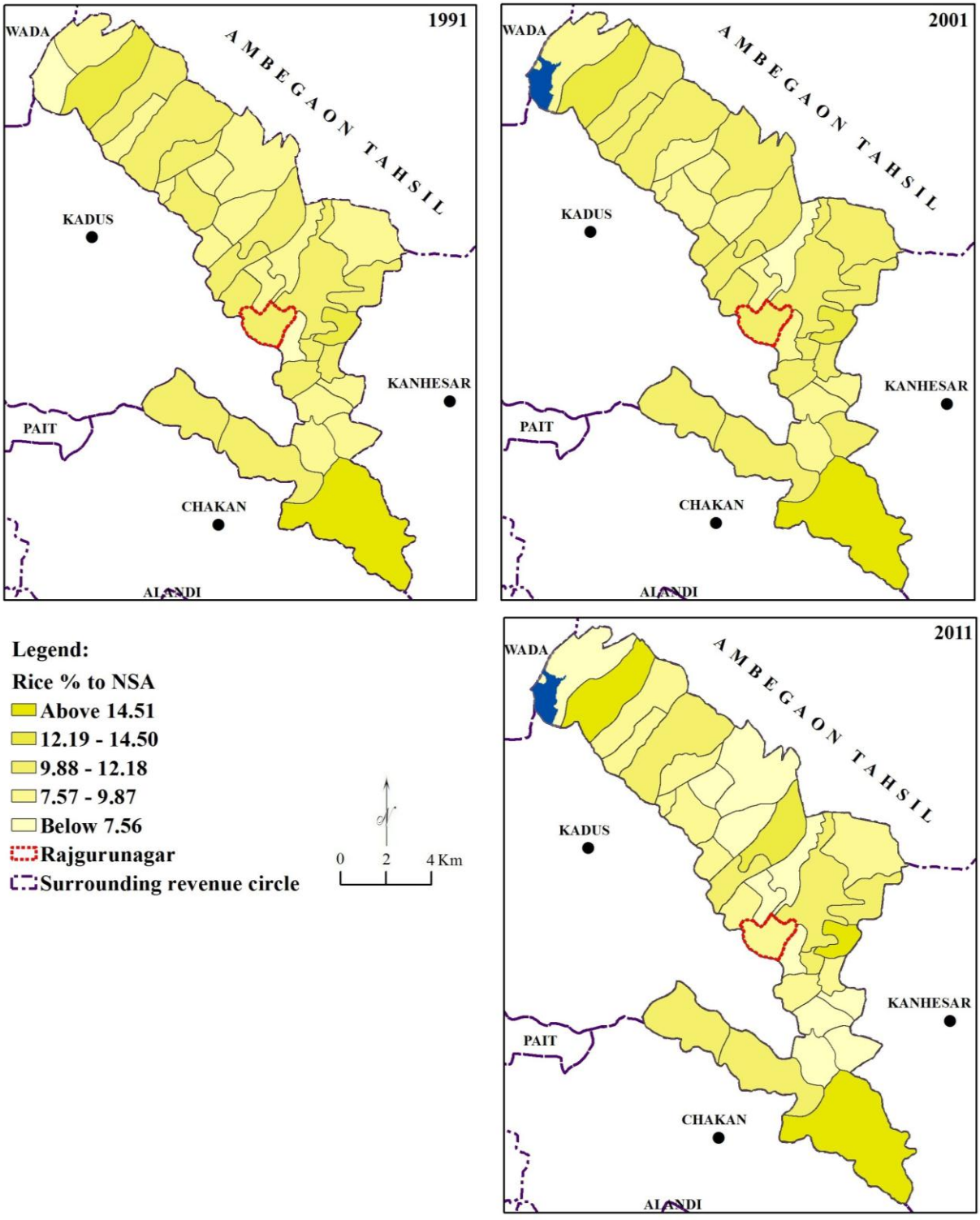

Figure 3.11 Rice

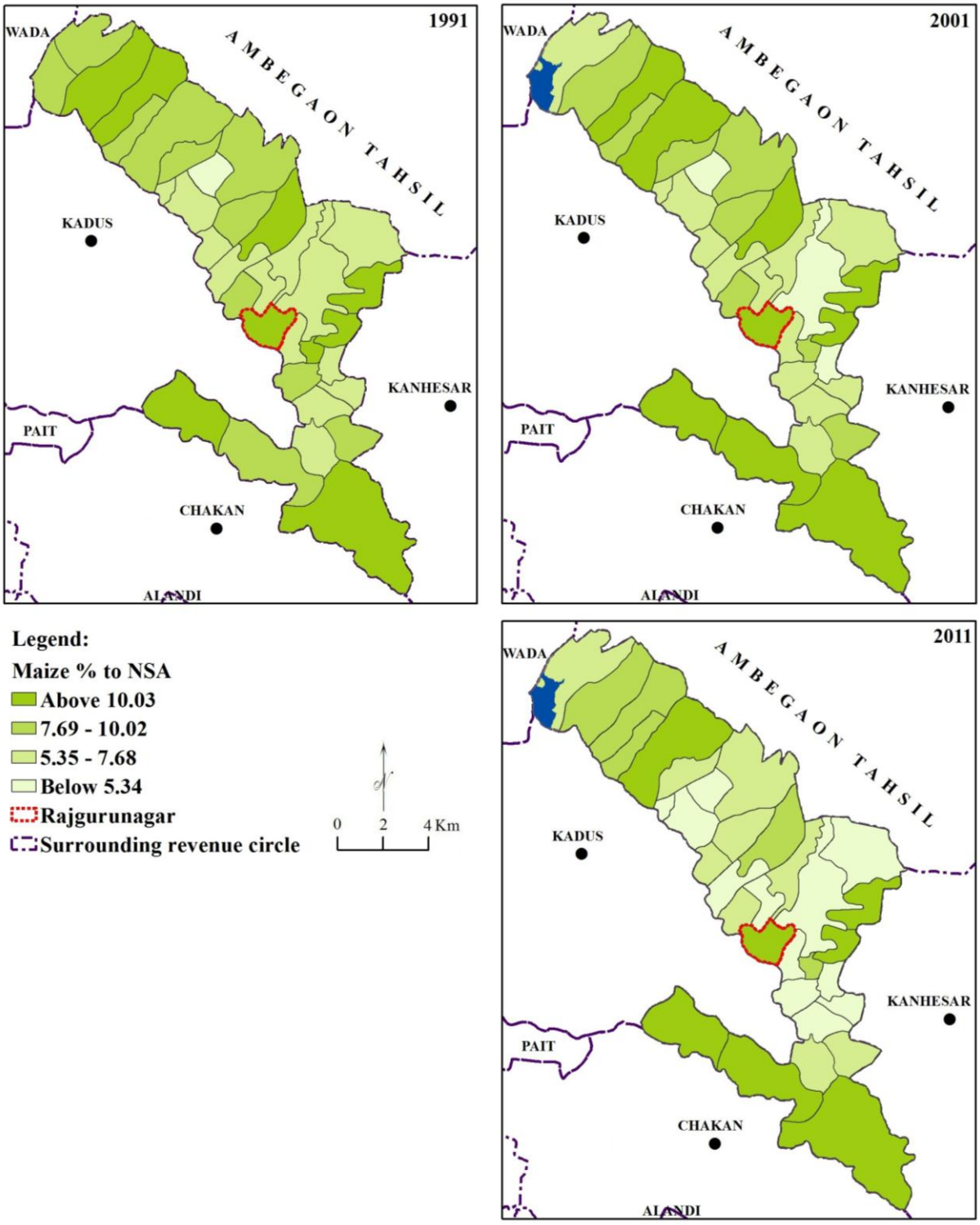

Figure 3.12 Maize

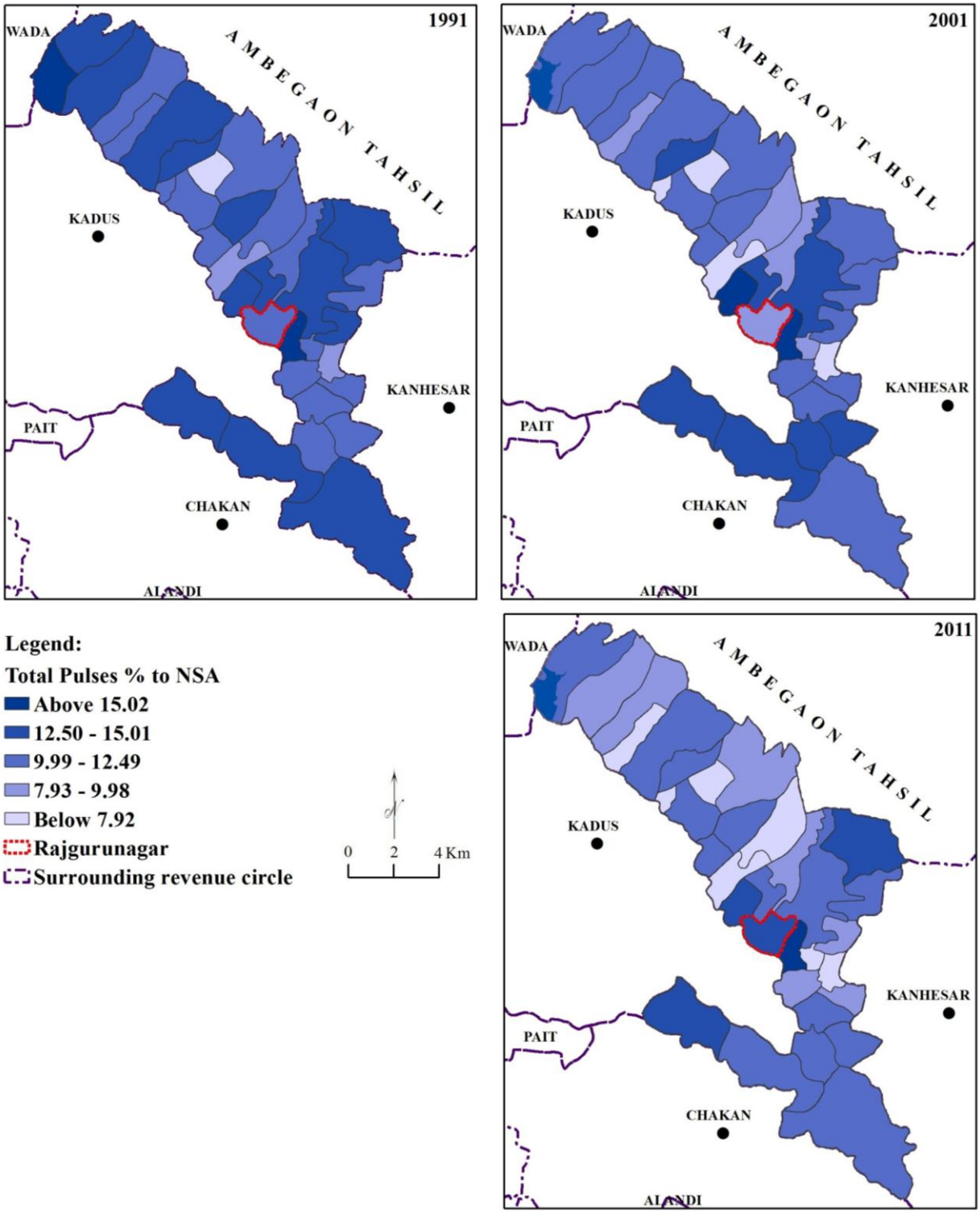

Figure 3.13 Toatal pulses

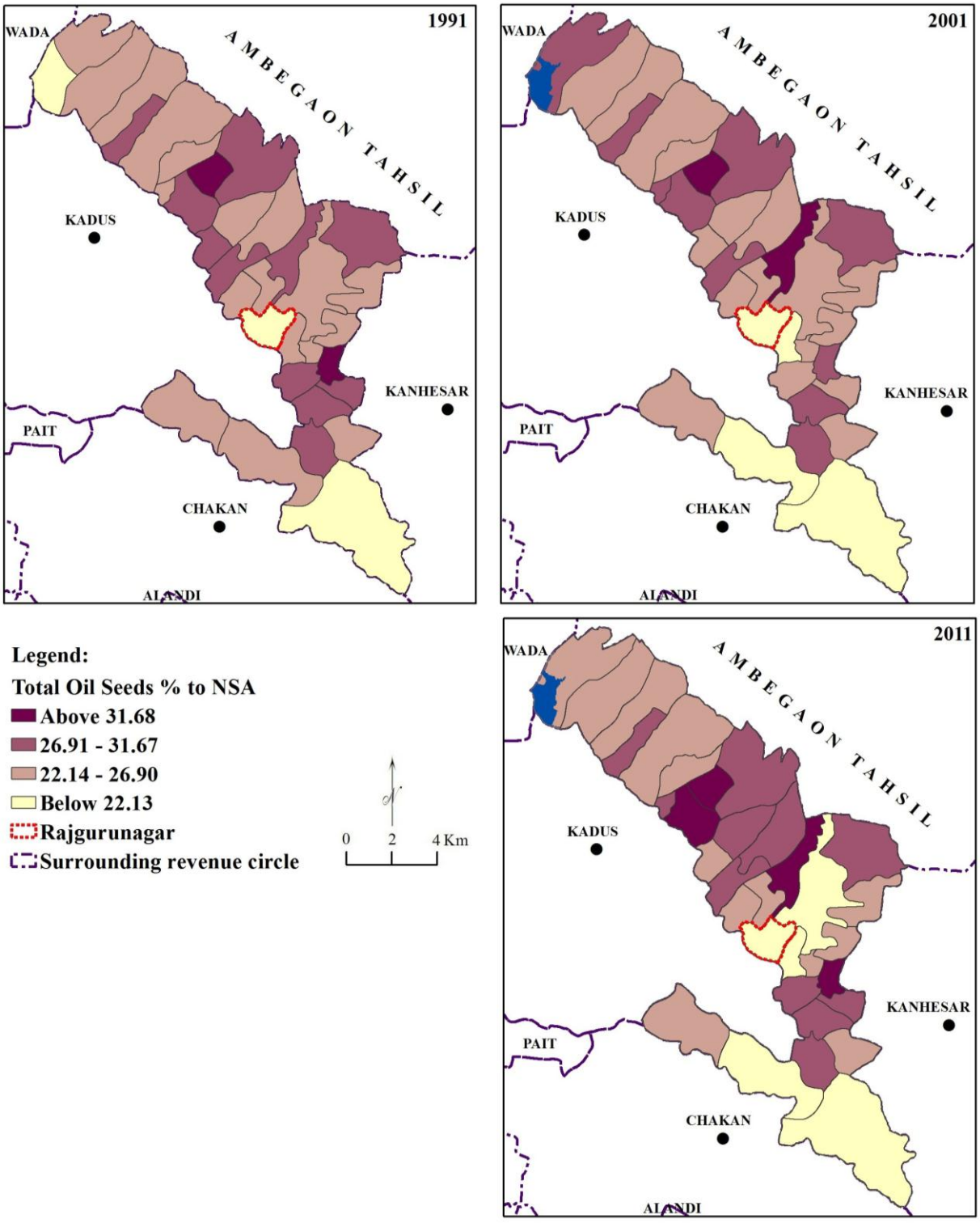

Figure 3.14 Total oil seeds

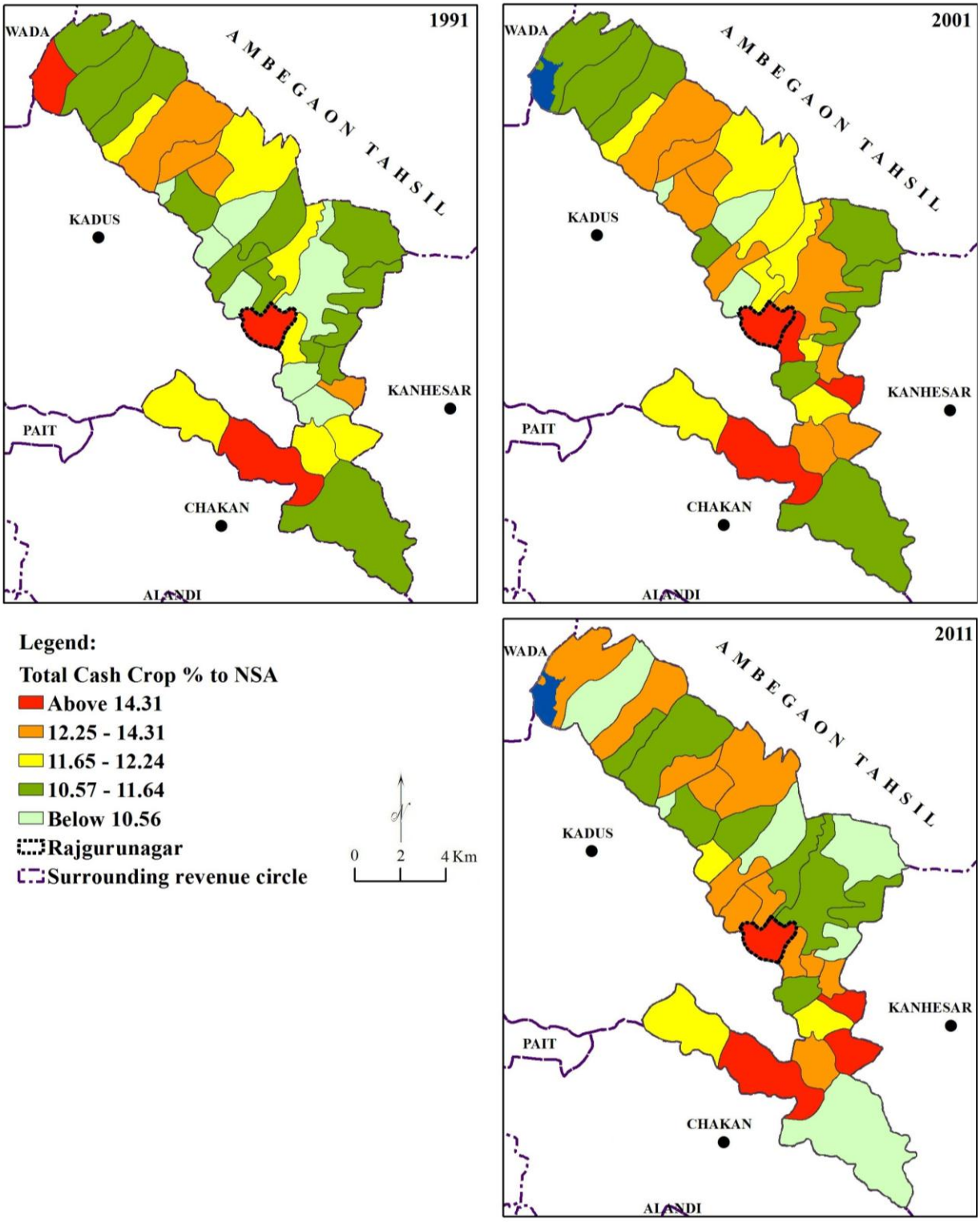

Figure 3.15 Total cash crops

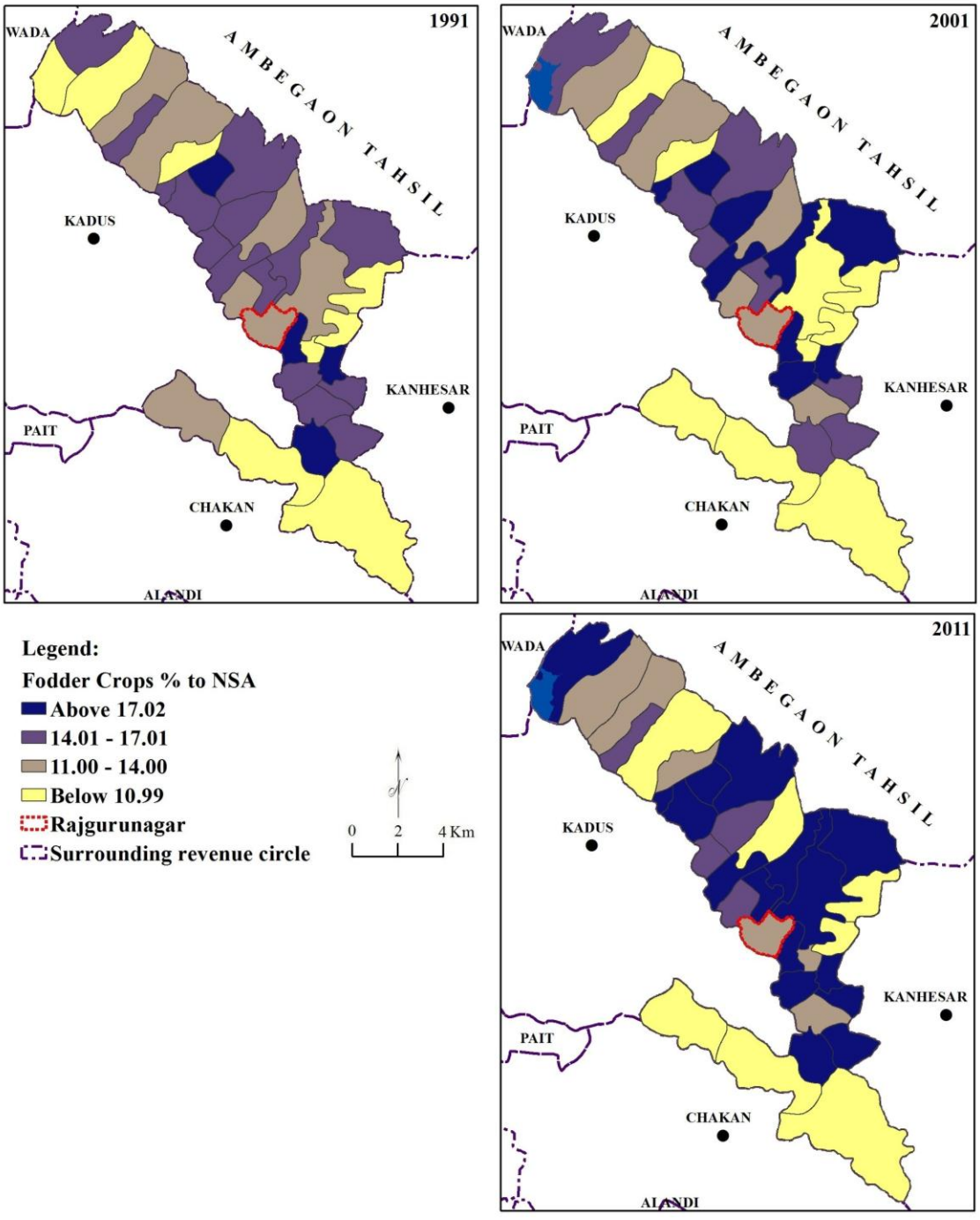

Figure 3.16 Fodder crops

3.2.2 *Rabbi* season

Jowar and wheat are the major crops in *Rabbi* season. In 1991, the area under *jowar* and wheat is very less in village Pimpari Bk (1.74%) and Butewadi (2.05%). After 2001, area under *jowar* crop increased in village Jaidwadi (87.79%), Mirjewadi

(70.30%), Bursewadi (66.39%) and Akharwadi (63.91%). Village like Pimpari Bk (1.59%) and Kharpudi Bk (3.03%) are decreasing trends in area under *jowar* (Figure 3.17). In 2011, village Pacharnewadi shows 20.62 %, Rakshewadi shows about 14.41% and Satkarsthal shows about 12.52% area under wheat (Figure 3.18). Onion and potato are also major crops in study area of *rabbi* season. The area under onion is slightly increased in 2011. The area under onion is increased in Bahirwadi to 65.31% of NSA after 2001 (Figure 3.19).

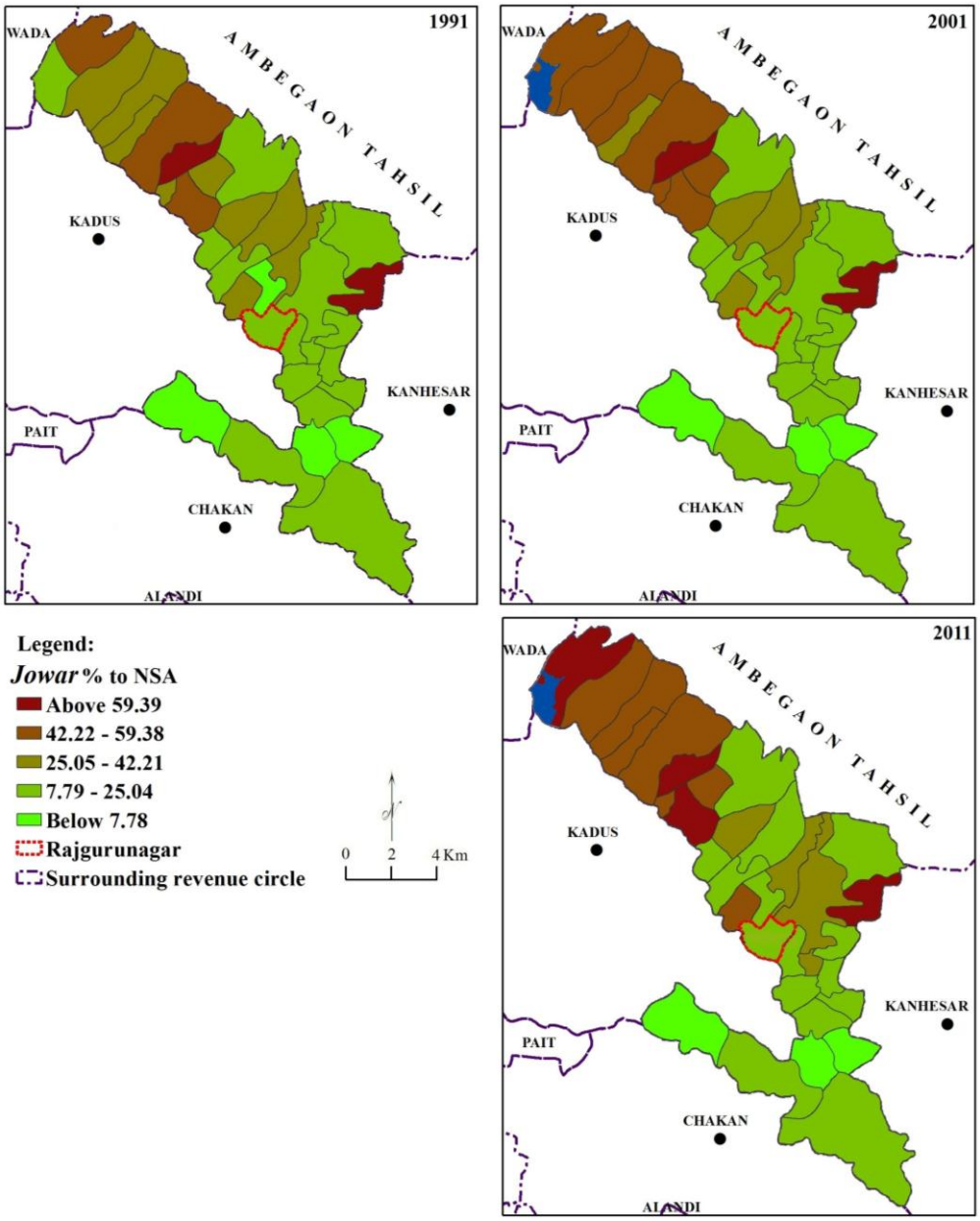

Figure 3.17 *Jowar*

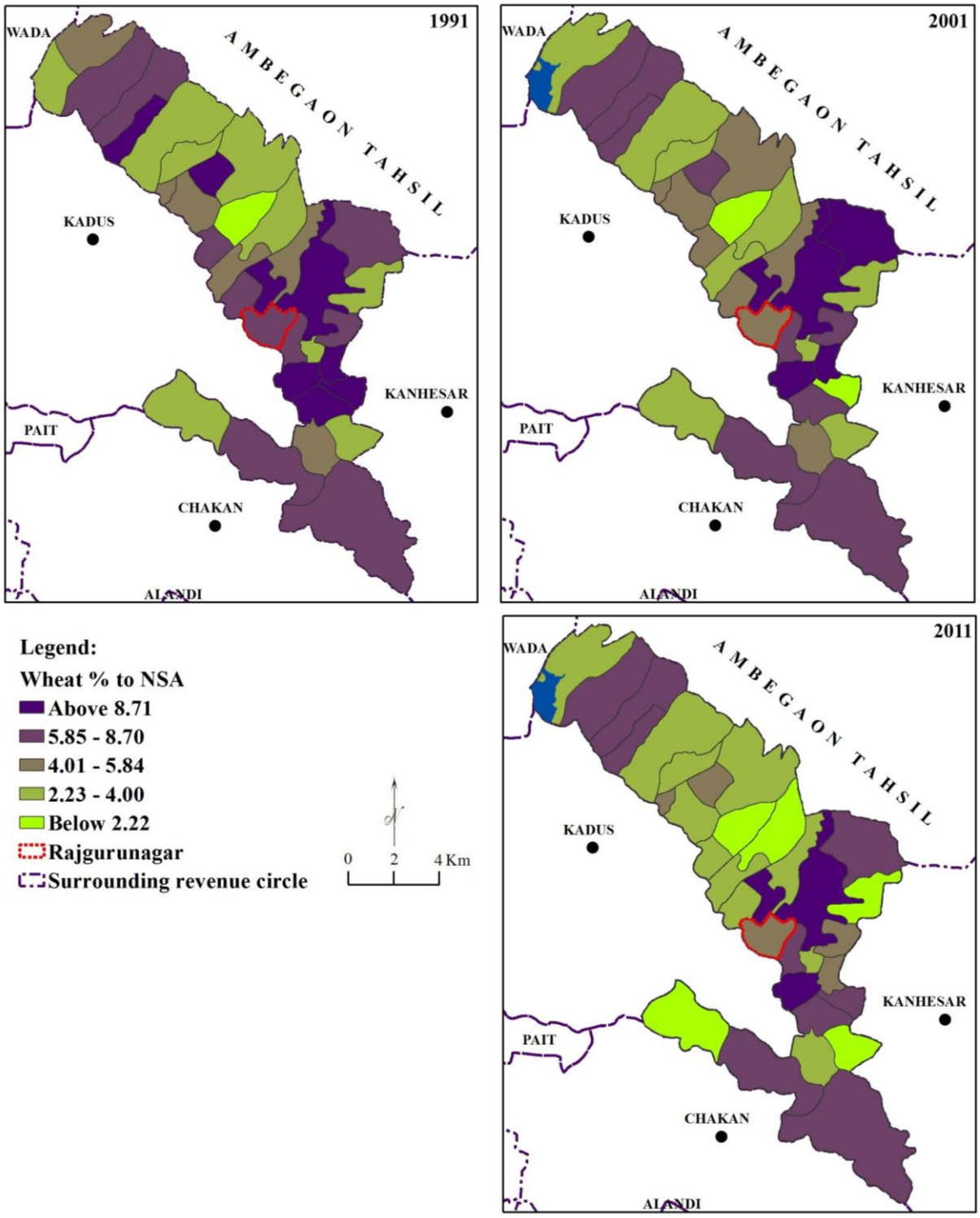

Figure 3.18 Wheat

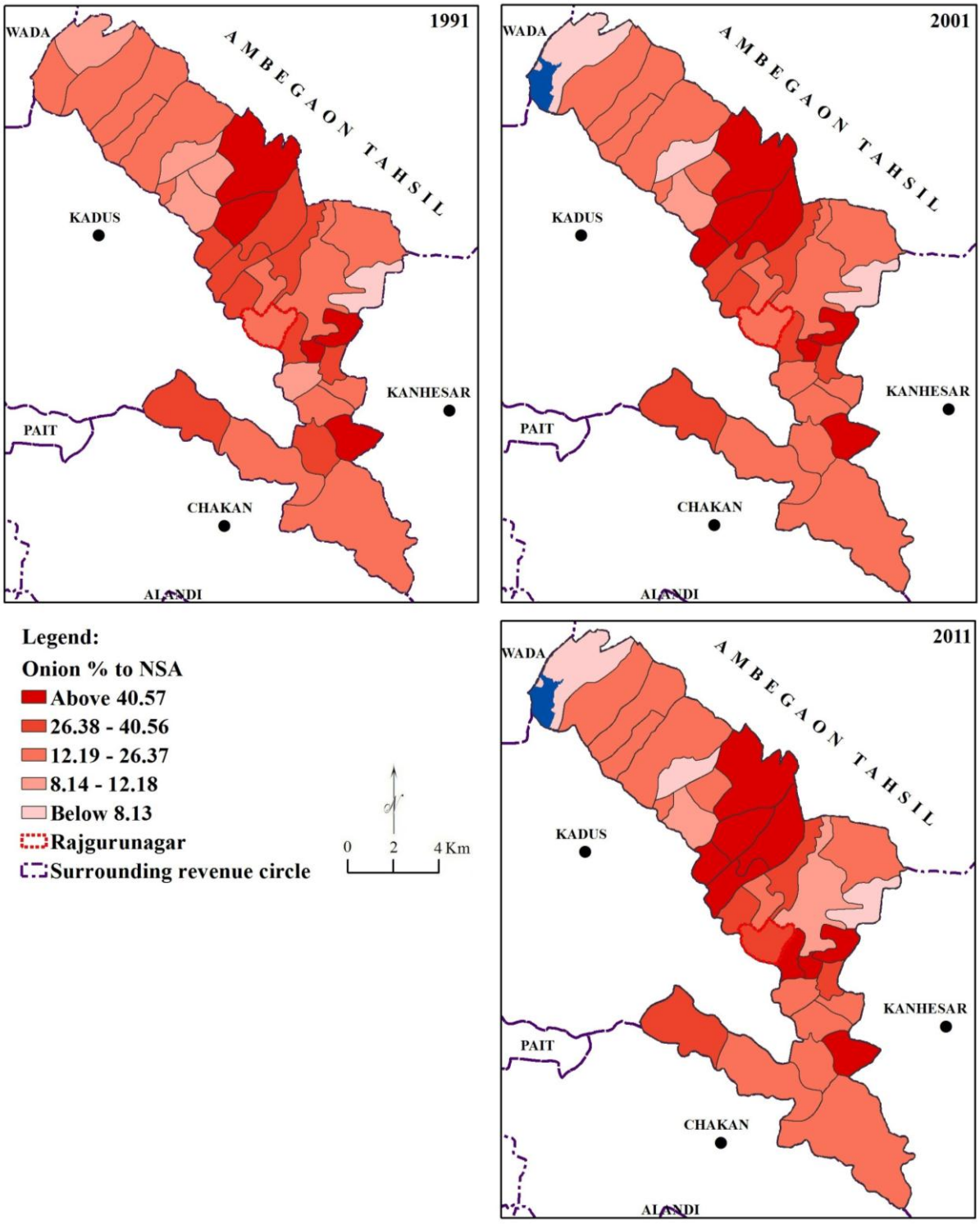

Figure 3.19 Onion

3.3 Resume`

Population characteristics and cropping pattern was calculated and plotted on the map to study the socio-economic profile of the study. The population densities of the villages near to the urban centres are increased in last decades. The urban centres have impact on not only distribution of human power but also sex ratio, male female power, literacy, standard of living, cropping pattern, etc. The crops like, *bajra, jawar* are decreasing trends and area under cash crops is increasing in these villages. Therefore, transformation and impact of this change on the proportion on cultivators is discussed in the next chapter.

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CHAPTER - IV

IMPINGEMENT ON CULTIVATORS

4.0 General

The changes in lifestyle and socio-economic activities during the process of urbanization indicate the areal growth (Yuan 2010). Submerge of fringe area into centre of urban area to become a part of urban core (Turker and Asik 2002). The present study area is passing through this process. Physiographic and socio-economic profile of the study area has been discussed in previous chapters. Distribution of land use/land cover, cropping pattern, distribution of population, cultivators, industrial and other workers are changed. This chapter focused on the explanations on the change in number of cultivators and there causes. Changes in agriculture land, cropping pattern, occupational structure and size of land holding are illustrated with the help of maps, graphs and correlation analysis.

4.1 Changes in number of cultivators

The distribution of cultivators has been changed from last decades, 1991, 2001 and 2011 in the process of impingement of urbanization on agricultural activities. Cultivators are transformed from agricultural activities to other economic activities after 2001 in the villages near to urban canters. Some of the villages like Bahirwadi, Akharwadi and Pangri have direct impact of urbanization and number of cultivators is decreasing with cultivable land. However, the villages like Mohakal, Chas, Pacharnewadi, Manjarewadi, Kalus, etc. show increase in number of cultivators continuously (Figure 4.1). The impact of urban centres like Chakan and Kadus have shown in the villages like Burasewadi, Kadadhe, Butewadi, Kohinkarwadi, Waki Bk,

etc. which number of cultivators changing irregularly. It shows land conversion in small holding size in such villages near to the urban centres.

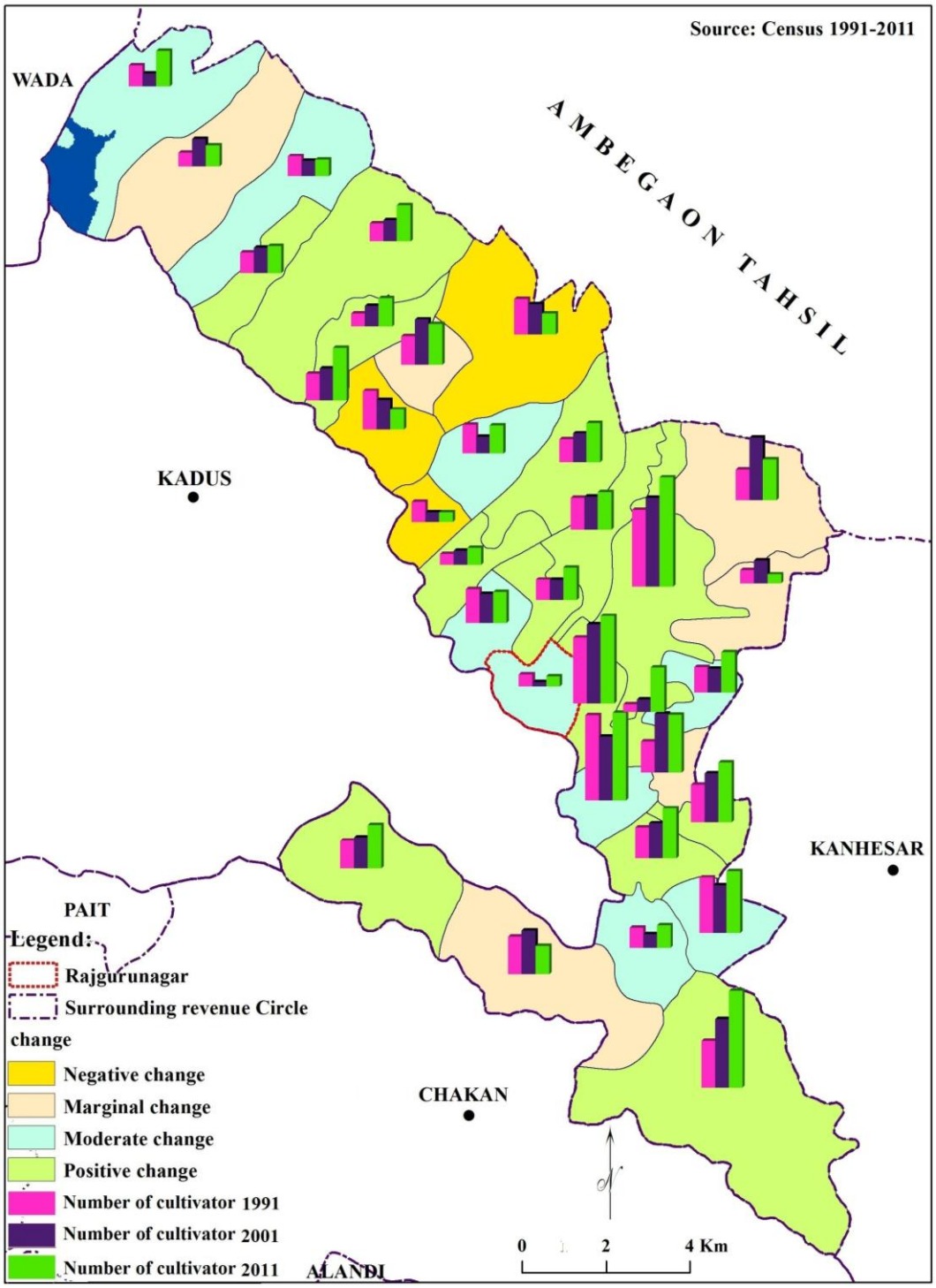

Figure 4.1 Changes in number of cultivators

4.2 Causes of changes in number of cultivators

The area under agricultural activities is decreasing continuously with the increasing non-agriculture use of lands after 1991. Non-agricultural use includes barren land, fallow land, settlement, etc. Conversion of agricultural lands into non-agricultural use shows impact on number of cultivators. These changes have relation with change in agricultural land, cropping pattern, occupational structure and size of land holdings in the decades, 1991, 2001 and 2011.

4.2.1 Change in the agriculture land

Agriculture land is decreasing after 2001 with changes number of cultivators (Figure 4.2). These types of changes have been observed in villages like located near to Rajgurunagar city area. The villages like Pacharnewadi, Arudewadi, Rakshewadi, dhorewadi, kalus, etc. show decrease in agriculture land but number of cultivators are increased in fragmentation of land. Whereas, villages like Bahirwadi, Akharwadi and Pangari show decrease in number of cultivators as well as agriculture lands. Pimpari Bk, Waki Bk, Kharpudi Bk, Kharpudi Kh, etc. show increase in number of cultivators.

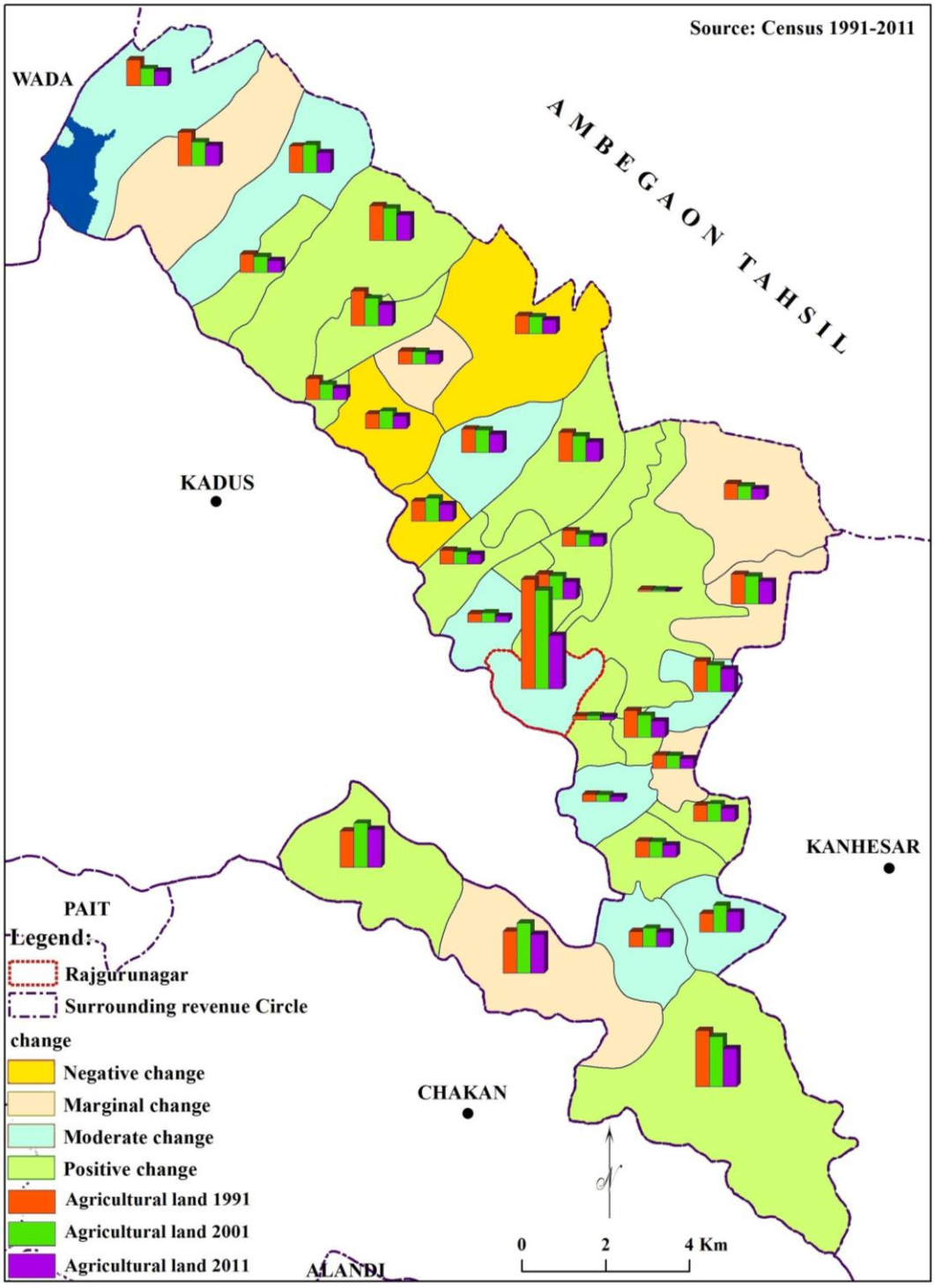

Figure 4.2 Change in the agriculture land

4.2.2 Change in cropping Pattern

The present study area mainly occupied with agriculture. However, this occupation is changing in the influence of urbanization. Urban area requires land for

industrialization, networking facilities, resources store and supply, etc. The changes in economic activities from agriculture to industrial sectors have impact on changes in cropping pattern in both *Kharif* and *Rabbi* season. The NSA of study area is decreased but farmers are using improved equipment, fertilizers, pesticides and irrigation facilities to maintain productivity (Table 4.1 and 4.2).

4.2.2.1 Cropping pattern in *Kharif*

Cropping pattern in *Kharif* season has slightly changed. Area under *Kharif* season was 14444 ha in 1991, 13456 ha in 2001 and 10033 ha in 2011. NSA decreasing with increasing productivity of oil seeds, cereals and cash crops, respectively. Groundnut and soyabean are oil seeds leading crops occupies 16.93% NSA (Table 4.1).

Table 4.1 Cropping pattern 1991-2011 (*Kharif*)

Crops	1991 (Area %)	2001 (Area %)	2011 (Area %)
Bajra	15.51	15.96	16.74
Rice	11.08	11.15	10.56
Maize	15.92	8.99	8.75
Total Cereals	36.78	37.01	36.71
Bean	4.87	4.62	4.27
String bean	3.97	3.60	3.36
Total Pulses	12.32	11.35	10.43
Groundnuts	15.82	15.89	16.93
Soyabeen	7.89	8.49	8.26
Total Oil Seed	24.37	24.76	25.54
Potato	6.99	7.06	7.41
Vegetables	4.49	4.69	4.64
Total Cash Crops	12.21	12.42	12.65
Fodder	13.04	13.23	13.58
Flowers	1.20	1.17	1.04
Spices	0.06	0.06	0.07

Source: Agricultural Census data

The net sown area under *bajra* crop is also increased from 1991 to 2011. The area under *bajra* was 15.51% in 1991, 15.96% in 2001 and 16.74% in 2011. Rice (10.56%), Maize (8.75%), Flower (1.04%), Bean (4.27%) and spring bean (3.36%) crop area is decreased after 1991(Figure 4.3). The area under fodder and total cash crops increased largely due to dairy farming near to urban markets. In 1991, fodder crop was 13.04%, in 2001 13.23% and in 2011it was 13.58%. The area under cash crops was 12.21% in 1991, 12.42% in 2001 and 12.65% in 2011. These transformations of *Kharif* crops show positive preference of cultivators to *bajra*, cash crops and fodder crops.

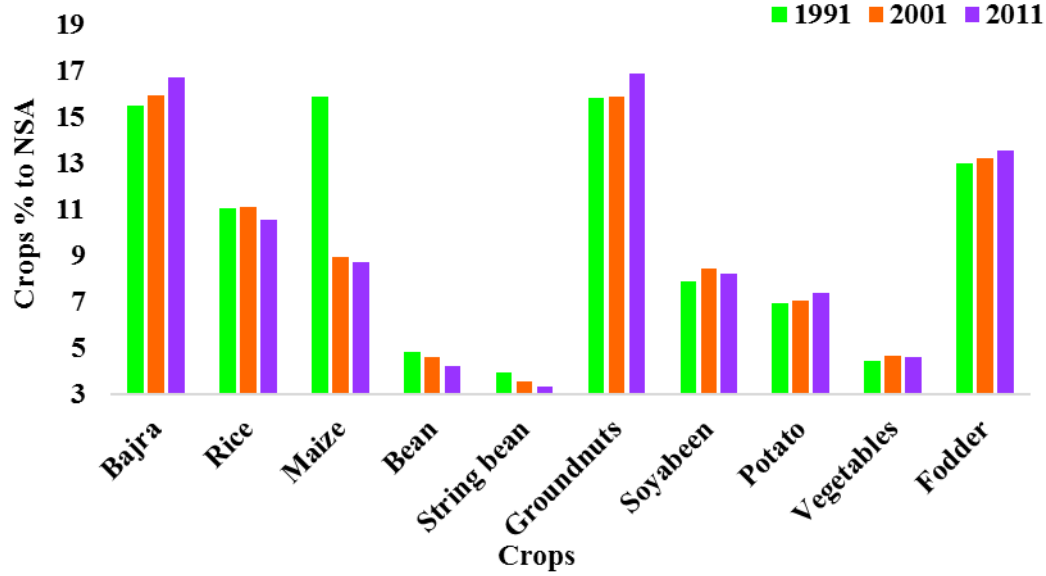

Figure 4.3 Cropping Pattern 1991-2011 (Kharip)

4.2.2.2 Cropping pattern in *Rabbi*

The same transformation has been observed in *Rabbi* crops also. Net sown area of this region is decreased with increasing productivity of *jowar*, cash crops and fodder crops (Figure 4.4).

Table 4.2 Cropping pattern 1991-2011 (*Rabbi*)

Crops	1991	2001	2011
Jowar	24.55	26.75	28.66
Wheat	6.19	5.50	5.22
Maize	8.90	8.45	7.57
Total Cereals	41.16	41.27	41.49
Total Pulses	4.91	4.09	3.44
Onion	25.00	26.14	26.93
Potato	6.11	5.87	5.60
Total Cash Crops	39.14	40.22	40.82
Fodder	9.74	10.14	10.43
Flowers	3.00	2.40	1.97
Spices	2.06	1.87	1.84

Source: Agricultural Census data

Jowar is a major cereal crop in *Rabbi* season. The area under *jowar* has increased to 24.55% in 1991, 26.75% in 2001 and 28.66% in 2011. Onion has covered second largest area (26.93%) with increasing productivity (Figure 4.4). The area under wheat (5.22%), maize (7.57%), potato (5.60%), flower (1.97%) and spices (1.84%) has been decreased in this period (Table 4.2). Farmers of the region give importance to cereals, fodder and cash crops largely to supply the fresh vegetables, flowers, milk product, etc. to urban centres.

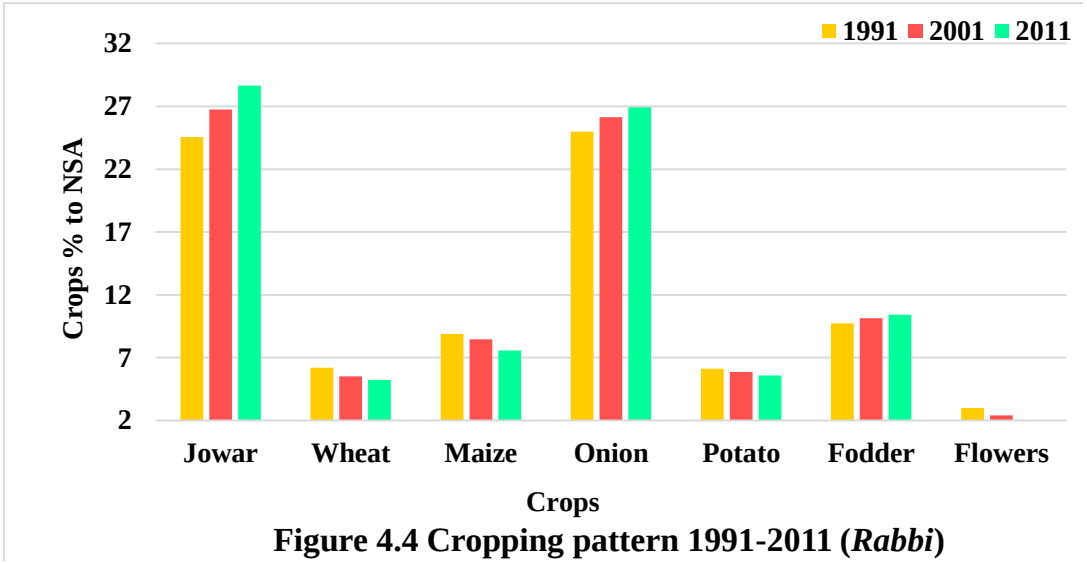

Figure 4.4 Cropping pattern 1991-2011 (*Rabbi*)

4.2.3 Change in occupational structure

Trend of occupation shows the direction and dimension of growing urbanization. The study of change in agricultural land and cropping pattern indicate the occupation structure of the study area which is also changed from 1991 to 2011. This occupational change has occurred due to the impact of increasing literacy, navigational network, industries, lifestyle, etc. Therefore, cultivators are moved in household industry and other occupation.

4.2.3.1 Household industry workers

Household industry is defined as an industry conducted by one or more members of the household at home or within the village and only within the precincts of the house where the household lives in urban areas (census 2011). People are engaged in making food products, weaving, sewing, gardening, etc. The numbers of household industry workers was very large in Kharpudi Kh (5.89%), Dhorewadi (4.66%) and Akharwadi (4.32%) in 1991. It's trends has suddenly decreased in 2001 and 2011 with increase in cultivators (Figure 4.5). The villages like Rakshewadi (2.83%), Pacharnewadi (2.32%), Kalechiwadi (2.01%) and Chas (2.55%) have more industrial workers as well as number of cultivators in 2011 with influence of urbanization at Rajgurunagar city area. Waki Bk, Kalus, Akharwadi, Pangari and Kharpudi Kh villages show decresing trend in household industry workers because the people of these villages are engaged in urban activities in near by cities.

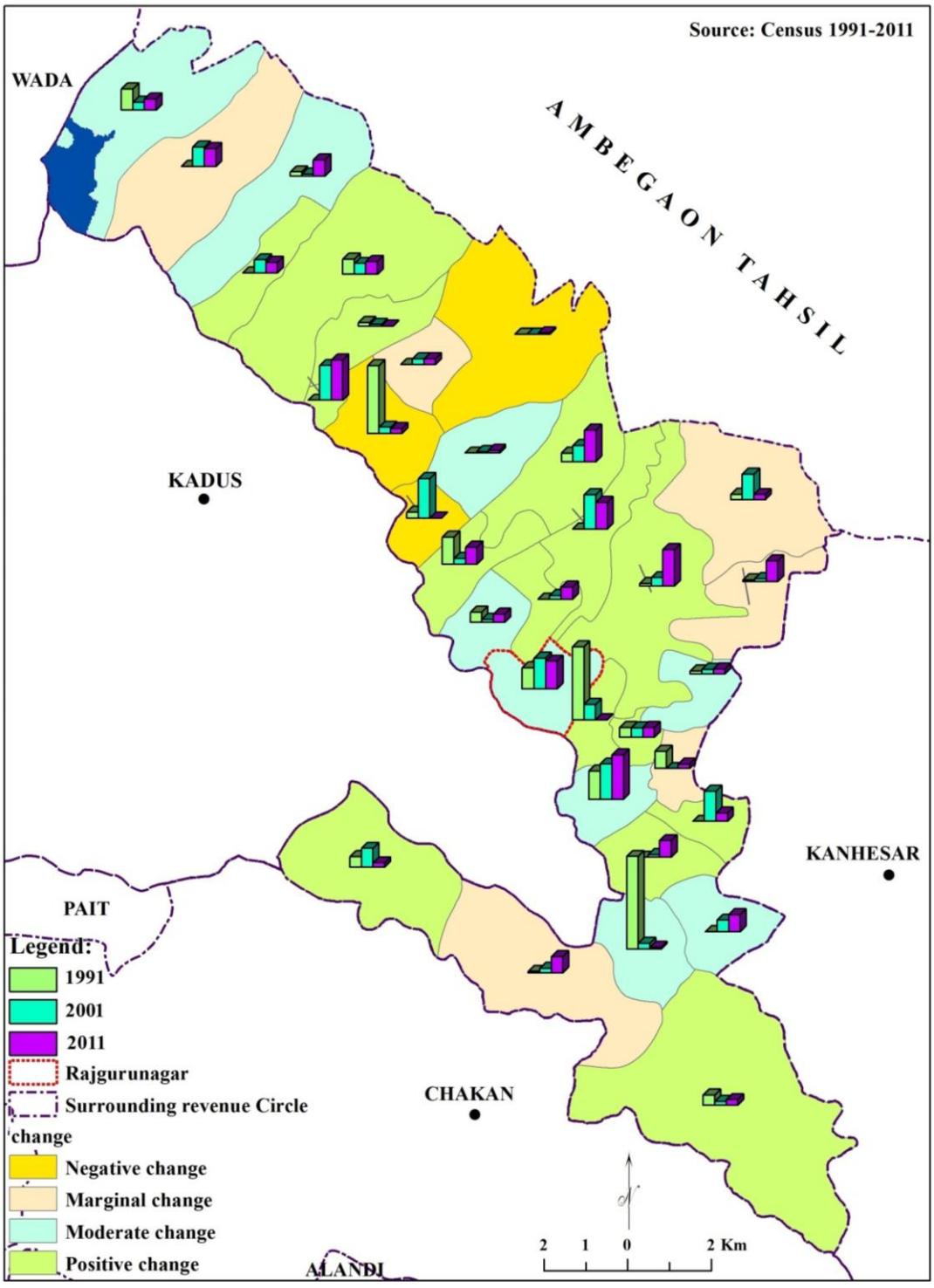

Figure 4.5 Household industry workers

Education and trainings for skills motivate to male and female young generation to shift from traditional activities to non-agricultural economical activities and industrial service sectors. Literate people attract for high living urban lifestyle and

higher income jobs. The correlation between literacy and total household workers in 1991 show no relation but relationship between them increased in 2001 r = 0.396 at 0.05 (95%) and 2011 r = 0.373 at 0.01 (97%) confidence level. These sectors of the economy of the region increased in last decades (Table 4.3).

Table 4.3 Literacy correlation with total household workers

Lit. Rate/Total Household Workers	1991	2001	2011
Lit. Rate 1991	0.070	.464**	0.325
Lit. Rate 2001	0.009	**.373***	.353*
Lit. Rate 2011	-0.066	.446**	**.396***
**. Correlation is significant at the 0.01 level (2-tailed).			
*. Correlation is significant at the 0.05 level (2-tailed).			

4.2.3.2 Total other workers

Other workers include workers who engaged in other economic activities during last one year, but they are not cultivators, nor agricultural labours or household workers (census 2011). In 1991, other workers are very less in study area and increased rapidly in villages like Satkarsthal, Rakshewadi, Pacharnewadi, Waki Bk, etc. near to industrial sectors like Chakan and Rajgurunagar (Figure 4.6).

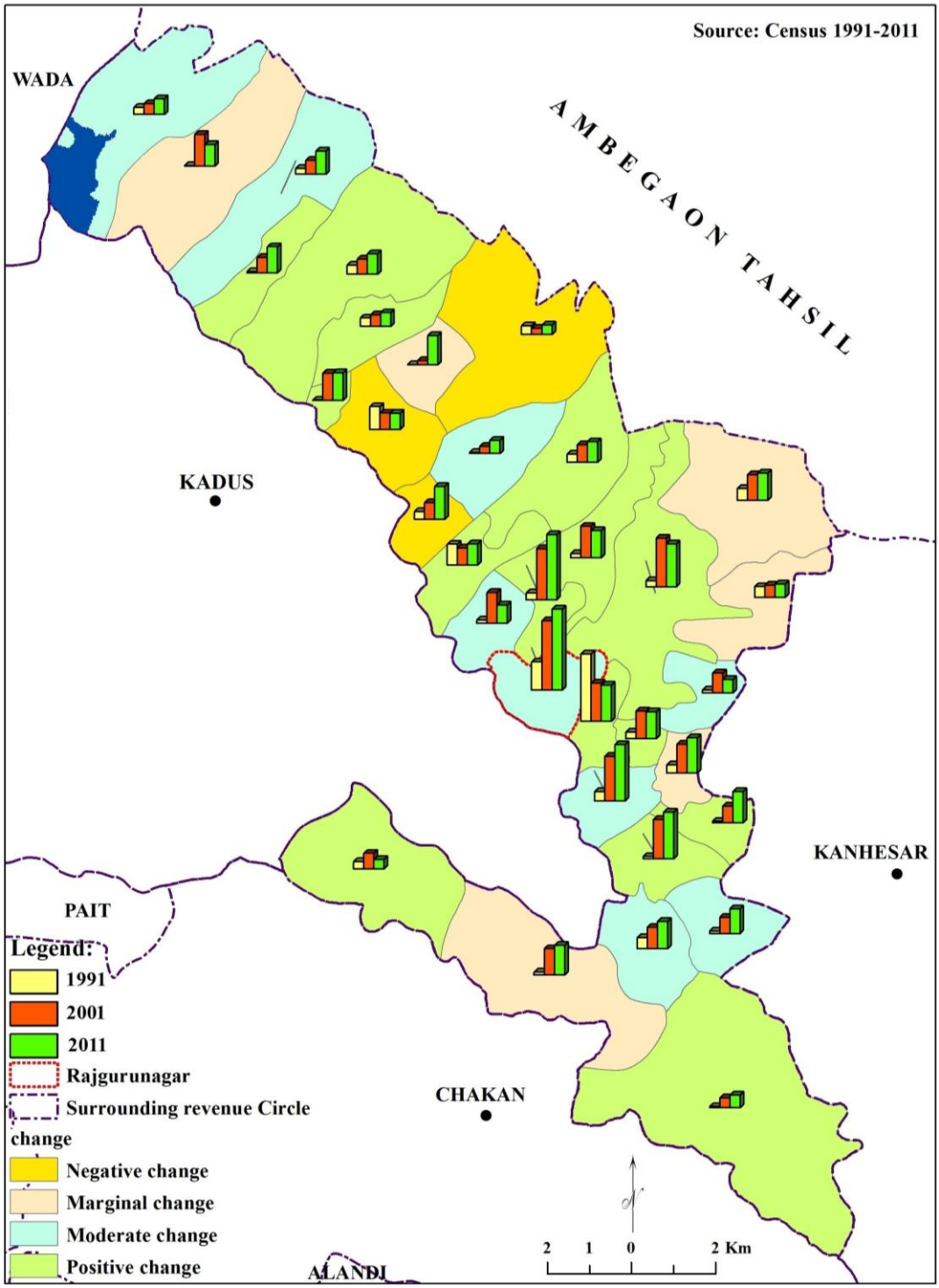

Figure 4.6 Total other workers

This changes are indicated in correlation analyses total other workers and literacy rate in 2001 (0.753) and 2011 (0.709) (Table 4.4). It means that the number of

total other workers increases with increasing literacy in the population. These changes are impact of transformation in population characteristics due to urban changes.

Table 4.4 Literacy correlation with total other workers

Lit. Rate/Total other workers	1991	2001	2011
Lit. Rate 1991	0.212	.708**	.689**
Lit. Rate 2001	0.155	**.709****	.735**
Lit. Rate 2011	-0.053	.604**	**.753****
**. Correlation is significant at the 0.01 level (2-tailed).			
*. Correlation is significant at the 0.05 level (2-tailed).			

4.2.4 Change in size of land holding

Another transformation has calculated to know the impact of urban growth on agricultural land and imbalance in cultivators' proportion. Class-wise cultivable land and number of cultivators represent the land under agricultural activities dividing with the increasing number of cultivators from 1991 to 2011. It means that the owner of agricultural land again dividing existing land and giving them to next generation i.e. son, daughter or relatives, etc.

Table 4.5 Cultivators and cultivable land classes distribution (1991 - 2011)

Land Classes	1991 %		2001 %		2011 %	
	Cultivators	Area ha	Cultivators	Area ha	Cultivators	Area ha
< 0.5	67.84	23.64	75.08	30.07	77.46	36.32
0.5-1	14.32	12.75	11.92	12.07	11.57	15.26
1-2	8.09	14.41	5.01	10.16	5.76	15.20
2-3	3.81	11.30	2.86	9.66	2.45	10.76
3-4	2.55	10.59	1.85	8.77	1.38	8.48
4-5	1.36	7.29	1.46	8.86	0.78	6.19
5-7.5	0.95	7.05	0.96	8.08	0.41	4.49
7.5-10	0.69	7.15	0.60	7.09	0.18	2.70
10-20	0.33	5.82	0.26	5.24	0.02	0.60
> 20	0.00	0.00	0.00	0.00	0.00	0.00
Source: Agricultural Census Department, Pune						

About 67.84% farmers in the study area had agricultural land less than 0.5 ha with 23.64% ha area in 1991, 75.08% of farmers had 30.07% ha area in 2001 and 77.46% farmers had 36.32% ha area in 2011(Table 4.5). The farmers categories from 0.5 to 1.0 ha and more show agricultural land reduced from 1991 to 2011 (Figure 4.7). This study area transforming their traditional structure to modern urbanization interface slowly.

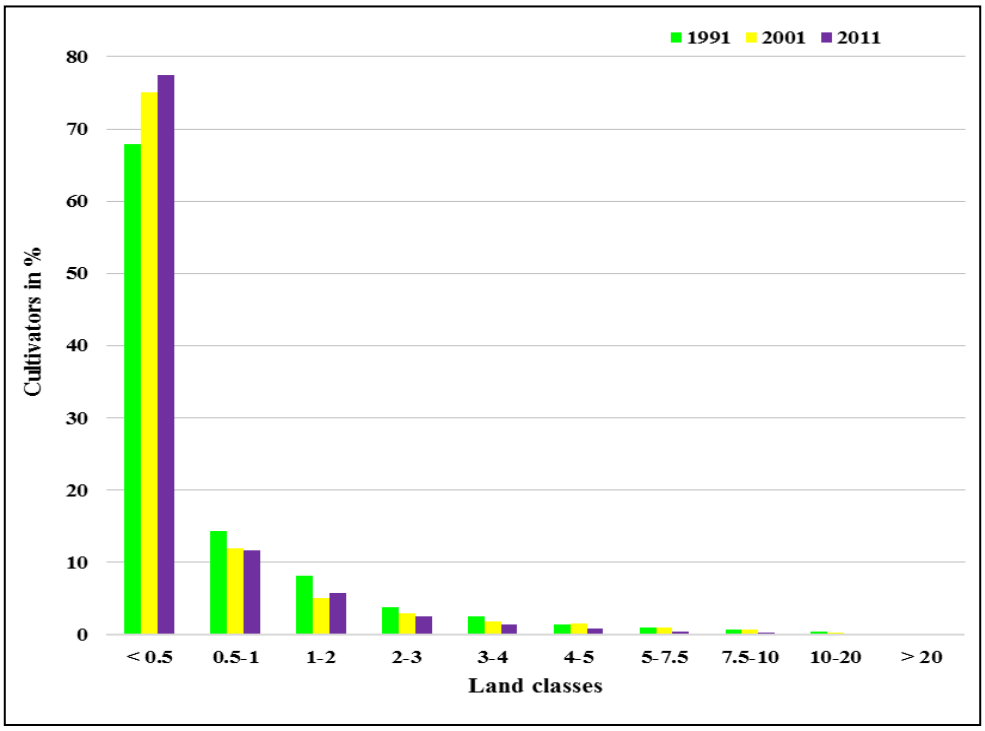

Figure 4.7 Distribution of cultivators (1991-2011)

The number of cultivators from the categories of large land holding and number of cultivators are reducing in fragmentation, land selling, converting agricultural land into non-agricultural land, etc.

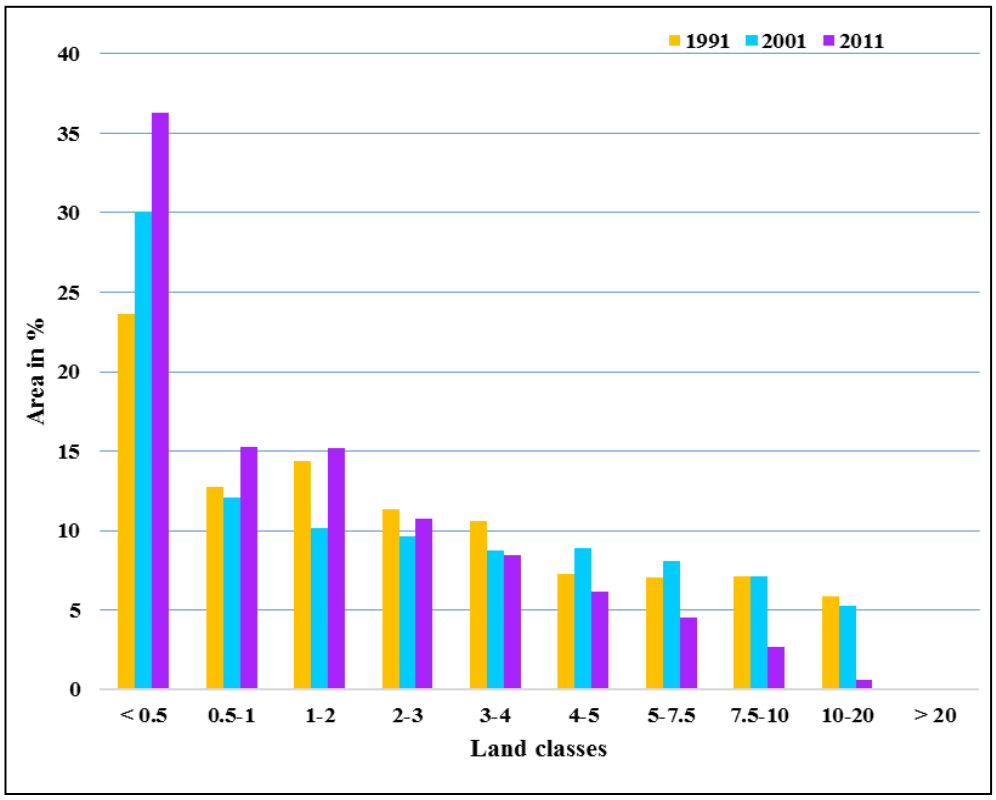

Figure 4.8 Distribution of cultivativated area (1991-2011)

The agricultural land (Figure 4.8) transformed from the highest class (>20 ha) to the lowest class (<0.5 ha). Size of land holding and farmers is decreasing decade by decade. The number of farmers with small holding increases and size is decreased to less than 0.5 ha. In addition to that non-agricultural land use is increasing with faster rate and making pressure on land.

4.3 Farmers' views on land transformations

Among total 34 villages in the study area 4 villages were selected to gather the farmers views on land transformation distributed within the classes indentified according to changes in number of population. About 10% farmers have been interviewed (Table 4.6) with prepared questionnaire (appendix 2).

Table 4.6 Random sample selection for interview

Sr. No.	Change	Sample Villages	Total Population**	Total Cultivators**	Sample interviewers*
1	Positive change	Pacharnewdi	777	226	23
2	Negative change	Bahirwadi	1096	234	23
3	Marginal change	Kadhade	3339	341	34
4	Moderate change	Rakshewadi	5903	1338	134
**.Total population, Total cultivator taken from census 2011 data					
*.Stratified Sample interviewers selected 10% from each village					

Table 4.7 Farmers' views on land transformations

Questions	Sample Villages	Pacharnewadi (%)	Bahirwadi (%)	Kadhade (%)	Rakshewadi (%)
Agriculture Land ownership	Main Cultivator	52.17	34.78	44.12	56.72
	Marginal Cultivator	34.78	43.48	38.24	29.85
	Others	13.04	21.74	17.65	13.43
Agriculture land brought From	Inheritance	34.78	47.83	52.94	50.75
	Purchase	43.48	34.78	29.41	7.46
	Both	21.74	17.39	17.65	41.79
Main occupational importance	Cultivation	60.87	43.48	47.06	43.28
	Non-agriculture	39.13	56.52	52.94	56.72
Side Occupation	Dairy Farming	43.48	39.13	35.29	26.12
	Poultry	34.78	8.70	14.71	9.59
	Household Industry	21.74	52.17	50.00	64.93

4.3.1 Agriculture land ownership

Main cultivators in Pacharnewadi village owned 52.17% agricultural land, marginal cultivators 34.78 % and others 13.04%. Bahirwadi show main cultivators (34.78%) and other people (21.74%) own less agricultural land compare to marginal cultivators (43.48%). Agricultural land ownership in Kadhade village belongs to main cultivators (44.12%), marginal cultivators (38.24%) and other people (17.65%).

Rakshewadi show main cultivators have 56.72% land, marginal (29.85%) and others 13.43% (Figure 4.9). Thus, ownership of the agricultural lands in the region belongs to the main cultivators. However, it is notable that the ownership is transforming to other people with alarming rate.

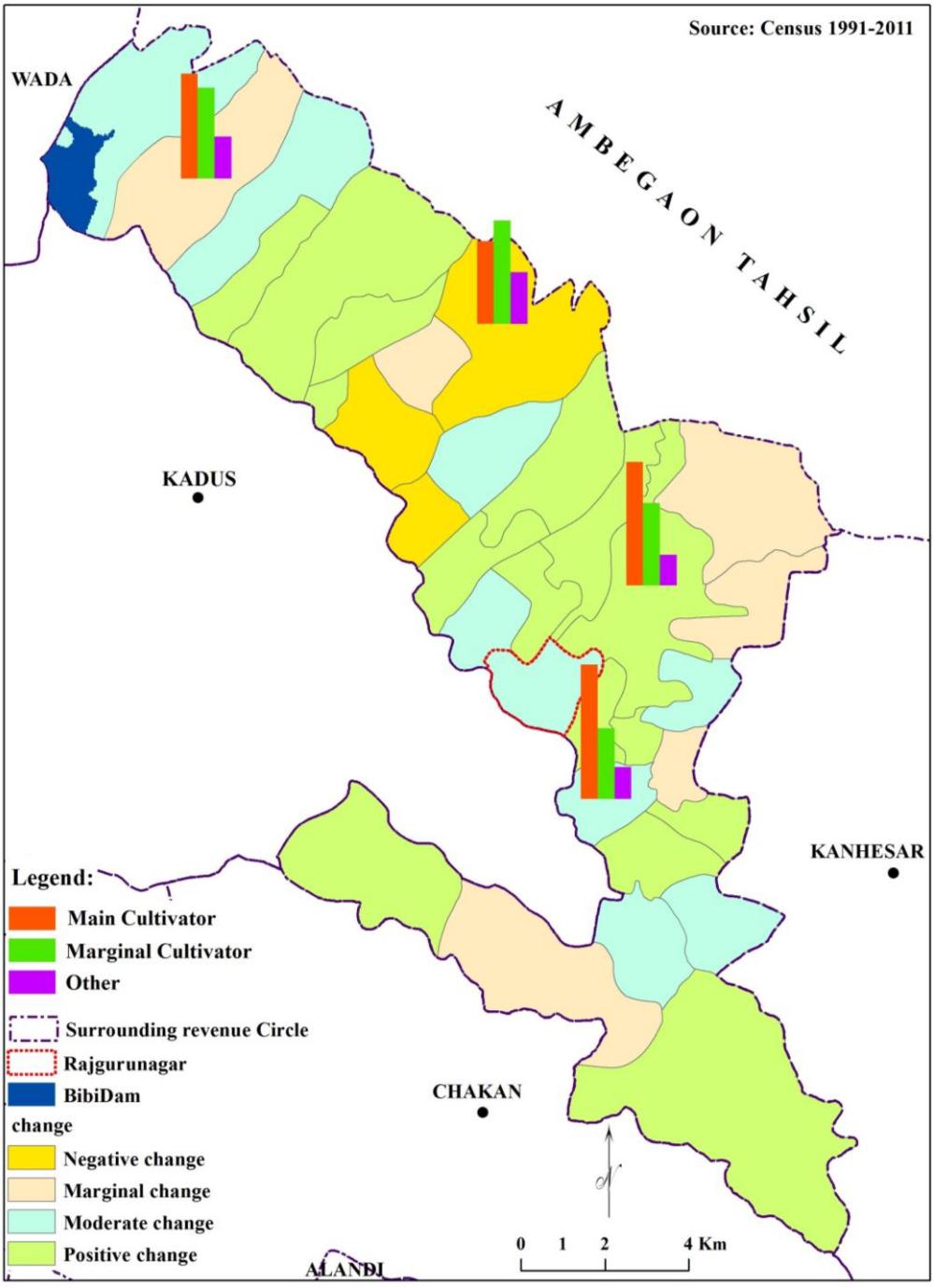

Figure 4.9 Agriculture land ownership

4.3.2 Source of ownership transformations

The land ownership can be transformed through in inheritance, selling, grabbing, etc. Most of the respondent shows that they have own land received from their ancestries in inheritance. Some of them have purchased agricultural land from other cultivators. This type of transformation observed with higher proportion in villages like Pacharnewadi (43.48%) and Rakshewadi (41.79%) near to urban centre (Figure 4.10).

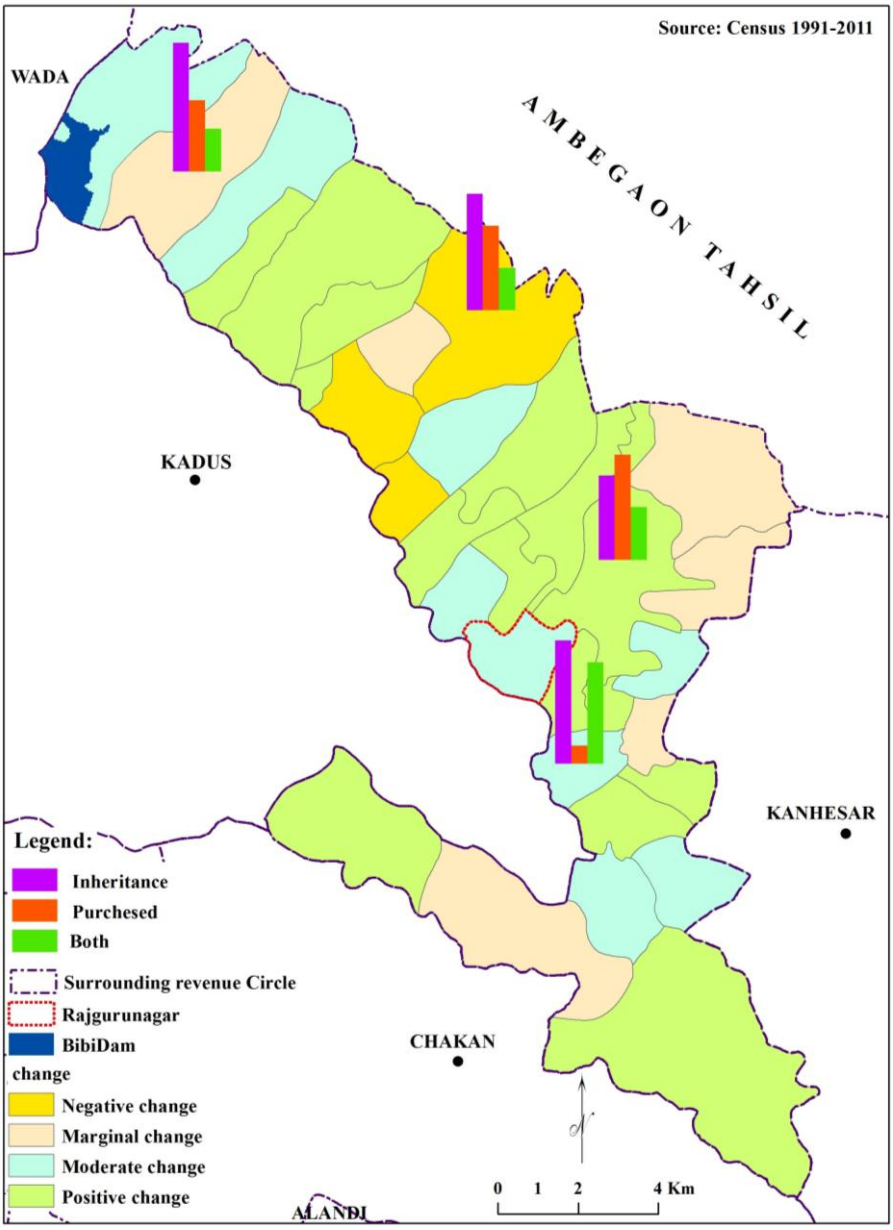

Figure 4.10 Source of ownership transformations

4.3.3 Occupation preferences of cultivators

The urbanization process has impact on occupation structure and people are willing to transform from agricultural sector to non-agricultural for better income. About 56.52% people of Bahirwadi, 52.94% of Kadadhe and Rakshewadi show willingness (Figure 4.11) to non-agricultural activities and show decreasing trend in density of cultivators and NSA. This assessment presents that the cultivators are thinking to transform agricultural sector to non-agricultural activities.

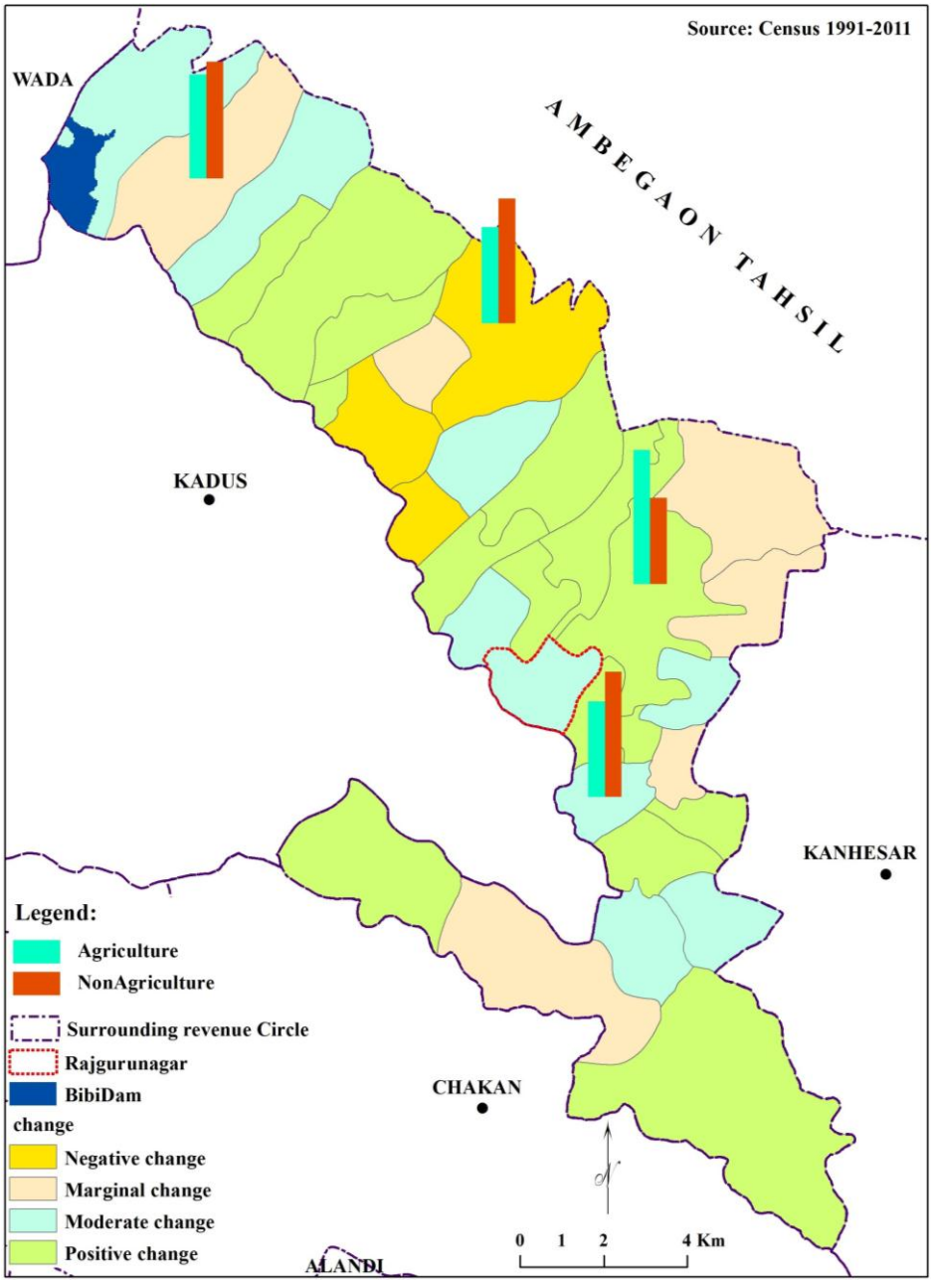

Figure 4.11 Occupation preferences of cultivators

4.3.4 Cultivators' preference for secondary occupation

Only agricultural activity is not sufficient to meet the basic economical satisfaction. Therefore, the secondary occupations help to the cultivators for balancing their economical condition. Many of the cultivators are engaged in household industry like fruits selling, flower selling, food processing, milk product, small hotels, etc. with agriculture. Some of them engaged in dairy farming and poultry.

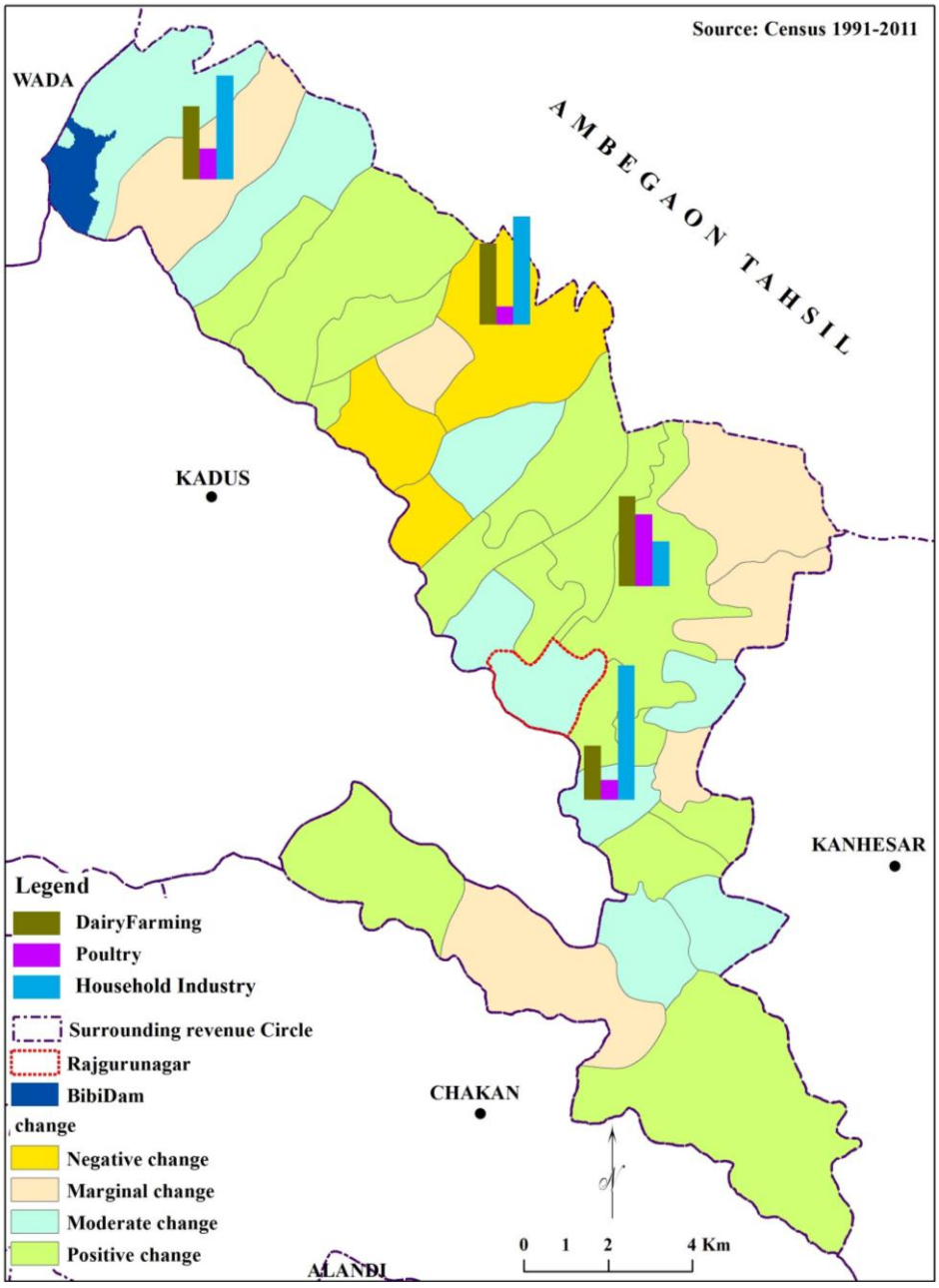

Figure 4.12 Cultivators' preference for secondary occupation

About 43.38% cultivators in Pacharnewadi village engaged in dairy farming, 34.78% in poultry and 21.74% in household industry. Bahirwadi (52.17%), Kadhade (50 %) and Rakshewadi (64.93%) show cultivators engagement in household industry (Figure 4.12). The present study shows that traditional occupation, lifestyle and economy of the study area is transforming from agriculture to non-agriculture sectors.

4.4 Resume`

This chapter deals with analyses of population characteristics, cropping pattern and farmers' willingness for occupation to understand the impingement of urbanization. The study shows that the impact of urbanization on land holdings, agricultural land transformations, number of cultivators, cropping pattern, occupational structure, farmers' willing to the agriculture and allied activities. Thus, analyses in the previous chapters have been successfully proved the hypothesis and objectives of the present study. Therefore, overviews, applicability and the limitations of this study are given in the next chapter.

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CHAPTER -V

OVERVIEWS AND CONCLUSIONS

5.0 General

The study of land use change especially in agricultural land has been explained in previous literature and many remarkable researches. All these changes are indicating transformation land cover into different categories. These transformations are happened in transformation of human activities, natural resources, environment changes, etc. The conclusions are very site and situation specific. The existing approaches have not considered the impact of land transformation on famers' communities. Therefore, the present study is focused on impingement of urbanization on the proportion of cultivators. The major objectives of the study are to study and understand the relationship between urbanization with land transformation and cultivators.

The physiographic profile of the study area has been discussed in the second chapter. Remote sensing data of Landsat-7 ETM+ and Landsat-8 OLI and TIRS satellite has been used for detection and delineation of land use and land cover with the help of ILWIS and statistical techniques like correlation analysis have been used for this study. Selected farmers have been interviewed to understand the farmers' views on land transformations. The results of the study proves that land transformation in the region has impact of urbanization along with economical and mind setup of the population. The people in the region are ready to accept the changes in land transformations. The cropping pattern, population characteristics like literacy, sex ratio, working manpower, etc. and land ownership have been changed according to land transformations.

5.1 Overviews

1. The impingement of urbanization is the change of rural society into an urban society.
2. Urbanization begins from the centre of the core area to the fringe area.
3. Rapid urbanization is increasing overcrowding, slums, illegal constructions and decrease in standard of living.
4. Urbanization leads change in traditional agriculture to modern the patterns of economic activities and therefore, land transformation from agricultural use to non-agricultural use.
5. Remotely sensed data is useful for land use /land cover classification at good accuracy level. Therefore, Landsat-7 ETM+ and Landsat-8 OLI & TIRS datasets have been used for the Land use – Land cover classification in the present study with the help of GIS software ILWIS 3.4 Academic.
6. Overall agricultural land use shows negative change.
7. Agricultural area in the study area is about 15.36% out of TGA, fallow land of 23.02%, barren land of 7.59% and settlement area of 17.38% with increasing trend from 1991 to 2011.
8. Area under dense forest (7.84%) and sparse vegetation (8.46%) has been slightly increased after 2001.
9. Population density and literacy rate is increased with decreasing trends in sex ratio from 2001 to 2011.
10. Number of main cultivators (21.89%) is decreasing but main agricultural labours (5.73%), main other workers (16%) and main household industry workers (1.22%) are increasing in the study area.

11. The highest population densities are observed in the villages near to urban and industrial centres like Kalus (1382 per ha) and the lowest in villages located far from these centres like Pangri (59 per ha).
12. The human power density is increased in three decades (1991 to 2011) and NSA is decreasing.
13. *Bajra*, rice and maize are major crops in *Kharif* season. The area under total cereals and pulses is decreasing and oil seeds, cash crops and fodder crops show increasing trends.
14. *Jowar* is major crop in *rabbi* season with increase in area. Wheat, maize and onion crops show increase in area.
15. The farmers of the region are dependent on *Kharif* crops production to meet the reduction in NSA.
16. The changes in density of cultivators have been categorised into major four type i.e. negative, marginal, moderate and positive change.
17. The villages like Bahirwadi, Akharwadi and Pangari show decrease in cultivators' density with negative changes.
18. Cultivators' densities in Waki Bk, Takalkarwadi, Jaidwadi, Sandbhorwadi, Papalwadi and Kadadhe have been slightly increased in 1911.
19. Positive changes in cultivators' density have been observed in 15 villages located near to urban and industrial centres.
20. These changes affect the agriculture land, cropping pattern, occupational structure, size of land holding, etc.
21. The change in occupational structure is indicating the trends of occupational engagement losing from agriculture sector and increasing in non-agricultural sectors i.e. household industries and other industrial sectors.

22. The size of land holding in the region is small in size. About 67.84% cultivators show land holding less than 0.5 ha.
23. Cultivators with large land holding converting into small holding with fast rate.
24. The ownership of agricultural land changing from main cultivators to marginal and others in all sample villages.
25. Farmers are willing to shift from agriculture to non-agricultural activities and give preference to industrial and other services for better income.
26. Cultivators of the region are supporting their income by adopting secondary business like dairy farming, poultry and household industry.
27. Thus, impact of urbanisation shows on farmers in the region in all respect including land holdings, occupation structure, population structure, willingness, etc.

5.2 Applicability of the study

The impact of urbanization shows on cultivators has been studied in this analysis. The methodology used and findings of this study are useful for various sectors and fields of urban research, development planning and management. The findings of this analysis are useful for the planning of this area and population related to the agricultural lands.

5.3 Limitations of the study

The researcher is aware of the limitations and drawbacks of the present study.

1. The satellite datasets used in this study have been captured in the year of 1992, 2001 and 2013 and used land use / land cover analyses which are not matching to year of population survey conducted i.e. 1991, 2001 and 2011.
2. The data regarding cropping pattern and agriculture land procured from different government offices is not matching with year of population census.
3. Farmers' willingness has been gathered in interviews conducted with selected farmers in sample villages may have limited applicability for wide space.

5.4 Conclusions

The impact of urbanization shows on land use, cultivators, land holdings, cropping pattern, population structures, farmers' willingness, occupation structures, etc. Therefore, the analyses, descriptions, overviews, findings of the present study are proved that the objectives of the study are achieved, satisfactorily. The hypothesis "the land transformations from agriculture to non-agricultural use shows notable impact on cultivators in the process of urbanization" is accepted.

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LIST OF ABBREVIATIONS

Ca	Calcium
Eq	Equation
ERDAS	Earth Resource Data Analysis System
ETM+	Enhanced Thematic Mapper Plus
FMPD	Female Manpower Population Density
GDP	Gross Domestic Product
GIS	Geographical Information System
GPS	Global Positioning System
HDI	Human Development Index
HRS	Household Responsibility System
ILWIS	Integrated Land Water Information System
K	Potassium
LLD	Landless Labourers Density
LULC	Land Use Land Cover
Mg	Magnesium
MMPD	Male Manpower Population Density
MPD	Manpower Population Density
MS	Microsoft
N	Nitrogen
NDVI	normalized difference vegetation index
NDWI	Normalised Difference Water Indices
NGO	Non-Governmental Organization
NRSC	National Remote Sensing Centre
NSA	Net Sown Area
OLI	Operational Land Imager
PD	Population Density
pH	Potential of Hydrogen
RS	Remote Sensing
SC	Scheduled Cast
SOI	Survey of India
SPOT	Système Pour l'Observation de la Terre
SPSS	Statistical Packages for the Social Sciences

ST	Scheduled Tribe
TGA	Total Geographical Area
TIRS	Thermal Infrared Sensor
UNESA	United Nations Department of Economic and Social Affairs
Zn	Zinc

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Appendix 1

Village wise TGA and NSA distribution (Census 1991 – 2011)

Sr. No.	Village Name	TGA	NSA1991	NSA2001	NSA2011
1	Bursewadi	1927	450	302	258
2	Kadadhe	933	580	415	349
3	Bibi	310	260	0	0
4	Kanhewadi Bk.	619	459	485	342
5	Kaman	987	609	563	445
6	Mohakal	443	317	274	206
7	Bahirwadi	443	315	292	240
8	Mirjewadi	1177	602	472	364
9	Papalwadi	243	225	216	171
10	Kalechiwadi	687	505	444	337
11	Akharwadi	341	255	304	217
12	Chas	2518	365	268	203
13	Butewadi	442	409	398	319
14	Sandbhorwadi	396	275	233	180
15	Pacharnewadi	48	35	29	18
16	Arudewadi	450	270	212	169
17	Pangari	704	347	398	287
18	Padali	299	240	218	169
19	Satkarsthal	461	438	411	302
20	Jaidwadi	728	515	486	392
21	Kohinkarwadi	171	145	161	102
22	Rajgurugar (Khed)	2161	1902	1710	927
23	Varchi Bhamburwadi	723	532	466	393
24	Dhorewadi	81	67	75	52
25	Khalchi Bhamburwadi	704	466	386	284
26	Takalkarwadi	249	233	225	173
27	Rakshewadi	138	125	119	85
28	Pimpri Bk.	931	631	767	661
29	Manjarewadi	341	286	309	229
30	Holewadi	335	285	278	212
31	Kharpudi Bk.	686	324	465	348
32	Waki Bk	1163	733	873	677
33	Kharpudi Kh.	401	267	327	261
34	Kalus	2015	977	875	661

Appendix 2

Questionnaires

- ## Identification of the Household

1. Name of the Household : _____
2. Address : _____

   _____

3. Family members' Information:

Sr. No.	Relation with head	Sex	Age	Education	Occupation	Marital Status	Agricultural area (ha)
1							
2							
3							
4							
5							
6							
7							
8							

- ## Background Questions :

1. How many cultivated area you have?

   _____

2. How many irrigated and non-irrigated area you have?

   a) Irrigated area _____

   b) Non Irrigated _____

3. Which equipment are used in agriculture?

_____

4. Which crops are taken in *Kharip* season?

_____

5. Which crops are taken in *Rabbi* Season?

_____

6. Which irrigation types do you have?

a) Well b) Canal c) Other _____

7. Where do you sell agricultural goods?

_____

8. Have you got farm by inheritance or not? If have then how much hectare?

_____

9. Have you sold your own farm? If sold then whom and how much?

_____

Causes of farm sold _____

10. Have you bought the farm? If bought then how many hectare?

_____

11. How many times go to the city for the agriculture related work?

_____

12. Do you do farming self-dependent or on sharing basis?

_____

13. Which side occupation are you doing with agriculture for the large income?

_____

14. Do you feel that agriculture is secondary occupation?

_____

15. Do you feel that there is an impact of urbanization on your agriculture?

_____

16. Which things do you give importance in future, agriculture or non-agriculture occupation for better income source?

_____

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