CHANGING PATTERN OF AGRICULTURAL LAND USE IN WASHIM DISTRICT (Maharashtra)

A Thesis submitted in partial fulfilment of the requirement for

The degree of

Doctor of Philosophy

In the subject Geography under the faculty of Social Science

By

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Aurangabad-431004

April 2015

GUIDE CERTIFICATE

This is to certify that work embodied in the thesis entitled, **"Changing Pattern of Agricultural Land Use in Washim district"** being submitted by **Mr. Udhav Eknath Chavan** to the Dr. Babasaheb Ambedkar Marathwada university, Aurangabad for the award of degree of **Doctor of Philosophy** in **Geography** is a record of bonafide research work carried out by his under my guidance and supervision, and has fulfilled the requirements for the submission of this thesis to my knowledge, has reached requisite standard.

The results contained in this thesis have not been submitted in part or in full, to any other University or institute for the award of any degree or diploma.

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Appendix- D

Changing Pattern of Agricultural Land use in Washim district

By

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Abstract:

The Washim district in Vidarbha region of Maharashtra encompassing from 19° 61’ to 21° 16’ North latitude and 76° 70’ to 77°14’ East longitude. The district comprises 789 villages of Washim, Risod, Malegaon, Mangrulpir, Manora and Karanja tehsils of Washim district. It has covers an area of 5131 Sq. Km covered 1.65 per cent area in Maharashtra. The total population of 1196714 persons, according to the census of India 2011 and density was 233 persons per Km^2. Washim district is a part of Balaghat plateau and it is geologically formed from Deccan trap basalt. Its elevation from mean sea level is from 330 to 525 meters. Soil of the region made from Deccan trap basalt.

Physiography of the entire region presents remarkable homogeneity in character with moderate slope towards the North, north east, south, south west and South east, so the area became runoff zone. Ajanta ranges is located at middle part of the district in elongated shape. Washim district is not pure flat land but it has rivers, valleys, hills and plateau. The River Penganga constitute the drainage system in the study region. All rivers are rain fed and seasonal in character.

The typical monsoon type climate with small variation in rainfall and range of temperature prevail. The region experiences intense heat in summer and fairly cold winter. The region is primarily agricultural in nature, in its occupational structure with 93.36 % working population to total workers is engaged in agricultural activities. The cultural and physical variables have influenced the spatial distribution of agricultural land use pattern in region. Increasing population decreases man land ratio from 0.57 to 0.43 hectare from base year to

recent. The average size of land holding is 2.43 hectare and the total irrigated area is 6.21 % to net sown area and Mangrulpir tehsil recorded highest 8.03% of irrigated area. Washim district have six agricultural produce market centers and ten sub centers serve to collection and distribution of agricultural goods.

The land utilization study unfolds different type land use, Washim tehsil has recorded highest (84.56%) net sown area and lowest net sown area in Manora tehsil (69.18%). It is noticed that central part of region has 73 to 84 % net sown area. The changes in land utilization shows changes during the study period. The net sown area of region is more than the net sown area of Maharashtra (Washim 79.16%, Maharashtra 59.49%). Within study period only 4.27% net sown area is increased. Other categories of land use have been found to decline steadily. The highest land under cultivable waste has declined 9.42% to total geographical area, followed by fallow land. The area of very low dynamism is found in two tehsils are Malegaon and Karanja. The area of low land use changes found in Washim and Manora tehsils. The area of moderate change is recorded in Risod and Mangrulpir tehsils. It shows these region have considerably stable in land use changes.

The agricultural land use pattern in the study area is dominated by the commercial crops and it reveals a wide gap in % of principal crops. In the base year 174274 hectare area under cotton, 117306 hectare area under Jawar, 26679 hectare area under Gram 22025 hectare area under Red gram, 9890 hectare under Black gram, 12883 hectare under Green gram and 16529 hectare under wheat crops to total net sown area under the principal crops. Near about 52.99% area under food grain crops. Fodder and sugar cane area shows decrease, soya bean occupies place of cotton, pulses and jawar with 52.42% area to net sown area in 2013-14. Soya bean is the first ranking crops with bumper area under this crop. Most of the cultivation of food and nonfood crops are rain fed. Irrigation being done only for limited Rabbi crops area. Kharif is the most important season for crops grown as well as their production. In base year cotton is the monoculture crop in four tehsil are Washim, Risod, Malegaon, and

Mangrulpir. Three crops combination is detected in Manora and Karanja tehsil. Cotton is the principal crops combination with Jawar, Red gram, and Gram. In 2013-14 definite changes observed, two crops combination was detected in all tehsil. These crops are soya bean and gram in first four tehsil and soya bean and cotton in other two tehsil of district in 2013-14.

The crops concentration in base year was Jawar, Black Gram, Red gram, Green gram, and gram occupies very high concentration. Cotton and Wheat occupies moderate and low concentration respectively. In last year of study period Jawar, Black gram, Green gram and gram lost their position and Red gram gain with soya bean and wheat. Crops diversification in region is very high at base year and in 2013-14 also. The extent of cropping intensity has been done, after the determination region have average 112.27% cropping intensity in base year and it improves up to 131.33% in 2013-14.

Crops per hectare yield increased in 2013-14. These crops are wheat, Gram, Red gram, Black gram, Green gram and soya bean has bumper increase from 732 Kg in base year and 1444 kg in 2013-14. The production of principal crops of food grains is 260085 metric ton in base year and it increased up to 265010 metric ton in 2010-11. The gross cropped area in base year was 401183 and it increased up to 527159 hectare in 2013-14. The overall or general productivity was moderate in region in base year and it is became high general productivity level in 2010-11.

The randomly selected six villages study unfolds in detail and inclusive analysis of agricultural land use pattern. It is observed that agriculture is the basic source of lively hood and therefore more than 93% working population to total working force is engaged in agricultural activity. Kharif is the most important season and 83% land to total arable land is brought under cultivation. Soya bean, gram, Red Gram, and wheat are dominant crops in cropping pattern which was cotton, Jawar, Red gram, Gram and wheat in base year. Now soya bean is the first ranking crop and Gram rank second in all sample villages.

It is found that Kalambeshwar and Hivara (Bk.) are the relatively more advance in partly developed villages in agricultural land use pattern and agricultural inputs. Both villages located in deep black soil area. Other villages are Karda, Kanzra, Pimpalgaon, and Virgavhan have partly developed and their agricultural land use also changed in respect to area and crops. In all villages irrigation is the drawback of agricultural development and it play an important role in agricultural land use change. Most of the farmers using chemical fertilizers, HVY seeds, mechanical agricultural implements, every village have sufficient and improved agricultural implements, Bank loan facility, and awareness about agricultural development, but market prices and lack of irrigation are the main problems in six villages or in region.

Udhav Eknath Chavan

Research student

DECLARATION BY THE RESEARCH STUDENT

I, hereby declares that the work included in this thesis entitled, "Changing Pattern of Agricultural Land Use in Washim district", is carried out by me under the guidance of Dr. P. H. Mhaske, 'Associate Professor' Head, Department of Geography, Shri Dnyaneshwar Mahavidyalay Newasa, Tehsil Newasa Dist. Ahmednagar. The work is original and has not been submitted in part or in full to any other University or institute for award of any research degree. The extent of information derived from the existing literature has been indicated in the body of the thesis at appropriate places giving the references.

Place:

Date: / / 2015

Mr. Udhav Eknath Chavan

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Udhav Eknath Chavan

Research Student

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List of Abbreviation

Abbreviation Letters	Title
Km	Kilometre
APMC	Agricultural Produce Market committee
Geo	The Earth
GDP	Gross domestic produce
DAC	Department of Agriculture and cooperation
IPM	Integrated Pest Management
INM	Integrated Nutrition Management
GIS	Geographic Information system
Km^2	Square Kilometre
CGWB	Central Ground water Board
Mbgl	Meter below ground level
MM	Millimeter
HVY	High Yield Variety
DSER	District social and Economic Review
KTW	Kolhapur Type Ware
LUS	Land utilization statistics 2010
NSA	Net Sown Area
BT	Bacillus thuringiensis
GG, RG, BG	Green gram, Red gram, Black gram
W, J, G, C, S,	Wheat, Jawar, Gram, Cotton, Soya bean
ICAR	Indian council of Agricultural Research
CPEL	Crops productivity efficiency level
NIA	Net Irrigated Area

Chapter-I

Introduction to the Problem

Chapter-I

Introduction to the Problem

1.1 Introduction:

Geography describes spatial distribution of various phenomena's on the surface of earth. Geography gives a wide range of knowledge about the earth. This subject has been divided in to two major branches, first one is Physical Geography and second one is Human geography. It's divided in too many sub branches of study. Agricultural geography is branch of Economic geography. Agriculture is one of the primary and basic economic activity. "Agriculture is a science and art of cultivating soil, growing and harvesting of crops, domestication of animal and raising of plants for the use of human needs". Agriculture is more diverse than any other human activity. It is not only because most of the human population depends on for food and raw materials but also because of largest amount of land under human occupancy is used for agricultural purpose. It is still mostly depend on environmental conditions and regional variation. The importance of agriculture in terms of employment generation and source of national income are the most important. The development of agricultural sector is an essential, for self-reliance conditions of rural development. Its development strengthens the rate of industrial development by increasing production. The traditional methods of cultivation continued to be since till we achieved independence. The agriculture continued in this country more as a way of life than as an occupation. The knowledge of cultivation transfers from one generation to another. As such as from a very longer period of time there was no change either in the methods of cultivation or in the cropping system. But now days we learn from the various studies that lighten, there is a changes in the agricultural occupation. There were many active agents, which could induce change. After the independence, the government, planner, farmers, and agricultural universities

and the researcher improve the agriculture by planned way. Large number of experiments was continued, which were responsible for gradual change in agricultural land use.

1.2 Changes in Agricultural Land use:

Land is a major resource, used for agriculture to deliver products that service human needs and wants including: nutritious food such as meats, milk, eggs, food grains, vegetables, and fruit, fibers for clothing and furnishings, and industrial products like oils, leather, starches and building materials. The actions and practices undertaken in using the resources to produce these goods have effects on the condition of land, vegetation and water resources. Where land use and its practices are contributing to affects land condition, and then the most obvious solution is to change land uses practices to more appropriate once. For use this effectively we should understand what and where land uses are now, and where trends and directions in land use are changing. Then it may be possible to describe desired scenarios for the future. We should expect that changing of land uses is a complex phenomenon. It will be differ greatly from region to region. Because of this importance of agricultural land use to the national economy and the condition of the natural resource base, the emphasis in this study is on changes in the areas of more intensive agriculture and systems of land use. The study obtains to identify spatial within rain fed and irrigated regions, the magnitude, scale and intensity of modifications in land use, productivity and enterprise diversification that have happened over the time of previous twenty years (1990-91 to 2010-11).

The agriculture of the study area has been undergoing a change since the introduction of new agricultural techniques, extension of irrigation, improved and high yielding verity seeds in selected crops, use of chemical fertilizer and mechanization of farming brought these changes. The change in agricultural land use indicates the change in proportion of area under different crops at within different time and space. Changes in cropping pattern indicate changes in socio-economic status of farmers and society. So there is a considerable

change in an agricultural land use during the last two decades in Washim District of Maharashtra.

1.3 Selection of the problem and Region:

Selection of the problem and region has been influenced by physical social and economic factors. Washim district was a part of Akola district before 1998. Before 1982 Akola district has six tehsils namely, Akola, Akot, Murtizapur, Mangrulpir, Washim and Balapur Tehsils in the district. After 1982 all six Tehsils divided in to13 new Tehsils namely Akola, Barshitakali, Akot, Telhara, Murtizapur, Karanja, Mangrulpir, Manora, Washim, Malegaon, Risod, Balapur and Patur in 1991. But From 1st July 1998 Akola district was divided into Akola and Washim districts. Newly formed Washim district has six tehsils namely Washim, Risod, Malegaon, Mangrulpir, Manora and Karanja. All six tehsils considered for the investigation from 1990-91to 2010-11. Following considerations are responsible for selection of problem and region.

Washim district is a part of Balaghat plateau and it is geologically formed from Deccan trap basalt. Its elevation from mean sea level is from 330 to 525 meters. Soils of the region made from Deccan trap basalt. Major part of district is covered by medium black soil 72.4 %, deep black soil 10.6 % and shallow or less fertile soil 17 %. Ajanta Ranges is located at middle part of the district some part of Malegaon, Mangrulpir and Manora tehsil in elongated shape. Washim district is not pure flat land but it has river valleys, hills and plateau and its slope towards the north, northeast, southwest and southeast. This type of topography is favorable for agricultural activities.

The River Penganga is the major river of region is flows from the western part of the district. River Penganga is a tributary of Godavari River. Chandrabhaga, Pus, Aran, Arunavati and Vembala Rivers are the south, south east flowing tributaries of Penganga River. River Katepurna, Morna and Nirguna are the tributaries of Purna River, flows towards the north. All rivers flooded with water only in rainy days in Washim district. They are not

perennial rivers. North West to south east part of district becomes a water divide which creates runoff zone topography in district. All rain water flows rapidly towards the north and south in nearest district. It affects the regions Irrigation capacity which is only 6.21 %. Washim district receives 750 to 1000 mm rainfall but the first order drainage pattern is not favorable for agricultural activities but there is still potential of irrigation using modern irrigation technology.

The climate of the district is very hot in summer season. Sometimes Temperature in summer goes up to 45˚C to 50˚C. In winter season, temperature decreases up to 8 to 10˚C.

In response to development of irrigation three medium and 156 minor projects, percolation tank 140, Kolhapur type ware 168 in the district. About 35878 hectare irrigation potentials have been generated by medium and minor schemes in study area.

Reported area of district is 513124 hectare is distributed as 386274 hectare (75.28 %) area was under cultivation, 35454 hectare (6.91%) area was under forest, and 8.52 % area was fallow land in 2010-11. More than 50 % area was under Soya bean crop in Washim district. In account of oilseed crop are dominant in study area.

Connectivity of study area was by Roads and railways as state highway 570.05 Km. main district road 446.94 Km., other district roads 789 Km., Rural roads 948.90 Km., and other rural roads 226.09 Km. total road length was 2989.70 Km. Railway length was 51 Km, as on 31st march 2011. For agriculture produce marketing, at every tehsil have Agricultural produce market committee (APMC). There were six main and 10 sub market centers in Washim district. Our conclusion is infrastructure and marketing facilities are favorable for the development of agriculture.

The study region comes within a typical agricultural tract of rain fed farming on the Deccan trap region. The study area came under the "Agricultural contingency plan for district: Washim", suggest strategies for

weather related contingency mainly for drought and rain fed situation. Hence the changing agricultural land use of the Washim district has been studied in order to uncover agricultural scenario of this region. This study of changing agricultural land use including its other facet has been attempted at tehsil level.

The aim and objectives of the proposed study to present a realistic picture of the changing agricultural land use pattern. The appropriate agricultural land use of the region calls for proper planning to exploit the potential of the region, particularly in the contents, the recent improvement and modernization of agricultural sector. District has been selected by the "planning commission" Government of India under the plan of "integrated rural area development for its inclusive development. Selection of region calls for such study as it's economically backward and its basic resources reveal considerable potential. The related and realistic infrastructure can be yield impressive results. Above all, the close familiarities with agrarian base of the district have motivated the researcher to undertake this investigation viz. ***"CHANGING PATTERN OF AGRICULTURAL LAND USE IN WASHIM DISTRICT"*** of Maharashtra covering the period of two decades from 1990-1991 to 2010-2011.

1.4 Meaning of Agricultural Geography:

Agricultural geography, according to **Hillman R. (1911)[1]:** constitutes a comparative study of the agriculture of the countries and continents. The basic focus of this definition is to compare the agricultural activities of different countries and continents.

Bernhard H. (1915)[2]: "Agricultural geography is a study of regional variations in agriculture and factors responsible for them". It is relative, more rational definition of agricultural geography as it takes into account the regional distribution of agricultural activities. It also attempts to identify the physical and cultural factors, which control the spatial distribution of agricultural pursuits.

In according of **Zimmerman (1951)[3]:** Agriculture would mean the cultivation of land. But agriculture includes for more than this. It also includes animal husbandry, tree culture, forestry and many other varied activities.

Morgan W.B. and R.J.C. Munton (1971)[4]: A scientific agricultural geography is not concerned simple with describe the nature of farming in particular places, but to understand the spatial aspects of the farm enterprises, i.e. crops and livestock, whether considered individually or in groups and farm operations.

Agricultural geography is a scientific study of the spatial pattern of agricultural activities in dimensions of time and space. It covers organization of soil resource and interaction with physical and human factors. The changes in resource use, technology and scientific knowledge, social institutions and human aspirations have been reflected in the use of land resource. The word 'agriculture' is comes from a Latin term *'agricultura'* which has its origin in the words ‘ager’ meaning a field and *‘cultura’* meaning to culture or cultivate. ‘Geography' derived from a Greek word *‘Geographiya’* which stems from two words, namely, *‘geo’* meaning the earth and *‘graphia’* meaning to describe **(Watson dictionary, 1976)[5].** Thus, agricultural geography is the discussion of the cultivation of field on the earth surface. The evolution of occupational pattern of mankind has passed through successive stages of development. In recent years, it has made considerable progress towards maturing as agricultural geographers have begun to treat data.

Jasbir Singh and S. S. Dhillon (1981)[6]: As a science agricultural geography is concerned with the formulation and testing of hypothesis, interpretation of geographic distribution and location of various characteristics of agricultural activities on the surface of the earth and measurement of geographic relationship. Furthermore, as a science, it also seeks to identify, describe and classify the problems of agriculture against a geographical back drop.

The opinion of **Andreae B. (1981)[7]:** as the science of the agriculturally transformed earth's surface, with its entire associated natural, economic and social interrelationship as reflected spatially.

According to **Johnston (1985)[8]:** Agricultural Geography: The study of spatial variations in agricultural activities, involving both the discretion of such variation and attempts to explain them".

This definition has been widely accepted by geographers as it describes not only the spatial or regional variations of agricultural phenomena but also explains the Geo-ecological and socio-economic bases of such variations. In reality the decision about the cropping patterns and associated activities are taken on the field at micro level.

1.5 Nature of Agricultural Geography:

According to **Morgan and Mutton (1971)[9]:** Agricultural geography is an interdisciplinary field with stronger inputs from economists and soil scientists. Even though, agricultural and geographical relationships constitute a single spatial phenomenon.

Agricultural geography, are concerned with the cultivation and harvests of crops, livestock and farm operations along with exchange, trade and marketing of the agricultural products. The main focus of interest in the progressive scale of the area units are the field, the farm, the nation and the universe. It is form of field systems, cultivation cycles and operational enterprises whose end product is agricultural produce. The farm is a larger unit, where location factors, land quality and systems of operation become most important. Geography and economics have similar fundamental concepts. The study of agricultural commodity depends on soil fertility, climatic suitability etc. Its value can be increased by the method of production, transport, market and efficiency of exchange. The real gains of farmers are land, labor, financial resources, seed, fertilizer, pesticides, cost of irrigation etc. The availability of resources makes the best use of their land at proper season. Agriculture is the pivot of an economic activity. Agriculture is

the major source of raw materials for manufacturing and a major commodity for retail activities. Only those areas of the world human population spread where agriculture was possible. Physical and cultural factors are reflected on agricultural production. Agriculture is not entirely determined by terrain, soil, and climate. The limitation of these factors can be modified through irrigation, temperature control, fertilizer and adoption of new techniques in crops and livestock combination. Finally make the control on the price level of agri-business.

1.6 Scope and Significance of Agricultural Geography:

The spatial variation of agricultural phenomenon is the main focus of agricultural geography. To investigate the spatial and temporal variability of agricultural activity is main trust of geographers in the modern agricultural geography. Agricultural regionalization is done by crop combinations, crop concentration, crop diversification, agricultural efficiency, land use pattern, land carrying capacity of region. In the study of land use and other farming variables like land tenure, field size, size of holdings and labor supply must be taken into consideration along with physical variables for instance terrain, temperature, moisture, soil etc. and economic variable viz. Irrigation, fertilizer, technology etc. In short in the comprehensive study of agricultural geography physical, social, economic, cultural and infrastructural variables has to be consider, on which unified approach is based. It is essential to study the agricultural land use in connection with geographical and manmade factor. Agricultural studies the geographical activities of man and his economic action for the fulfillment of the needs. As a result the diverse circumstance of atmosphere in the various regions of the earth. Agricultural system and production play vital role in economic progress. The mutual study of the agricultural life as a result of these similar and dissimilar circumstances is made under agricultural geography. The scopes of the study of agricultural geography as:

1) To explain how different kinds of agricultural area distributed over the earth and how these function in spatial arrangement.
2) To understand how particular types of agriculture have developed in particular areas and how they are similar to or different from farming in other areas.
3) To analyze the operation of farming system and the changes they undergo.
4) To highlight in what direction and in what volume the changes in agriculture are taking place.
5) To demarcate the crop production regions or the crop combination regions or the agricultural enterprise or the agricultural development regions.
6) To measure and examine the level of differences between the regions.
7) To identified weaker areas in terms of agricultural productivity.
8) To delimit the areas of agricultural inactivity, transition and dynamism or poverty, parity and prosperity.

All these within the scope of agricultural geography. Besides, in agricultural geography attention must be paid to the study of three basic sets of relationship as:

1) Those between physical environment and agricultural operations or attributes.
2) Those between population distribution, density or characteristics and the available agricultural space or activities.
3) Those between the socio-economic or cultural ecology and agricultural land use and productivity patterns.

The study of agricultural geography is considered to accomplishment man's irresistible desire to understand and investigate the arrangement and distribution of agricultural phenomenon at spatial and temporal scale. Moreover, the emergence of agricultural geography as an independent distinct and a leading branch of modern geography is becoming a pivotal event in agricultural land use planning and development. The significance of

agricultural geography is that it provides help and guidelines for decision maker and useful for:

1) The agricultural specialist wishes to improve the structure of agriculture.
2) The food economist who wishes to increase the production of foodstuff.
3) The irrigation engineer plans to introduce new irrigation schemes.
4) The regional planner, who is on the lookout for the most favorable location for recreation areas.
5) The transportation engineer has to lay the new rail and road lines.
6) The demographic planner, who plans public services and utilities.
7) And numerous other specialists.

1.7 The Role of Agriculture in Indian Economy:

Agriculture sector is vital for the food and nutritional security of the nation. The sector remains the principal source of livelihood for more than 58% of the population though its contribution to the national GDP has declined to 14.2% due to high growth experienced in industries and services sectors. Compared to other countries, India faces a greater challenge, since with only 2.3% share in world's total land area; it has to ensure food security of its population which is about 17.5% of world population. This leads to excessive pressure on land and fragmentation of land holdings. Against the backdrop of the burgeoning population's demands for food grains, degrading natural resource base, emerging concerns of climate change and other challenges, the Department of Agriculture and Cooperation (DAC) has focused on mobilizing higher investment in agriculture, bridging yield gaps that exist across the states/ regions, timely and adequate supply of quality inputs, and providing adequate support services to the farmers to make agriculture a remunerative vocation on a sustainable basis. Increasing agricultural production with limited natural resources in a sustainable manner for ensuring food and nutritional security and providing income security to farmers are the major challenges before the Government.

Agriculture sector has touched a growth rate of 4.4% in the second quarter of 2010-11 thereby achieving an overall growth rate of 3.8% during the first half of 2010-11. The sector witnessed a growth of 5.1 per cent in 2005-06, 4.2 per cent in 2006-07, 5.8 per cent in 2007-08, - 0.1 percent in 2008-09 at 2004-05 prices. The low growth rate of 0.4 percent recorded by this sector in 2009-10 was mainly due to poor rainfall in 2009. As per the Advance Estimates of Central Statistical Organization for the year 2010- 11, the agricultural sector contributed about 14.2 per cent to the GDP, at 2004-05 prices. There has been a continuous decline in the share of agriculture in the GDP from 17.4 percent in 2006-07 to 14.2 percent in 2010-11 as per Advance Estimates at 2004-05 prices. Falling share of agriculture in GDP is an expected outcome in a fast growing and structurally changing economy. Agriculture can contribute substantially to improvement rural as well as overall economy. Thus agriculture has the more dynamic role in the development of country.

1.8 Agriculture in Maharashtra:

Agriculture plays an important role in the state's economy, more than 65% of the population depends on it for their livelihood. In recent years the relative contribution of agriculture to the State's GDP has decreased with consequent increase in rural poverty and migration of landless individuals from villages to towns and cities. In 2010-11, the area under cultivation (17.8 million hectare) occupied 58% of the total physical area of the state (30.8 million hectare). In the same year the total irrigated area in Maharashtra (3.9 million hectare) was only 18% of the gross cultivated area (21.6 million hectare), while the potential area suitable for irrigation was estimated at 9.7 million hectare. The average cropping intensity in the state is about 121%. Food crops, including cereals and pulses, occupy 13.4 million hectare (62 % of the gross cultivated area), while sugarcane and cotton occupy 3.8 million hectare (18% of gross cropped area).

The most important kharif crops are sorghum, millets and rice among the cereals, and grams and pigeon pea within the pulses. Wheat is the major cereal

crop grown in the rabbi season, while grams are the most important pulse crops. Oil seed crops such as soybean, groundnut, sesame and mustard occupy large areas during kharif season, while sunflower is a common oil seed crop in the rabbi season. The agricultural productivity of Maharashtra is generally low as compared to the national averages of various crops. This can be attributed to limited area under irrigation, low natural fertility of soils, large extend of degraded land, large areas prone to recurrent drought, and low rate of adoption of improved soil and crop management practices. There is weak coordination between canal operation schedule and agricultural production plans in the irrigated areas. Farmers have a low rate of participation in the planning and management of the irrigation systems. Delivery of support services for water use and crop production is generally inadequate. On the other hand, the State has outstanding agricultural education and research institutions both in the private and public sectors, as well as diverse agro-ecological conditions. Experience shows that agricultural progress provides the best safety net against hunger and poverty. Rapid progress can be made to improve productivity, profitability and sustainability of farming systems, if technology development is complemented by proper agricultural policies.

Growth in agriculture should be based on firm agro-ecological foundations through sustainable use of natural resources and agro-diversity, promotion and improvement of traditional agricultural knowledge, efficient use of farm residues, maintenance and improvement of watersheds, efficient water harvesting methods, and proper on-farm water management. These objectives would only be achieved with concerted efforts of farming communities and relevant development agencies. In December 2002 the Agriculture Department of Maharashtra established a high level committee to prepare an action plan for development of agriculture in the State. The committee has proposed that a labor intensive agriculture development should be the basis for the State's increased economic growth, provided that institutional structures are developed to support small producers in the production and

post-harvest phases. Agricultural development can be accelerated if there is a systems approach to production with due attention to marketing.

The committee has reported a number of cases of progressive farmers that may be scaled up to larger areas. They concluded that future development of agriculture in Maharashtra would be based on innovations that would assure increased productivity, enforce norms that promote high quality and proper standards, protect the environment, and lead to financial profitability and sustainability of farm operations. The committee envisaged that significant gain in productivity would be achieved through optimum utilization of water, introduction of new high yielding hybrid varieties, adoption of IPM and INM technologies, increase efficiency in the use of production inputs, and effective production and dissemination of improved crop management practices. The sustainability and expansion of gains in productivity and profitability would come about as a result of the effective integration between producers, consumers, processors and exporters.

1.9 Hypothesis:

Following are the general assumptions, which this inquiry follows:

1) Physical and cultural factors may play an important role in making the change in agricultural land use.
2) There are spatial changes in agricultural land use, area, yield and production of crops in study area.
3) The physiographic controlled and input differential is responsible for the growth disparity i.e. on land that the land use patterns are controlled by the relief of the region.
4) Scarcity of irrigation is mainly responsible for a large area being put under fallow lands that lack of irrigation is also responsible for low cropping intensity in Washim district.
5) The cropping pattern in the study area controlled by terrain, rainfall and irrigation, in irrigated areas greater inter crops shifts have taken place.

1.10 Area of Investigation:

The district Washim is formed in 1998. The geographical location is 19^0 61' North to 21^0 16' North latitude and longitudinal extension is 76^0 07' east to 77^0 14' east, with the total geographical area 513124 hectares. Total population was 1197160 (2011 census).Washim district has six Tehsils as Washim, Risod, Malegaon, Mangrulpir, Manora and Karanja. The climate of the district is on the whole dry except during the south-west monsoon. The average annual rainfall in the District is 750-1100 mm. About 80% of the total rainfall is received during the south west monsoon season. Rainfall during the North-east Monsoon is October to November.

1.11 The Approach's to Study Agricultural Geography:

Agricultural geography as it stands today as a one of the recent branch of economic geography. In the late twenties re-organization and regional description were its common themes, studies in agriculture are not the exclusive concern of geographers, but economists, agricultural scientists and other scholars too study agriculture. The approach of each of them however, is different. An economist confines himself to the study of production, consumption and distribution of agricultural commodities and prescribes the means of maximizing profits with given inputs. An agricultural scientist studies various aspects of agriculture, such as agronomy, plant pathology, entomology etc. Historian concentrates upon the development of agricultural through time. But an agricultural geographer is always concerned with the study of spatial variations in agricultural phenomenon. Even when he has to be study the temporal trends in agriculture he does so, through the element of space. The agricultural geographers focus is mainly sequential rather than chorological. The theoretical and methodological base attained stability and cerographical and numerical precisions became indispensable tools to geographers. In 1967, B.B. Singh[10] presented seven fundamental concepts of agricultural geography as:

1) The concept of agricultural landscape.

2) Dynamic nature of agricultural phenomena.
3) Agricultural landscape as function of resource structure, process and stage.
4) Location of agricultural activities.
5) Agricultural region and area differentiation.
6) Inter region equilibrium and spatial functional interaction.
7) Regional agricultural development and planning.

1.12 Objectives of investigation:

The prime objectives of this study is to evaluate and analyze geographically, describes and interpret the changes in agricultural land use pattern of Washim district from 1990-91 to 2010-11 with a vision to investigate certain physical and socio-economic variable involved in land use patterns and provide meaningful investigation. Present investigation has undertaken under the following objectives for detailed and extensive study as follows:

1) Investigate the area variations in the changes in agricultural land use pattern in Washim district 1990-91 to 2010-11.
2) To examine spatial pattern of agricultural land use at the end of investigation (2013-2014).
3) To assess the effect of high yielding variety seeds, mechanical and other inputs on agricultural development.
4) To investigate the role of physical aspects in agricultural land use pattern.
5) To examine and map the spatial distribution of irrigation facilities and its effects on cropping patterns.
6) To study the occupational structure of population and its effects on agricultural land use.
7) To find out agricultural productivity and its growth.
8) To focus general land use, cropping pattern in selected villages and mark out the agricultural land use at micro level.

9) Development in area and yield of crops so as to explain the trends of efficiency.
10) To draw conclusion and find out the agricultural problems and suggest suitable preparations to solve them.

1.13 Sources of data:

The data collected are, 1) Primary and 2) secondary sources, supported by interview of farmers to cross-check their reliability. The inaccessible and unpublished data have been generated by designing relative questionnaire. This questionnaire covers crops grown in the farm, mode and methods of agriculture practices, type of irrigation facilities, economic conditions of the farmers, loan facilities. The designed questionnaires were circulated among villager's officials, namely, Sarpanch, Talhati and farmers. The elicited information through questionnaires helped in the interpretation of the contents. Spot inquiries of the farmers during field work served to uncover the realistic picture of total and changes in agricultural land use patterns.

The secondary data includes all published materials. It also includes unpublished records preserved in land revenue department. The tehsil offices was the prime source for area under individual crops from 1990-91 to 2010-11, in the villages and tehsil level. Besides this, published records and abstracts such as, socio-economic review of Washim district, district census handbook, district statistical report, crop and seasons report, district gazetteers of Akola, agricultural bulletin published by agricultural department, Maharashtra state, Pune. Periodicals and other documents have been tapped for obtaining relevant data and information bearing on the theme.

To delimit the Washim district has been attempted by marking out the water shade of rivers for which GIS Global Mapper Version 14 are used. For the in-depth investigation of all the six tehsils is obviously time consuming and strenuous work. So the six villages are randomly selected for in-depth investigation. These villages were selected by random sampling method. All these six villages are studied at micro level. The crop of each fields holding

data has been collected by survey in persons. These sample villages may be considered as the representative character, mirroring up the agricultural scenario in the selected years. The relevant and readily accessible data and information have been collected by preparing questionnaire. The format of questionnaire has been set out. The questionnaires incorporate all aspects of agricultural practices, general land use, existing cropping pattern, yield of each crop per hector, various means and intensity of irrigation, socio-economic conditions of farmers, problems and prospects of agriculture.

1.14 Methodology:

In the existing study the data collected from different sources are processed and analyzed in the form of charts, tables, maps and diagrams and also used effective analysis of the applicable. Statistical information relating to agricultural aspects of district concern.

For studying the changes in land use pattern between 1990-91 to 2010-2011 is measured by a simple method of **Jasbir Singh** and **S.S. Dhillon (1973)**[11] as per this method, in a given area unit the summation of positive changes in land use types on one side and the summation of negative changes in land use types on the other side, would certainly give equal value. Which is the degree of dynamic or stable in the dynamic nature of physical and socio-economic environments. For study the degree of dynamism in land use, the index of total volume of change is calculated by using following formula as:

$$\text{The index of total volume of change} = \frac{F + B + C + A}{O}$$

Where:

A = Agricultural land.

B = Forest.

C = Fallow land.

F = Non-cultivable land.

O = other uncultivated land.

Above letters have been grouped in a combination formula, where letters present the land use type and figures show their role and rank. K. Doi's and Rafiullahas methods are used to determine the crop combination in Washim district. Bhatias method is used for the computation of index for the determination of crop concentration as:

$$\text{Index of determining Concentration of crop} = \frac{\text{Area of 'a' crop in the Component areal unit}}{\text{Area of all crops in the Component area unit}} \div \frac{\text{Area of 'a' crop in the entire region}}{\text{Area of all crops in the entire region}}$$

In order to assess agricultural productivity, Jasbir Singh's methods (1976)[12]. Those are, Crop Yield Index, Crop concentration Index and Indices ranking co-efficient has been employed. The statistical procedure of this method is as follows:

1. Crop Yield Index:

$$Yi = \frac{Ya}{Yr} \times 100$$

Where:

Yi = Crop yield Index.

Ya = the average yield per hectare of crop 'a' in zone.

Yr = the average yield per hectare of crop 'a' in the region.

2. Crop concentration Index:

$$Ci = \frac{Aau}{Cu} \div \frac{Tar}{Cr}$$

Where:

Ci = crop concentration index.

Aau = area under ‘a’ crop in ‘a’ zone.

Cu = total cropped area in ’a’ zone.

Tar = total area under ‘a’ crop in the region.

Cr = total cropped area in region.

3. Ranking Co-efficient:

The resulting crop yields and crop concentration indices for the crop are ranked separately. Yield and concentration ranks for individual crops are added and then divided it by two, thus giving the crop yield and concentration indices ranking co-efficient.

The equation is as follows:

$$\text{Crop yield and Concentration indices = Ranking co-efficient For the crop 'a'} = \frac{\text{Crop yield index ranking of crop 'a'} + \text{crop concentration index ranking of crop 'a'}}{2}$$

The absolute number of population change is obtained by subtracting the population of an earlier date from that of the later date. The relative change is calculated by dividing the absolute change by the population at an earlier census date. It is customary to denote the relative change in the percentage change; in that case, the change is multiplied by 100. The formula for obtaining the percentage change in the population size is as:

$$\text{Change in the population size} = \frac{P_2 - P_1}{P_1} X100$$

Where:

P_1 and P_2 denote the population figures of earlier and later points of time. Thus the percentage changes in the population of Washim district during two census operation. An obtained rate of change is by dividing the Relative change or Relative percentage change by number of years between two census dates.

1.15 Review of Literature:

1. Introduction:

The above analysis provides the introductory framework for the present investigation to assess and evaluate the agricultural land use patterns in the Washim District. The study of land use patterns explicitly relate to the evaluation of land and its characteristics. The main objective of such evaluation is to uncover past and present agricultural land use patterns. This can serve to reveal improved and suitable land use planning for the region. In this direction, efforts have been made in India and abroad by many government and non-government agencies. There are many scholars and planners devoted to expound the land and its characteristics by carrying out pilot land use surveys. These land use surveys have great significance for further suitable land use studies. With taking into account the importance of this aspect. Investigator, in the present chapter, attempted to present brief review of literature related to land use studies.

2. Conceptual framework of land use:

The concept of regional survey of land use and its mapping was firstly evolved by Patrick Geddes which had supported by providing concrete framework in World Land use Survey by Volkenberg (1949). But practical work on Land use study was carried out in 1930 by **Late L.D. Stamp**[13] in Britain. This is perhaps, the first land use survey which was, later on, adopted by many Geographers, Economists and planners

for Land use studios among them. Notable work is done by **Baker O.E. (1926)[14]** Agricultural Department in United States (1935).

Mandal R. B. (1969)[15]:

He has modified the weaver's method in analyzing crop combination regions with special reference to North Bihar. He has been studied number of crops of North Bihar. He used weaver's method of crop combination with modification for the North Bihar.

Ayyar N. P (1969)[16]:

He has studied crop regions of Madhya Pradesh. He used statistical approach to the study of crop combination region. He suggested maximum distance method to group important crops into associations.

Shinde S. D. (1974)[17]:

He worked on "An Agricultural Geography of Konkan". He used choreographic and chorological methods for interpretation of data. He has studied general land use agricultural land use, village crops, and Horticulture and Crop combination of Konkan region. He has also used various statistical methods. The study of Konkan region organized into three parts

(1) Physical, social and Economic setting.

(2) Spatial distribution of agriculture and

(3) Regionalization of agriculture.

He found that there is vast variation in agricultural land use cropping pattern in Konkan region. Agriculture is not developed in this region and facing various problems like, lack of irrigation, lack of use of High yielding variety seeds, chemical fertilizers etc.

Majid Hussein (1969)[18]:

He studied "The geographical basis of the well irrigation in the upper Ganga, Yamuna, Doab." In this paper author correlated geographical factors with drilling the tube well. He has also considered the effect of tube well irrigation on changing cropping pattern of the study region. In this paper four

maps are used for interpretation of data. The proportion of the cropped land irrigated by tube wells has been depicted in map.

Das (1973)[19]:

He has been studied the population pressure and intensity of cropping in the Koshi area of Bihar State. In his study, he has used correlation co-efficient, Student's't' test for the study.

Das (1979)[20]:

He studied the "problems of population and land use in Bhagalpur district of Bihar". He studied the distribution of population, population growth and future estimate of population. He also studied tehsil wise cropping pattern and population pressure on agricultural land. He considered different aspects in connection with agriculture.

Majid Hussein (1970)[21]:

He Studied "Pattern of crop concentration in Uttar Pradesh: A geographical Review of India." The aim of the study was to define the pattern of crop concentration of U.P. by applying location quotient method. The statistics used in the paper limited to the district and are the averages of five years. The method applied in this paper for the determination of crop diversity brings out some interesting contiguous zones of different densities of the important crops grown in the area. Moreover, the technically clearly indicates the zones of high, medium and low concentration of first ranking crops which are in conformity with the rainfall distribution and the physical and economic condition of the area.

Majid Hussein (1972)[22]:

He Examined "crop combination Regions of Uttar Pradesh A study by applying the arbitrary choice method, the minimum deviation method, advocated by weaver J. C. and maximum positive method advanced by Rafiullaha. The resultant patterns have been plotted on maps. The precision, authenticity and usefulness of the different statistical and non-statistical methods of crop combination regions have been reviewed. The agricultural

statistics used in the paper related to the district unit and are averages of five years (1964-68). The application of the arbitrary choice method e. g. first crops only, first two crops or the first three crops etc. The statistical approaches applied reveal that the method i.e. the minimum deviation method and though suffer from laborious calculations have their precision in the designation of crop region.

Mohan Darbal (1973)[23]:

He studied "A new method of delineating crop combination in a mountainous geographical Region: A study of Garhwali Himalayas. To find out suitable method for crop combination especially for a mountainous tract, he has analyzed various statistical methods. Dyer method (1969) was found most suitable for these types of tracts. To determine the crop combination dyer has used the term crop dimensions.

Ali Mohammad (1972)[24]:

He examined Agricultural efficiency Regions: A case study of Kashmir Valley. The study aims to classify the Kashmir valley into agricultural efficiency regions on the basis of per hectare productivity taking Tehsil as a unit. Various methods to measure the efficiency were reveled and a suitable method propounded by S. S. Bhatia was adopted for this region. Due to small number of units a suitable and convincing picture of this classification could not be availed. Therefore, a suggestion has been made to base this study on the village level data for such a smaller and homogeneous agricultural land limit.

Martin Billings (1975)[25]:

He **s**tudied agricultural production in Mali. Agricultural development of the Sahel is possible, as illustrated by analysis of the conditions and opportunities in Mali. Two key elements like water control and energy were considered by another National Financing and skills are also considered by him. Agricultural regions, crop production, cash crops, co-operatives, water.

Agricultural support organization, prices and marketing has been elaborately discussed.

Majid Hussein (1976)[26]:

He examined a new Approach to the agricultural productivity of Sutlej-Ganga plain of India. In this paper an attempt has been made to delineate the agricultural productivity regions of the Great Plains of India taking into consideration the area and production value in terms of money of the 25 crops grown in the area under review. A three year average (1968-71) data of all the reporting crops has been taken into consideration. Index has been calculated for the determination of agricultural productivity of each of the component area unit (district).

More K.S. and Shinde S.D. (1978)[27]:

They studied population pressure on Agriculture (Kolhapur Dist.): A geographical analysis. They have calculated crude density, caloric density, physiological density and nutritional densities for the population pressure on agricultural lands they calculated co-efficient of over-population for the study region, At that time co-efficient of over population was 1.49 for the study region where 0.76 for the state of Maharashtra.

Das K.N. (1979)[28]:

He studied about "Population and land resources in North Bihar plain-west of the Koshi" in which he has shown the relationship between the population and the intensity of the utilization of land in the study area.

Jha B.N. (1980)[29]:

He studied the problems of utilization in the Koshi basin, which passes through the various physical and cultural activities including the emerging problems of land utilization in the region.

Jana M.M. (1987)[30]:

They studied "Cropping pattern in west Bengal". In this paper attempts have been made to rank the crops in different districts on the basis of cropped land to compare the yield rates for finding out the crop specialization in the

district of west Bengal. He has calculated the concentration indices of crops different areas of west Bengal Ranking method is also used by the author.

Mohammad A. (1987)[31]:

He has studied Agricultural responses to population differentials in Punjab-Haryana plain. In this study a parametric text has been used, Pearson product movement coefficient of correlation and ordinary least squares bi-variant regression have been adopted for parametric texts. He has found that the crop yield and pressure of population are having a positive relationship.

Zafar Iqbal khan and shafat Ali Khan (1992)[32]:

He has studied "levels of agricultural productivity in Jammu And Kashmir State." They have studied the levels of agricultural productivity and the factors responsible for variations in agricultural productivity in Jammu Kashmir. Author's applied methods of M. Shafi (1972) and Enyedi (1964) for the calculation of index of productivity. Their discussion reveals that the overall situation of the agricultural productivity in the region was not satisfied. There is variation in agricultural productivity in the region.

Anuradha Sengupta (2002)[33]:

She has studied a water resources and agricultural productivity in Malda district of West Bengal. This paper seeks to analyses the water resource management with special physiographic parameter to increase the level of productivity, to reduce the regional imbalance in the Malda district of west Bengal. Author found that within all environment factors soil has been maximum utilized and the manpower also. But all other factors are not properly utilized to the same extent.

Mohammad T., M. Ahemad and Abdul M. (2002)[34]:

They have studied spatial analysis of agricultural productivity in western Uttar Pradesh. Western Uttar Pradesh is the most developed and prosperous region of the state. Author's used secondary data. District has been taken as the unit of study. The productivity indices of crops considered for each District. Authors found high concentration of cereals in western Uttar Pradesh

due to impact of various institutional and technological factors. The low productivity of pulses requires attention of the farmers and government agencies. Efforts should be directed towards the increase of area and production of pulses. It can be achieved through the adoption of new varieties of seeds and by safeguarding the interest of the farmers.

Author's concluded that the modern form of technology and socio-economic development are entwined in a symbiotic relationship. Advanced form of technology undoubtedly leads to socio-economic wellbeing and it in turn sets the farm technology on wheels.

In India for making an intensive land use study, the first credit goes to Prof. M. Shafi. He carried out sample study of land utilization in twelve villages in Uttar Pradesh and relative findings have appeared in his "The Geographer" (1951). Prof. M. Shafi presented a most valuable paper to the 20th International Geographical Congress at London (1966) with suggestions on the technique suitable for conducting land use survey in India. After a brief review of, various techniques adopted in different countries recommended that any technique adopted for land use survey in India should aim at recording existing use of land in the first instance, followed by mapping of land capability or land potentiality at the next stage.

Prof. M. Shafi (1965)[35]:

In the years 1965 to 1966 Prof. M. Shafi contributed many valuable papers as follows:

1) Pattern of crop land use in the Ganga Yamuna Doab.

2) The measurement of food production efficiency in India.

3) The technique of rural land use planning in India.

He published his research findings in the well-known paper entitled "The problems of wasteland in India". He uncovers different types of wasteland and suggested methods of land reclamations. In "Science Today," M. Shafi (1969) concludes that "carrying capacity" of the

“Indian land” is considered. It can be feed five times the present Indian population if it is coaxed well.

The paper entitled "Techniques of Rural Land use Planning with reference to India" by M. Shafi (1966) embodies his opinion that the land use survey like India can be conducted on the basis of sampling as it is a stupendous, laborious and time consuming task to procure data for all the villages in the country. Moreover, the marked similarity in the land use pattern of extensive regions comprising of many villages. A sample village would be a practical proposition.

Dr. K.Z. Amani (1968)[36]:

He presented two studies to find out the changes that have taken place during the period of forty years (1926-1927 to 1966-1967) in agricultural land use and crop production in Harnarayanpur and Golghari villages in Aligarh District (1968). He indicated the reflection of a long process of interaction between physical and socio-economic factors. According to him, the interaction of existing land use should be based on a thorough inquiry into various variables that have exercised their impact for a long time.

Another important work carried out by **D.S. Chauhan (1966)[37]** on "The studies in Land Utilization of agriculture". He discussed the theme covering scope, concept, principles and pattern of Land utilization with relative emphasis on land use policy to promote national plan of economic growth.

1.16 Land use Studies in Maharashtra:

In Maharashtra, the selected works on land use studies have been carried out by Dr. B.A. Marathwada University, Pune University, Shivaji University and Mumbai University, either as part of project works or as doctoral works. This works on land use studies focused on the land and its characteristics for Maharashtra. The notable works are as below:

1. Critical Study of Agricultural Development in Solapur District, Dr. P.R. Budhvant (1997).
2. Spatio-temporal Analysis of Agricultural Land use in Beed District- A Geographical Review, Dr. H.B. Rathod (2001).
3. Study of Agricultural Land use in Jalna district- A Geographical Review, Dr. S.B. Jadhav (2003).
4. Critical Study of Agricultural Land use in Ahmednagar District, Dr. Nikam S.K. (2002.)
5. Spatio-temporal land use in Latur district, Dr. D.S. Gajhans (2007)
6. Agricultural Land use in Upper Godavari Basin, Dr. A.R. Kumbhar (1978).
7. Agricultural Land use of the Western District of upland Maharashtra, Dr. P.R. Karmarkar (1981).
8. Spatial Analysis of Agricultural Land use in Poona District Dr. V.S. Datye (1983).
9. Changing pattern of Agricultural land use in Kolhapur District Dr. K.S. More (1980).
10. Some aspects of Agriculture of Satara District: A Geographical Analysis, Dr. V.D. Jagtap (1980).
11. Changing pattern of agricultural land use in Raigarh district, Dr. M.V. Suryavanshi (2009)

In addition these, the commendable works on land use studies have been carried out as research work for M. Phil and Ph.D. course in Dr. B. A. Marathwada University, Aurangabad, Shivaji University, Kolhapur and Pune University, Pune in Maharashtra. This attempt is to present agricultural land use study in Vidarbha region, by investigator, on an agricultural land use in the Washim District of Maharashtra.

1.17 Chapter Planning:

This work has been divided into nine chapters as:

1. **The first chapter:**

It deals with Introduction, Changes in Agricultural Land use, Selection of the problem and region, Meaning of Agricultural Geography, Nature of Agriculture Geography, Scope and Significance of Agricultural Geography, The Role of Agriculture in Indian Economy, Agriculture in Maharashtra, Our Hypothesis, Area of Investigation, The Approaches to study Agriculture Geography, Objectives of investigation, Sources of data, Methodology, Review of Literature, Land use Studies in Maharashtra, Chapter Planning, Problems and Limitations, Reference Books.

2. **The second chapter**:

It highlights, Introduction, Location and spatial relation of study area, Geology, Geomorphology and Soil types, Soil Analysis, Hydrology, Physiographic Division, Drainage, Climate, Area under Forest, Reference Books.

3. **The Third Chapter**:

It explains Introduction, History of Washim District, Historical Importance, Cultural importance, Population, Density of Population, Distribution of Population density, Occupational structure, % of Total Workers to Total Population, % of Cultivators to Farm Workers, % of Agriculture Laborers to Farm Workers, % of Farm Workers to Total Workers, Transportation, Agricultural Market, Agricultural Land Holdings, Livestock, Agricultural Implements, Agricultural Inputs, Reference Books.

4. **Fourth chapter:**

It deals with Introduction, Sources and Growth in Irrigated Area, Sources of Irrigation, Spatial Pattern of change in Net Irrigated area, Relative increase in intensity of Irrigation, which mainly responsible for agricultural changes, its results on agricultural land use and cropping pattern during 1990-91 to 2010-2011 described in detail.

5. **Fifth chapter:**

This is devoted to the changes in land use categories like concepts of land use, classification, general land use pattern and changes therein, Tehsil-wise trends of land use, overall volume of change in land use, land use efficiency.

6. **Sixth chapter:**

It deals with Agricultural situation, agricultural land use pattern, changing cropping pattern, Tehsil-wise trends in area under various crops, crop combination regions, and changes therein, crop concentration, pattern of crop diversification and changes therein in the study area.

7. **Seventh chapter:**

It covers the study of broad trend and variation in production and yield of selected crops in the study area. Tehsil-wise trends of production, yield, productivity measured by Jasbir Sings method (1972) yield index and crop concentration index are analyzed.

8. **Eighth chapter**:

It concerned with case studies or selected villages such as general land use, cropping pattern and livestock agricultural implement etc. in selected villages at micro level.

9. **The Ninth chapter:**

Is regarded with summery, observation of the study to get comprehensive view. An attempt is made to discuss the agricultural problems of the study region and give suitable implication to achieve agricultural development.

1.18 Problems and Limitations:

The present study converges upon available data for crops at tehsil level in order to depict clear picture of the existing land use pattern in Washim district. Both accessible and available data and information have been used for analytical, inclusive and meaningful analysis. But frequent changes in administrators, lack of updated records of crops hectares at village and tehsil level have led to unforeseen problems for the investigation. While engaged in field work and data collection from government offices and while analyzing

data unanticipated problems alluded like transfers of village Talhati that handicapped in getting accurate information and data of crops in concerned village. In many cases farmers felt apprehensive and reluctant in furnishing correct and reliable data which do not match the published data.

The updated data and information in fulfilling objectives was not readily available. Hence investigator has confined present study on agricultural land use pattern for single year and more stress has been given on spatial analysis. There is hardly access to the data on livestock and land holdings in tehsil level. Hence these aspects have not been fully elaborated in the present study. These constraints and limitations of non- availability of accurate data spells out handicapped realistic land use analysis.

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Chapter-II

Physical profile of Washim District

2.1 Introduction:

2.2 Location and spatial relation of study area:

2.3 Geology:

2.4 Geomorphology and Soil types:

2.5 Soil Analysis:

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Chapter-II

Physical profile of Washim District

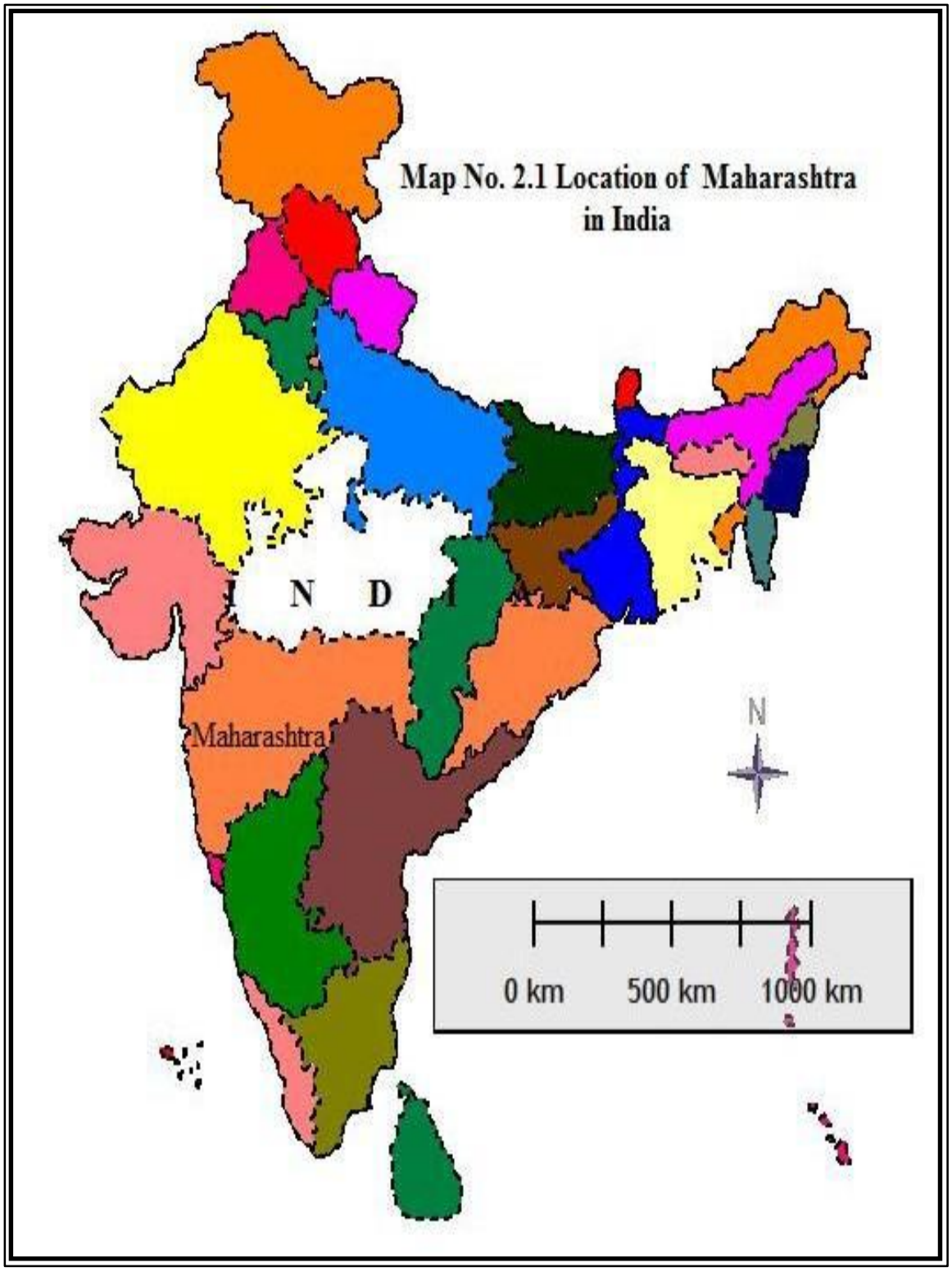
2.1 Introduction:

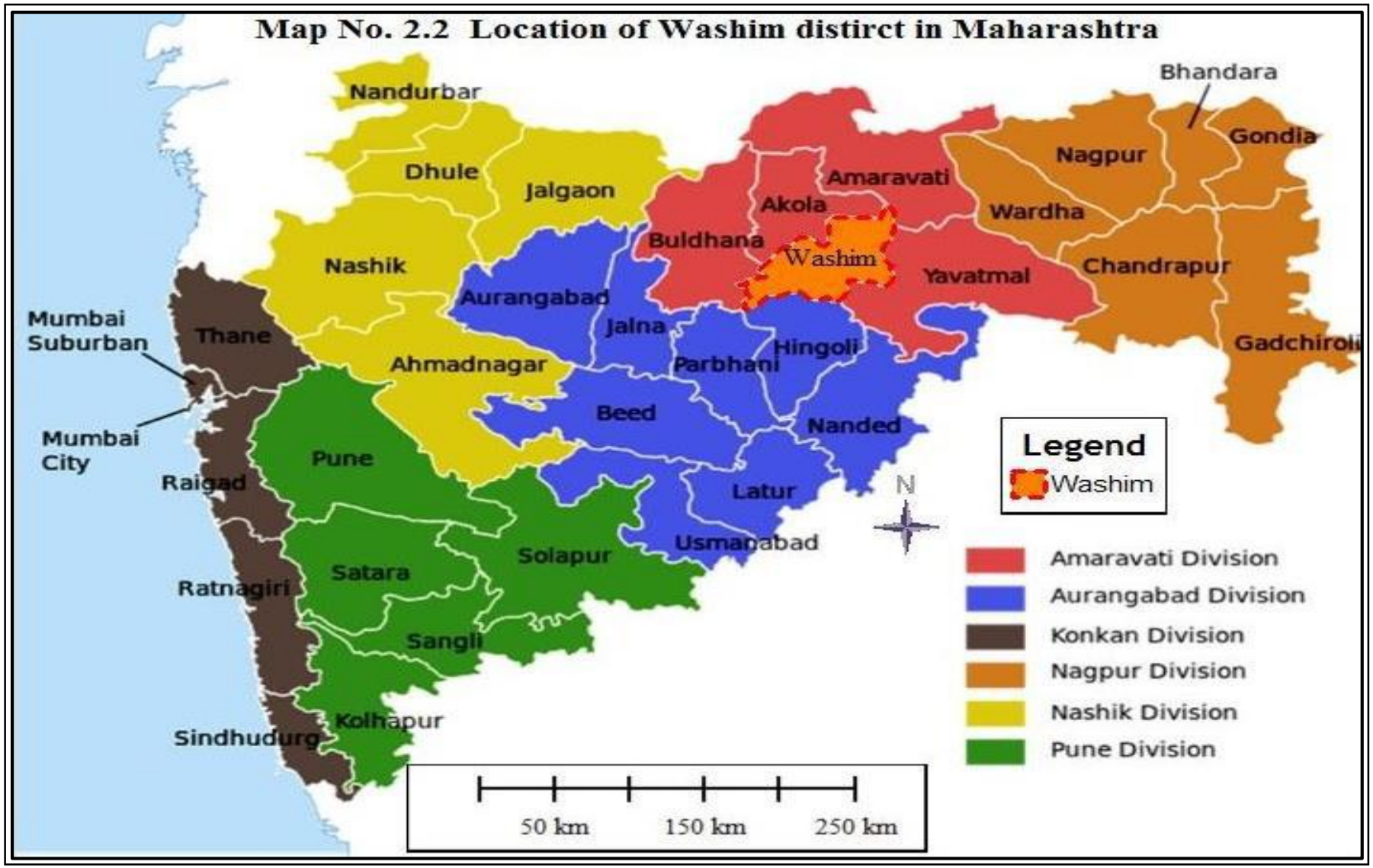
Agricultural activities depend on the physical environment. Human community tried to minimize the restrictions enforced by nature. "Land is the basic resource of human beings". Its utilization shows a reciprocal relationship between ecological conditions of a region and man. **Visher, Stephen S. (1932)[1]** has rightly put forward the theory that "A special field of geography concerns itself with the study of the influence of natural environment on the nature and distribution of human's activities". Nature, in its diverse manifestations, namely, the soil, the water and the climate, provides man in different area with a verity of possibilities for development **Hettner, (1947)[2].** It's therefore necessary to evaluate the agricultural land use of the study region needs to unfold the physical determinants in Washim District.

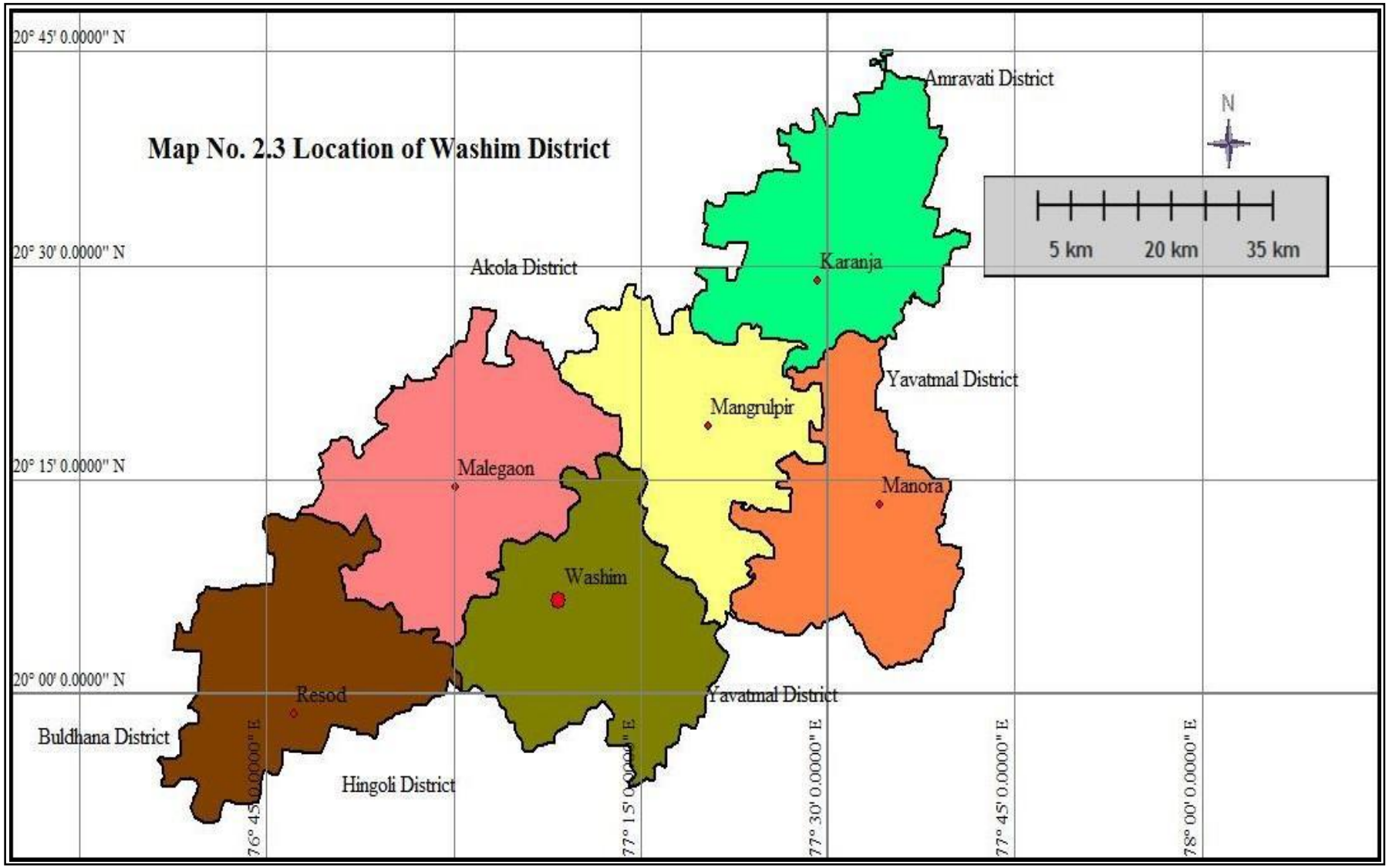
This chapter discovers the profile of physical background of the region, Relief, Climate, Geology, Drainage, Soil and Vegetation. Simple cartographic method was used to show soil and rainfall divisions. Geographical Information System **(Global Mapper V-14.2)** is used to depict the contour and drainage system and demarcate the Washim District.

The data related to temperature and rainfall has been obtained from Regional Meteorology Department, Nagpur. The rainfall figure for six Tehsils, Washim, Risod, Malegaon, Mangrulpir, Manora, and Karanja were collected from Agriculture Department Govt. of Maharashtra Pune. The soils divisions of the study region are depicted on the basis of the soil map of Washim district.

2.2 Location and spatial relation of Study Area:




Map No. 2.2 Location of Washim distirct in Maharashtra
Nandurbar
Dhule
Jalgaon
Nashik
Thane
Mumbai Suburban
Mumbai City
Raigad
Ratnagiri
Sindhudurg
Pune
Satara
Sangli
Kolhapur
Solapur
Ahmadnagar
Aurangabad
Jalna
Beed
Latur
Usmanabad
Parbhani
Hingoli
Nanded
Buldhana
Akola
Amaravati
Washim
Yavatmal
Wardha
Nagpur
Bhandara
Gondia
Chandrapur
Gadchiroli
N
Legend
Washim
Amaravati Division
Aurangabad Division
Konkan Division
Nagpur Division
Nashik Division
Pune Division
50 km
150 km
250 km


Map No. 2.3 Location of Washim District
20° 45' 0.0000" N
20° 30' 0.0000" N
20° 15' 0.0000" N
20° 00' 0.0000" N
76° 45' 0.0000" E
77° 15' 0.0000" E
77° 30' 0.0000" E
77° 45' 0.0000" E
78° 00' 0.0000" E
N
5 km
20 km
35 km
Amravati District
Akola District
Karanja
Yavatmal District
Mangrulpir
Malegaon
Manora
Washim
Resod
Yavatmal District
Buldhana District
Hingoli District

Washim district is located in the southern region of Vidharbha. Akola lies to its north, Amravati lies to its north-east, Hingoli lies to its south, Buldhana lies to its west, Yavatmal lies to its south-east and Amravati in the Northeast (Map No2.2). Washim was a part of Akola District and is separated in 1998 with headquarter at Washim. Washim is one of the 11 districts of Vidarbha. It is situated in the north eastern part of the Maharashtra State abutting Madhya Pradesh and lies between 19°61' to 21°16' north latitudes and 76°07' to 77°14' east longitude. It appears in Survey of India degree sheets 55 D, 55 H, 56 A and 56 E. The district has a geographical area of 5196.88 km^2. For Administrative convenience, the district is divided in to six tehsils. The district has 4 Nagar Parishads, six Panchayat Samitis and 493 Gram Panchayats. This district is divided into two sub-divisions Washim and Mangrulpir. The tehsils are Washim, Risod, Malegaon, Mangrulpir, Karanja and Manora covering 789 villages. There are four Vidhan Sabha constituencies in this district. These are Medshi, Washim, Mangrulpir and Karanja. Washim is the only Loksabha constituency of the district, consisting of all four assembly segments of the district and two assembly segments of Yavatmal district.

Table No. 2.1 Tehsils in Washim District 2011

Sr. No.	Name of Tehsil	No. of Villages	Area in Km^2	Population 2011	Density
1	Washim	126	863.31	255188	296
2	Risod	99	830.96	207545	250
3	Malegaon	122	914.73	189051	207
4	Mangrulpir	136	780.82	175208	224
5	Karanja	169	865.75	213824	247
6	Manora	135	779.28	156344	221
Total	District	789	5196.88	1197160	230

Source: Census of India 2011

Washim district covers an area of 5196.88 km^2. (519688 hectares). It's the 1.65 percent area of Maharashtra State. It's Population of about 1197160 persons (census of India 2011) with an average

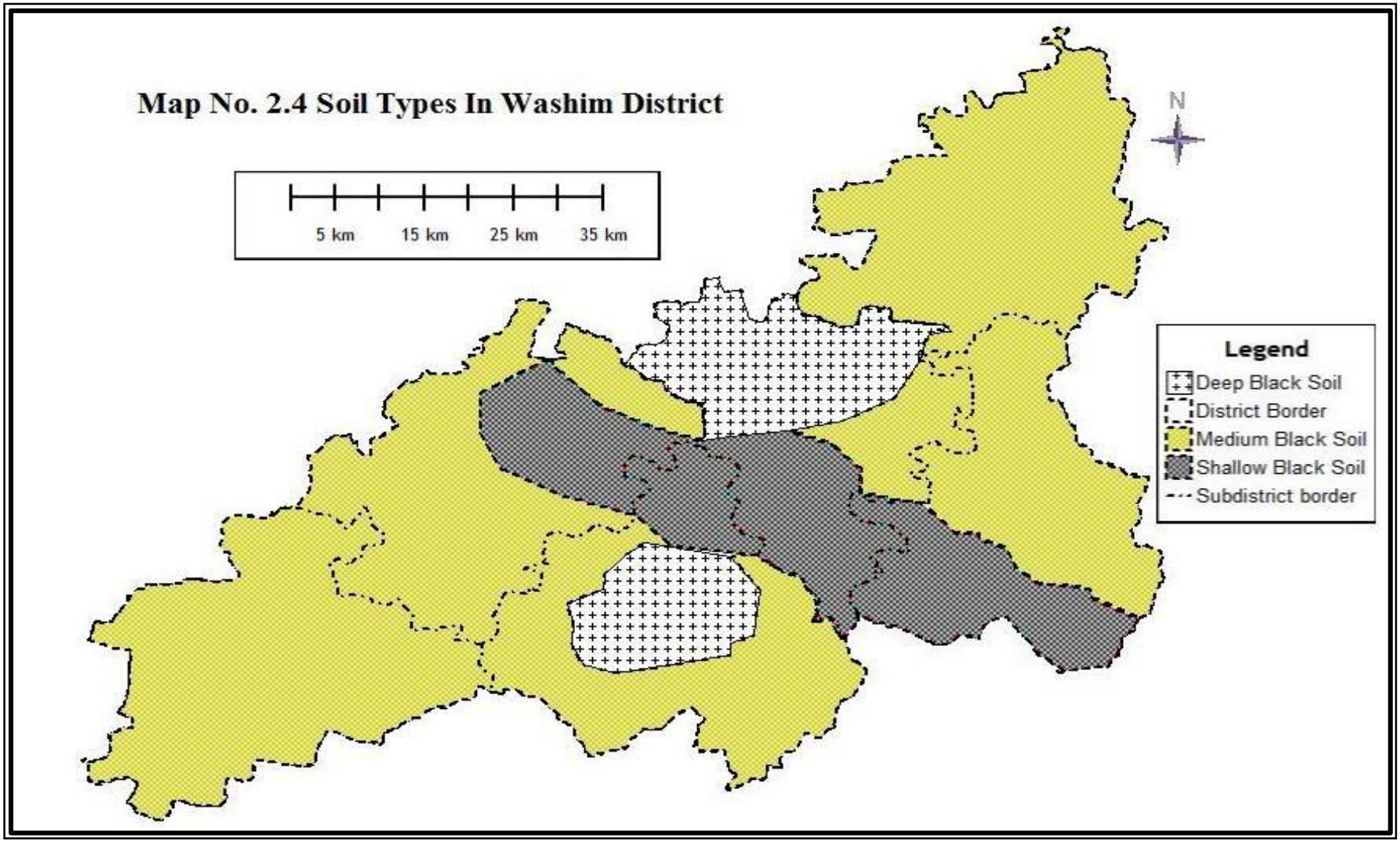
population density of 230 persons per sq. km. Above Table No. 2.1 shows the Tehsils, Number of villages, area, population and density in the Washim District.

2.3 Geology:

The region under study is covered by Basalt. Geologically, the basalt formed by outpouring of enormous lava flow which spread over vast area **(Akola District Gazetteer 1971)**[3]. There are two types of basalt, namely, vesicular and non-vesicular. The vesicular basalts are soft and susceptible to weather and erosion while non-vesicular basalts are hard, tough, compact and medium to fine grained with conchoidal fracture. Soils in the District derived from the rock base due to constant weathering. The alluvial soil of the region presents the transportation of soil particles through course of time. Soil differentiation in the Washim district clearly shows the base of two types of basalt and finally reflected on the land use types in the area under study.

2.4 Geomorphology and Soil Types:

The district forms part of Deccan Plateau with slope towards southeast from Sahayadri hills and has a varied topography consisting of hills, plains and undulating topography near riverbank. The district forms a part of Godavari and Tapi basin. Balaghat Plateau comprises of low-lying hills forming water divide. Godavari and Tapi rivers have many tributaries originate from the Balaghat Plateau. Penganga is the main river flowing through the district. Other rivers are Aran, Arunavati, Nirguna, Pus, Wembala, Katepurna and Morna. The soil of the district is basically derived from Deccan Trap Basalt and major part of the district is occupied by medium black soil of 25-50 cm depth occurring in the plains in entire south western, north eastern and northern part of the district, whereas the shallow Black soil


Map No. 2.4 Soil Types In Washim District
N
5 km
15 km
25 km
35 km
Legend
Deep Black Soil
District Border
Medium Black Soil
Shallow Black Soil
Subdistrict border

of 7.5 to 25 cm depth occur in restricted hilly part of the district in central elongated part and the northern peripheral part (Map No. 2.4).

2.5 Soils Analysis:

The soils in the Washim District are the key parameter influence on the existing cropping pattern. Soils vary with changing climatic condition in region. Soils and its inherent properties give control on the crops and crop yielding. Moreover, its mineral composition, texture, thickness and fertility set fundamental limit to the land use pattern. The fertility of land depends on organic, inorganic material and water available in soil. It is, therefore, necessary to make a detailed study of the soil for proper land use. **Jainendra Kumar, (1985)[4]** has rightly pointed out that the need for careful study of soils in order to make efficient land use as soil provides basic nutrients to plants far longer than chemical fertilizers.

Table No. 2.2 Soil Types in the Washim District

Soil Texture Classes	Proportion in percent					
	Coarse sand	Fine Sand	Silt	Clay	pH	Soil color
Clay	11.90	22.08	13.75	48.00	8.5	Dark Black
Sandy Clay	15.85	33.03	06.25	41.75	8.0	Dark Black
Clay Loam	17.30	09.70	28.75	38.00	7.8	Medium Black
Loam	15.00	30.76	20.00	28.00	7.7	Shallow Black
Sandy Loam	26.70	29.55	22.50	18.50	8.3	Shallow coarse
Silt Loam	13.70	13.23	52.50	18.00	8.1	Shallow Soil

Source: Department of Agri. Govt. of Maharashtra Pune

The significance of soils can be assessed by the following facts:

1. It provides physical support to vegetation.
2. It serves as a medium for storing water and bringing water into Contact with roots.
3. It supplies a small but essential percentage of material which

is converted into food by plants.

The assessment' of soil of Washim District has not so far been made earlier. The soil division's map of Washim District was prepared on the basis of soil % area in Washim district. It is broad soil divisions of the Washim district. This map gives realistic picture regarding color, texture, slope and drainage. Majority of soil types of the Washim district are formed in situ by weathering process of the prevalent basalt. It is rich in nutrients such as lime, iron and alkalis. The information obtained from soil analysis of samples has been incorporated in Table No: 2.2. On the basis of chemical constituents, shades of color and texture, soils fall into three types as follows:

1) The coarse shallow soil. 2) The medium black soil, and

3) The deep black soil.

1**) Deep Black Soil:**

This soil covers 10.6 per cent of the study area lying in central part of Washim Tehsil and Northern part of Mangrulpir Tehsil. (Map No. 2.4). The black soil in region is called "Regur". It appears as dark brown to grayish black in color. The soil particles are very fine and coherent. It is black in color due to excessive predominance of humus content ever ingredient and has high power of retaining Moisture. It becomes pasty in rainy season. This soil contains 0.35 % nitrogen 1.28 % potash and 14 % calcium, whereas pH is 8.2, Table No.2.3.

Table No. 2.3 Analysis of Deep Black Soil

Elements	**%**	**Parameters (in %)**			
Coarse Sand	17.80	N	0.35	$CaCo_3$	4.40
Fine Sand	22.20	K	14.00	Co	41.58
Silt	13.75	P	1.28	Mg	8.17
Clay	43.00	pH	8.2	ZN	Nil

Source: Department of Agri. Govt. of Maharashtra Pune

The deep black soil in the Washim District varies in depth from two

feet to ten feet. The ploughing of the soil in summer is not easy as it became very hard. It develops cracks in summer season and sometimes such cracks in summer season appear more than three feet deep. The deep black soils of this region have good fertility due to its high moisture retentive capacity. Though the crops can be cultivated on black soil, cotton and hybrid Jawar are predominant crops in this soil type as this soil has high yield per hectare.

2) Medium Black Soils:

This soil covers 72.4 % area in the Washim district (Map No.2.4). It is relatively less fertile than earlier soil type as the proportion of sand and gravel increases in medium soil.

Table No. 2.4 Analysis of Medium Black Soil

Elements	**%**	**Parameters (in %)**			
Coarse Sand	15.10	N	0.27	$CaCo_3$	8.7
Fine Sand	34.85	K	1.72	Co	43.20
Silt	11.60	P	20.50	Mg	10.32
Clay	33.00	pH	7.8	-	-

Source: Department of Agriculture, Govt. of Maharashtra, Pune

This soil can be characterized by fewer clods and less fine mud is saturated in dry period. Locally, this soil is known as "Barad Soil" as it combines 34.85 % Fine sand and 33 % clay. Table No. 2.4 shows analysis of medium black soil in the Washim District. The medium black soil acquires loose particles in dry and muddy in wet and lime content Occurs in a moderate quality. Moreover, its soil soaks water easily and has less productivity than earlier. The Cotton, Jawar, Wheat, Red Gram, Gram is raised successfully in this soil.

3) The Coarse shallow Soils:

This soil type is confined in the north-south Ajanta Ranges hilly area

of the Washim district covering 17 % of the region (Map No. 2.4). Locally this soil is known as 'Kharadi and Bardi Jamin'. The analysis of coarse shallow soil sample is given in Table No. 2.5.

Table 2.5 Analysis of Shallow Black Soil

Elements	**%**	**Parameters (in %)**			
Coarse Sand	22.70	N	0.26	$CaCo_3$	9.40
Fine Sand	29.55	K	0.84	Co	30.24
Silt	22.50	P	4.73	Mg	15.05
Clay	18.50	pH	8.1	-	-

Source: Department of Agriculture, Govt. of Maharashtra, Pune

This soil type has predominance of coarse sand (22.70 %) and silts (22.50 %). The particles of sand finds closely spaced rapidly soaked in nature. This soil has low evaporation rate than earlier soil types and is poor in phosphorus and nitrogen (Table No. 2.5). All crops can grow but with low yield due to low productivity of the soil. Rice and local Jawar are raised in this soil type in the Washim District.

2.6 Hydrology:

Water bearing formation is weathered / fractured /jointed vesicular / massive basalt under phreatic & semi-confined condition. Flows are represented by massive portion at bottom & vesicular at top & are separated from each other by red bole. Weathered and fractured trap are occurring in topographic lows from main aquifer in district. The vesicular portion of different lava flow varies in thickness from; 8-10 m. it forms the potential zones, **CGWB (2007)**[5].

1. Pre Monsoon Water Level:

The water level in the district under normal rainfall conditions during month of May ranges beetween5-12 meter below ground level (mbgl) shallow water level within 10 mbgl are seen in almost northern part of Risod Tehsil &

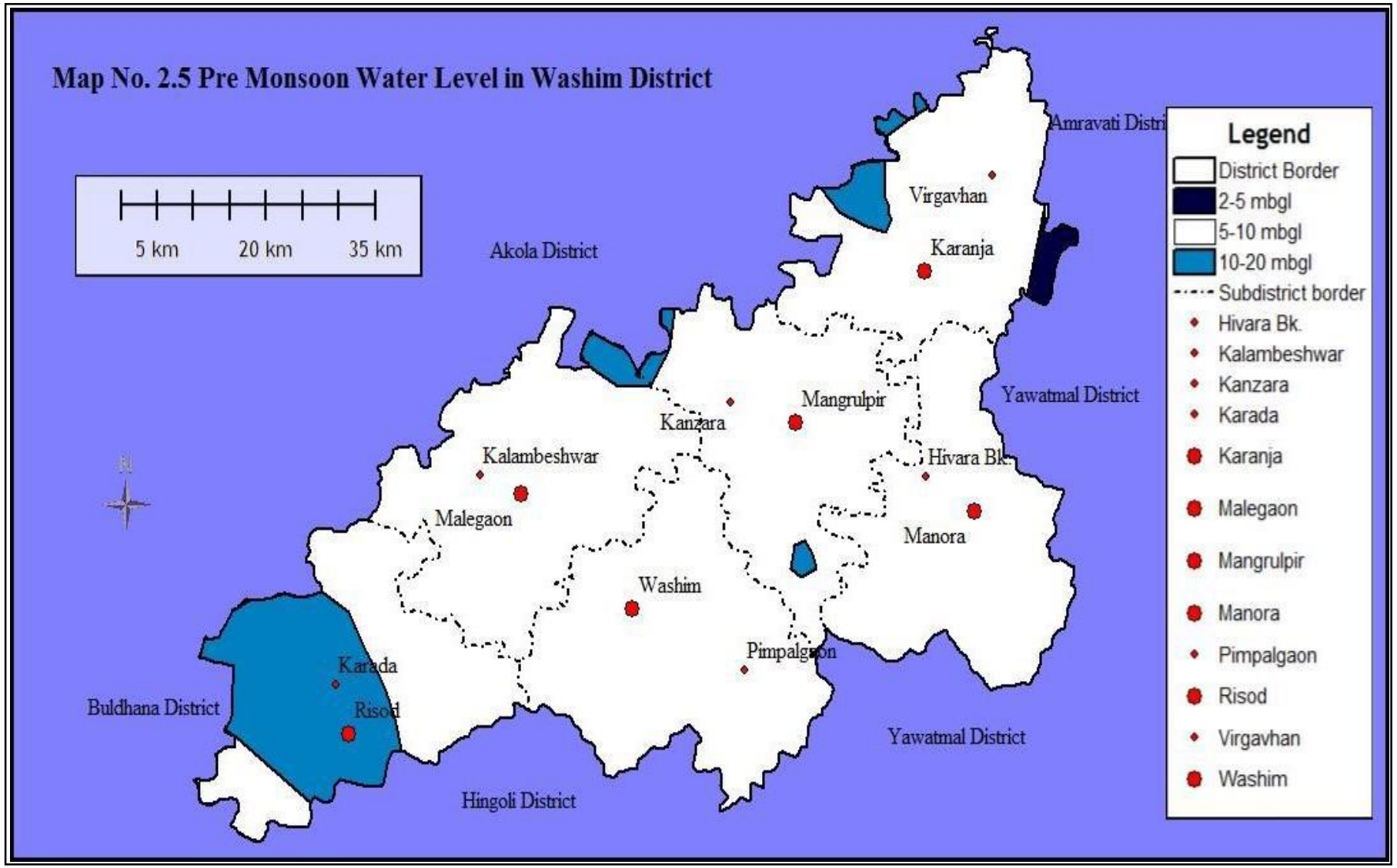
entire Malegaon, Washim, Mangrulpir, Manora and Karanja Tehsil (Map No.2.5). Water level in the ranges of 10-29 mbgl are observed in isolated patches in southern part of Risod, northern part of Malegaon & north-west part of Karanja Tehsil.

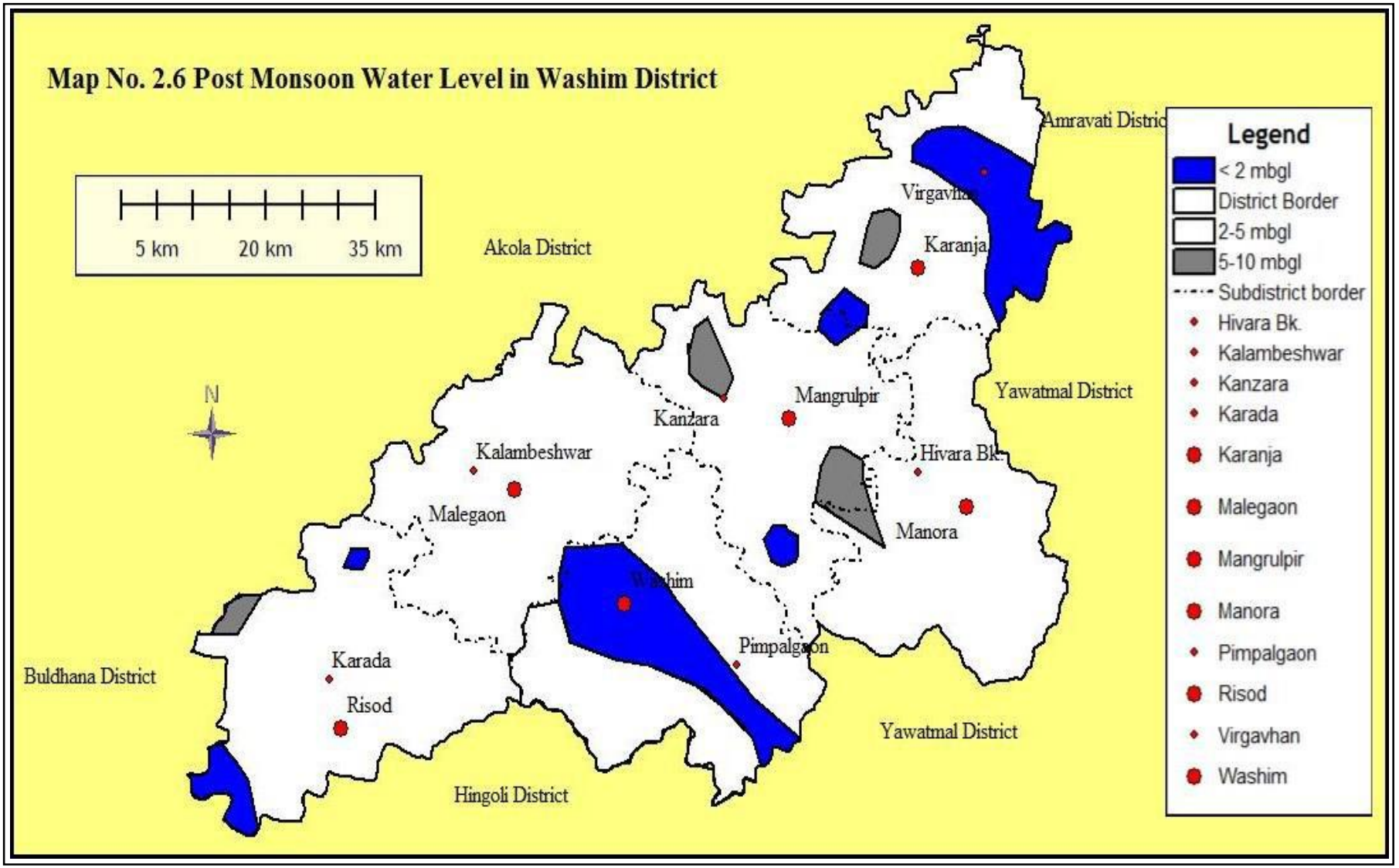
2. Post Monsoon Water level:

The water level during month of November in the entire district the water levels are shallow within 10 mbgl. water levels of 2-5 mbgl is most dominant range occupying almost entire Risod, Malegaon, Manora, & major parts of Washim, Mangrulpir and Karanja Tehsil (Map No. 2.6). Water level less than 2 mbgl are observed in isolated patches in southern parts of Karanja Tehsil. Water level of 5-10 mbgl is also observed in isolated patches in southern parts of Karanja Tehsil. Washim, Malegaon, Risod, Manora Tehsil belongs to the runoff zone.

There is first order drainage & having shallow water table during monsoon to winter season. Water bearing zone is from 80-100 feet, below that there is massive compact hard trap. It has no acceptance of rainwater hence during monsoon period some bore wells become overflow. Karanja, Mangrulpir Tehsil belong to the recharge zone.

There is second order drainage moderately to highly fractured trap act as good aquifers water bearing zone for bore well is from 160 to 200 feet. There is good groundwater potential for development. Near about 95 % bore wells & dug wells having adequate water even though in summer season there is moderately to highly fractured trap act as a good aquifer (Map No. 2.6).


Map No. 2.5 Pre Monsoon Water Level in Washim District
5 km
20 km
35 km
Akola District
Amravati Distri
Virgavhan
Karanja
Yawatmal District
Mangrulpir
Kanzara
Kalambeshwar
Hivara Bk.
Malegaon
Manora
Washim
Pimpalgaon
Karada
Risod
Buldhana District
Yawatmal District
Hingoli District
Legend
District Border
2-5 mbgl
5-10 mbgl
10-20 mbgl
Subdistrict border
Hivara Bk.
Kalambeshwar
Kanzara
Karada
Karanja
Malegaon
Mangrulpir
Manora
Pimpalgaon
Risod
Virgavhan
Washim


Map No. 2.6 Post Monsoon Water Level in Washim District
5 km
20 km
35 km
N
Akola District
Amravati District
Yawatmal District
Buldhana District
Hingoli District
Yawatmal District
Virgavhan
Karanja
Mangrulpir
Kanzara
Kalambeshwar
Hivara Bk.
Malegaon
Manora
Washim
Pimpalgaon
Karada
Risod
Legend
< 2 mbgl
District Border
2-5 mbgl
5-10 mbgl
Subdistrict border
Hivara Bk.
Kalambeshwar
Kanzara
Karada
Karanja
Malegaon
Mangrulpir
Manora
Pimpalgaon
Risod
Virgavhan
Washim

2.7 Physiographic Division:

The Balaghat on the top of the Ajanta ranges comprising Washim and Mangrulpir Tehsils to the south. The landscape in the district though not highly hilly, still offers interesting contrasts between the plateau and the plains, further enriched by a forested ghat country and a bad land topography joining the Mun river (Map No. 2.7).

1. Hills:

The district does not have any large area under extensive hill ranges. The northern extreme of the district in the foothills of Satpuda and the ghat country through which the land rises from the Purna plains to the Balaghat plateau as well as the isolated broken hill terrain in the extreme south-east in Mangrulpir Tehsil are the only regions of relatively higher elevation.

2. Ajanta Range:

The Ajanta range carrying on its flat top the Buldhana plateau (Balaghat) of Washim, Malegaon and Mangrulpir Tehsils has steep rims facing north and descending to the Purna plains. This hilly ghat country at an overall elevation of about 400 m. is extremely uneven and rough with a tangle of hill masses covered by jungles. This escarpment is much less defined than the Satpuda scarp. It has a curving trend from west to east. It is highly dissected, carrying everywhere small un-dissected sections of plateaus forming isolated stretches of mesa separated by deep river valleys in which the rivers have serpentine courses. Another area of hilly terrain within the district is seen in the southern part of the Manora Tehsil particularly, along the boundaries of Yavatmal district. This tangle of the hill Masses rising to an elevation of 500 to 600 m. are much less dissected than the northern scarp slope at a comparatively lower elevation. This slope in many places is cut into by the tributaries of the Penganga forming deep entrenched valleys that constitute the main lines of the access and habitation development.

3. Plateaus:

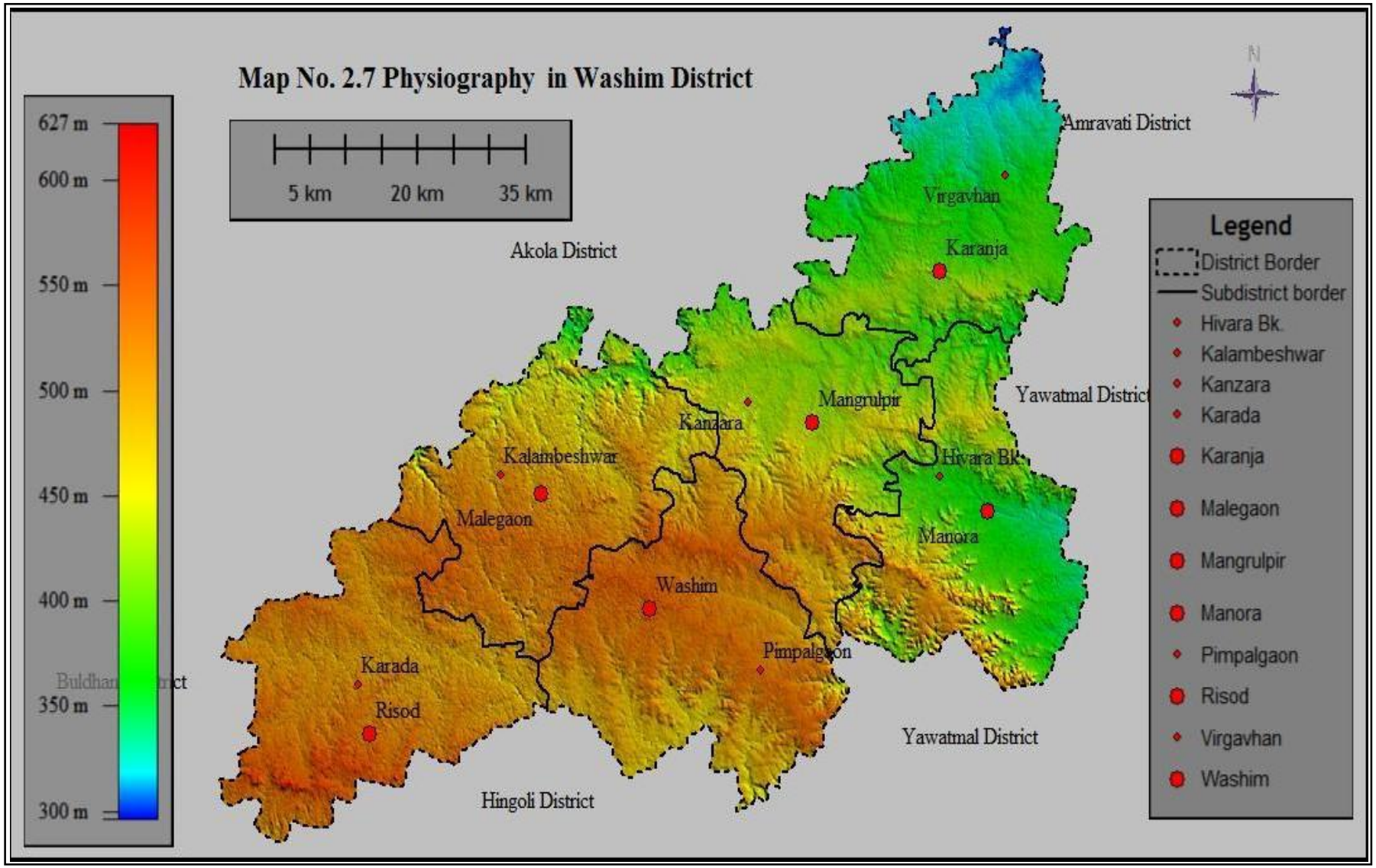
The Washim and Mangrulpir plateaus in the Balaghat are at an elevation of about 400 to 500 m. sloping gently to the east. It is a rolling country with a number of residual hills and knolls dotting the country plains. It is along the rim of the plateau that the terrain becomes much more rugged and uneven developing a ghat aspect. Comparatively the Washim Tehsil is much more level and even than Mangrulpir. The plateau is drained eastwards mainly and to a lesser extent to the north due to the recession of scarp on the northern edge (Map No. 2.7).

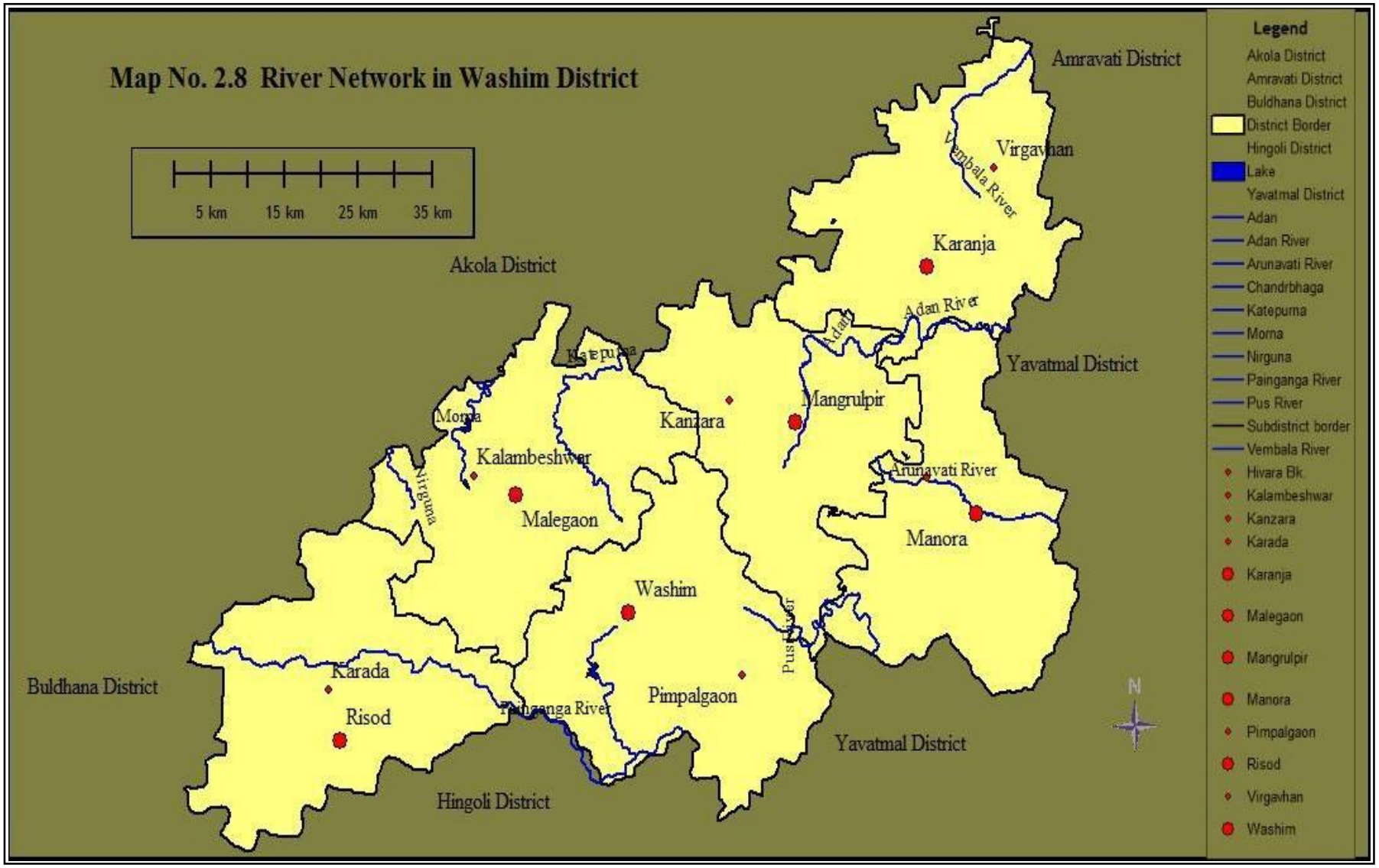
2.8 Drainage:

Surface water that is the water on the surface of Land represents the drainage from the Land and a part of the rainfall that is absorbed by the soil also becomes surface water by its discharge when it seeps into hills and runnels. The portion of rain or snow that penetrates deeply becomes the ground water recharge and it is discharged into the streams slowly.

The surface water is by far the most important means for providing substantial irrigation which stabilizes and improves agro climatic life in an area that has otherwise plenty of land potential. Because of the uncertainty in the flow of surface water, it is probable that any attempt to improve agricultural techniques and land use planning without combating the problem with the help of shallow and deep water table is found to be abortive **Chauhan D.S. (1987)[6]**.

However drainage is one of the most important components of physical environment of which affects agriculture directly and indirectly, **Lanbein W.B. J.V. B. wells (1955)[7]**. The main river of the district is the Penganga, the other less important rivers being the tributaries of these two rivers. They are the Katepurna, Shahanur, Morna, Mun, Nand, Man and Lima, which are the tributaries of the Purna. The Adan, Arna and the Pus are the tributaries of Penganga (Map No.2.8).


Map No. 2.7 Physiography in Washim District
627 m
600 m
550 m
500 m
450 m
400 m
350 m
300 m
5 km
20 km
35 km
N
Amravati District
Virgavhan
Karanja
Akola District
Yawatmal District
Mangrulpir
Kanzara
Kalambeshwar
Hivara Bk.
Malegaon
Manora
Washim
Pimpalgaon
Karada
Risod
Hingoli District
Yawatmal District
Legend
District Border
Subdistrict border
Hivara Bk.
Kalambeshwar
Kanzara
Karada
Karanja
Malegaon
Mangrulpir
Manora
Pimpalgaon
Risod
Virgavhan
Washim


Map No. 2.8 River Network in Washim District
5 km
15 km
25 km
35 km
Amravati District
Akola District
Yavatmal District
Buldhana District
Hingoli District
Yavatmal District
Virgavhan
Vembala River
Karanja
Adan River
Adan
Katepurna
Morna
Kalambeshwar
Nirguna
Malegaon
Kanzara
Mangrulpir
Arunavati River
Manora
Washim
Pus River
Karada
Risod
Painganga River
Pimpalgaon
N
Legend
Akola District
Amravati District
Buldhana District
District Border
Hingoli District
Lake
Yavatmal District
Adan
Adan River
Arunavati River
Chandrbhaga
Katepurna
Morna
Nirguna
Painganga River
Pus River
Subdistrict border
Vembala River
Hivara Bk
Kalambeshwar
Kanzara
Karada
Karanja
Malegaon
Mangrulpir
Manora
Pimpalgaon
Risod
Virgavhan
Washim

1. River Katepurna:

The Katepurna rises in the northern slopes of the Ajanta ranges in Malegaon Tehsil at an elevation of 320 meters (Map No.2.8). It mainly flows north in a non-perennial channel. It joins the main river on the left bank of the village Batori. It has an overall length of 100 km in the both district. The river in its lower course turns by sharp bends westwards and northwards. Its immediate banks are mostly liable to flooding. It is a tributary of River Purna.

2. **River Morna**:

The Morna River rises in the Malegaon Tehsil near Shirpur village and flows through an open and flat country of the plateau, before passing through the large village of Medsi on the edge of the plateau. From here, the river goes through the ghats in a romantically picturesque country with sharp bends in between interlocking spurs developing a deep valley with a cliff face on the outer bank and wide alluvial flats on the inner bank before entering into the Payanghat plains.

3. **River Penganga:**

The Penganga River raises in the Deulghat hills of the Buldhana plateau and flows east to enter Washim district in its North-western parts in Risod Tehsil near the village Wakad. The river has an overall length of 100 km. in its course through the district. Initially, it flows through a rolling plateau country in a narrow channel less than 100 m. wide with sharp bends. It forms the boundary between this district and Hingoli from the village Warud Topha downstream till its exit into the Yavatmal district. In this section, where it forms the boundary, the river bed is wider and rugged and the river channel itself is braided. The river turns at sharp bends, suggestive of the joint control of the bed rocks. In its entire course through the district, the river is non-perennial. It has many tributaries within the district which are also non-perennial. Kas River rises in Washim Tehsil and flows south to join the Penganga near the village Masla. The Adol River flowing past Shirpur and the Chandrabhaga are other small tributaries.

4. River Pus:

The Pus River rises in the south-eastern part of Washim Tehsil and descends down the rugged plateau edge through a series of sharp bends controlled by the pentagonal joints in the basalt, before leaving the district to enter Yavatmal district near the village Rui. The scarp on its banks has retreated by parallel recession to develop wide alluvial flats that are dotted with villages in the deep valley bottom, and are enclosed by hills to remain isolated in many parts. Its significant source tributary, Bopalpandi River also rises in this district.

5. River Aran:

It rises in the eastern parts of Washim Tehsil and then flows towards east through the northern parts of Mangrulpir Tehsil before entering into Darwha Tehsil of Yavatmal district. The Aran and its tributary, the Kupti, rise in Mangrulpir Tehsil and flow east in the southern parts to enter Yavatmal district.

2.9 Climate:

The climate is also a noteworthy constituent exerting influence on crops in the Washim District. The vegetation cover and the prevalent climate are the variables entering into the formation of soils and this soil rises to give for existing agricultural land use. The proper and suitable climate is essential for better yield, growth, production and reproduction, **Chauhan D.S. (1971)[8]**. The climate of the Washim District is typical monsoonal in character with a small range of rainfall and temperature. The study region experiences intensive heat in summer and intensive cold in winter. The intensive heat in summer is drier and affects the vegetation in shunting its growth. The Washim District climatically can be divided into four seasons as below:

1. The Cold Winter Season

The cold winter season is restricted to four months, November, December, January and February. It commences in mid-November and ends in February Clear sky, fine weather, low humidity and large diurnal variations in temperature are common characteristic features in cold winter in Washim District. The temperature starts to go down from November and it continues further in February. Both day and night temperature decrease fairly and rapidly with the advent of winter. Table No. 2.6 shows the average monthly rainfall and temperature at Washim. In cold season rainfall amount is negligible in the study area. Temperature experiences during these months are dropped down considerably. January appears to be coldest (Table No.2.6) in the year. Maximum temperature of November and December are 31.1°C and 29.3°C respectively. February experiences temperature of 32.5°C (Table No.2.6). The winter season with usually dry weather has a beneficial effect on the winter wheat crops. The occasional stormy rain in the season harms the standing crop in the winter. The standing crops are swept down on the soils.

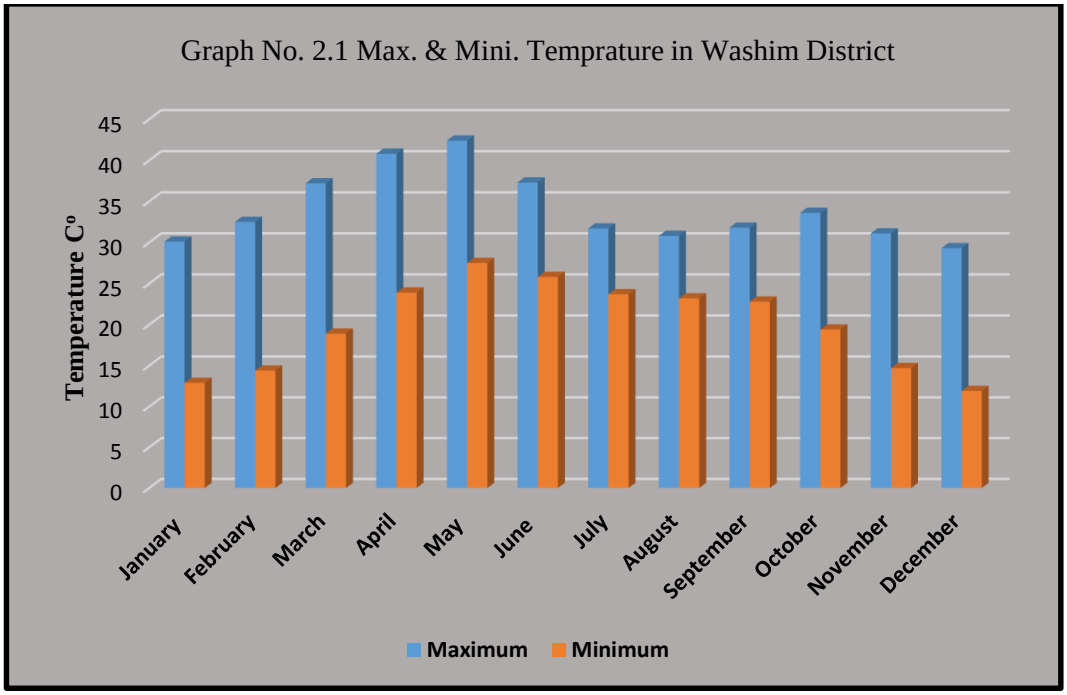
2. **The Hot Weather Season**

In month of March, April, May and first half of June constitute hot weather season in the Washim District. This season is very unpleasant and is dominated by westerly dry winds. The nights are uncomfortable and. days are marked by intensive heat. The average temperature in Washim district during summer is 42.4°C. Right from March, the day temperature starts rising and reaches maximum in May (Table No. 2.6) (Graph No. 2.1).

Table No. 2.6 Temperature, Humidity in Washim District 2010

Months	**Temperature Cº**		**Relative humidity %**
	Mean daily maximum temperature	Mean daily minimum temperature	
January	30.1	12.9	55
February	32.5	14.4	46
March	37.2	18.9	32
April	40.8	23.9	28
May	42.4	27.5	27
June	37.3	25.8	64
July	31.7	23.7	79
August	30.8	23.2	80
September	31.8	22.8	79
October	33.6	19.4	62
November	31.1	14.7	57
December	29.3	11.9	59
Average	**34.05**	**19.9**	**55.6**

Source: Regional Meteorology center, Nagpur.



May is the climax of the year with intensive and unbearable heat (42.4°C) whereas. March and April experience 37.2°C and 40.8°C temperature respectively. Excessive heat has desiccating influence on vegetation. The trees are shading their leaves to protect from intensive heat in summer. The relative humidity in summer remains always less than (28 %) that of other seasons. The high speed dry winds are common phenomena which raises a huge cloud of dust in the sky. Such phenomena originate due to abnormality in weather. The weather in March and April is conducive for ripening, threshing and winnowing of the rabbi crops.

Table No. 2.7 Monthly Rainfall in Washim District 2010

Months	Rain gauge center & Monthly Normal Rainfall (MM)					
	Washim	Risod	Malegaon	Mangrulpir	Manora	Karanja
Jan.	15.2	0	25	43	17	12
Feb.	0	0	0	0	0	0
Mar.	8	0	0	1	0	10
April	0	0	0	0	0	0
May	0	0	0	0	0	0
June	216	280	210.6	122.7	201.7	111
July	468	290.3	466.7	488.9	523.7	309.1
Aug.	215	240.6	273.6	265.5	272.1	209.9
Sept.	145.5	137.4	108.4	122.1	68.9	100.7
Oct.	68.6	52.2	69.6	58.7	93.1	82.7
Nov.	0	0	0	0	0	0
Dec.	0	0	0	0	0	0
Total	**1136.3**	**1000.5**	**1153.9**	**1101.9**	**1176.5**	**835.4**

Source: Agriculture department Govt. of Maharashtra, Pune.

1. The rainy season:

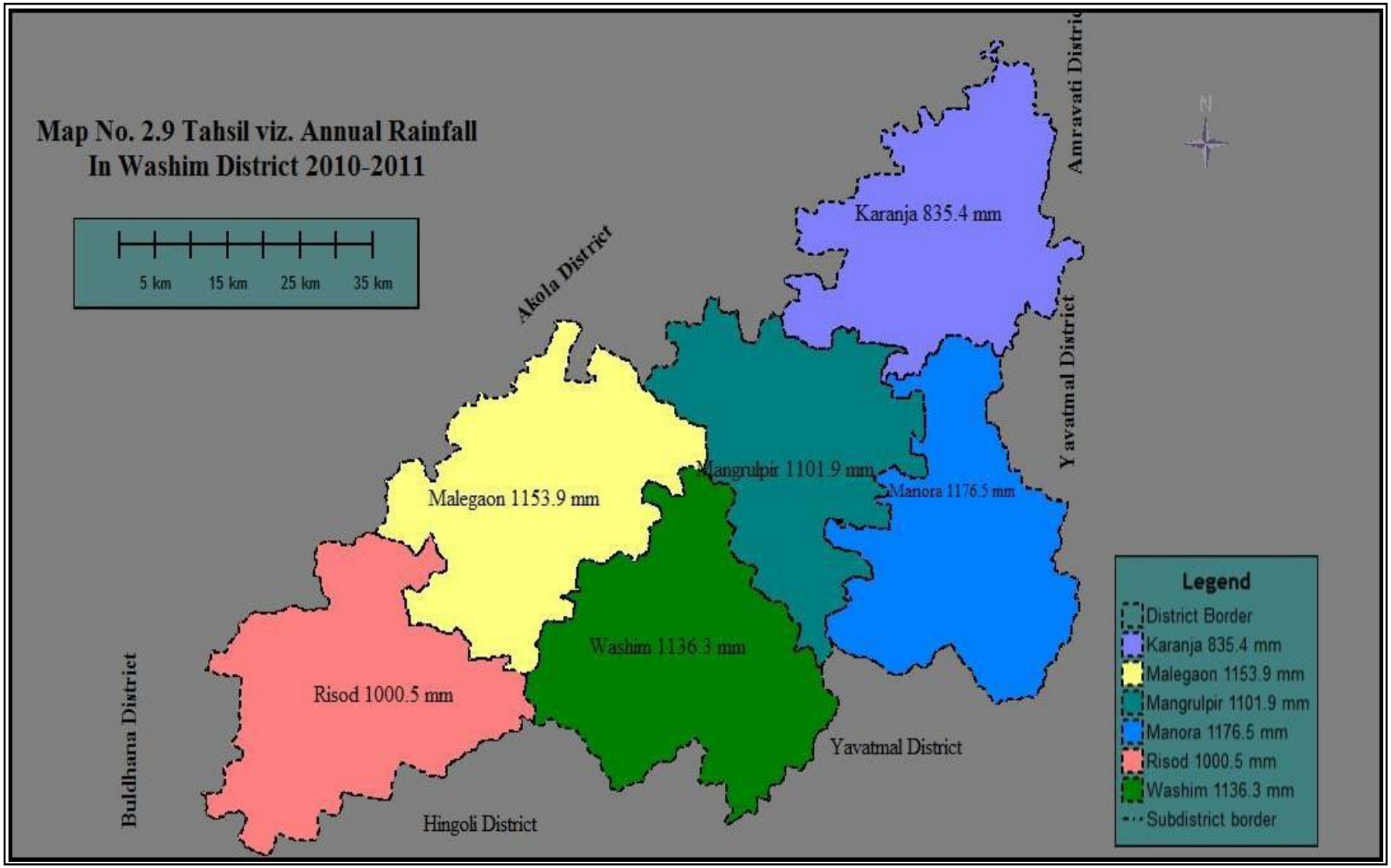
During the rainy season in the Washim District nearly ninety %

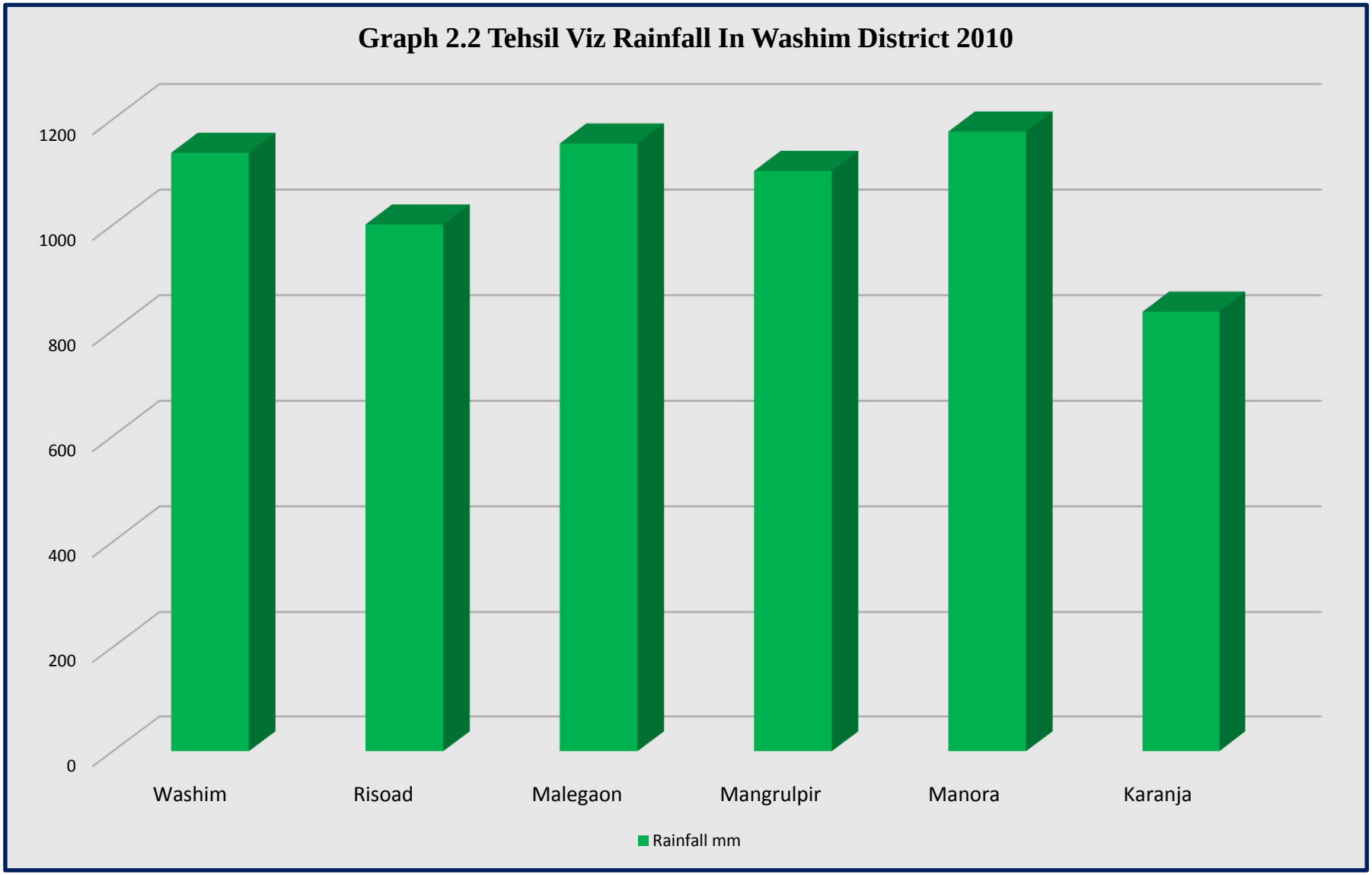
crops are raised. The regime and amount of rainfall serve to shape the land use pattern. The early or late outbreak of the monsoon hampers the sowing operations. The monsoon generally bursts in the middle of June and lasts till September. The advent of rainy season brings change in weather condition. The restless nights and days of summer are converted into Comfortable days. Temperature goes down steadily (Table No. 2.6) (Graph No. 2.1).

The distributional pattern of annual rainfall in Washim District is shown in Map No. 2.9. The Table No. 2.7 presents the monthly rainfall in six Tehsils, Washim, Risod, Malegaon, Mangrulpir, Karanja and Manora. These six stations records, rainfall in increasing order with its maximum at Manora (Table No. 2.7) (Graph No. 2.3) in the Washim District. This season of the year is characterized by heavy and prolonged rainfall with large scale inflow of maritime air. Uneven distribution of rainfall is common in this period. Cloudless skies, accompanied by long spells of bright sunshine dry out the standing crops. Dry spells of weather intervene in between wet days, which are unpredictably uneven. This phenomenon has its impact on the yield of crops.

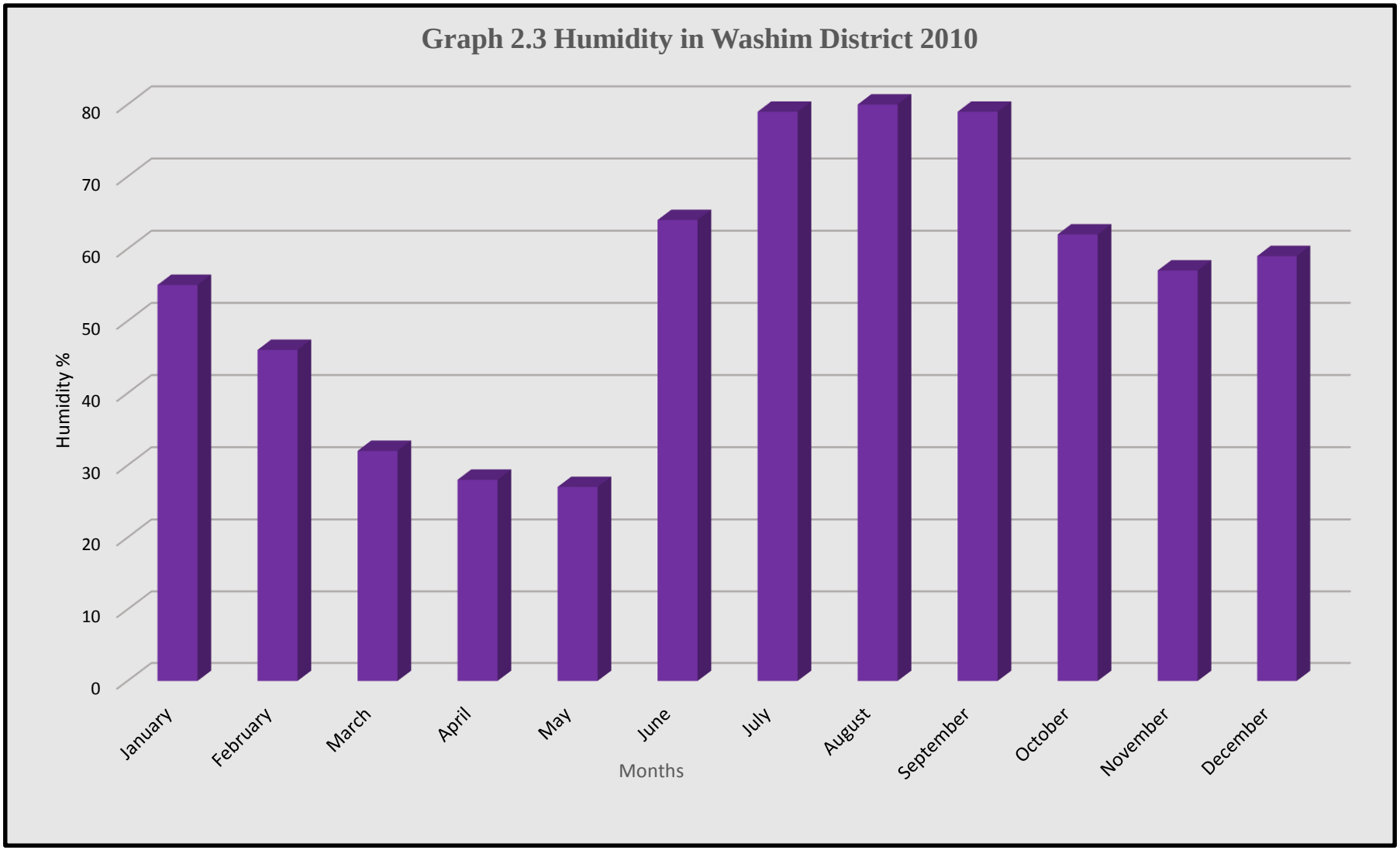
2. Post Monsoon Season:

This season prevails from October to November due to rapid and largest decreasing amount of rainfall in late September. These two months receive little rainfall. Table No. 2.6 shows the average rainfall in October (70.8 mm) and November (00 mm). Increasing day temperature drops down rapidly in afternoon. The relative humidity is rather reduced than that of rainy season.


Map No. 2.9 Tahsil viz. Annual Rainfall
In Washim District 2010-2011
5 km
15 km
25 km
35 km
Akola District
Amravati District
Yavatmal District
Karanja 835.4 mm
Mangrulpir 1101.9 mm
Manora 1176.5 mm
Malegaon 1153.9 mm
Washim 1136.3 mm
Risod 1000.5 mm
Buldhana District
Hingoli District
Yavatmal District
Legend
District Border
Karanja 835.4 mm
Malegaon 1153.9 mm
Mangrulpir 1101.9 mm
Manora 1176.5 mm
Risod 1000.5 mm
Washim 1136.3 mm
Subdistrict border


Graph 2.2 Tehsil Viz Rainfall In Washim District 2010
1200
1000
800
600
400
200
0
Washim
Risoad
Malegaon
Mangrulpir
Manora
Karanja
Rainfall mm

3. **Humidity:**


Graph 2.3 Humidity in Washim District 2010
Humidity %
0
10
20
30
40
50
60
70
80
January
February
March
April
May
June
July
August
September
October
November
December
Months

The air is generally dry over the Washim district except in the monsoon season. Before commencing monsoon therefore, the humidity considerably drops down. The high humidity is observed in the rainy season. It decreases to 59 % in December and to less than 25 % in March due to extreme dryness. July and August have highest humidity (Table No. 2.6) (Graph 2.3).

4. Clouds:

The Washim district appears generally to have clear sky throughout the year, except during rainy season. In rainy season the clouds overcast the sky. These phenomenon of continuous clouds in sky have adverse effect on crops and the cropping patterns. The flowering of Red Gram plants drops down and thus adversely affects the crop.

5. **Winds:**

Strong wind in summer has adverse effect on standing crops in the Washim district. Strong winds in rainy season uproot plants of crops. But most period of the year remain unaffected as the harvesting is over earlier.

2.10 Area under Forest:

Area under forest was 350 km^2 in 2011. Most of the district is either hilly and flat and covered by forest. Forests can be found in some parts of Malegaon, Washim, Mangrulpir and Manora Tehsils. Forests have trees of species like teak, Ain (Terminalia alata), Khair (Acacia catechu) and Anjan (Hardwickia binata), Babhul (Acacia nilotica), Mango (Mangifera Indica), Jambhul (Syzygium Cumini), Babhul (Acacia Arabia), Kadu Nimb (Melia Azadarachta), Palas (Butea Frondosa), Pimpal (Ficus Religiosa), Bor (Zizuhus Jujuba), Chinch (Tamarindus indica), Moh (Madhuca Latitolia), Maharukh (Ailanthus excelsa) Sitaphal (Anana Sanamosa), and weeds are found in the district. Animals like deer, blue

antelope and monkeys and bird species like peacocks and wild fowl are found in the district.

This forest is mixed and scrub type which drops their leaves in summer in order to protect them from unbearable intensive heat. The rivers and small streams have sparse tress along the both sides. The forest of the region does have insignificant effect on agricultural land use pattern as it covers less and dispersed in areal extent in the Washim district.

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11. Superintendent of Agriculture, department Washim district Washim.
12. Department of forest, Washim district.

Chapter-III

Socio Economic Profile of Washim District

3.1 Introduction:

3.2 History of Washim District:

3.3 Historical Importance:

3.4 Cultural importance:

3.5 Population:

3.6 Density of Population:

3.7 Distribution of Population density:

3.8 Occupational structure:

3.9 % of Total Workers to Total Population:

3.10 % of Cultivators to Farm Workers:

3.11 % of Agriculture Laborers to Farm Workers:

3.12 % of Farm Workers to Total Workers:

3.13 Transportation:

3.14 Agricultural Market:

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Reference Books:

Chapter-III

Socio Economic Profile of Washim District

3.1 Introduction:

After unfolding the background of physical setting of the Washim District in Chapter two investigate the climate, soils, and relief structure, it would be relevant to understand the role of socio-economic aspects in shaping agricultural land use pattern in area under study. Both the physical and socio-economic variables exert their impact on agriculture practice and its production.

The traditional system of agriculture and decision making, have their bearing on the regional variations in agricultural land use in the Washim District. This has been elaborated and discussed in this Chapter. **J. Singh & S.S. Dhillon (2004)**[1] have rightly stressed the necessity for the evaluation of socio-economic variables in terms of inputs involved in agriculture sector that have been ultimately forming land use pattern and yield per hectare. The present study is significant in this respect.

The objective of this Chapter is to investigate the socio-economic background of the region. The population, occupational structure, irrigation, marketing, transportation and their impact on land use pattern of the area under investigation. The data of population in 1991 and 2011 have been collected from Akola and Washim District Census Handbook, Area under irrigation and land holding has been obtained from Land Records of Tehsil concerned. The suitable cartographic methods are used (GIS Global Mapper Version -14) to depict the density of population, occupational structure and irrigation of the area under investigation.

3.2 History of Washim District:

Washim is a district in the state of Maharashtra. The district headquarter are situated at Washim. Washim is a city and a municipal council in Washim district. The erstwhile name of Washim was Vatsagulma. It used to be the seat of power of the Vakataka dynasty. Basim is another name of Washim. It is an Arabic word which means the one those smiles. The name was given by Basim R. Iqbal who ruled the Jamar clan in 436. Washim was created only few years back. It has a great pilgrimage past. It is said that Tirupatis Lord Balaji comes here for resting after the harvest. Shreekshetra Pohradevi is known as Kashi of Banjara community. Washim was the capital of King Wakatak, also known as Vatsagulm. Due to its strategic location, Washim was made a district under the British rule. The district has been made famous due to Hemadpanthi temples and numerous ponds.

In 1816, the British Government was aroused by the depredations of the Pendharis in Berar. This led to their protest against the Nizam. According to the Residents Counsel, no less than 7,500 horses were stationed in the province for its protection. Hyderabad was in a very bad state. The army of Hyderabad which was a mere rabble was nearly 70,000 in strength and was costing the State exchequer a major portion of the revenue. The Government inefficiently fought with a large portion of the state. A war-like community in the districts of Nanded, Parbhani and Berar called Hatkars were in a state of open rebellion from 1798 AD.

The Zamindars of Sironcha and Mahadevpur were also in rebels. The administration practically collapsed in the country. The financial embarrassment of the state was exploited to the fullest extent by Palmer and Company. The Third Maratha War started at this time. The Peshva Baji Rav II fought against the British in the battle of Khadki in 1817. He fled from Pune as he was defeated. The Nizam's army was co-operating with the British in this war and the Hyderabad Contingent took a leading part in the operations

in the Deccan and Malva. Not all of the Nizam's officers were friendly to the British **(Akola District Gazeeteer, 1971)**[2].

The district of Washim came into existence on July 1, 1998. Washim was once known as Vatsagulma, the capital of the Vatsagulma line of Vakataka dynasaty. The district was divided into Akola and Yavatmal under the British rule in 1905. It again became a district in 1998.

3.3 Historical Importance:

Washim district has a history of 2000 year. It was under dynasty of king Wakataki name is mentioned in Watsagulma Mahatmya also. At present Shri Balaji Temple is one of the ancient relics along with Padmatirth talav and Mahurvesh. The city had Parkota & four Vesh Kativesh, Chandikavesh, Mahurvesh. Karanja, Shri Datt Mandir is inspiration of whole Datt Community. Karanja Krushi Utpann Bazar Samiti has in its honors as the Indias first Bazar Samiti. The holy hair of Mohammad Paigambar kept in Mangrulpir, Shirpur Jains Antariksha Parshvanath Temple, Davhas: Vishwamandir, Risod: Sant Sakharam Maharaj Temple is all symbol of National integrity.

In Bhaskaraacharyas "Siddhartha Shiromani" manuscript, Madhyamaeshwar Temple is defined as center of imaginary line joining Sri-Lanka & Meru Mountain. This line is considered to be the central line of earth. This line passes through Washim indicated by Lord Madhyameshwar in an ancient time. At the same place, there was an observatory during Wakataks period.

1. Karanja:

Shri. Guru Mandir is famous. During 1378 Karanja was Datt Avtar Nursingha Sarawati Birthplace. Sansthan celebrate 45 days festival from his Shaligaman Yatra.

2. Rushi Talav:

The nearby rushi talav is having its importance since ancient times. Many of the saints did Tapascharya on its bank.

3. Malegaon:

In Malegaon tehsil, Shirpur Jains Antariksha Parshvanath Temple is Jain community's famous shrine. In the Temple Parshvanath Tirthankars statue is buoyant in the air & hence the name. This idol is placed in underground room. The statue is in a state meditation and made of (Basalt) black rock.

4. Pauli Temple:

In the western fringe of the Village Pauli Temple is located. The probably may be the actual Temple. Elichpurs king Eel has constructed this temple. It is said that at the time of Moguls attack the original idol was shifted in the constructed by panchayats of the village. The bricks found at the excavation site of Pauli temple floats on water, because they are made of coriaceous lava.

5. Davha:

It is about 7 Km away from Malegaon an auspicious Parampujya Nagnath Maharaj two week festival on Rathsaptami is celebrated for Samadhi.

6. Mangrulpir:

Mangrulpir got its name after Pir Dargah. There is high fort like Buruj Dada Hayat Kalander Kabir Dargaah sharif. There are only three and a half kalandars in the world; like the one of the Pakistan: Mast Kalandar, Iraqs: Rabia basari (Female), and Mangrulpirs Dada Hayaat Kalander alias Shah Badruddin. In Hijari samvat 651 Dada Sayam came to India. Hence his one Golden handa is on it. There are seven Gold colored minarets. Mohammad Paigambers holy hair is kept safe in the Dargaah. In August month big urs is celebrated.

7. Risod:

In Risod tehsil, Sant Shri Sakharam Maharaj Temple is located at 25 km. away from Risod at Loni. In Kartik Marathi month on Datt Amavasya "Rathotsava" a grand festival is celebrated.

8. Washim:

In Washim tehsil, in west side of Kata village, Shive Shakti temple is located. Katepurna River originates from this place. Along with River Aran,

Chandrabhaga, Vatsara, Pus has their origin from this area. Along with this southern portion of Washim is included in Godavari catchments and northern portion is in Tapi-Purna catchment.

3.4 Cultural importance:

From Mund to Vakataks period, Washim has his cultural importance. Here Hindu, Muslim, Bohra, Banjara (tribal) and other community reside cultural harmony celebrating their respective festivals.

3.5 Population:

The population is an important resource for economic point of view of the regional development of agriculture. It influences the economic activity and determines the level of consumption and agriculture force. It also forms the workforce, cultivators, and agricultural laborers. Agricultural density **(Ferenczi, 1938[3] & Trewartha, 1953)[4]** provides one with means to make a comparison between agricultural population and cultivation area. The absolute number of population change is obtained by subtracting the population of an earlier date from that of the later date. The relative change is calculated by dividing the absolute change by the population at an earlier census date. It is customary to denote the relative change in the percentage change; in that case, the change is multiplied by 100. The formula for obtaining the percentage change in the population size is as:

$$\text{Change in the population size} = \frac{P_2 - P_1}{P_1} \times 100$$

Where: P_1 and P_2 denote the population figures of earlier and later points of time.

Thus the percentage changes in the population of Washim district during two census operation. An obtained rate of change is by dividing the change or percentage change by number of years between two census dates. The population of Washim District is 1197160 persons (census 2011). It

accounts for 1.05 % of the Maharashtra State. The average density of population in the area under study is 230 persons per km^2 while agricultural density is (per person) 0.32 hectares. 93.35 % working population to total has engaged in agricultural activity and rest is involved in household, industry, trade and transportation in the area under study.

The population data of growth are not readily available for Washim District. Therefore, investigator has obtained the population data from District Census Handbook Washim and Akola District. The Table No. 3.1 shows the population since 1991 with its decadal variations and percentage of growth. It is observed from the table No. 3.1 that the population in the Washim District has been steadily increasing from 1991 to 2011. The population in Washim District in 1991 was 862312 while it increased and attained 1197160 persons in 2011.

Table No. 3.1 Population Decadal Growth in Washim District

Years	Population	Growth	Growth %
1991	862312	-	-
2001	1020216	157904	15.47
2011	1197160	176944	14.78

Source: census of India 1991-2011

The total increase in population during the above 20 years period is 334848 persons. From 1991 onwards the population increased with high rate. It has increased by 15.47 % growth in 2001 and 14.78 % in 2011. The ratio of cultivated land (381444 hectare), **(Agri. Census 2001)**[5] and human power (Farm Worker 531943,) in the Washim District was 0.71 hectare per person as per 2011census.

3.6 Density of Population:

Density of Population has been studied in order to understand the

regional variations in the population density and its influence on agricultural land use. The area under study has 93.35 % working population which is directly involved in agriculture **(Census of India, 2011).** The population density value was here calculated as ratio of total population to the total area from 1991 to 2011 and is shown in Table No. 3.2. It is revealed from the table No. 3.2 that density of population in the Washim District is increasing since 1991 from 174 persons per km^2 to 233 persons per km^2 in 2011. The density of population increased gradually during 20 years. The two decade from 1991 to 2011, shows high (57 persons per km^2) rate of density was observed in two decade 1991 and 2011 in the Washim District.

Table No. 3.2 Decadal Population density in Washim District

Years	Population	Area in Km^2	Density/Km^2
1991	862312	4951.11	174
2001	1020216	5131.24	199
2011	1197160	5131.24	233

Source: District Census Handbook Akola, Washim1991, 2011.

3.7 Distribution of Population density:

Table No.3.3 (Map No.3.1, 3.2. Graph No. 3.1, 3.2) shows the spatial distribution of population density in the Washim District in 1991 and 2011. It is observed from the table No. 3.3 that there are considerable spatial variations in the density distribution within the region. The highest density in Washim District is 203 persons per sq. km. in Washim Tehsil in the south and lowest in Manora Tehsil in the south-east (145 persons per sq. km.). The density of population distribution is increasing towards south in the Washim Tehsil, in the east Karanja Tehsil and in south-west in Risod Tehsil

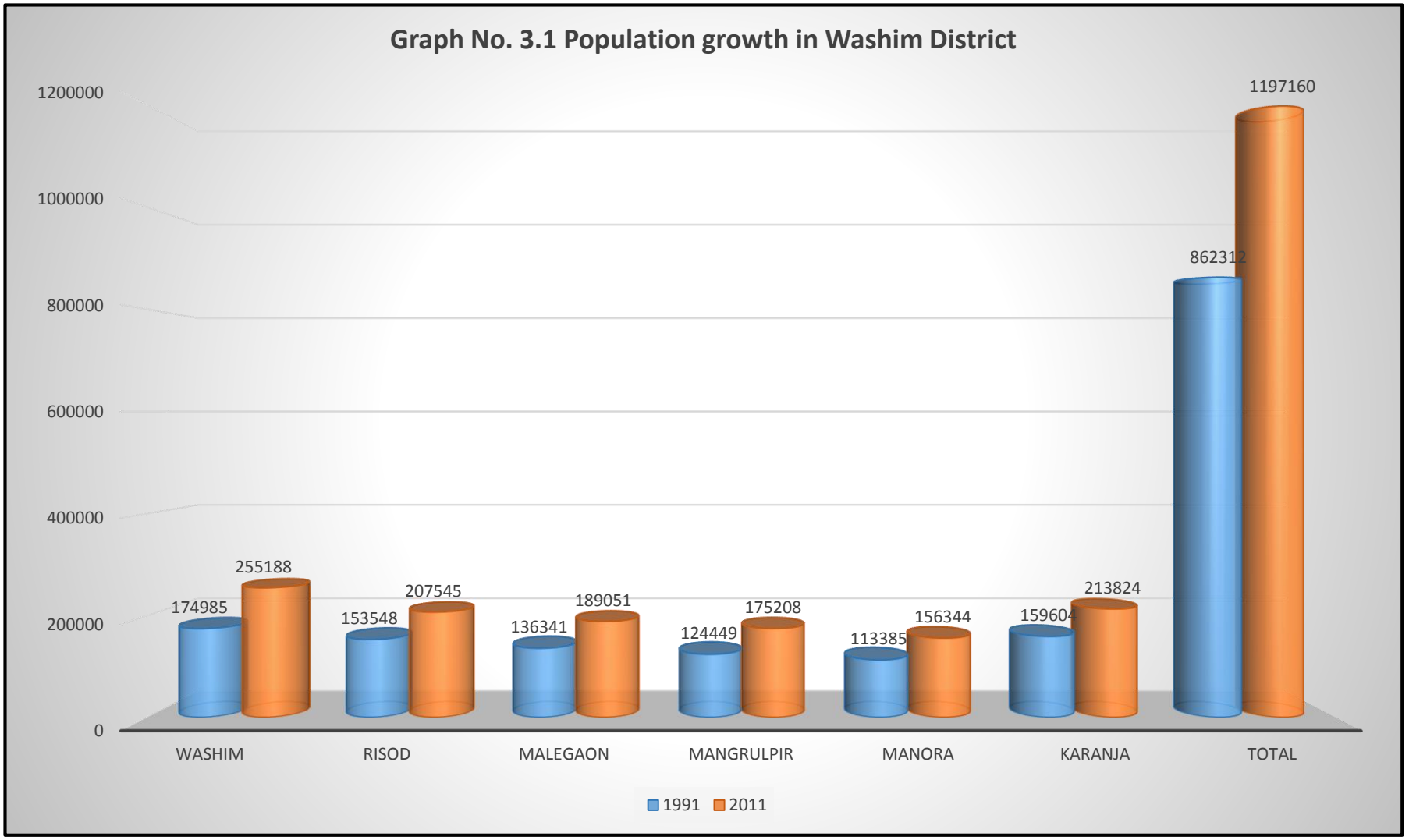
(Map No.3.1).

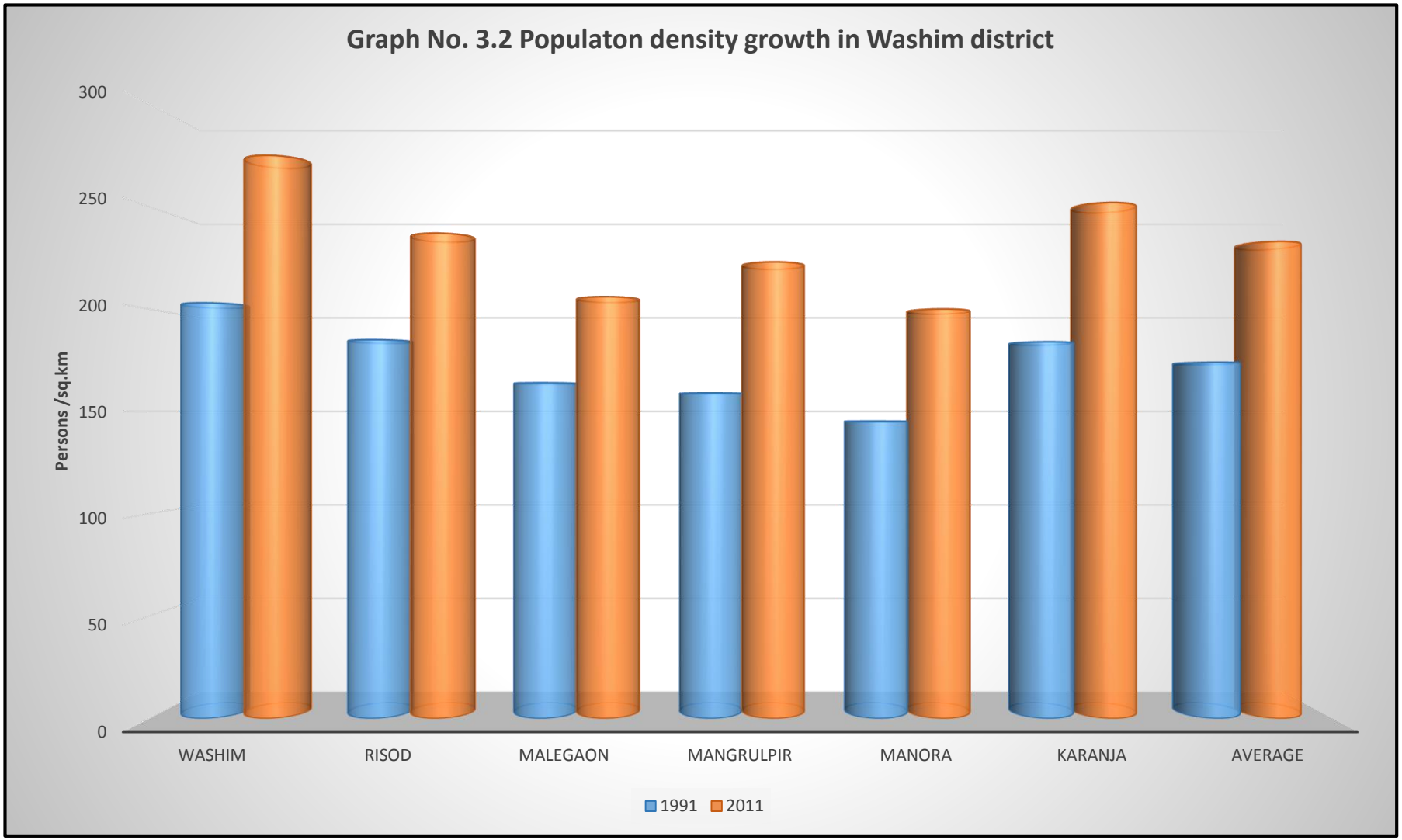
Table No. 3.3 Spatial Distribution of Population density in Washim District

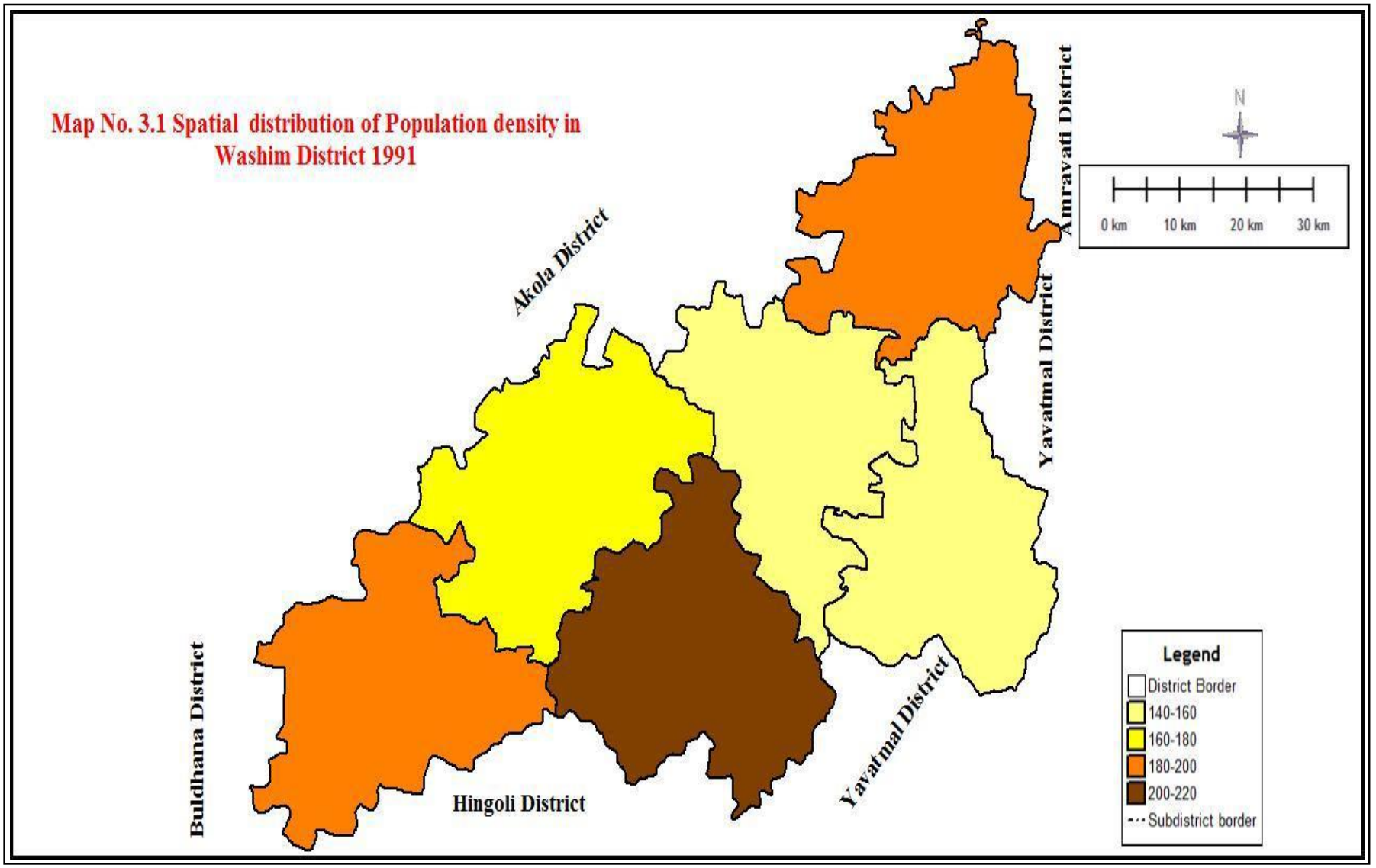
Tehsil	Years					
	1991			2011		
	Population	Area km^2	Density	Population	Area km^2	Density
Washim	174985	863.31	203	255188	926.32	275
Risod	153548	830.96	185	207545	873.90	237
Malegaon	136341	830.96	164	189051	915.99	206
Mangrulpir	124449	780.82	159	175208	785.69	223
Manora	113385	779.28	145	156344	782.24	200
Karanja	159604	865.75	184	213824	847.10	252
Total	862312	4951.1	174	1197160	5131.24	233

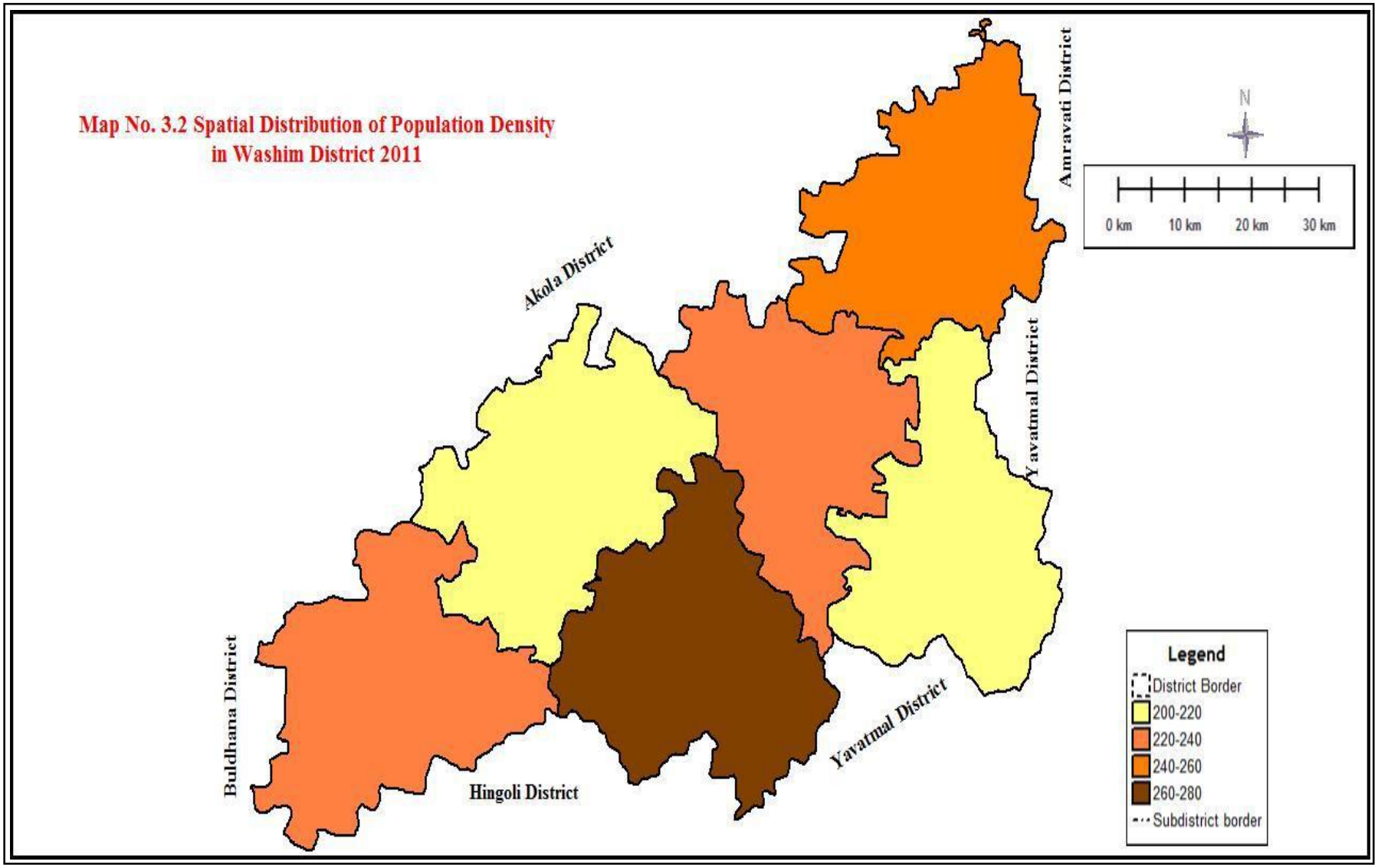
Source: District Census Handbook Akola, Washim1991, 2011.

Less than 200 persons per km^2 density in 1991 are observed in five Tehsils are Karanja (185), Risod (184), Malegaon (164), Mangrulpir (159) and Manora (145). These Tehsils have low density due to absent of market like Washim. Washim is district place where vegetables, cotton, wheat and other agricultural produce are sold on a great extent. More than 200 persons per sq. km. density are in the Washim Tehsil in the southern parts of District.


Graph No. 3.1 Population growth in Washim District
1200000
1000000
800000
600000
400000
200000
0
174985
255188
153548
207545
136341
189051
124449
175208
113385
156344
159604
213824
862312
1197160
WASHIM
RISOD
MALEGAON
MANGRULPIR
MANORA
KARANJA
TOTAL
1991
2011


Graph No. 3.2 Populaton density growth in Washim district
Persons /sq.km
300
250
200
150
100
50
0
WASHIM
RISOD
MALEGAON
MANGRULPIR
MANORA
KARANJA
AVERAGE
1991
2011


Map No. 3.1 Spatial distribution of Population density in Washim District 1991
Akola District
Amravati District
Yavatmal District
Buldhana District
Hingoli District
Yavatmal District
N
0 km
10 km
20 km
30 km
Legend
District Border
140-160
160-180
180-200
200-220
Subdistrict border


Map No. 3.2 Spatial Distribution of Population Density
in Washim District 2011
Amravati District
Akola District
Yavatmal District
Buldhana District
Hingoli District
Yavatmal District
N
0 km
10 km
20 km
30 km
Legend
District Border
200-220
220-240
240-260
260-280
Subdistrict border

The population density pattern in the Washim District for Census of India, 2011 has slightly changed than 1991 (Map No.3.1*)*. This Map shows the density 200 persons per km^2 has been replaced by 275 persons per km^2 in Washim Tehsil southern part of the District, the population density occurs from 200 to 275 persons per km^2. The Sub districts included in this category are Manora (200), Malegaon (206), Mangrulpir (223), Risod (237), Karanja (252) and Washim (275) in the Washim District (Map No.3.2*)*.

3.8 Occupational structure:

The availability of labors resource and its involvement in various activities of agriculture represent the scenario of development of the region. The Washim District has preponderance of agriculture, engaging 93.35 % population as working force (Census of India, 2011). The population can generally, be grouped into two groups:

1. Working population
2. Nonworking population.

The working population means participation in economical and productive activity either physical or mental in nature. Thus involves not only actual work but also supervision and direction, whereas non-working population means, those who did not work at all during the preceding year **(Census of India, 1991)[6].**

The working population owes special significance as it is directly involved in economic activities. The proportion of population, its demographic characteristics and economic composition have a bearing on the agricultural land use pattern. The Planning Commission Organization has suggested two types of working population: 1) Main workers and 2) Marginal workers. The main workers have been again grouped into four sub groups as follows:

1) Cultivators.

2) Agricultural laborers.

3) Workers engaged in household industry and,

4) Other workers such as trade and transport.

As per definition, main workers are those who are engaged in economic productivity activity for a major part of the preceding year (at least six months or 180 days), while marginal workers means, those who worked for some time but not for the entire year **(Census of India, 1991)**.

In the Washim District have 569792 total workers (47.59 % to total population). The main workers (502755) and marginal workers (67037) account for 88.23 % and 11.76 % to total workers **(Census of India, 2011)** respectively. Table No.3.4 shows the population structure and Table No.3.5 shows occupational structure from 1991 to 2011 in the Washim District. The occupational structure in the Washim District has been studied under four groups as follows:

1) % of total workers to total population.

2) % of agriculture laborers to farm workers.

3) % of cultivators to farm workers and,

4) % of Farm workers to total workers.

Table 3.4 Occupational Structure of Washim District

Sr. No.	Category	1991	% to total Population	2011	% to total Population	% to total Workers	
1	Total population	719232	100	1197160	100	1991	2011
2	Total Workers	392564	54.58	569792	47.59	100	100
3	Cultivators	131447	18.27	176613	14.75	33.48	30.99
4	Agricultural Laborers	203961	28.35	355330	29.68	51.95	62.36
5	Farm workers (3 +4)	335408	46.63	531943	44.43	85.44	93.35

Source: computed by author (District Census 1991, 2011)

Table No. 3.5 Changes in Occupational Structure of Washim District

Sr. No.	Categories	Years		Change +/-
		1991	2011	
1	% of total workers to total population	54.58	47.59	-6.99
2	% of agriculture laborers to farm workers	60.80	62.36	1.56
3	% of cultivators to farm workers	39.19	33.20	-5.99
4	Farm workers to total workers	85.44	93.35	7.91

Source: computed by author. (District census 1991, 2011)

3.9 Percentage of Total Workers to Total Population:

The spatial distribution of percentage of total workers to total population in the Washim District for 1991 and 2011 are shown in Table No. 3.4, 3.5. In 1991, 392564 persons were in the working population category (54.58 % to total population) in the Washim District. It is observed that the total working population is decreased. The working population in 2011 was 569792 workers (47.59 % to total population) in the Washim District and it is decreased by -6.99 % after two decade, the minor decrease in total working population (1991 to 2011).

3.10 Percentage of Cultivators to Farm Workers:

The cultivators include (Table No. 3.4, 3.5) both tenant and owner of farm workers, whereas, farm workers refer to cultivators and agricultural laborers **(Census of India, 1991).** The involvement of farm workers in agriculture in Washim District has significance as it is a major activity. The total cultivators are 131447 persons (39.19%) in 1991 and 176613 persons (33.20%) in 2011 that shows decreasing cultivators by -5.99% in the area under study.

3.11 Percentage of Agriculture Laborers to Farm Workers:

The per cent of agricultural laborers to farm workers has been worked out district level for the Washim District. The agriculture laborers are increased by 1.56 % in the study area. The spatial distribution of agricultural laborers to farm workers is shown in Table No. 3.5 for 1991-2011.

3.12 Percentage of Farm Workers to Total Workers:

The Washim District is predominantly agricultural in nature. Near about 93.35 % working force is engaged in agriculture activity. The spatial distribution of farm workers to total workers is shown Table No. 3.5 for 1991 and 2011. The farm workers include the cultivators and agriculture laborers, whereas, workers refer to participation in economically productive activity (mentally and physically) as well as supervision and direct work.

Table No.3.4 shows the spatial distribution of farm workers to total workers for 1991 and 2011 in the area under study. The region has 335408 farm workers (85.44 % to total workers) in 1991and 531943 (93.35 % to total workers) in 2011. It shows increasing farm workers by 7.91% in the area under study. The % of farm workers to total workers has been worked out at district level.

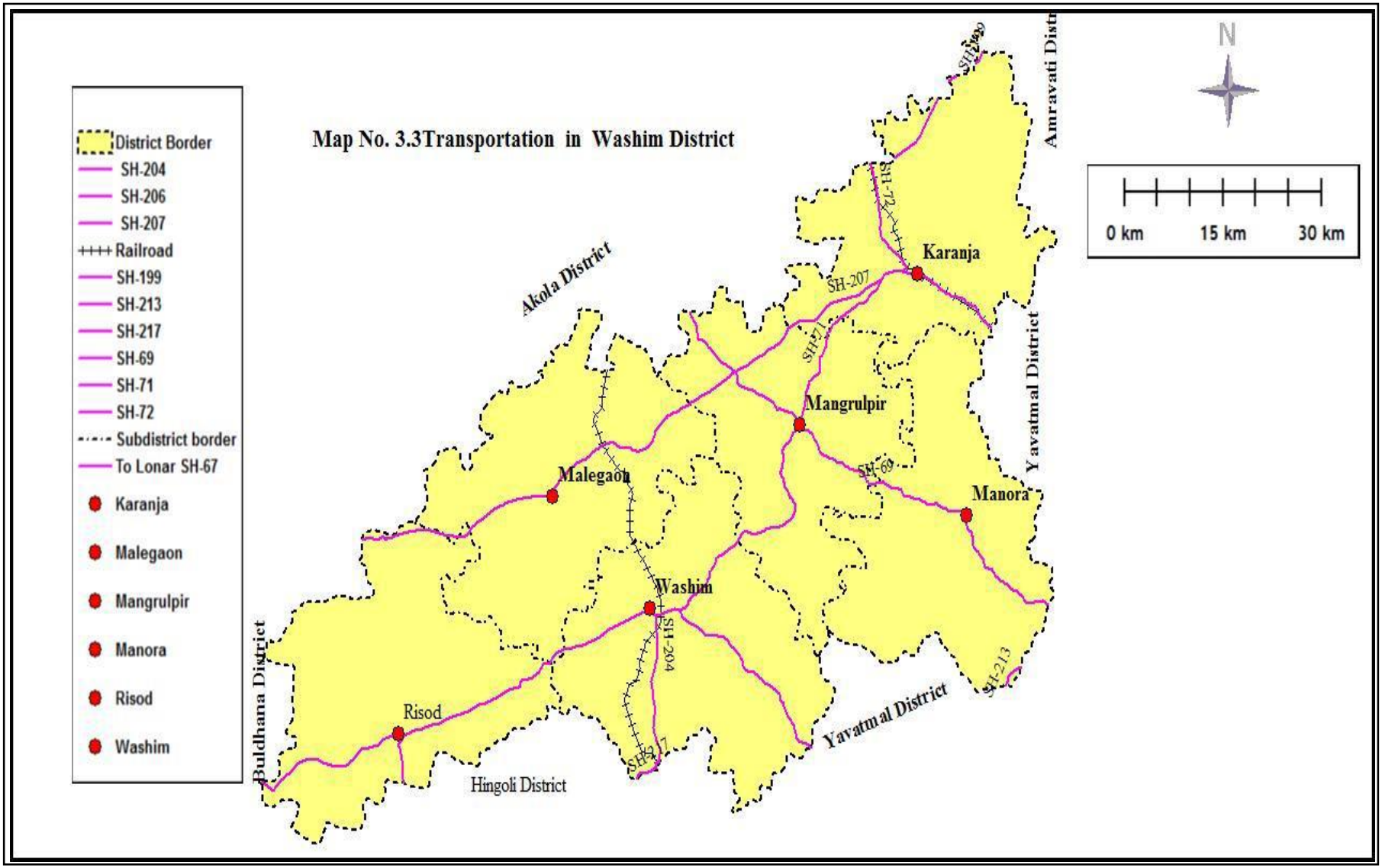
3.13 Transportation:

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 products within the region. The improvement in transportation facilities extends the hinterland of markets and brings isolated productions areas in direct contact with the market centers thus, opening new avenue of spatial interaction, **Datye V.S. (1983)[7].** Such improvement and change in frequency, speed and capacity indicate the changes in traditional agricultural patterns.

From this point of view, it would be necessary to examine the existing means of transport in the Washim District. The Washim District has two types of transport namely, Roadways and Railways, both covering 2989.70 km. length in the region.

The area under study has dense linkages of roadways than railways (Map No.3.3). The roadways play a significant role in collecting and distributing agricultural products. There are four types of roadways appear in the Washim District, are State Highway, Major District Roads (MDR), Other District Roads (O.D.R.) and Village Roads or metalled roads. The total length of roadways in the Washim District is 2989.70 Kms. The Washim District has 2385.10 km. Tar roads within the study area. The major district roads and other district roads show a wide network of transportation within the study are. These roadways are linked to Tehsils, either by Tar or metalled roads. The metalled roads are maintained by Zilla Parishad and Public Works Department.

The total length of major district roadways and other district roadway are 611.49 and 479.19 km. respectively in the Washim District. The village roadways are metalled in nature and are linked to M.D.R. and O.D.R. These metalled roads are unsuited for transportation in the monsoon season and it becomes dirty and muddy and hence it reduces the degree of transportation. The most common and traditional modes of transport is bullock cart in the Tehsil to collect and distribute the agricultural products. Trucks are occasionally used for transportation. It is observed that most Tehsils are linked by bus services of minimum two frequencies to each village. This bus service is owned by State Transport Service, Maharashtra Government. In rainy season the frequency of bus service reduces to district and interior Tehsils in the Washim District due to metalled road which are badly affected in the rainy season.


Map No. 3.3Transportation in Washim District
District Border
SH-204
SH-206
SH-207
Railroad
SH-199
SH-213
SH-217
SH-69
SH-71
SH-72
Subdistrict border
To Lonar SH-67
Karanja
Malegaon
Mangrulpir
Manora
Risod
Washim
N
0 km
15 km
30 km
Akola District
Amravati Distri
Yavatmal District
Buldhana District
Hingoli District
Yavatmal District
Karanja
Mangrulpir
Malegaon
Manora
Washim
Risod
SH-72
SH-207
SH-71
SH-69
SH-204
SH-213
SH-217

The limited network of railway appears in the Washim District. The Khandva-Purna and Murtujapur-Yavatmal railway (Broad and meter Gauge Line) passes through the region covering 51.00 kms in length (Map No. 3.3). This railway line gives much significance from agricultural point of view as it is used for public travel and also for agricultural produce. It perhaps, can be useful in famine and emergency periods.

3.14 Agricultural Market:

Marketing can be defined as the performance of business activities that direct the flow of goods and services from the producer to the consumer so that they may reach the consumer at the time, place and in the form he wishes and at a price he is willing to pay **(Kohls R.L, 1958)[8].** Many times different prices of agricultural commodities are one of the basic causes of risk and uncertainty in agriculture. The price of agricultural commodity, which is force the farmers to decide about the combination of crops. Therefore any variation in the price system exerts a decisive influence on farming.

Difference in yield and technological changes in farming and institutional and infrastructural mentality seem to be beyond the control and visualization of farmers. The price variation is basic causes, which finely affect the farmers main concern therefore is to secure a satisfactory margin between the cost of production and price of their produce. The market of agricultural commodities is generally controlled by buyers rather than sellers as the position of the latter is usually weak.

The only way in which farmers can protect their interest is by the farmers groups or by sellers to act on behalf of persuading government to step in. But now a day, the agriculture produce marketing is controlled by 06 "Agricultural Produce Marketing committees (APMCs) (at Washim, Risod, Malegaon, Mangrulpir, Manora and Karanja Tehsil) and 10 sub centers of the same located in the Washim district.

3.15 Agricultural Land Holdings:

The size of land holding is one of the aspects influencing on agricultural land use patterns. The easy application of inputs is possible if the size of land holdings are large and extensive. Otherwise, it puts limit and difficulties in proper and efficient land utilization. The Washim District, like other regions has heavy pressure of growing population coupled with the customary laws of inheritance has resulted in subdividing agricultural land into small holdings.

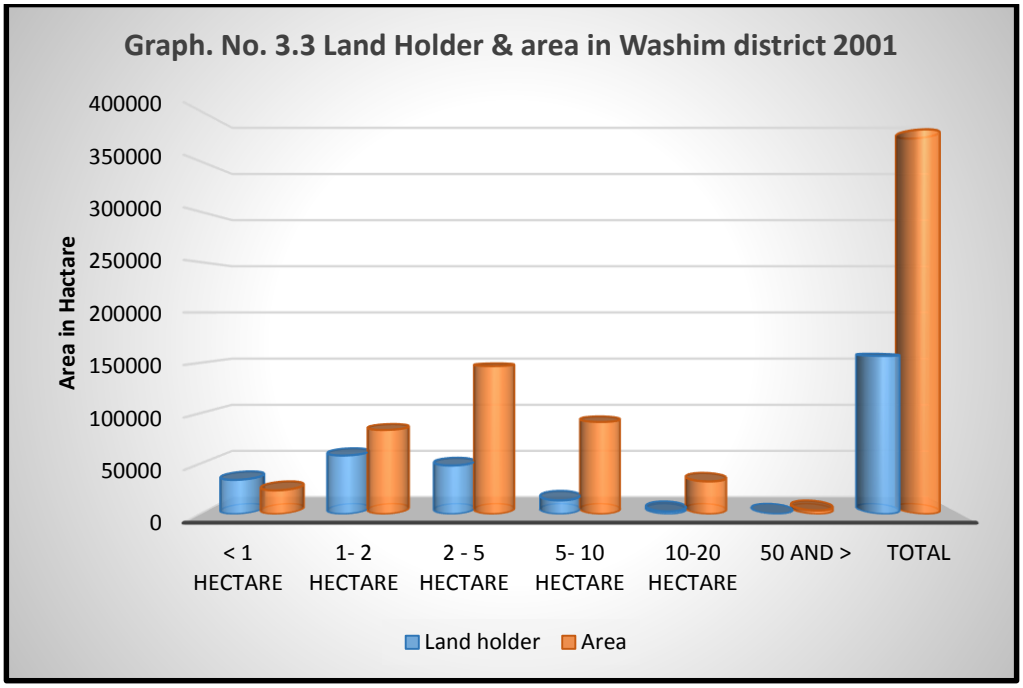
Table No. 3.6 Land Holding In Washim District 2001

Sr. No.	Land holding Class	Land Holder	%	Area in Hectare	%
		2000-01	2000-01	2000-01	2000-01
1	< 1 Hectare	34032	21.69	23616	6.19
2	1- 2 Hectare	58140	37.05	83481	21.88
3	2 - 5 Hectare	48264	37.76	146829	38.49
4	5-10Hectare	13678	8.71	91429	23.96
5	10-20 Hect.	2642	1.68	32477	8.51
6	50 and >	136	0.11	3612	0.97
7	Total	156892	100%	381444	100%

Source: Agricultural census 2001

During the field work and interview with farmers, the fact discovered 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. As thus, small size of land holding has adverse effect on efficient land utilization. Moreover, it is observed that the average size of land holding (Graph No. 3.3) in the Washim District is 2.43 hectares which is comparatively low than that of Maharashtra (4.20 hectare). So there

is need to consolidate the land for efficient land use in Washim District.



3.16 Livestock:

Live stock is an essential part of agriculture and consists of cattle, buffaloes, sheep, goats and poultry etc. Together they contribute on considerable extent to the rural economy. All farmers keep cattle primary to provide draught force, buffaloes are maintained for milk and cow is kept to provide bullocks rather than milk. Besides this, livestock provides much of the organic manure used on the farm. Therefore, in addition of crops, drought animal and milk livestock are raised and maintained by an individual farmer. They are the constant companions in the field by day and live beside his house or even under his roof at night **(Singh J. 2004)[9].** There are large number of unproductive cattle. There is tremendous change in the outlook as well as in the way of life. The agricultural scene, itself has been changing radically especially with the expansion of dairy and livestock farming during the last century **(Chisholm 1970)[10]**. Thus the study area is therefore, passing, through past economic period, which observed some diffusion in livestock.

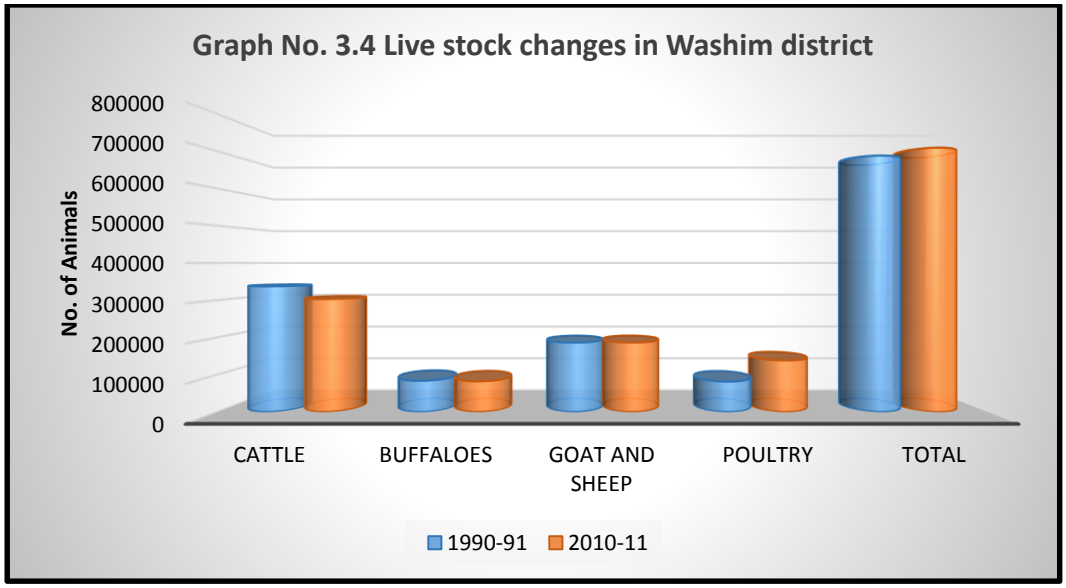
Classification of Livestock Washim district possesses number of livestock. Yet the productivity value of cattle live husbandry is not comparable to its size because of the local quality.

Total numbers of livestock are presented in table No.3.7. From this, it is found that livestock population increased from 688122 (1991) to 709375 in 2011(Graph No. 3.4).

Table No. 3.7 Livestock in Washim District 1990-2011

Sr. No.	Livestock Categories	Year				
		1990-91	%	2000-11	%	+/-
1	Cattle	337055	48.98	302917	42.70	-6.28
2	Buffaloes	83579	12.14	82054	11.56	-0.58
3	Goat and Sheep	185951	27.02	186131	26.23	-0.79
4	Poultry	81537	11.84	138273	19.49	7.65
5	Total	688122	100	709375	100	

Source: Socio-economic Review and Statistical Abstract of Washim District: 2001 and 2011.



Buffaloes and cattle are the chief farm animal. The numbers of buffaloes are decreased from 83579 (1990-91) to 82054 (2010-11), while that of the number of cattle also decreased. This has been decreased due to decrease in

fodder crops and fragmentation of land. Fragmentation of land and mechanization of farming reduced the need for bullocks as drought animals (Graph No.3.4).

Among the all livestock number of sheep's and goats are declined from 27.02 % in 1990-91 to 26.23 % in 2010-11. To fulfill the demand of meat, it decreases the number of goats and sheep's. Their growth has been slower but demand for meat has been greater. Poultry farming as a subsidiary activity has become more common especially during last three decades the study area has 81537 poultry birds in 1990-91, which increased up to 138273 in 2010-11. Such an increase indicates the diversification of agricultural poultry farming. It generally practiced around urban center. The increase in the price of goat and sheep meat, poultry has become a major source of meat, poultry birds are become source of eggs and meat for the market. Other livestock involves horses, donkeys etc. These animals are largely associated with to low class, landless population to which these animals particularly horses and donkeys are largely associated as means of earning livelihood and source of transportation.

3.17 Agricultural Implements:

The timely availability of agricultural implements and its proper use in the process of agricultural operation is imperative for proper and efficient land use in any region. The Washim District, like other regions apply numerous agricultural implements in ploughing, harrowing, leveling, ridging, hoeing and inter cultivation. Now a days The common implements are used in agricultural operation in the Washim District are tractors and its operated implements, iron plough, wooden plough, harrow, Bakhar, Kolpa, Kurhad, Pawada, Khurpi, Vila (Sickle), and Koyata. The types of implements used in agricultural operation, indicates the type of farming and resulted level of agriculture in the region. It is observed that the small land holding (less than two Hectare) farmers generally lack required

implements which are borrowed from neighbors for time to time. While large (10 and above hectare) **(Input Survey, 2001)[11]** land holding farmers own themselves most of the improved agricultural implements for timely application on field.

1. Wooden Plough:

The wooden plough locally called 'Nangar'. It is light weight, simple, cheap, and local made implement by carpenter. Cultivators can carry the light weight plough on his shoulder to and fro his fragmented holdings (Spate and Lear mouth, 1967). Farmers poverty and cheap available facility within the village good reason to him to use the wooden plough **(Jasbir Singh, 1976)[12]** Table No. 3.8 indicate that total number of wooden plough are declined from 27630 (1990-1991) to 25360 (2010-2011). The Graph 3.5 shows decrease in wooden plough, because introduction of iron plough and it's utility.

Table No. 3.8 Agricultural Implements in Washim District 1991-2011

Year's	Wooden plough	Iron plough	Diesel engine	Electric pumps	Tractors	Carts
1991	27630	34230	2527	4260	2330	18630
2011	25360	28520	3610	20377	5152	42530
+/-	-2000	-5710	1083	16117	2822	23900

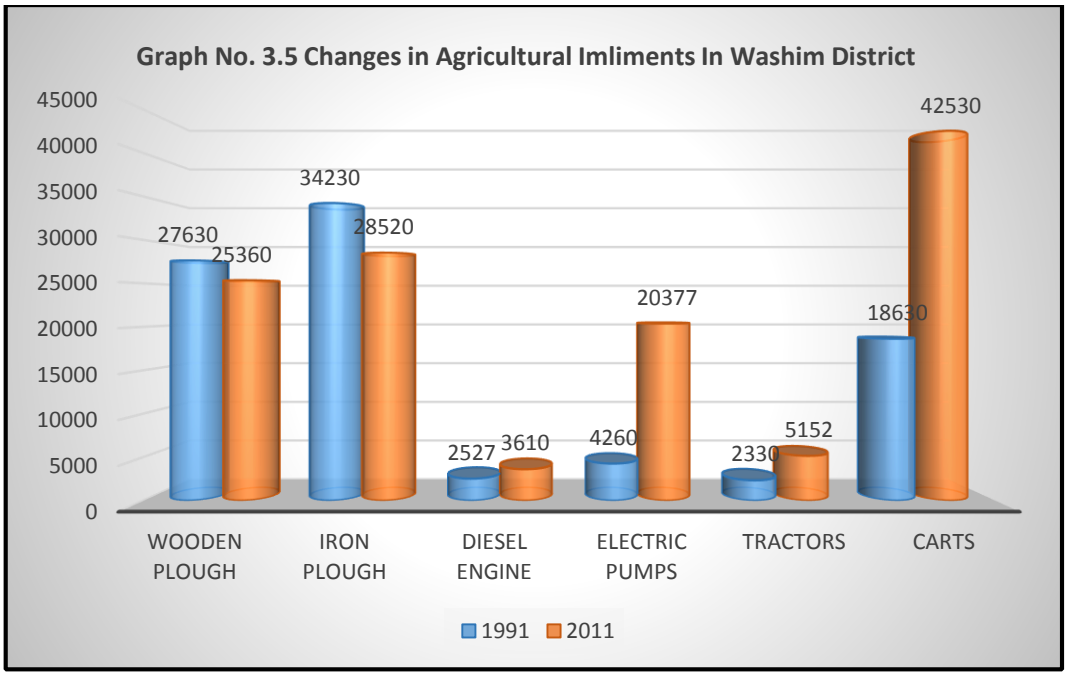
Source: Socio-economic Abstract of Washim District 2010-2011

2. Iron Plough:

In the deep black soils more deep and efficient ploughing is needed. This can be achieved efficiently only by iron plough. Iron ploughs dominate in the cotton tract. Iron plough is an improvement upon the wooden plough and farmer use it without difficulties, nearly 34230 iron plough (1991) and 28520 iron ploughs (2011) in use in the district. There is decrease in the use of iron plough because of introduction of tractor and its utility (Graph No.3.5).

3. Bull Carts:

Bull Carts have the most important place in the Indian agriculture. It has been selected as one of the transportation vehicle. Therefore, instead of on farm road accessibility, use of carts is important. It is used everywhere in the state. In 1991district have 18630 bull carts and it is increased up to 42530 in 2011. Because of bull Carts is cheap means of transportation for to and fro. Total numbers of carts are increased from 4260 (1990-1991) to 20377 (2010-2011).



4. Electric Pumps:

Electric pumps are used to fetch the water from well, tank and rivers. So electric pumps are increased from 4260 (1990-1991) to 20377 (2010-2011). The increase in numbers of electric pump sets is found in (Graph No. 3.5) Washim district.

5. Tractors:

The role of tractor as an agent of further modernization of farming practice and rural way of life is three fold. first the tractor not only as a tilling machine and curtails the time gap devoted for preparation of field in between two

crops but also some times it is used for providing operational power to thresher, tube wells and chaff cutter and thus an intensive cultivation results.

The efficiency of tractor farming requires a matching combination of irrigation, Fertilizers, pesticides etc. which the farmers are tempted to manage and third the extra income brought to the owner through the use of tractor is invested in innovation like the bio-gas plant, Piped Water supply electrification and the like, which combine to upgrade the quality of life as also at the same time provides models for other potential acceptors. Number of Tractors was 2330 to 5152 from 1991 to 2011(Graph No. 3.5). It means that tractors numbers increased by near about dabbled in two decade. The total tractors were distributed as in Karanja Manora, Risod, Washim, Mangrulpir, and Malegaon Tehsil in 2011.

3.18 Agricultural Inputs:

1. **Irrigation:**

All agricultural activities depend on water (irrigation facility). In study area, water is probably single determinant of land use. The supply of moisture for agriculture is commonly unsatisfied, being associated with the erratic nature of monsoon rains. Agriculture in most parts of district is handicapped without water from November to May. Irrigation is essential for extending the cultivated area. Its availability and optimum use will reduce the dependence upon the fluctuations of the monsoon. With the help of irrigation farmer can be sown two times within a year.

Washim district had negligible area under irrigation. It was recorded 25951 (2010-11) hectares of the total cultivated land amounting only 6.21 % was under irrigation as compared to the state as whole 18.2 %. This is despite the fact that the study area has wide scope for development of irrigation.

2. **Chemical fertilizers:**

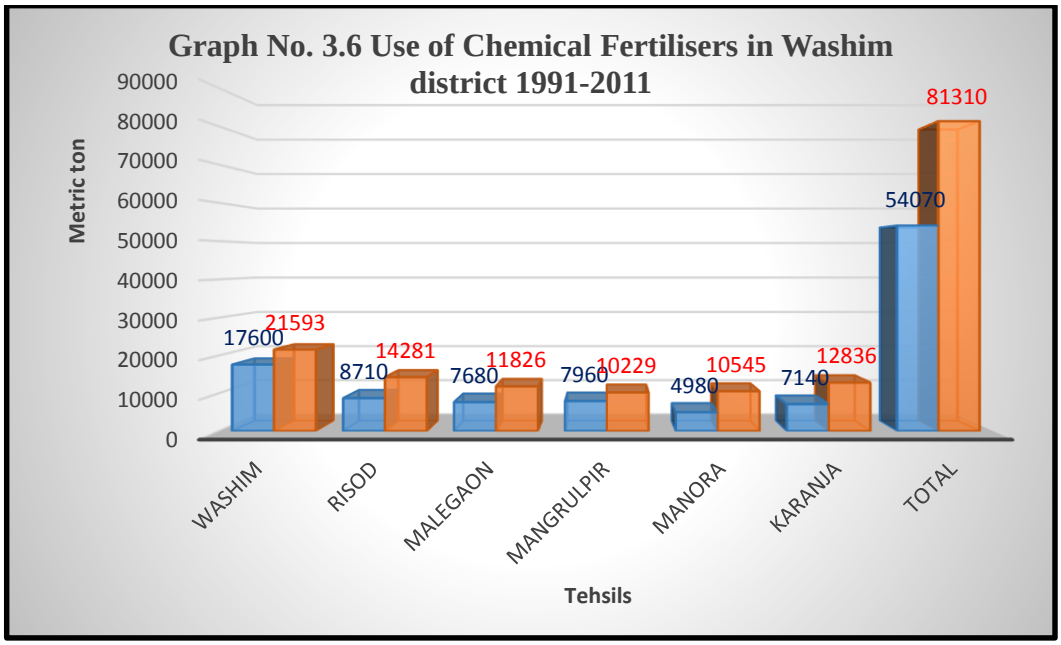
Chemical fertilizers are an important yield boosting inputs. Its use depends on the availability of soil moisture either natural or artificial, the physical and chemical properties of the soils. Three types of chemical

fertilizer are used via. Phosphates, nitrogenous and potash fertilizer are used high in Washim Tehsil and low in Mangrulpir Tehsil.

Table No. 3.9 Use of Chemical Fertilizers in Washim District

Sr. No.	Tehsil	Year (Metric ton)	
		1990-91	2010-11
1	Washim	17600	21593
2	Risod	8710	14281
3	Malegaon	7680	11826
4	Mangrulpir	7960	10229
5	Manora	4980	10545
6	Karanja	7140	12836
	Total	54070	81310

Source: District superintendent of Agriculture Washim District.



The total use of fertilizer in 1990-91 (Graph No. 3.6) was about 54070 metric tons and it has been continuously increasing up to 81310 metric ton in 2010-11 in the study area. But as compared to Maharashtra state the rate of

increase in the use of fertilizers is low, because of some financial obstacles for instance. Need of more irrigation facilities, regular electric power supply and other inputs to change the nature of Rain fed farming.

3. High Yield Variety:

The high yield variety seeds have been evolved, which have helped in boosting of the production of food-grains as well as cash crops. High yield variety shows better performance than local varieties of seeds in the study area. The water requirement of high yield varieties is much higher than local varieties. Therefore, without an assured supply of water neither the HYV nor chemical fertilizer, the pivot of modern agricultural growth can profitably be used **(Harris, 1972)[13].**

Improved variety of soya been generally used in the study area Soybean (JS-335, JS-93 -05) Pigeon pea (AKT- 8811,Vipula, PKV- Tara, BSMR-736) Bt. cotton. Any crop damage due to insect's, pests and weeds on the crops can be reduced by applying plant protection measures along with better seeds, fertilizers and insecticides are also considered as the supporting factors for increasing agricultural production. Among the liquid formulated pesticides are used in study area. Application of insecticides and pesticides is possible on large scale because of various availability of crop finance pest control chemicals and availability of sprayers and dusters.

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Chapter-IV

Irrigation development In Washim district

4.1 Introduction:

4.2 Sources and Growth in Irrigated Area:

4.3 Sources of Irrigation:

4.4 Spatial Pattern of change in Net Irrigated area:

4.5 Relative increase in intensity of Irrigation:

Reference Books:

Chapter-IV

Irrigation Development in Washim District

4.1 Introduction:

The forgoing chapter, the physical, social and economic factors have been examined in relation to agriculture. Agriculture of this area is a product of physical, social and economic complaint. This chapter is suggested to examine the progress in irrigated area under different sources of irrigation. The concept of irrigation implies the existence of source of water supply within a reasonable distance and an arrangement to regulate the supply of water according to the day to day needs of the crops raised in the fields. Naturally therefore all areas which are cultivated under purely rain fed conditions are treated as unirrigated lands **(Census of India, 1991)[1].** Spatial pattern of changes in net irrigated area to net sown area, along with a deliberation of sources wise trends in irrigated area. The emphasis is on to focus the spatial distribution of Irrigation pattern in Washim district. Geographical and cultural factors have considerable impact on agriculture. But all of them are not equally significant in affecting the area variation and gradual development of agriculture in area. Water is probably the most important input besides fertilizers, insecticides, high yield variety (HVY) seeds and modern technology is useful for agricultural development.

The irrigation is the main axis, which the whole agricultural activities revolve around it. Even in study area, water is probably single determinant of land use. The supply of moisture for agriculture is commonly unsatisfactory, being associated with the erratic nature of monsoon rainfall. Moreover, agriculture in most parts of district is handicapped for lack of water through November to May. Irrigation is necessary for spreading the cultivated area, in its wider use will reduce the dependence upon the oscillation of the monsoon and increase the area that can be sown two times within a year. Washim

district have 513124 hectares total geographical area. It has negligible area under irrigation. It was recorded 25951 hectares of the total cultivated land (81.47%) 418076 hectares amounting only 6.21 % was under irrigation as compared to 18.2 % in the state as whole **(DSER 2011)**[2]. This is despite the fact that the Washim district has wide scope for development of irrigation.

4.2 Sources and Growth in Irrigated Area.

Table No 4.1 shows the different sources of irrigation are the Canal, wells, Tanks and other source in Washim district (Graph No.4.1). These sources of irrigation are largely governed by local terrain and soil conditions, local climatic and geological conditions, farmer's capacity to invest, and the government policies, economic returns from the crops, which are the an important phenomena's in irrigation development.

Table No.4.1: Area Irrigated by sources in Washim district

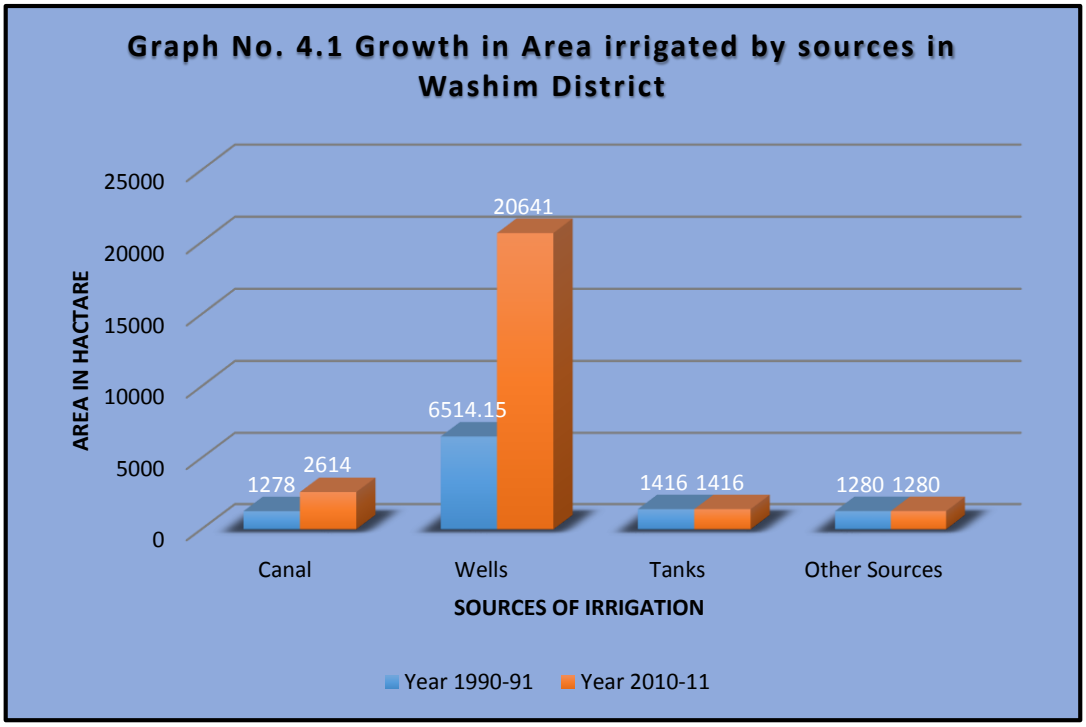
(Area in hectares & percentage to net irrigated area)

Sr. No.	Sources	Years	
		1990-91	2010-11
1	Canal	1278	2614
	% to Net Irrigated Area	12.18	10.07
2	Wells	6514.15	20641
	% to Net Irrigated Area	62.11	79.54
3	Tanks	1416	1416
	% to Net Irrigated Area	13.79	5.46
4	Other Sources	1280	1280
	% to Net Irrigated Area	12.20	4.93
5	Total	10488.15	25951
	% to Net Irrigated Area	100	100

Source: Compiled by the Author

Due to variation in these factors marked regional imbalances in study area. It may be seen from graph No.4.1 during the period of 1990-91 to 2010-

11 in two decades, there was net increase of 15463 hectares of irrigated area in the district. Irrigated area under canals and Wells are found continuously increased. On contrary irrigated area under tank and other sources have been remain almost same in the period of under study. The percentage of total irrigated area increased as there is increase in Canal and Well irrigation. The important source available in the district is only wells.



4.3 Sources of Irrigation:

Irrigation is done with the help of canal or by lifting sub-soil water. The total irrigated area more than 79.54 % is irrigated by wells, canals 10.07 %, tanks and other sources provide 5.46 % and 4.93 % respectively in 2010-11. There has been substantial temporal variation in part of irrigated area by following sources.

1) Canals:

Canal is second ranking means of irrigation. Net irrigated area by canals increased from 1278 hectares in 1990-1991to 2614 hectares in 2010-2011.

Table No.4.2: Tehsil wise irrigated area by different Sources

(Area in Hectares)

Name of Tehsil	Year	Irrigated area by different Sources				Total
		Canal	Well	Tank	Other	
Washim	1990-1991	**545**	**1307**	**537**	**45**	**2434**
		22.39	**53.69**	**22.06**	**1.84**	**100**
	2010-2011	545	4659	537	45	5786
		9.42	80.52	9.28	0.78	100
	Growth %	00	71.95	00	00	71.95
Risod	1990-1991	**-**	**1469**	**-**	**1181**	**2650**
		-	**55.43**	**-**	**44.57**	**100**
	2010-2011	198	1650	-	1181	3029
		6.54	54.47	-	38.99	100
	Growth %	100	10.97	-	00	12.51
Malegaon	1990-1991	**-**	**1020**	**874**	**01**	**1895**
		-	**53.82**	**46.12**	**0.05**	**100**
	2010-2011	405	3721	874	01	5001
		8.10	74.40	17.48	0.02	100
	Growth %	100	72.59	00	00	59.45
Mangrulpir	1990-1991	**583**	**730**	**04**	**07**	**1324**
		44.03	**55.13**	**0.30**	**0.52**	**100**
	2010-2011	583	4063	04	07	4658
		12.52	87.23	0.08	0.15	100
	Growth %	00	71.55	00	00	71.57
Manora	1990-1991	**150**	**780**	**-**	**46**	**976**
		15.37	**79.92**	**-**	**4.71**	**100**
	2010-2011	247	3625	-	46	3918
		6.30	92.52	-	1.18	100
	Growth %	39.27	78.48	-	00	75.09
Karanja	1990-1991	**-**	**1208.15**	**-**	**-**	**1208.15**
		-	**100**	**-**	**-**	**100**
	2010-2011	636	2923	-	-	3559
		17.87	82.13	-	-	100
	Growth %	100	58.67	-	-	66.05
District Washim Total	1990-1991	**1278**	**6514.15**	**1416**	**1280**	**10488.15**
		12.18	**62.11**	**13.79**	**12.20**	**100**
	2010-2011	2614	20641	1416	1280	25951
		10.07	79.54	5.46	4.93	100
	Growth %	51.11	68.44	00	00	59.58

Source: 1. Compiled by author 2. District social. & Econ. Review of Washim District 2010-11. 3. Census Handbook of Akola district 1991.

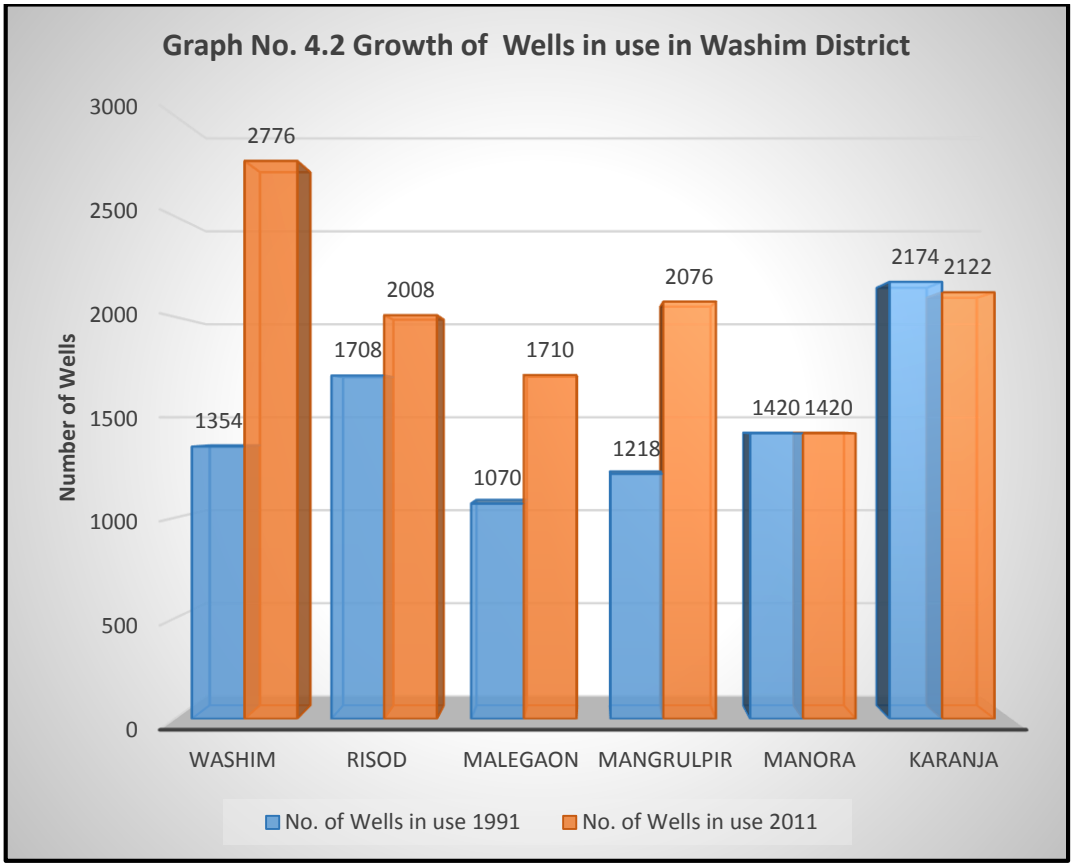
It increased by 51.11 percent (Table No.4.2) which is lower than the growth in total irrigated area. The plateau terrain favourable for canal

irrigation, but first order Rivers and first order topography are not favourable for big irrigation projects in study area. Therefore, Stress has been given on minor irrigation schemes viz. bunds, Bandharas etc. (Graph No.4.1) various modes of irrigation through the five year plan, and number of minor irrigation schemes were completed. Presently, there are 03 medium projects, 61 minor irrigation projects, 95 local minor irrigation projects, 140 percolation dam and 168 K.T.W. in study area **(DSER, 2011).**

As a result, the percentage of irrigated area has increased under canal irrigation. It is not single significant source of irrigation in the Washim district. Average intensity of canal irrigation is 1.04 % in study area. Out of total irrigated area canal irrigation by tehsil in Washim 9.42 %, Risod 6.54 %, Malegaon 8.10 %, Mangrulpir 12.52%, Manora 6.30 % and Karanja 17.87 % respectively (Table No. 4.2) in 2011. The growth in canal irrigation is obtained for 1991 and 2011 census. It is observed that, there is no change in irrigated area by canal in Washim, Mangrulpir tehsil. Manora has positive growth in canal irrigation (39.27 %) and Risod, Malegaon, Karanja Tehsil, has newly canal irrigation is created in the next decade in Washim district.

2) Wells:

Well irrigation is a traditional source of irrigation. It is as an old as an agriculture. Wells ranks first source of irrigation in the study area. The area irrigated by wells is 6514 hectares or 62.11 % in 1991 and 20641 hectare or 79.54 % in 2011. The total Wells irrigated area increased 68.44 % (Table No. 4.2). The numbers of irrigation wells are 8944 in use and irrigated area was 6514 hectares in 1991. The numbers of irrigation wells are 12112 in use and irrigated area was 20641 hectares in 2011 and average irrigated area, per well in the study area is only 0.73 hectares and 1.70 hectares respectively.



Washim district farmers given more priority for the construction of new well's as well as renovation of the old wells. Irrigational wells are increased through by five year plans in Washim District. In 1990-91 out of the total irrigation (Table No. 4.3) wells, 80.84 % wells are in use and 78.40 % in 2010-11 in Washim District. In between two decades 26.16 % number of Wells are increased in study area. This source of irrigation well suited to all farmers. There is great demand for irrigation wells due to the scarcity of other irrigation sources.

By Tehsil Washim 14.95%, Risod 26.32 %, Malegaon 32.5%, Mangrulpir 25.87%, Manora 19.95% and Karanja 1.32 % wells are not in use in year 199 0-91. In 2010-11 out of the total irrigation wells below 21.60 % wells were not in use in Washim District. By tehsil Washim 00 %, Risod 13.37 %, Malegaon 23.04%, Mangrulpir 35.43%, Manora 19.95% and Karanja 32.48% wells are not in use in year 2010-11(Graph No. 4.2).

Table No.4.3: Tehsil wise Irrigation Wells in Washim District.

Name of Tehsil	Years					
	1990-1991			2010-2011		
	No. of Wells in use	No. of wells not in use	Total No. of wells	No. of Wells in use	No. of wells not in use	Total No. of wells
Washim	1354	195	1549	2776	00	2776
	87.41	**14.95**	**100**	**100**	**00**	**100**
Risod	1708	610	2318	2008	310	2318
	73.68	**26.32**	**100**	**86.63**	**13.37**	**100**
Malegaon	1070	507	1577	1710	512	2222
	67.85	**32.5**	**100**	**76.96**	**23.04**	**100**
Mangrulpir	1218	425	1643	2076	1139	3215
	74.13	**25.87**	**100**	**64.57**	**35.43**	**100**
Manora	1420	354	1774	1420	354	1774
	80.5	**19.95**	**100**	**80.5**	**19.95**	**100**
Karanja	2174	29	2203	2122	1021	3143
	98.68	**1.32**	**100**	**67.52**	**32.48**	**100**
Total District	8944	2120	11064	12112	3336	15448
	80.84	19.16	100	78.40	21.60	100
Washim District Growth +/-	**Year**	**Total Well**	**In Use**	**None Use**		
	1991	11064	8944	2120		
	2011	15448	12112	3336		
	Growth%	**28.38**	**26.16**	**36.45**		

Source: Socio-economic Review of Washim District 1990-91, 2010-11.

It means that the rate of use of well increased up to 26.16 % during the period of investigation (Table No. 4.3). Most of the wells are dry in summer season. The increase number of wells is considered to several factors like government facilities, bank loan facilities for digging of new wells and installation of electric pumps sets for lifting water.

Density of Wells:

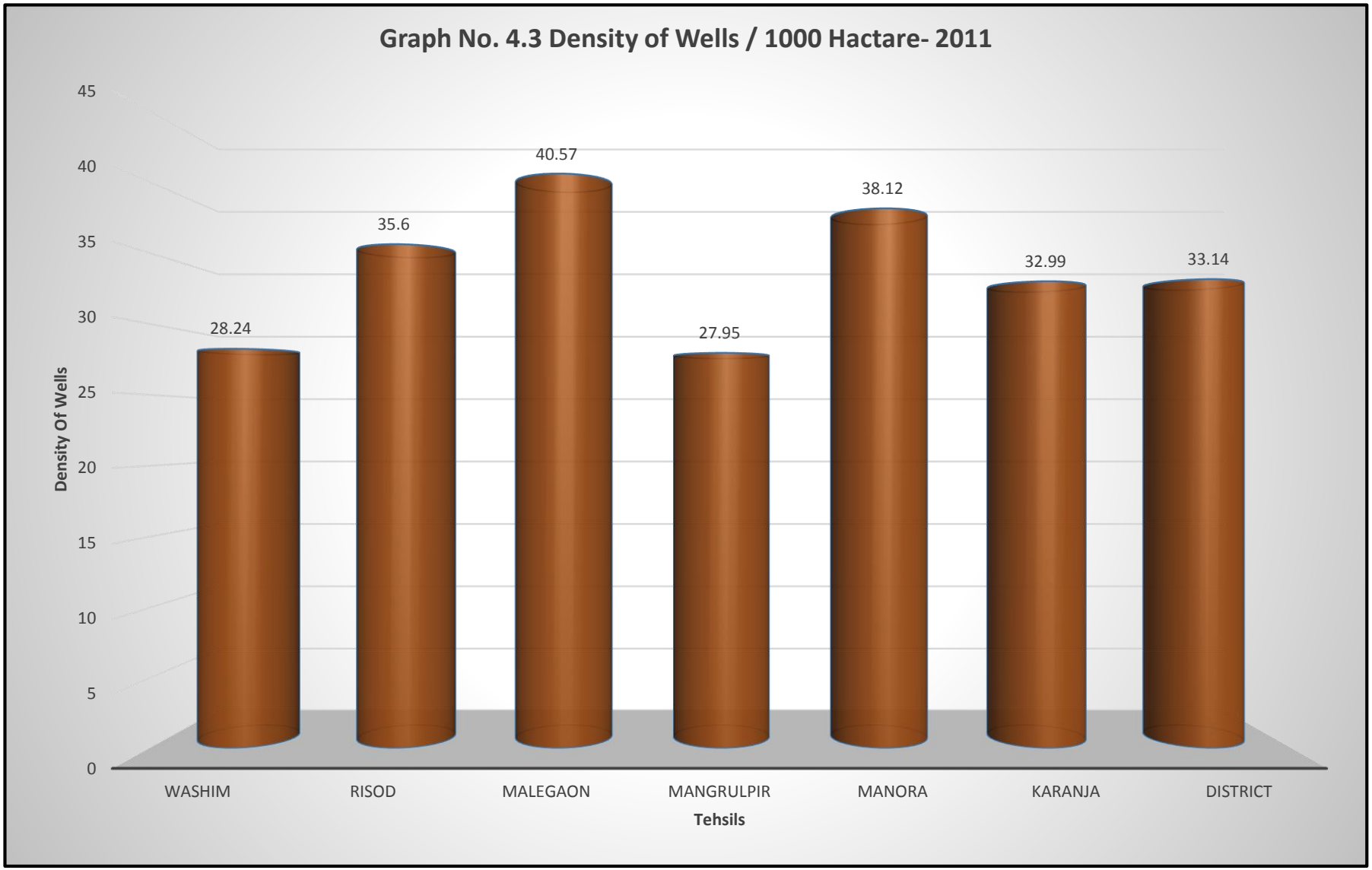
The situation of water table and the topography determines the physical setting of well. This attempt is made for to find out the density of wells in relation to total net sown area. The average density of wells as per 1000 hectares of net sown area in the district was 33.14 Wells/1000 hectares.

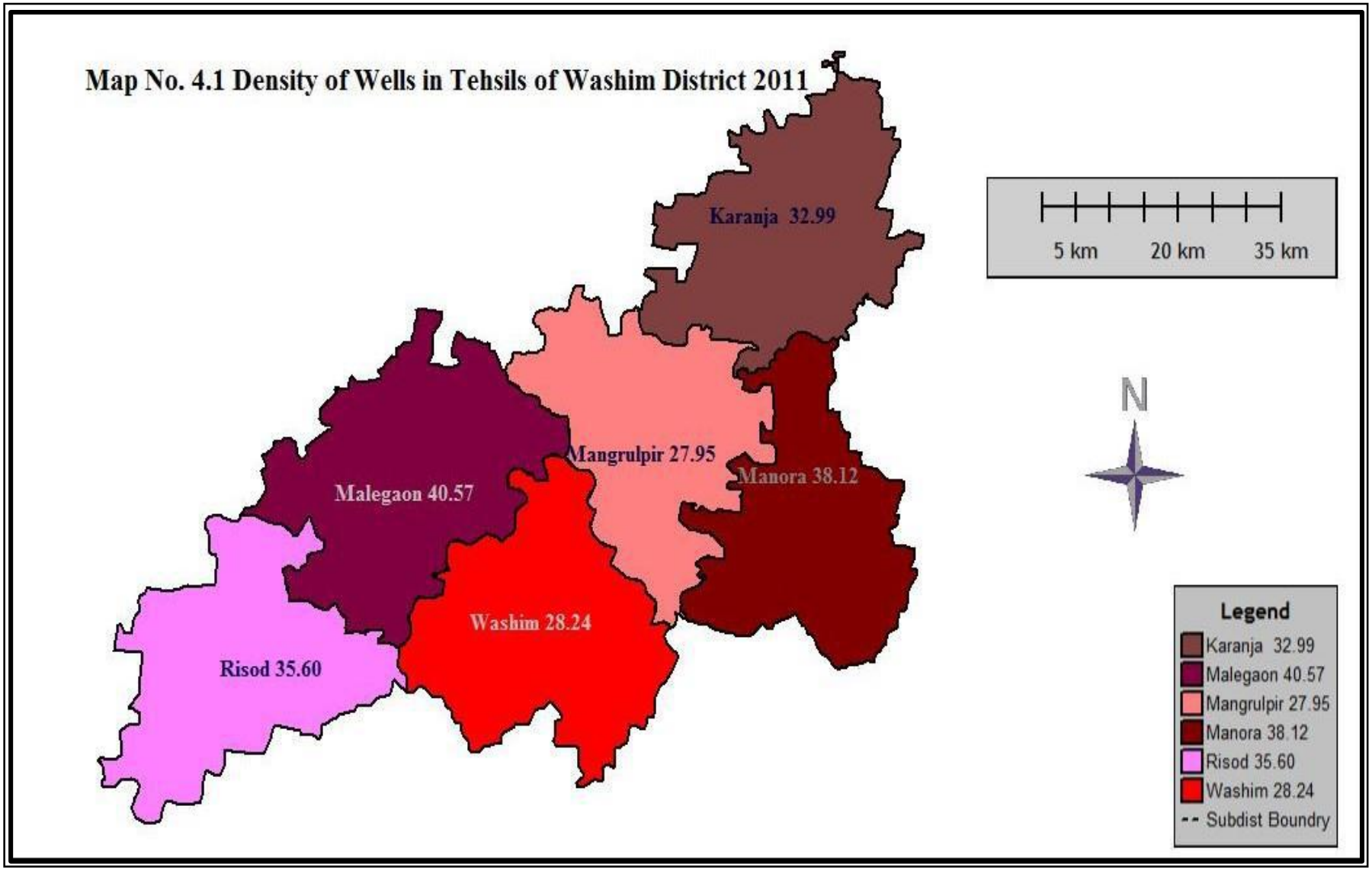
Table No. 4.4 Cultivated area & density of Wells in Washim District

Sr. No.	Tehsil	NSA in hectare 2010-2011	No. of Wells in Use	Wells Density/ 1000 hectare
1	Washim	78383	2776	28.24
2	Risod	71488	2008	35.60
3	Malegaon	69370	1710	40.57
4	Mangrulpir	58023	2076	27.95
5	Manora	54132	1420	38.12
6	Karanja	70000	2122	32.99
total	District	401396	12112	33.14

Source: compiled by Author.

The density was below average in Washim (28.24), Karanja (32.99) and Mangrulpir (27.95). More than district average 33.14 wells density was found in Malegaon, Manora and Risod Tehsils. (Map No. 4.1) The spatial distribution of wells in study area is uneven. The study area has high potential of water resources due to assured rainfall. If every drop of rain should be percolate in the land. There is a lot of scope for digging additional wells in the Washim district. The financial and technical aids should be provided to the farmers in a cheaper but careful manner, so that there will not be any misuse of assistance. The government should provide the information regarding the water table and geological structure at the location of wells. So that the farmers should manage the time and cost.


Graph No. 4.3 Density of Wells / 1000 Hactare- 2011
Density Of Wells
45
40
35
30
25
20
15
10
5
0
28.24
35.6
40.57
27.95
38.12
32.99
33.14
WASHIM
RISOD
MALEGAON
MANGRULPIR
MANORA
KARANJA
DISTRICT
Tehsils


Map No. 4.1 Density of Wells in Tehsils of Washim District 2011
Karanja 32.99
Mangrulpir 27.95
Manora 38.12
Malegaon 40.57
Washim 28.24
Risod 35.60
5 km
20 km
35 km
N
Legend
Karanja 32.99
Malegaon 40.57
Mangrulpir 27.95
Manora 38.12
Risod 35.60
Washim 28.24
Subdist Boundry

3) Tanks:

Tanks receives water from streams and rivers. This stored water is used for irrigation purpose. Tanks are formed till recently and an extremely important irrigation source in study area (Table No. 4.2). Tanks have been constructed mostly across small seasonal streams, though many have catchments just on high ground. A series of tanks have been constructed one below the another tanks in the upper course are much smaller and intended often only a check dams to prevent soil erosion in the catchments above them and inflow of silt in to the tank below. Tanks are prime source of irrigation in Washim, Malegaon, and Mangrulpir Tehsils (Table No.4.2).Tank construction and irrigation represent an inventive human response to the environment. Feasible relief and rainfall regime with a significant winter element render tanks a possible intention in this area.

Water is taken to the field by gravitational flow and when the water in the tanks falls below the level of the channel, the water has to be lifted either by pumps or by wooden shovels hung by a rope from a tripod of sticks. Tanks irrigation is significant in study area, where as 1415 hectares cultivated land is irrigated by tanks which constituting 13.50 % of the total irrigated area.

4) Other Sources of Irrigation

Other than canals wells and tanks some other apparatuses are also used for irrigation by farmers in the study area. These other methods depend mainly on locally available surface water resources in an area and the extent of development of the resources like canals, Wells, tanks. The capacity of these methods is very small in most cases. Streams which are perennial or continue to flow for a long even after the rain have ended. It enable farmers to raise one or two crops during the year. Other sources are a predominant source of irrigation in Risod, Washim, Manora and Mangrulpir tehsils in 1991 (Table No. 4.2). The study area has about 12.20 % of its irrigated area under such sources.

Table No.4.5 Trends in Net Irrigated area as % of Net Sown area

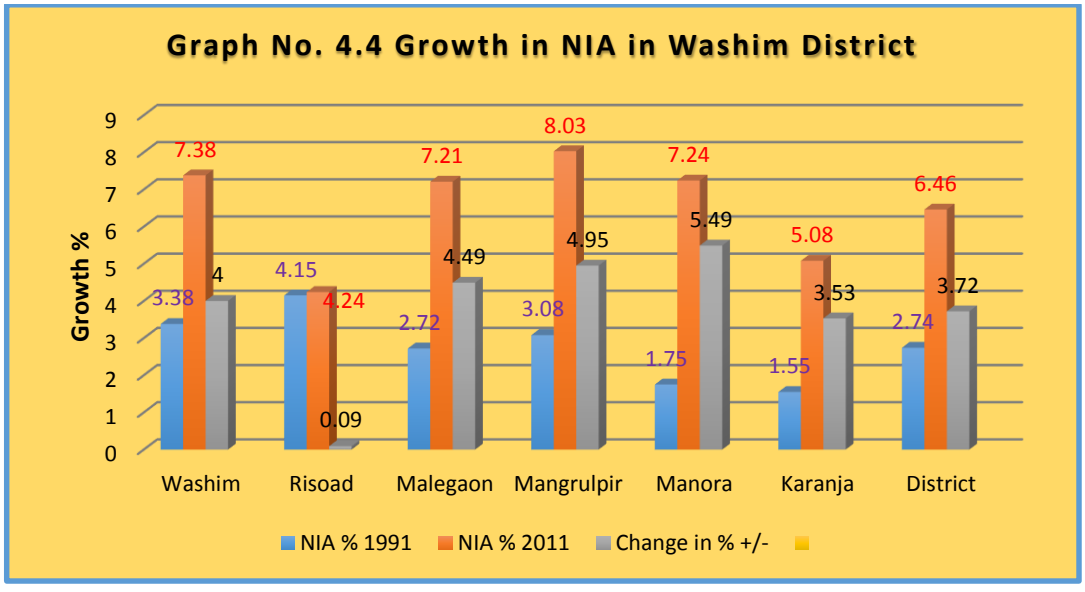
(Area in hectare)

Sr. No.	Name of Tehsil	Years						Change in % +/-
		1990-1991			2010-2011			
		NIA	NSA	%	NIA	NSA	%	
1	Washim	2434	71900	3.38	5786	78383	7.38	4.00
2	Risod	2650	63900	4.15	3029	71488	4.24	0.09
3	Malegaon	1895	69600	2.72	5001	69370	7.21	4.49
4	Mangrulpir	1332	43200	3.08	4658	58023	8.03	4.95
5	Manora	976	55900	1.75	3918	54132	7.24	5.49
6	Karanja	1208	78100	1.55	3559	70000	5.08	3.53
8	District	10488	382600	2.74	25951	401396	6.46	3.72

Source: Compiled by Author from Socio-economic Review 2011 Washim District.

4.4 Spatial Pattern of change in Net Irrigated area:

The intensity of irrigation (means net irrigated area as % of net sown area) **(Jasbir singh, S.S. Dhillon, 2004)**[3] from all sources varies evidently in the district. This regional imbalance in the development of irrigation facilities is due to the limitations of physical-socio-economic conditions.



The present intensity of irrigation for the study area was 6.46 %. (Table No. 4.5), (Graph No. 4.4) shows net irrigated area as % of net sown area is

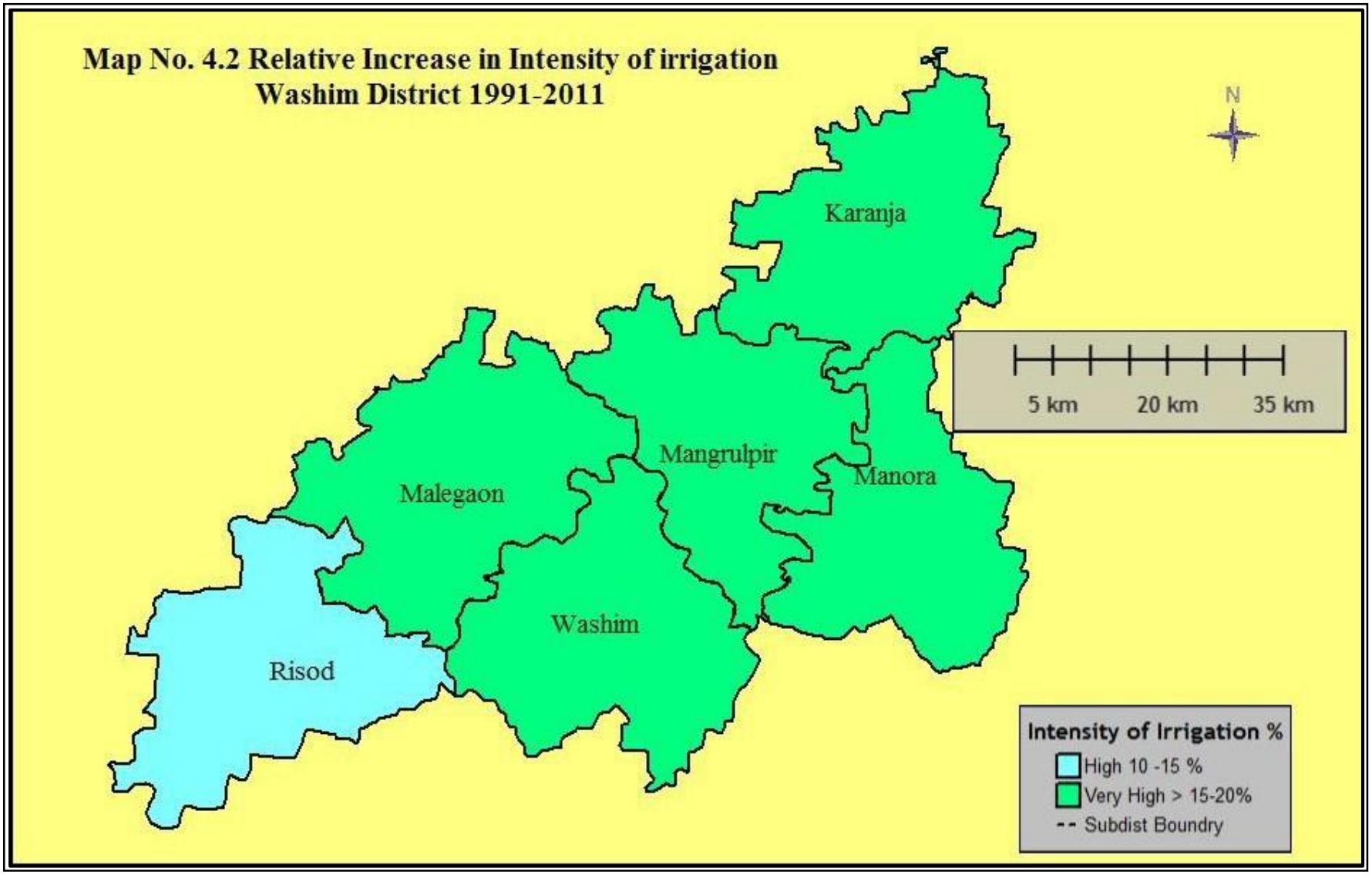
increased from 2.74 % to 6.46 % in the study area during the period of investigation. All Tehsils with initial stage irrigational base are still poor. In these all Tehsils terrain dominated by first order topography and first order river system. So for the extension of irrigation facilities need of economic supports because farmer's was economically backward. Near about half of the farmers have less than 2 to 4 hectares land. Out of the total net sown area more than 4 % net sown area was found under irrigation in all Tehsils in 2010-2011. More than 4 % to 8 % area under irrigation in Risod 4.24%, Karanja 5.08 %, Malegaon 7.21 %, Manora 7.24 % and Washim 7.38 %. Above 8 % net sown area (Table No. 4.5) was under irrigation in Mangrulpir (8.03 %) Tehsils. These Tehsils have deep black soil, sufficient water resources and favourable terrain are responsible for growth in irrigation. All tehsil shows (Table No. 4.5) positive increase in net irrigated area as % of Net sown area.

4.5 Relative increase in intensity of irrigation:

Table No. 4.6 Relative increase in intensity of irrigation

Sr. No.	Tehsil	years		Relative Growth % +/ -
		1990-1991	2010-2011	
		Net Irrigated Area	Net Irrigated Area	
1	Washim	2434	8745	**259.28**
2	Risod	2650	3029	**14.30**
3	Malegaon	1895	5001	**163.90**
4	Mangrulpir	1324	4658	**251.81**
5	Manora	976	3918	**301.43**
6	Karanja	1208	3559	**194.61**
8	District	10488	25951	**147.43**

Source: Computed by author


Map No. 4.2 Relative Increase in Intensity of irrigation
Washim District 1991-2011
N
Karanja
Mangrulpir
Manora
Malegaon
Washim
Risod
5 km
20 km
35 km
Intensity of Irrigation %
High 10 -15 %
Very High > 15-20%
Subdist Boundry

The relative increase in intensity of irrigation is calculated in % with **Dhillon & Sandhu's Method (1979)** by following formula:

$$\text{Relative Increase} = \frac{Ic - Io}{Io} \times 100$$

Where:

Ic = Net Irrigated Area of 2010-2011

Io = Net Irrigated Area of 1990-1991

Table No. 4.6 shows the relative increase in the intensity of irrigation. This relative increase categorised as: Moderate 5% to 10 %, High 10% to 15% and very high 15 % to 20 % and above.

The Very high and above intensity of irrigation (Map No.4.2) is noted in Washim Tehsil. The high relative increase in intensity of irrigation (5 % to 10 %) is noted in Risod Tehsil. Very high and above relative increase in intensity of irrigation is found in Malegaon 163.90 %, Karanja 194.61 %, Mangrulpir 251.81% and Manora 301.43 % by tehsils within two decades (1991-2011).

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Chapter-V

Changes in General Land Use Pattern

Chapter- V

Changes in General Land Use Pattern

5.1 Introduction:

In the preceding three chapters, the physical, economic and social bases of agriculture have been investigated. This chapter explains the concept of land use, factors affecting land use and general land use utilization in study area. Examine the Tehsil wise trends in general land use pattern, distribution of net Sown area and changes in general land use from 1990-1991 to 2013-2014. Land use is the surface utilization of all developed and fallow land on a specific time and space. Land use is a function of land, water, air, temperature and man. Both play their own essential role in its life time. Land constitutes with water, air and human acts as a dynamic factor to shows its land use types and distribution. Agriculture is basic occupation in India. The traditional methods of crop cultivation continue from independence. Agriculture is a way of life than as occupation. The knowledge of crop cultivation was transferred from one generation to another. As such for a very long period, there was absolutely no change in the methods of cultivation. We learn from the various accounts that neither there was a change in the occupation nor there are any active agents, which could induce changes.

The government and agricultural scientist improve the agriculture in a planned ways. Their experiments on agricultural development were conducted, which were responsible for gradual changes in agriculture. The major change takes place due to the industrial development in country. The industrial revolution phases gave great impact on the agricultural production and induce a major change in the techniques and methods of production. The introduction of High Yielding Verity (HYV) seeds from 1966-67.Use of chemical fertilizer, pesticides, insecticides and development in irrigation

increase the yield per unit in selected crops. The use of modern inputs has been equally update the out dated traditional subsistent agriculture.

5.2 The Concept of Land use:

Geographically, land has been regarded as a specific area of the earth surface, which is the most important asset of the Nation. From the earliest time, man has used it to satisfy his multiple needs. Land use is a primary indicator of the extent and degree. From man has been using the resources. A systematic application is in human control. There is an intimate relationship between predominant ecological conditions and man. It is the result of combination between nature and human behaves. Human have been brought to bear on it in the past is still active in the present. Land is mainly used for the agriculture as an important economic activity of man. He uses vast tracts of land for crop cultivation. This agricultural land belongs to rural area and it is essentially a rural activity. The use of this land resource is of great interest to the geographer **(L.D. Stamp, 1960)**[1] who surveyed the whole agricultural land of Great Britain to prepare a series of land use map.

The cultivator has to decide what type of crop and cropping system has to be adopted within the frame work of environment. Land use orientation is an area conditioned by the physical, social and economic environment. That exist land use models of agriculture have been constructed and used to understand the characteristics of land use pattern. Most of the models of agricultural land use were economic in nature. They treated agriculture as an economic activity of man. Since the suitable use of land use was the aim of such models **(Von Thunen, 1826**)[2]. Land use is an area is the cumulative outcome of historical events and the interaction between economic forces, with the natural environment.

A natural environment has significant influence on distribution and use of geographical area. Subsequently adjustments of land use to the cultural ecology are clearly evident. This suggests that it is an opportunity moment for an appraisal of the relationship between land use and environment. The

idea of a land use hierarchy varies with the production and consumption factors. The production factors are land, transportation facilities and the stage of technological development. The consumption factors include the number of people, consumption of goods per person and gross export. The growth of population may change the forest and pasture land into cultivated land, in comprising residential and industrial land utilization survey made up till now were mostly concerned with the smaller area of rural and urban sector.

Land utilization has geographic, economic and demographic dimensions. The geographic aspect consist mainly the survey of the temperature, humidity, physiographic and soil conditions. It is influence the land utilization for crops, pasture or forest. The demographic aspect consists of studies of population distribution, composition, characteristics and trends not only in the area being survey, but also in the entire country. Land use is an important aspect of geographic studies particularly relevant to agricultural geography. However, this concept of land use has been used in so many ways, that no generally accepted scheme of classification exists despite many years of land use studies by geographers. The moreover problem as how land resources are used and how much production comes from various major uses is exceedingly complex, being determined by several interrelated factors. Like the environmental, socio-economic and also the historical background of the land use **(Anderson, 1970)**[3]. But the impact of environmental controls is too acute and often interwoven will socio-economic forces from which the former cannot be easily divorced for geographical investigation of change in land use pattern.

5.3 Factors Affecting Land use:

The details of terrain are well encompassed by the elements of relative relief, average slope and dissection index **(Sharma, 1968)**[4]. Slope of the area is play significant role in agricultural land use. If a region have very steep slope there is less possibilities for agricultural land use. The pattern of land use in general and the agricultural land use in particular in arid and semiarid

regions will be closely associated with five factors, are environmental, technological, political, economic and social. Natural environment includes relief, geology, soil, drainage, and climate. Economic consideration are of a different nature, having less physical reality, moreover, and economic factors appear as both independent and dependent variables. The term 'social factors' are used in a broad sense it includes, the relationship of human groups, considerations of educational levels and land tenure system. Political consideration is related with enforcement of planning and regulations. Most of these factors have been analysed. It is quote proper to Jasbir Singh, says "an analysis of the problem of the land use, one should bear in mind that the earth is inert and man an active factor in partnership, its man who wants to make living out of land, the saying accepted for India, where, about three fourth of the work force is directly dependent on land for substance. Therefore, it is he who determines the use to which he wishes to put the land **(Jasbir Singh, 1974)**[5] in general; physical factors have decisive influence on land use in developing economy. Some is true in this study area, where with other thing the nature of terrain, soil and amount of rainfall determine the amount of area sown. Among them rugged of terrain, poor soils, and scarcity of water supply coupled together with poor development have all contributed this situation. The average net sown area is very high (above 76.36 %).The Washim district forms part of Deccan plateau with slope towards the southeast from Sahaydri Hills and has a varied topography consisting of hills, plains and undulating topography near River banks. The district forms a part of Godavari and Tapi Basins. Balaghat plateau comprises of low-lying hills forming water divide. The soil of the district is basically derived from Deccan Trap Basalt and major part of the district is occupied by shallow black soil (deep black soil occurs in central part of Washim Tehsil and north eastern part of Mangrulpir Tehsil) medium black soil is 25- 50 cm depth occurring in the plains in entire south western, north eastern and northern part of district. The shallow black soil 7.5-25 cm depth occurs in restricted hilly parts

of district in the central elongated part and northern peripheral part. These soils are rich in fertility, therefore, instead of forest, most of the area is under cultivation. The low and levelness of land also facilitate the development of transportation. So the influx of cultural and technological innovation required for the agricultural development. Direct influence of amount of rainfall and its spatial and seasonal distribution shows that the study area receives more than 90 % (2013-14) of the total rainfall from the south-west monsoon. The influence of human factors is difficult to determine, however, it can be out lined broadly. It has exerted influence on land use in general and agricultural land use particular, such as providing ready market for agricultural produce, assistance of technical innovations and financial institutions. Therefore cropping in study area is become more commercial in nature.

5.4. Land use Classifications:

Land use is a basic and indispensable resources for agriculture, its quality and extent largely determine the variety and magnitude of agricultural production, studies on agricultural land-use so, for rare in India. Land-use is determines by physic-socio-economic environment of region. These entire components are taken into consideration, while classifying the land under different categories and sub-categories, census of India have classified land-utilization in nine different categories, but the present study, these have been grouped into five major land-use categories, as the percentage of area under individual categories is relatively insignificant. The concepts and terms used for different land use **(LUS, 2010)**[6] categories were as follows:

A: Nine Fold Classification:

1. Forest Area:

This includes all land classified either as forest under any legal enactment, or administered as forest, whether State owned or private, and whether wooded or maintained as potential forest land. The area of crops raised in the forest and grazing lands or areas open for grazing within the forests remain included under the “forest area”.

2. Area under Non-agricultural Uses:

This includes all land occupied by buildings, roads and railways or under water, e.g. rivers and canals, and other land put to uses other than agriculture.

3. Barren and Un-cultivable Land:

This includes all land covered by mountains, deserts, etc. Land, which cannot be brought under cultivation except at an exorbitant cost is classified as uncultivable whether such land is in isolated blocks or within cultivated holdings.

4. Permanent Pasture and other Grazing Land:

This includes all grazing land whether it is permanent pasture/meadows or not. Village common grazing land is included under this category.

5. Land under Miscellaneous Tree Crops, etc.:

This includes all cultivable land, which is not included in „Net area sown" but is put to some agricultural use. Land under trees, thatching grasses, bamboo bushes and other groves for fuel, etc. which are not included under "Orchards" are classified under this category.

6. Cultivable Waste Land:

This includes land available for cultivation, whether taken up or not taken up for cultivation once, but not cultivated during the 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 inaccessible and may lie in isolated blocks or within cultivated holdings.

7. Fallow Lands other than Current Fallows:

This includes all land, which was taken up for cultivation but is temporarily out of cultivation for a period of not less than one year and not more than five years.

8. Current Fallows:

This represents cropped area, which is kept fallow during the current year.

9. Net Area Sown:

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

B. Definitions of Some Commonly Used Terms:

(I) Geographical Area:

The latest figures of geographical area of the State/Union Territories are as provided by the Office of the Surveyor General of India.

(II) Reporting Area for Land Utilisation Statistics:

The Reporting area stands for the area for which data on land use classification is available. In areas where land utilization figures are based on land records, reporting area is the area according to village papers, i.e. the papers prepared by the village accountants. In some cases, the village papers may not be maintained in respect of the entire area of the State. For example, village papers are not prepared for the forest areas but the magnitude of such area is known. Also there are tracts in many States for which no village paper exists. In such cases, estimates of classification of area from agricultural census, 2000-01 and 2005-06 are adopted to complete the coverage.

(III) Gross Cropped Area:

This represents the total area sown once and/or more than once in a particular year, i.e. the area is counted as many times as there are sowings in a year. This total area is also known as total cropped area or total area sown.

(IV) Area Sown more than once:

This represents the areas on which crops are cultivated more than once during the agricultural year. This is obtained by deducting Net Area Sown from Gross Cropped Area.

(V) Irrigated Area:

The area is assumed to be irrigated for cultivation through such sources as canals (Govt. & Private), tanks, tube-wells, other wells and other sources. It is divided into two categories:

(a) Net Irrigated Area:

It is the area irrigated through any source once in a year for a particular crop.

(b) Total Net Un-irrigated Area:

It is the area arrived at by deducting the net irrigated area from net sown area.

(VI) Total /Gross Irrigated Area:

It is the total area under crops, irrigated once and/or more than once in a year. It is counted as many times as the number of times the areas are cropped and irrigated in a year

(VII) Total/Gross Un-Irrigated Area:

It is the area arrived at by deducting the gross irrigated area from the gross sown area.

(VIII) Cropping Intensity:

It is the ratio of Total Cropped Area to Net Area Sown.

(IX) Agricultural Land/Total Cultivable Land /Total Cultivable Area/Total Arable land:

This consists of net area sown, current fallows, fallow lands other than current fallows, cultivable waste land and land under miscellaneous tree crops.

(X) Total Un-Cultivable Area/Land:

It is the area arrived at by deducting the total cultivable area from the total reported area.

(XI) Total Cultivated Area/Land:

This consists of net area sown and current fallows.

(XII) Total Un-Cultivated Area/Land:

It is the area arrived at by deducting the total cultivated area from the total reported area.

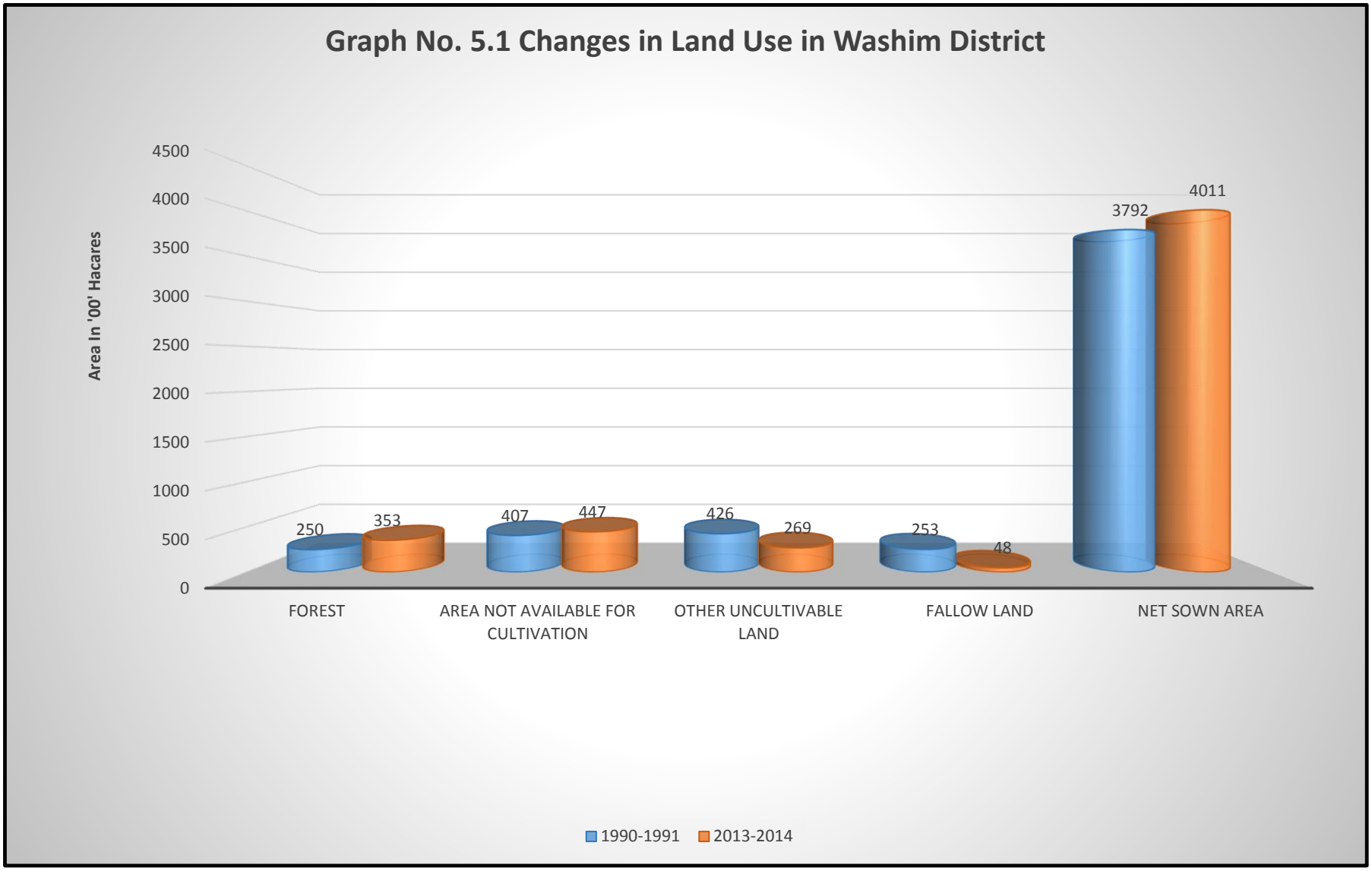
5.5 Changes in general land use Pattern:

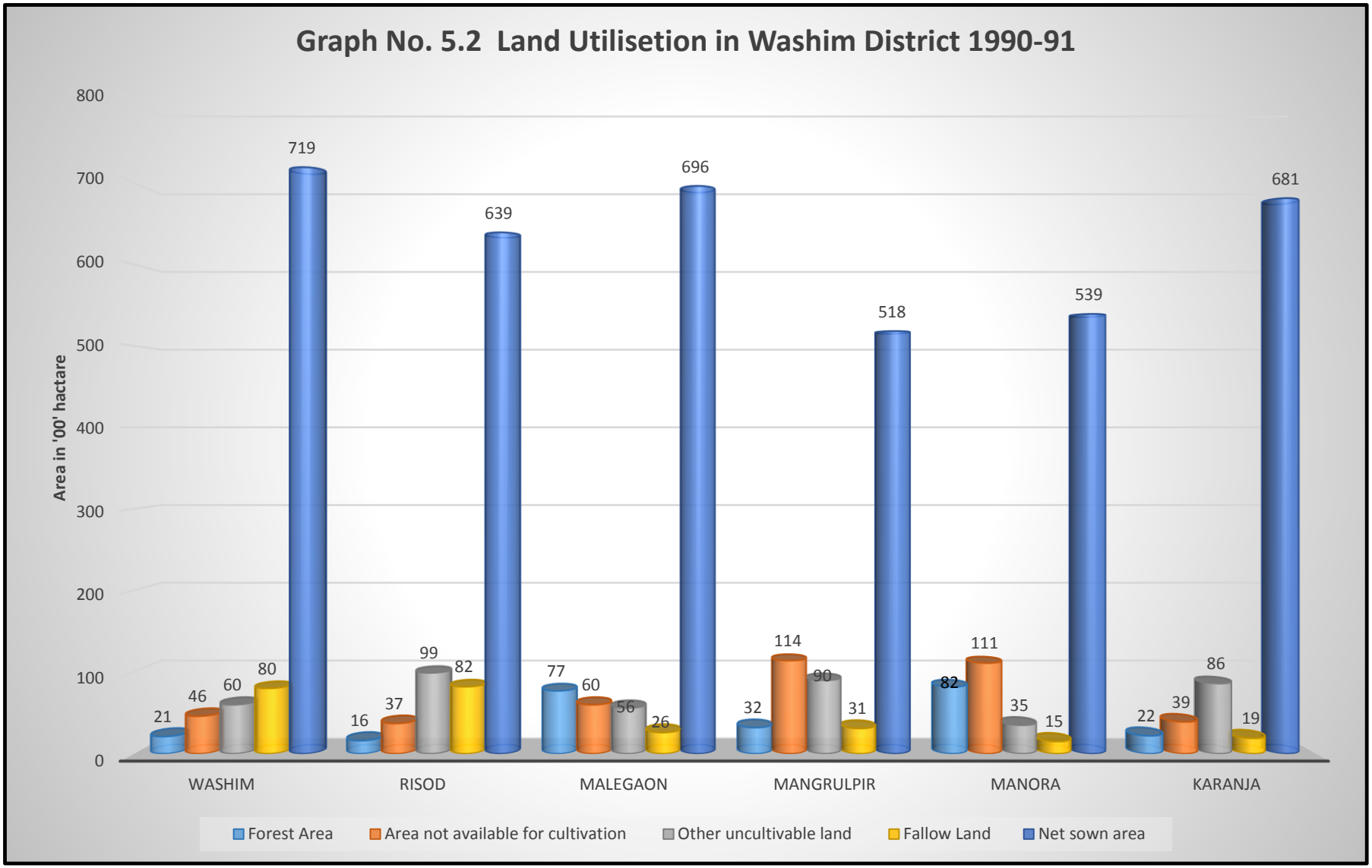
The table No. 5.1 shows Washim district as a whole 78.22 % of its total net sown area is more than the state (56.57 %) and Amravati division (66.95%) in 2013-14.The study area has almost favourable terrain and association elements. Of the total geographical area 78.22 % is under agricultural use.

Table No. 5.1 Changes in general land use Pattern of Washim District

Area in '00' hectare	**Land Utilization Statistics % to the Reporting Area**					
	Non arable land use			**Arable land use**		
Period	Forest	Area not available for cultivation	Other uncultivable land	Fallow land	Net sown Area	Total %
1990-1991	250	407	426	253	3792	5128
	4.87	7.94	8.31	4.93	73.95	100
2013-2014	353	447	269	48	4011	5128
	6.88	8.72	5.24	0.94	78.22	100
Change in %	**2.01**	**0.78**	**-3.07**	**-3.99**	**4.27**	**-**
Amravati Division	7063	3501	2684	1945	30774	45967
	15.36	**7.62**	**5.84**	**4.23**	**66.95**	**100**
Maharashtra	52145	31720	24092	25619	174007	307583
	16.95	**10.31**	**7.83**	**8.33**	**56.57**	**100**

Source: Socio-economic Review of Washim District, 1990-91 and 2013-14


Graph No. 5.1 Changes in Land Use in Washim District
Area In '00' Hacares
4500
4000
3500
3000
2500
2000
1500
1000
500
0
250
353
407
447
426
269
253
48
3792
4011
FOREST
AREA NOT AVAILABLE FOR CULTIVATION
OTHER UNCULTIVABLE LAND
FALLOW LAND
NET SOWN AREA
1990-1991
2013-2014


Graph No. 5.2 Land Utilisetion in Washim District 1990-91
Area in '00' hactare
800
700
600
500
400
300
200
100
0
WASHIM
RISOD
MALEGAON
MANGRULPIR
MANORA
KARANJA
21
46
60
80
719
16
37
99
82
639
77
60
56
26
696
32
114
90
31
518
82
111
35
15
539
22
39
86
19
681
Forest Area
Area not available for cultivation
Other uncultivable land
Fallow Land
Net sown area

Graph No. 5.3 Land Utilisetion in Washim District 2013-14

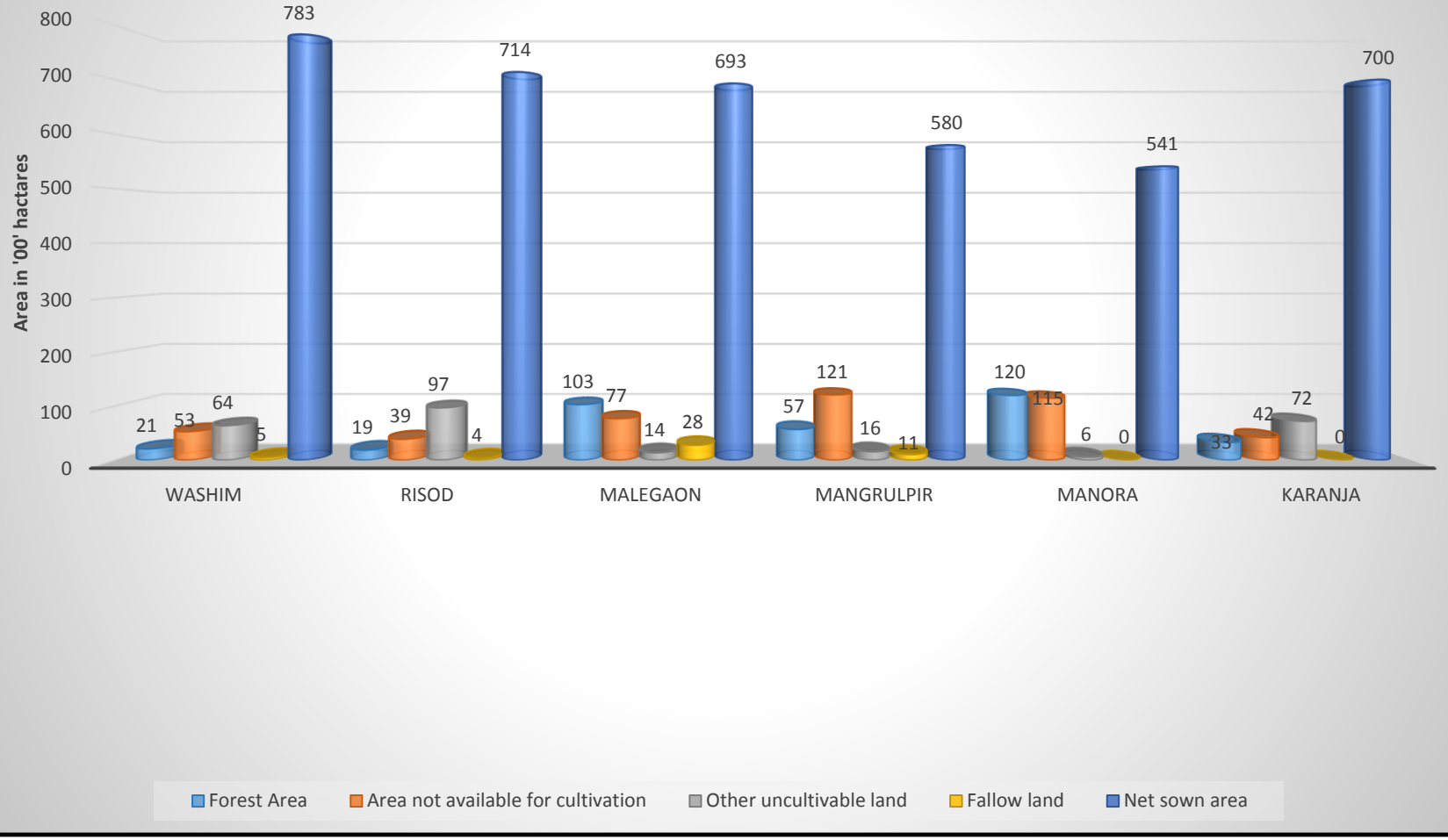


Table No. 5.2 Tehsil wise changes in general land use pattern

Tehsil	**Year**	Forest Area %	Area not available for cultivation %	Other uncultivable land %	Fallow Land %	Net sown area %	Total
		(Area in "00" hectare)					
		A	B	C	D	E	R. A
Washim	1990-91	21	46	60	80	719	926
		2.27	4.97	6.48	8.64	77.64	100
	2013-14	21	53	64	05	783	926
		2.27	5.72	6.91	0.54	84.56	100
	% Change	0.0	0.75	0.43	-8.1	6.92	-
Risod	1990-91	16	37	99	82	639	873
		1.83	4.24	11.34	9.39	73.20	100
	2013-14	19	39	97	04	714	873
		2.18	4.47	11.11	0.46	81.78	100
	% Change	0.35	0.23	-0.23	-8.93	8.58	-
Malegaon	1990-91	77	60	56	26	696	915
		8.41	6.56	6.12	2.84	76.07	100
	2013-14	103	77	14	28	693	915
		11.26	8.41	1.53	3.06	75.74	100
	% Change	2.85	1.85	-4.59	0.22	-0.33	-
Mangrulpir	1990-91	32	114	90	31	518	785
		4.08	14.52	11.46	3.95	65.99	100
	2013-14	57	121	16	11	580	785
		7.26	15.41	2.04	1.40	73.89	100
	% Change	3.18	0.89	-9.42	-2.55	7.9	-
Manora	1990-91	82	111	35	15	539	782
		10.49	14.19	4.48	1.92	68.92	100
	2013-14	120	115	06	00	541	782
		15.34	14.70	0.78	0.0	69.18	100
	% Change	4.85	0.51	-3.7	-1.92	0.26	-
Karanja	1990-91	22	39	86	19	681	847
		2.60	4.60	10.16	2.24	80.40	100
	2013-14	33	42	72	00	700	847
		3.90	4.96	8.50	0.0	82.64	100
	% Change	1.3	0.36	-1.66	-2.24	2.24	-

Source: Census Handbook, DSER of Washim district (Akola) 1991, 2013-14

The proportion of fallow land is 0.94 %, which is less than the state average (8.33 %). Changes in (Table No.5.1) general land use have been observed during the period of investigation 4.87 % area was under forest in 1990-91. It is increased up 6.88 % during the year 2013-14. It means 2.01 % positive change was recorded in forest area in Washim district. The positive change is observed in non-cultivable area (0.78 %) but other cultivable land shows negative change (-3.07 %). This is mainly due to favourable physiographic situation. It is possible to bring maximum land under Agriculture. The proportion of net sown area was 73.95 % in 1990-91 and it has increased by 4.27 % in 2013-14.

Due to the location and physical setting the general land use pattern of the region under study differs from Tehsil to Tehsil. The existing land use pattern is represented in Graph No.5.1, 5.2, 5.3. It has been resulted from the process of land utilisation within the setting of physical, social and economic involvement. It is improved by the expansion in irrigation and the growth of population. There is changes in geographical factors in study area. Physiography, soil's, rainfall are played important role in determining the agricultural products. About 78.88 % to 79.16 % of the total geographical area is under cultivation

5.6 Tehsil wise changes in general land use pattern:

1. Area under forest:

Area under forest (Table: 5.2) showed increased from 4.87 % to 6.88 % in two decades (1990-91-2013-14). Washim, Risod and Karanja Tehsils are having less forest area as compared to other Tehsils. Out of the total geographical area below 4% area was found under forest in Karanja, Washim and Risod Tehsils. More than 5% to 10% area under forest was found in Mangrulpir Tehsils. Above 10% forest area was recorded in Malegaon and Manora Tehsils in two decades. There is a positive change in forest area in Washim district.

2. Area not available for cultivation:

This category includes:

1) The land put to non-agricultural use and

2) Barren and uncultivable land.

Above type of use shows that both areas will be not available for crops cultivation. Area not available for crop cultivation shows a close relationship with other uncultivated land and the net sown area in study area. It means if there is a change at all more net sown area will be transferred to above categories and this may happen particularly due to increasing urbanization predominantly the spread of the urbanization in six Tehsil. The land under these categories we can't bring under cultivation, due to very high prices. Out of the total geographical area of each tehsil below 1% change was found under this category in Washim, Risod, Mangrulpir, Manora and Karanja Tehsil whereas above 1 to 2 % change was found under this group in Malegaon Tehsil during 1990-91to 2013-14.

3. Other uncultivable land (Excluding fallow land):

Other uncultivable land excluding fallow land consist three types land viz.

1) Cultivable waste.

2) Permanent pasture and grazing land and

3) Land under miscellaneous trees crops etc.

Table No. 5.2 (Graph No. 5.2,5.3) represents that 1% to 2% negative change in area not available for cultivation was noticed in Risod and Karanja Tehsil while 2% to 5% negative change in this categories was recorded in Malegaon and Manora and above 9% negative change found in Mangrulpir Tehsils. Below 1% Positive change is observed in Washim tehsil from 1990-91 to 2013-14.

Negative change in other uncultivated land was found in five Tehsils due to the proportion of other uncultivated land which has been gone to either non-agricultural land or agricultural land and particularly the permanent pasture and grazing lands are brought under cultivation or other uses.

4. Fallow land:

The fallow land includes current fallow and old fallow land and largely found due to inadequate water supply or excess of moisture supply. Extensive holdings and clayey soils different for cultivation at proper time. Sometimes they are kept fallow land for preserving fertility and maintaining crop yields to be recognised. Census

of India (1991), has divided this categories into two types: 1) land kept fallow during one year is called current fallow and, 2) when it kept fallow for 1 to 5 years it is called as permanent fallow land. However in the present study both the sub categories are grouped together. The sum total of fallow land and net sown area gives the extent of arable land in limitation to land that is not cultivated at all. The fallow land area is decreased from 25300 hectares to 4800 hectares from 1990-91 to 2013-14. Below 2% negative change in fallow land was found in Manora tehsil, while above 2% negative change in fallow land was noticed in Mangrulpir and Karanja tehsils during the study period. Table No. 5.2 shows above 8 % negative change in fallow land was observed in Washim and Risod tehsil. While below1 % positive change was found in Malegaon tehsil from 1990-91 to 2013-14. Positive change in fallow land was took place due to decrease in area in other categories while negative change showed that net sown area is increased to some extent in these Tehsils.

5. Net Sown Area:

NSA and fallow lands together constitute the extent of cropped area in any region and therefore, it plays vital significance in studies relating to agricultural geography. The net sown area is the actual area under crops not counting areas sown more than once in the same year only once. Net sown area is increased in Washim district, except Malegaon tehsil shows negative change in NSA from 1990-91 to 2013-14. Table No. 5.2 shows that below 1% negative change in net sown area was found in Malegaon Tehsil on the other hand below 1% positive change in net sown area was recorded in Manora Tehsil and above 2% positive change in NSA is found in Karanja tehsil. Whereas above 6% to 8% positive change in net sown area was recorded in Washim, Mangrulpir tehsils and above 8 % positive change is recorded in Risod tehsil from 1990-91 to 2013-14 (Graph No. 5.2). Increase in NSA due to addition of land from fallow land where as some net sown area was added to fallow land therefore decrease in NSA from 1990-91 to 2013-14.

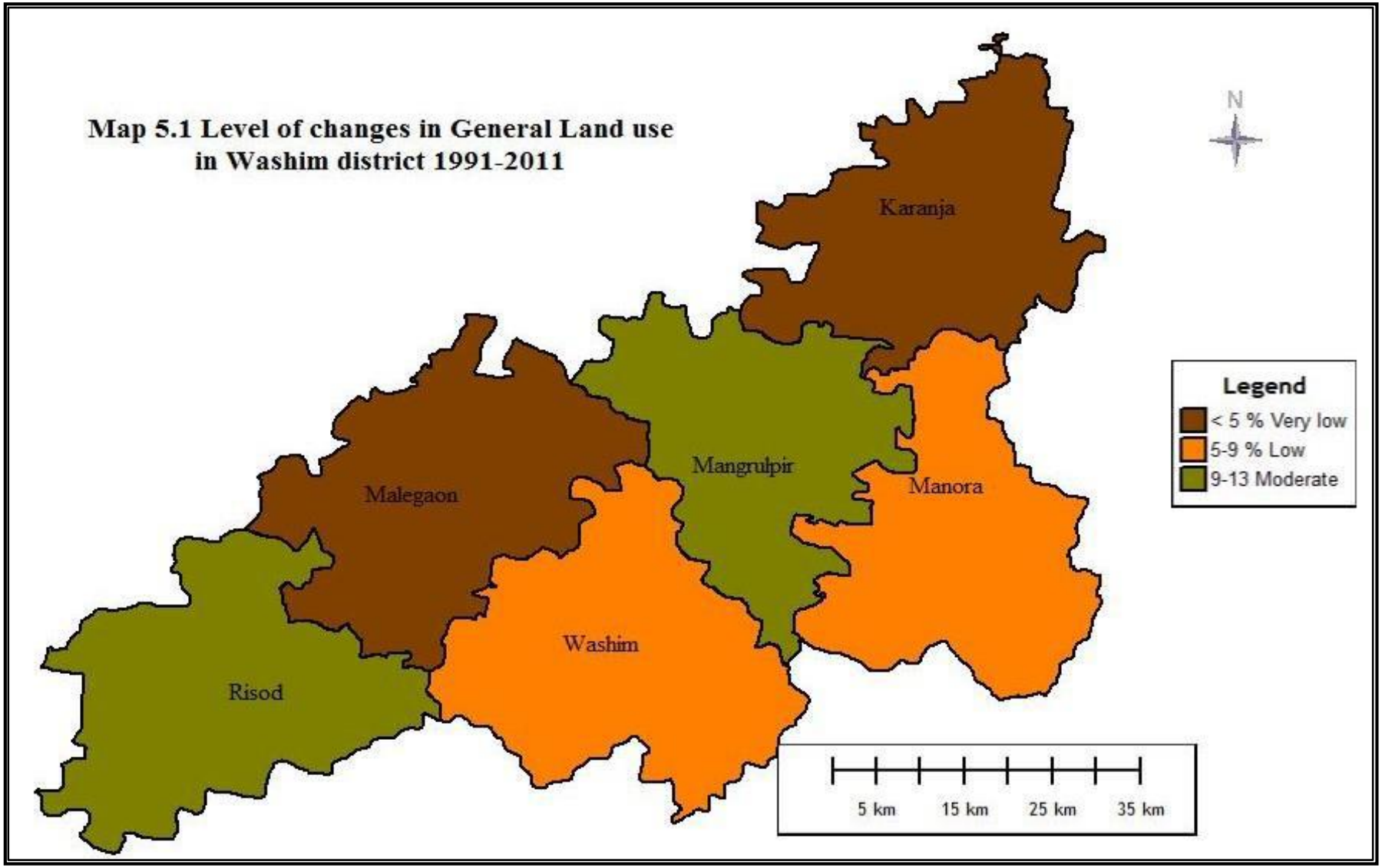
5.7 Degree of dynamism in General land use Pattern:

The gross volume of change in land use pattern from 1990-91 to 2013-14 is measured by simple method of Jasbir singh and Dhillon S.S. (1973)[7]. As per this method, in a given area unit the summation of positive changes in land use types one side and the summation of negative changes in land use types on the other side, would certainly give equal value and which is the degree of dynamism or the total magnitude of change in the land use pattern over a period of time.

Table No. 5.3 Dynamism in Land use Pattern of Washim District

Sr. No.	Tehsil / District	Increase / Decrease in different categories of Land use The Index of Change	Land use change in% from 1990-91 to 2013-14
1	Washim	A 0.0+B 0.75+C 0.43+ E 6.92 ---------- D 8.1	8.1 ---------- 8.1
2	Risoad	A 0.35+B 0.23+E 8.58 ---------- C 0.23+E 8.93	9.16 ---------- 9.16
3	Malegaon	A 2.85+B 1.85+D 0.22 ---------- C 4.59+E 0.33	4.92 ---------- 4.92
4	Mangrulpir	A 3.18+B 0.89+ E 7.9 ---------- C 9.42+D 2.55	11.97 ---------- 11.97
5	Manora	A 4.85+B 0.51+ E 0.26 ---------- C 3.7+D 1.92	5.62 ---------- 5.62
6	Karanja	A 1.3+ B 0.36+E 2.24 ---------- C 1.66+D 2.24	3.9 ---------- 3.9
7	Washim District	A 2.01+B 0.78+E 4.27 ---------- C 3.07+ D 3.99	7.06 ---------- 7.06

Source: Computed by Author


Map 5.1 Level of changes in General Land use
in Washim district 1991-2011
N
Karanja
Malegaon
Mangrulpir
Manora
Washim
Risod
Legend
< 5 % Very low
5-9 % Low
9-13 Moderate
5 km
15 km
25 km
35 km

It delivers a comparative view of the areas, where land use pattern has been relatively dynamic or stable in the dynamic nature of physical, social and economic condition. In the present calculation higher the index value, more dynamic is the land use, similarly lower the index value more stable in the land use.

Table No.5.3 shows a valuation of the accumulated change between the five major land use types, each group is computed at Tehsil level. The proportion of land involved in change from one land use type to another in Washim district, accounted to 7.06 %, which is definitely a low proportion of land involved in the process of land alteration.

Area of very low dynamism is less than 5 % is found in two Tehsils, namely Malegaon (4.92 %), and Karanja (3.90%). The area of low magnitude (5% to 9%) of land use change in Washim (8.1 %) and Manora (5.62 %) Tehsils. The area of moderate change is recorded in Risod (9.16 %) and Mangrulpir (11.97 %) tehsil.

Table No.5.4 Level of changes in Land use pattern

Sr. No	Magnitude of Dynamism	Index value of Dynamism in %
1	Area of High Dynamism	Above 13
2	Area of Moderate Dynamism	9 to 13
3	Area of Low Dynamism	5 to 9
4	Area Of Very Low Dynamism	Below 5

It is show that these areas have shown considerable amount of stability in their land use pattern. From the above analysis, it is found that the very low changes in two Tehsils are Malegaon and Karanja because lack of irrigation and industrialization in both Tehsils. Area of low changes found in Washim and Manora Tehsil due to development in irrigation to some extent for agriculture and favourable physical conditions. The area of moderate change

is recorded in Risod and Mangrulpir tehsil, is mostly may be due to induce of new technology in agriculture during the period of investigation.

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Chapter- VI

Changes in Agricultural Land use Pattern

6.1 Introduction:

6.2 Present Agricultural situations:

6.3 Changes in Agricultural land use Pattern:

6.4 Changes in Area under Crops in six Tehsil:

6.5 Crops Combinations:

6.6 Changes in Crops Concentration:

6.7 Trends in Crops Diversification:

6.8 Growth in Cropping Intensity:

Reference Books:

Chapter- VI

Changes in Agricultural Land Use Pattern

6.1 Introduction:

The preceding chapter explains general land use and its Meaning and concept of land use, factors affecting land use, land use classification, Tehsil wise trends in land use from 1990-91 to 2013-14 and degree of change in land use pattern are explained in detailed. Existing chapter explains the present agricultural situation, changing agricultural cropping patterns, Tehsil wise tendencies in area under crops, crops combinations, Crop concentration, Crop diversification and land use intensity in the period of investigation.

6.2 Present Agricultural Situation:

Washim district is predominantly an agricultural district. Economy of the district depends upon agriculture. Agriculture is main occupation of more than 82 % of population. The cropping pattern in Washim district is as developing agricultural economy. The more than 52 % of the cultivated area was devoted to industrial crops or cash crops, mainly for sale them in market, remaining 40 % area under food grains, 7% area under fibre crops, except few horticultural products surpluses are sold directly in the nearest markets for domestic and farm expenses. Agriculture in the study area is many ways different from the rest of the state, which has specific major characteristic in respect to agricultural practices and cropping pattern. Agriculture is mainly of intensive and commercial types. Whereas soybean, Gram, Red Gram, cotton and Wheat are five principal crops. Field Size is marginal land holder (below 1.0 hectares) 6.10 %, small (1.0-1.99) 22.18 %, semi-medium (2.0-3.99) 28.65 %, medium (4.0-9.99) and large (10 and above) 9.03 % in which large amount of human labour and relatively small amount of capital are used to harvest a cash and food grain crops. Semi-medium sizes of field and subsistence type of agriculture are need of high man power. The use of

chemical fertilizers and improved seeds has been limited and it also beyond the capacity of an average farmers in the study area. It affects per hectare of yield so the returns is not satisfied.

Washim district in many respects to agricultural situation for example, there is very high 78.22 % of total area under cultivation. If we consider the cultivated area with state, there is high difference between state and district. The state of Maharashtra has 56.57 % area under cultivation in 2013-14. Similar is the position in respect of use of inputs also. But only in respect to irrigation farmers are handicapped, because there was 6 % of area irrigated to total cultivated area. Whereas the state averages was 18.2% in 2013- 2014. Use of improved agricultural implements and tools and practice of plant protection measures are in medium level. In short, it may be decided that the agriculture in study area, both in respect of arable land and agricultural infrastructure is at developing level. Now, agriculture in study area has been experiences a renovation since the introduction of high yielding varieties (HVY) and impact of commercialization on traditional farming practices and also the supporting role of government policies. It making agriculture more strong and active.

6.3 Changes in Agricultural land use Pattern:

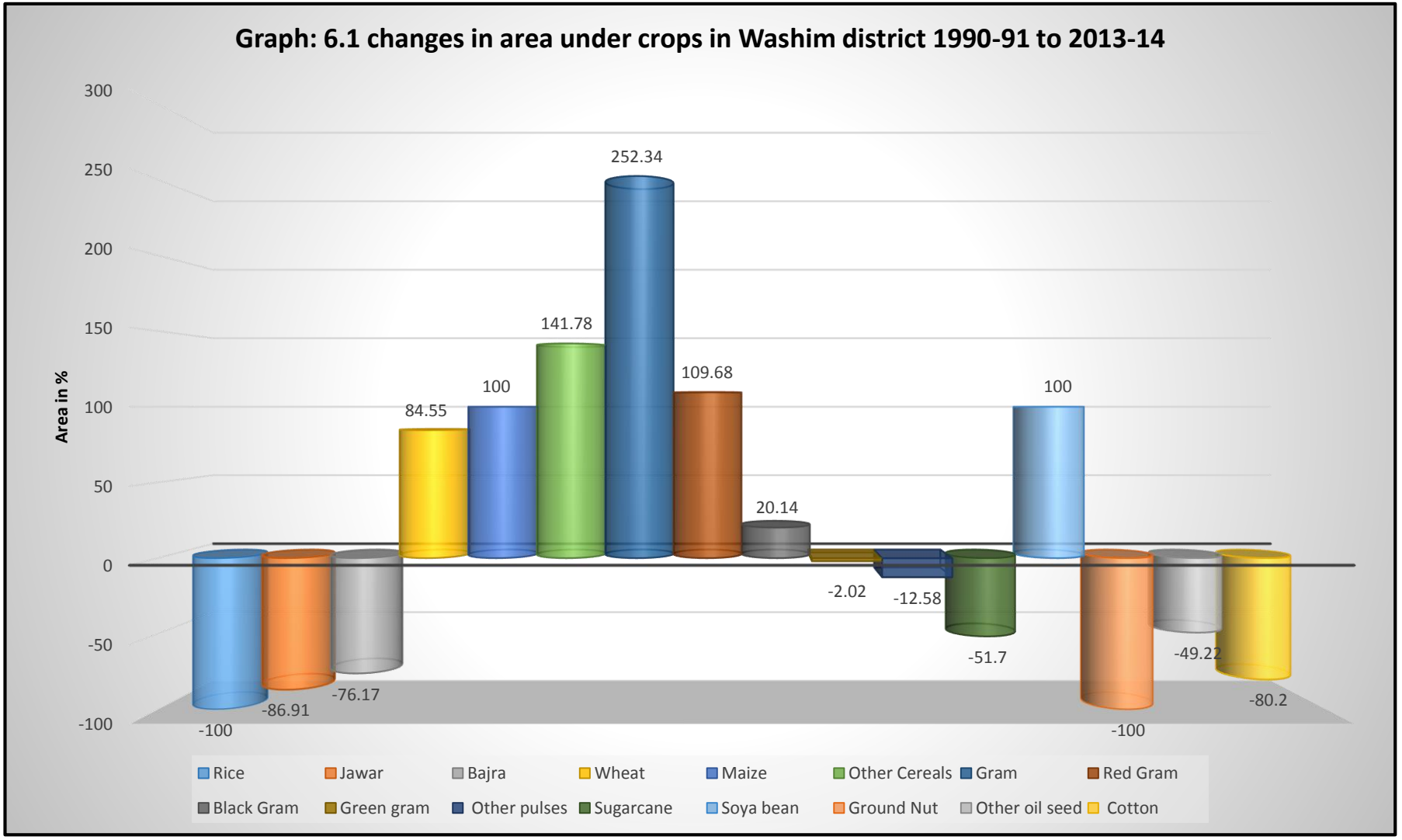
Cropping pattern means the percent share of area under number of crops within a year. It is the basic unit of agricultural land use. It is dynamic concept specifies that none of the cropping pattern is ideal and good for all years. The cropping pattern is different from region to region both the space and time. Cropping pattern of any region is designed by physical, cultural and technological factors. Cropping pattern is governed by farmers in their individual farms. This denotes decision making share of the farmers in favour of one or preference for one over other competing crops. These selections are directly governed by specific purposes of crops are to be grown and influenced by geographical factors and modified by the developing social and economic situation.

Table No. 6.1: Changes in Area under Crops in Washim district

Sr. No.	Crops	1990-1991 Area in Hectare	% to NSA	2013-2014 Area in Hectare	% to NSA	1990-91-2013-14 % Change + or -	Difference in % Share + or -	Changes in Area (area in Hectares) + or -
1	Rice	3570	0.89	00	00	-100	-0.89	-3570
2	Jawar	117306	29.24	15350	2.91	-86.91	-26.24	-101956
3	Bajra	1565	0.39	373	0.07	-76.17	-0.32	-1192
4	Wheat	16529	4.12	30505	5.79	84.55	1.67	13976
5	Maize	--	--	386	0.07	100	0.07	386
6	Other Cereals	280	0.07	677	0.13	141.78	0.06	397
7	**Total Cereals**	**139250**	34.71	**47291**	8.97	-66.04	-25.74	-91959
8	Gram	26679	6.65	94001	17.83	252.34	11.18	67322
9	Red Gram	22025	5.49	46183	8.76	109.68	3.27	24158
10	Black Gram	9890	2.46	11882	2.25	20.14	-0.21	1992
11	Green gram	12883	3.21	12622	2.39	-2.02	-0.82	-261
12	Other pulses	1860	0.46	1626	0.31	-12.58	-0.15	-234
13	**Total pulses**	**73337**	18.28	**166314**	31.55	126.78	13.27	92977
14	**Total food crops**	**212587**	52.99	**213605**	40.52	0.48	-12.47	1018
15	Sugarcane	441	0.11	213	0.04	-51.70	-0.07	-228
16	Fruits & Veg.	1926	0.48	--	--	-100	-0.48	-1926
17	Condiments & spices	1123	0.28	--	--	-100	-0.28	-1123
18	**Soya bean**	--	--	**276345**	52.42	100	100	276345
19	**Ground Nut**	5496	1.37	--	--	-100	-1.37	-5496
20	Other oil seed	4894	1.22	**2485**	0.47	-49.22	-0.75	-2409
21	**Total Oil seeds**	**10390**	2.59	**278830**	52.89	2483.64	50.30	268440
22	**Cotton**	174274	43.44	**34511**	6.55	-80.20	-36.89	-139763
23	Other fibres	442	0.11	--	--	-100	-0.11	-442
24	**Total Cropped area**	**401183**	100	**527159**	100	31.40	7.50	125976

Source: compiled by the Author

Graph: 6.1 changes in area under crops in Washim district 1990-91 to 2013-14



The trends in cropping pattern have been assessed in term of changes in percentage share of individual crops in net sown area at two points of time. Base year 1990-91 and 2013-14last year's data of area under single crops have been measured and used for find out their share in net sown area. The cropping pattern in the study area is dominated by the commercial or cash crops and it reveals a wide gap in the percentage of principal crops. Table No. 6.1 shows in the period of 1990-91, the total net sown area was 401183 hectares. Out of total NSA 174274 hectares area was under Cotton, Jawar 117306 hectares, Gram 26679 hectare, Red Gram 22025 hectares, area under Black Gram 9890 hectare, Green Gram12883 hectare and wheat 16529 hectares of total area to net sown area was under other cereals, pulses 2140 hectares and fruit, vegetables and condiments and spices occupied and 3049 hectares cultivated area. As much as 212587 (52.99 %) hectares of the total net sown area was under food crops. Table 6.1 indicates that some crops of the study area added area and enhanced their comparative position in the crop involved, while others came down gradually. Area under Cotton decreased from 43.44% of the net sown area in 1990-91 to 6.55 % in 2013-14 and percentage growth during the investigation period recorded -80.20 %, whereas difference in % share declined up to -36.89 % in the study region.

Throughout the investigation period amount of Gram increased from 6.55% to 252.34%. Wheat area had shown increase in their area whereas, area under Jowar decreased by 86.91%, Red Gram increased up to 109.68 %, and Green Gram -2.02% and Black gram increased up to 20.14 % in their area while area under other cereals increased up to 0.06% and pulses shows decrease in area. Total oil seeds area is increased from 2.59 % to 52.69 % in this period. Fodder crops shows negative change during the investigation period. Sugarcane area showed decrease from 0.11% to 0.04 %, whereas percentage of growth observed -51.70% while difference in percentage share recorded -0.07 % in the area (Graph No. 6.1). from 1990-91 to 2013-14 the average percentage

growth rate and difference in percentage share of crops area to NSA are recorded 31.40 % and 7.50 % respectively.

The physical and cultural conditions of area and Farmers influences the crop hectare age and cropping pattern of region. In study area after the 1995 HVY crop soya bean was introduced, which effects the agricultural cropping pattern of district. Soya bean occupies place of cotton, pulses and Jowar. Its percentage share grows up to 52.42 % area to NSA in 2013-14. It ranks first among all crops in study region. Most of the cultivation of food and non-food crops are rain fed. Irrigation being done only for limited rabbi crops area in the region. Kharif is the most important season for Crops grown in area as well as their production.

6.4 Changes in Area under Crops in six Tehsils:

Table No. 6.1-6.7 discloses that the tendencies in area under crops in the study area. Cropping pattern means the amount of area under different crops at a time and point. Food grains play an energetic role in the area under crops in Washim district. Area under food grains, it produce enough food grains to sustain the need of food for population. So the food grains crops occupies dominant area under food crops. The spatial distribution of leading food grain crops shows their climatic and edaphic (soil conditions) preferences and human need. There was notable diversity in the distribution of food grain crops in the study area. It is from above 66% and below 53 % of the total net sown area in 1990-91. Very high percentage area under food grain crops are noted in Washim tehsil in study area (Table No. 6.1to 6.7). As above trends shows, food grains and pulses dominate the agricultural land use. After the 1995, soya bean crops increased gradually with in eighty years, in 2013-14 soya bean crops occupied the area under crops more than 52 %. So the trends of area under food grain crops lost their position. Soya bean crop become a signal largest growing cash crops in study area which introduced study area as soya bean hub of Maharashtra i.e. Washim district.

Table: 6.2 Changes in Area under Crops in Washim Tehsil

1990-91 to 2013-14

Sr. No.	Crops	1990-1991 Area in Hectare	% to NSA	2013-2014 Area in Hectare	% to NSA	% Change + or -	Change in area Hectare + or -
1	Rice	2629	3.50	00	00	-100	-2629
2	Jawar	25723	34.25	1425	1.43	-94.46	-24298
3	Bajra	90	0.12	00	00	-100	-90
4	Wheat	2193	2.92	6174	6.18	181.53	3981
5	Maize	-	--	22	0.02	100	22
6	Other Cereals	60	0.08	68	0.07	13.33	8
7	**Total Cereals**	**30695**	40.86	**7689**	7.69	-74.95	-23006
8	Gram	5671	7.55	15104	15.12	166.34	9433
9	Red Gram	5648	7.52	11131	11.14	97.08	5483
10	Black Gram	3380	4.50	1853	1.85	-45.18	-1527
11	Green gram	3605	4.80	2181	2.18	-39.50	-1424
12	Other pulses	578	0.77	900	0.90	55.71	322
13	**Total pulses**	**18882**	25.14	**31169**	31.20	65.04	12287
14	**Total food crops**	**49577**	66.01	**38858**	38.89	-21.62	-10719
15	Sugarcane	**90**	0.12	65	0.06	-27.78	-25
16	Fruits & Veg.	**195**	0.26	--	00	-100	-195
17	Condiments & spices	**128**	0.17	--	00	-100	-128
18	**Soya bean**	--	--	**59659**	59.71	100	59659
19	**Ground Nut**	98	0.13	**00**	00	-100	-98
20	Other oil seed	1014	1.35	63	0.06	-93.79	-951
21	**Total Oil seeds**	**1112**	1.48	**59722**	59.77	5270.66	58610
22	**Cotton**	**23883**	31.80	**1267**	1.27	-94.69	-22616
23	Other fibre's	**120**	0.16	--	--	-100	-120
24	**Total Cropped area**	**75105**	100	**99912**	100	33.03	24807

Source: compiled by the Author.

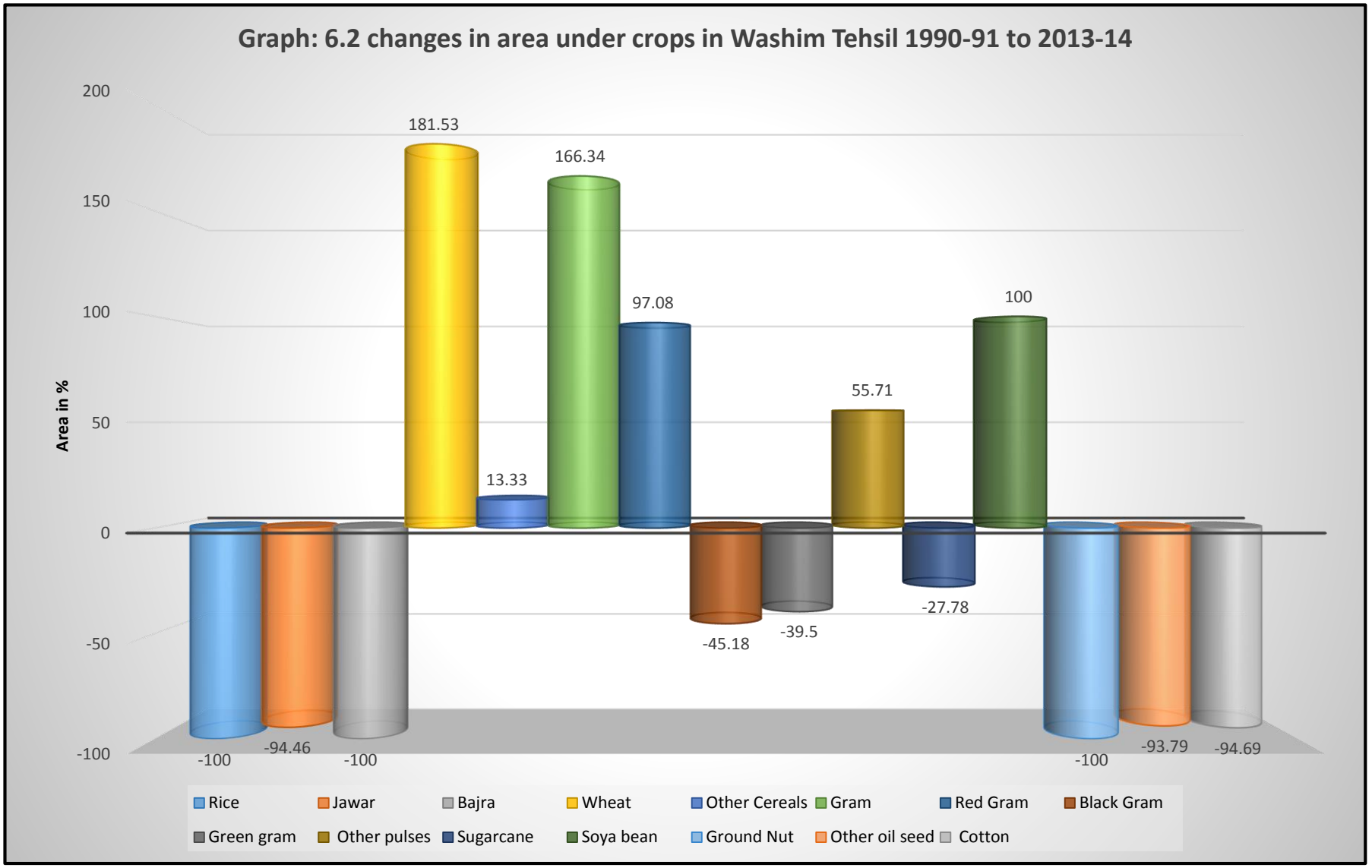

Graph: 6.2 changes in area under crops in Washim Tehsil 1990-91 to 2013-14
Area in %
200
150
100
50
0
-50
-100
181.53
166.34
97.08
13.33
55.71
100
-100
-94.46
-100
-45.18
-39.5
-27.78
-100
-93.79
-94.69
Rice
Jawar
Bajra
Wheat
Other Cereals
Gram
Red Gram
Black Gram
Green gram
Other pulses
Sugarcane
Soya bean
Ground Nut
Other oil seed
Cotton

Table: 6.3 Changes in Area under Crops in Risod Tehsil 1990-91 to 2013-14.

Sr. No.	Crops	1990-1991 Area in Hectare	% to NSA	2013-2014 Area in Hectare	% to NSA	% Change + or -	Change in area in hectare + or -
1	Rice	333	0.48	00	00	-100	-333
2	Jawar	23935	34.54	778	0.67	-96.75	-23157
3	Bajra	485	0.70	00	00	-100	-485
4	Wheat	1150	1.66	4530	3.92	293.91	3380
5	Maize	--	--	206	0.18	100	206
6	Other Cereals	21	0.03	250	0.22	1090.47	229
7	**Total Cereals**	**25924**	37.41	**5764**	4.99	-77.76	-20160
8	Gram	8994	12.98	38842	33.63	331.86	29848
9	Red Gram	4144	5.98	11595	10.04	189.45	7851
10	Black Gram	1386	2.00	1214	1.05	-12.41	-172
11	Green gram	1587	2.29	1161	1.00	-26.84	-426
12	Other pulses	693	1.00	00	00	-100	-693
13	**Total pulses**	**16804**	24.25	**52812**	45.73	214.28	36008
14	**Total food crops**	**42728**	61.66	**58576**	50.72	37.09	15848
15	Sugarcane	**69**	0.10	136	0.12	97.10	67
16	Fruits & Veg.	**97**	0.14	--	--	-100	-97
17	Condiments & spices	**48**	0.07	--	--	-100	-48
18	**Soya bean**	--	--	56111	48.58	100	56111
19	**Ground Nut**	188	0.27	--	--	-100	-188
20	Other oil seed	471	0.68	236	0.20	-49.89	-235
21	**Total Oil seeds**	**659**	0.95	**56347**	48.79	3450.38	55688
22	**Cotton**	**25626**	36.98	**432**	0.37	-98.31	-25194
23	Other fibres	**69**	0.10	--	--	-100	-69
24	**Total Cropped area**	**69296**	100	**115491**	100	66.66	46195

Source: compiled by the Author.

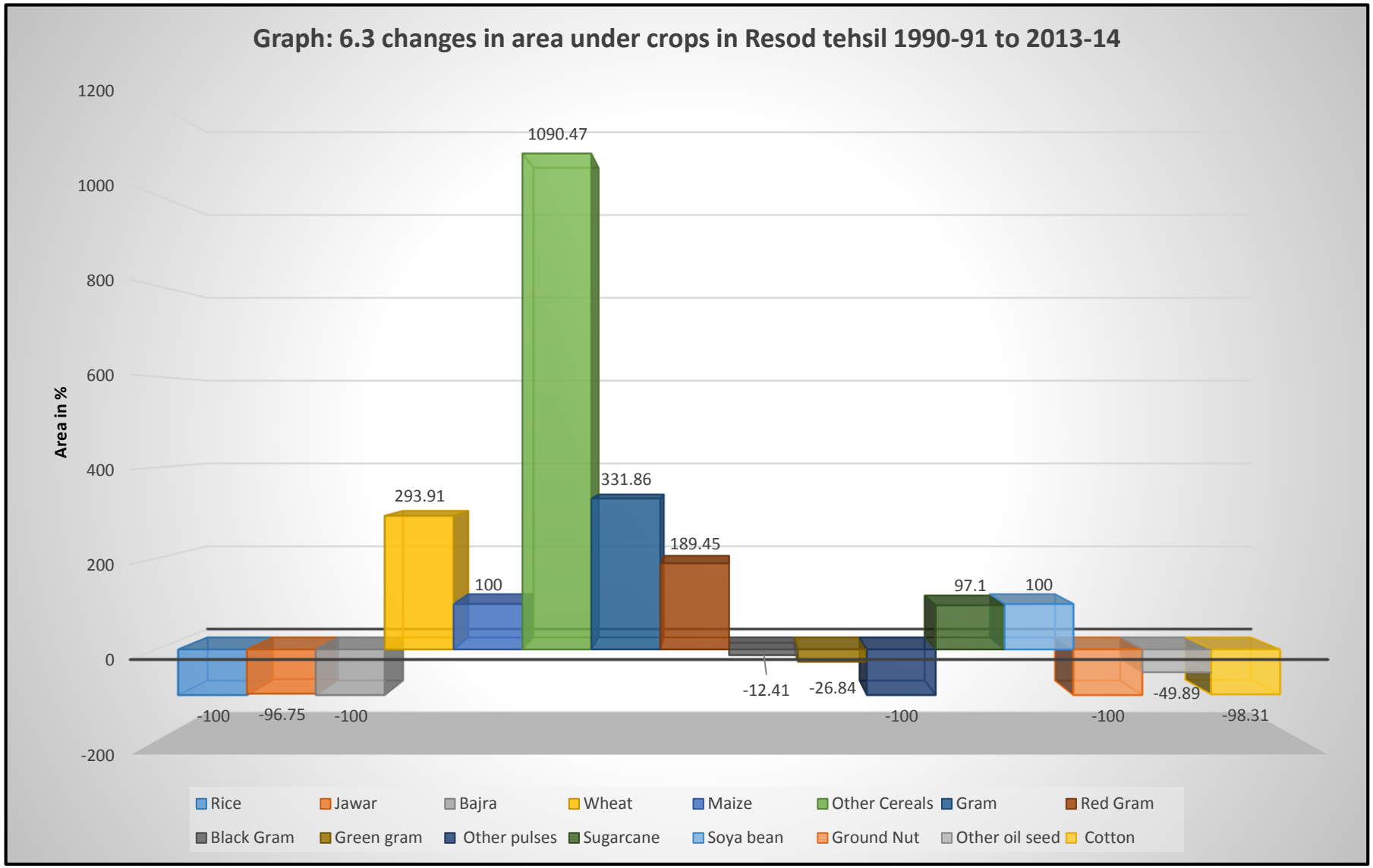

Graph: 6.3 changes in area under crops in Resod tehsil 1990-91 to 2013-14
Area in %
1200
1000
800
600
400
200
0
-200
-100
-96.75
-100
293.91
100
1090.47
331.86
189.45
-12.41
-26.84
-100
97.1
100
-100
-49.89
-98.31
Rice
Jawar
Bajra
Wheat
Maize
Other Cereals
Gram
Red Gram
Black Gram
Green gram
Other pulses
Sugarcane
Soya bean
Ground Nut
Other oil seed
Cotton

Table: 6.4 Changes in Area under Crops in Malegaon Tehsil 1990-91 to 2013-14.

Sr. No.	Crops	1990-1991 Area in Hectare	% to NSA	2013-2014 Area in Hectare	% to NSA	% Change + or -	Change in area Hectare + or -
1	Rice	1008	1.44	00	00	-100	-1008
2	Jawar	26412	37.74	3537	4.20	-86.61	-22875
3	Bajra	14	0.02	00	00	-100	-14
4	Wheat	1526	2.18	3908	4.64	153.09	2382
5	Maize	--	--	36	0.04	100	36
6	Other Cereals	49	0.07	00	00	-100	-49
7	**Total Cereals**	**29009**	41.45	**7481**	8.88	-74.21	-21528
8	Gram	2737	3.91	10878	12.92	297.44	8141
9	Red Gram	4983	7.12	8750	10.39	75.60	3767
10	Black Gram	2820	4.03	2603	3.09	-7.69	-217
11	Green gram	2799	4.00	2494	2.96	-10.90	-305
12	Other pulses	2799	4.00	00	00	-100	-2799
13	**Total pulses**	**16138**	23.06	**24725**	29.37	53.21	8587
14	**Total food crops**	**45147**	64.51	**32206**	38.25	-28.66	-12941
15	Sugarcane	**63**	0.09	**01**	00	-98.41	-62
16	Fruits & Veg.	**91**	0.13	**00**	00	-100	-91
17	Condiments & spices	**42**	0.06	**00**	00	-100	-42
18	**Soya bean**	--	--	49959	59.33	100	49959
19	**Ground Nut**	168	0.24	00	00	-100	-168
20	Other oil seed	700	1.00	252	0.30	-64.00	-448
21	**Total Oil seeds**	**868**	1.24	**50211**	59.63	5684.68	49343
22	**Cotton**	**23711**	33.88	**1775**	2.11	-92.51	-21936
23	Other fibres	**63**	0.09	**00**	00	-100	-63
24	**Total Cropped area**	**69985**	100	**84193**	100	20.30	14208

Source: compiled by Author

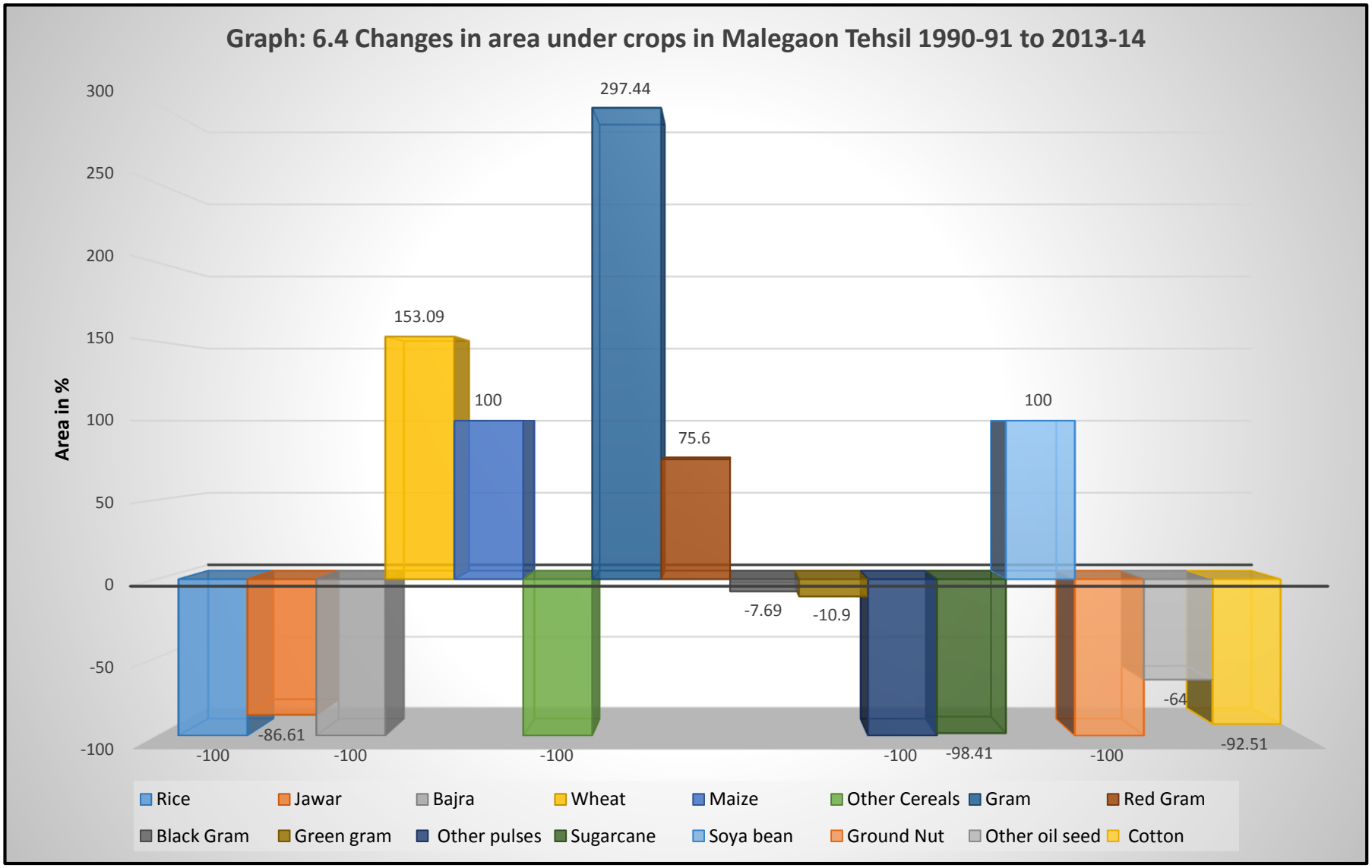

Graph: 6.4 Changes in area under crops in Malegaon Tehsil 1990-91 to 2013-14
Area in %
300
250
200
150
100
50
0
-50
-100
297.44
153.09
100
75.6
100
-7.69
-10.9
-86.61
-64
-92.51
-100
-100
-100
-100
-98.41
-100
Rice
Jawar
Bajra
Wheat
Maize
Other Cereals
Gram
Red Gram
Black Gram
Green gram
Other pulses
Sugarcane
Soya bean
Ground Nut
Other oil seed
Cotton

Table: 6.5 Changes in Area under Crops in Mangrulpir Tehsil

1990-91 2013-14.

Sr. No.	Crops	1990-1991 Area in Hectare	% to NSA	2013-2014 Area in Hectare	% to NSA	% Change + or -	Change in area Hectare + or -
1	Rice	695	1.20	00	00	-100	-695
2	Jawar	20225	34.97	3798	4.87	-81.25	-16454
3	Bajra	469	0.81	73	0.09	-84.43	-396
4	Wheat	1187	2.05	4996	6.40	320.89	3809
5	Maize	--	--	34	0.04	100	34
6	Other Cereals	40	0.07	321	0.41	702.5	281
7	**Total Cereals**	**22643**	39.11	**9222**	11.82	-59.27	-13421
8	Gram	2615	4.51	14900	19.10	469.79	12285
9	Red Gram	3486	6.02	5944	7.62	70.51	2458
10	Black Gram	2942	5.08	3120	4.00	6.05	178
11	Green gram	2316	4.00	2760	3.54	19.17	444
12	Other pulses	579	1.00	726	0.93	25.39	147
13	**Total pulses**	**11938**	20.61	**27450**	35.19	129.94	15512
14	**Total food crops**	**34581**	59.71	**36672**	47.01	6.05	2091
15	Sugarcane	**46**	0.08	**6**	0.01	-86.96	-40
16	Fruits & Veg.	**127**	0.22	**--**	00	-100	-127
17	Condiments & spices	**208**	0.36	**--**	00	-100	-208
18	**Soya bean**	--	--	35152	45.07	100	35152
19	**Ground Nut**	1430	2.47			-100	-1430
20	Other oil seed	620	1.07	924	1.18	49.03	304
21	**Total Oil seeds**	**2050**	3.54	**36076**	46.25	1659.80	34026
22	**Cotton**	**20862**	36.02	**5247**	6.73	-74.85	-15613
23	Other fibres	**40**	0.07	**--**	00	-100	-40
24	**Total Cropped area**	**57912**	100	**78001**	100	34.69	20089

Source: compiled by the Author.

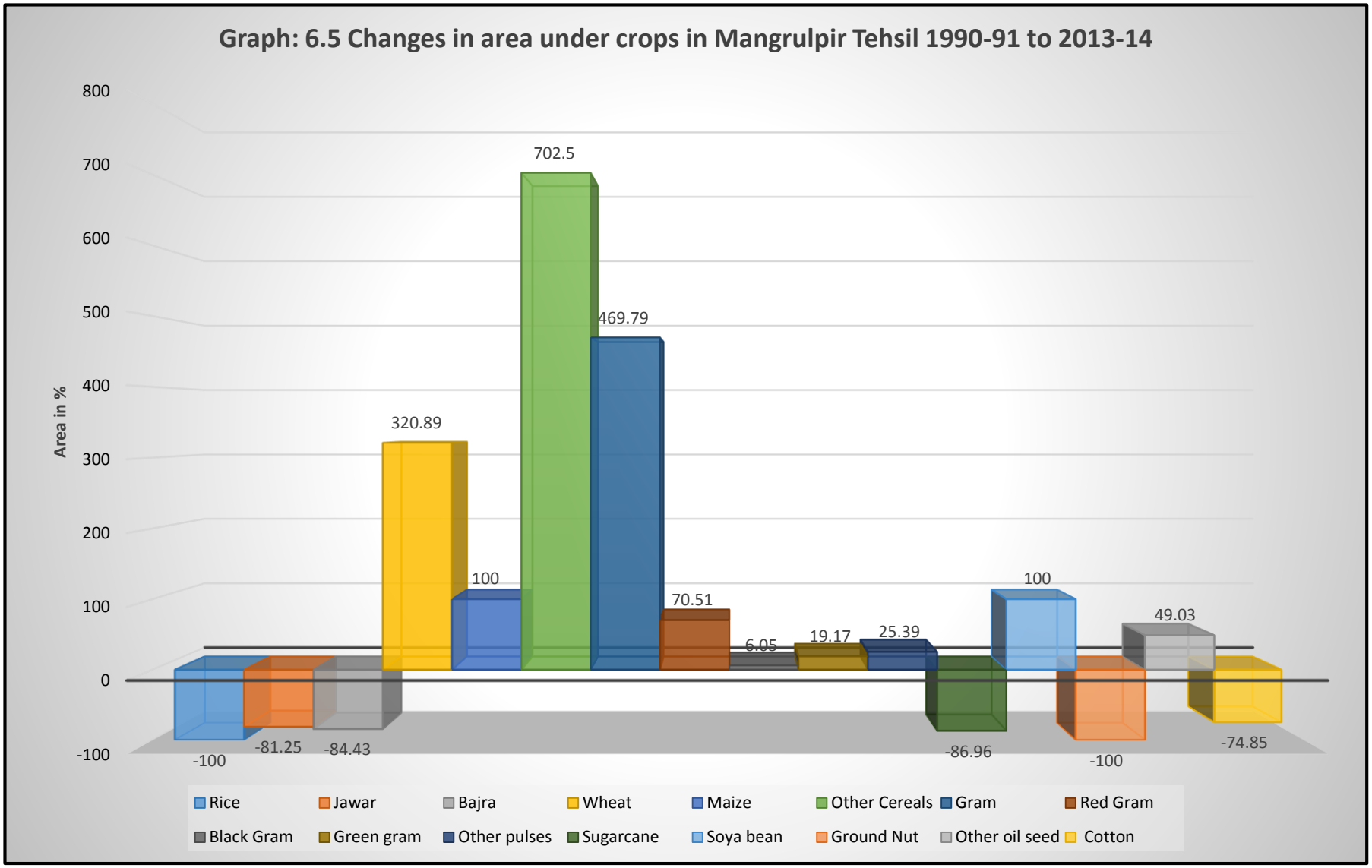

Graph: 6.5 Changes in area under crops in Mangrulpir Tehsil 1990-91 to 2013-14
Area in %
800
700
600
500
400
300
200
100
0
-100
-100
-81.25
-84.43
320.89
100
702.5
469.79
70.51
6.05
19.17
25.39
-86.96
100
-100
49.03
-74.85
Rice
Jawar
Bajra
Wheat
Maize
Other Cereals
Gram
Red Gram
Black Gram
Green gram
Other pulses
Sugarcane
Soya bean
Ground Nut
Other oil seed
Cotton

Table: 6.6 Changes in Area under crops in Manora Tehsil

1990-91 to 2013-14

Sr. No.	Crops	1990-1991 Area in Hectare	% to NSA	2013-2014 Area in Hectare	% to NSA	% Change + or -	Change in area Hectare + or -
1	Rice	494	0.79	00	00	-100	-494
2	Jawar	19115	30.56	3062	4.39	-83.98	-16053
3	Bajra	1051	1.68	290	0.41	-72.40	-761
4	Wheat	1407	2.25	6264	8.97	345.20	4857
5	Maize	--	--	42	0.06	100	42
6	Other Cereals	250	0.04	00	00	-100	-250
7	**Total Cereals**	**22317**	35.68	**9658**	13.84	-56.72	-12659
8	Gram	2360	3.77	9396	13.46	298.13	7036
9	Red Gram	3165	5.06	5313	7.61	67.87	2148
10	Black Gram	2252	3.60	742	1.07	-67.05	-1510
11	Green gram	2127	3.40	746	1.07	-64.93	-1381
12	Other pulses	819	1.31	00	00	-100	-819
13	**Total pulses**	**10723**	17.14	**16197**	23.20	51.04	5474
14	**Total food crops**	**33040**	52.82	**25855**	37.04	-21.75	-7185
15	Sugarcane	**106**	0.17	**00**	00	-100	-106
16	Fruits & Veg.	**138**	0.22	--	--	-100	-138
17	Condiments & spices	**213**	0.34	--	--	-100	-213
18	**Soya bean**	--	--	29754	42.63	100	29754
19	**Ground Nut**	2539	4.06	00	00	-100	2539
20	Other oil seed	732	1.17	601	0.86	-17.90	-131
21	**Total Oil seeds**	**3271**	5.22	**29760**	42.64	809.81	26489
22	**Cotton**	**25721**	41.12	**13590**	19.47	-47.16	-12131
23	Other fibres	**62**	0.10	--	--	-100	-62
24	**Total Cropped area**	**62551**	100	**69800**	100	11.59	7249

Source: compiled by the Author.

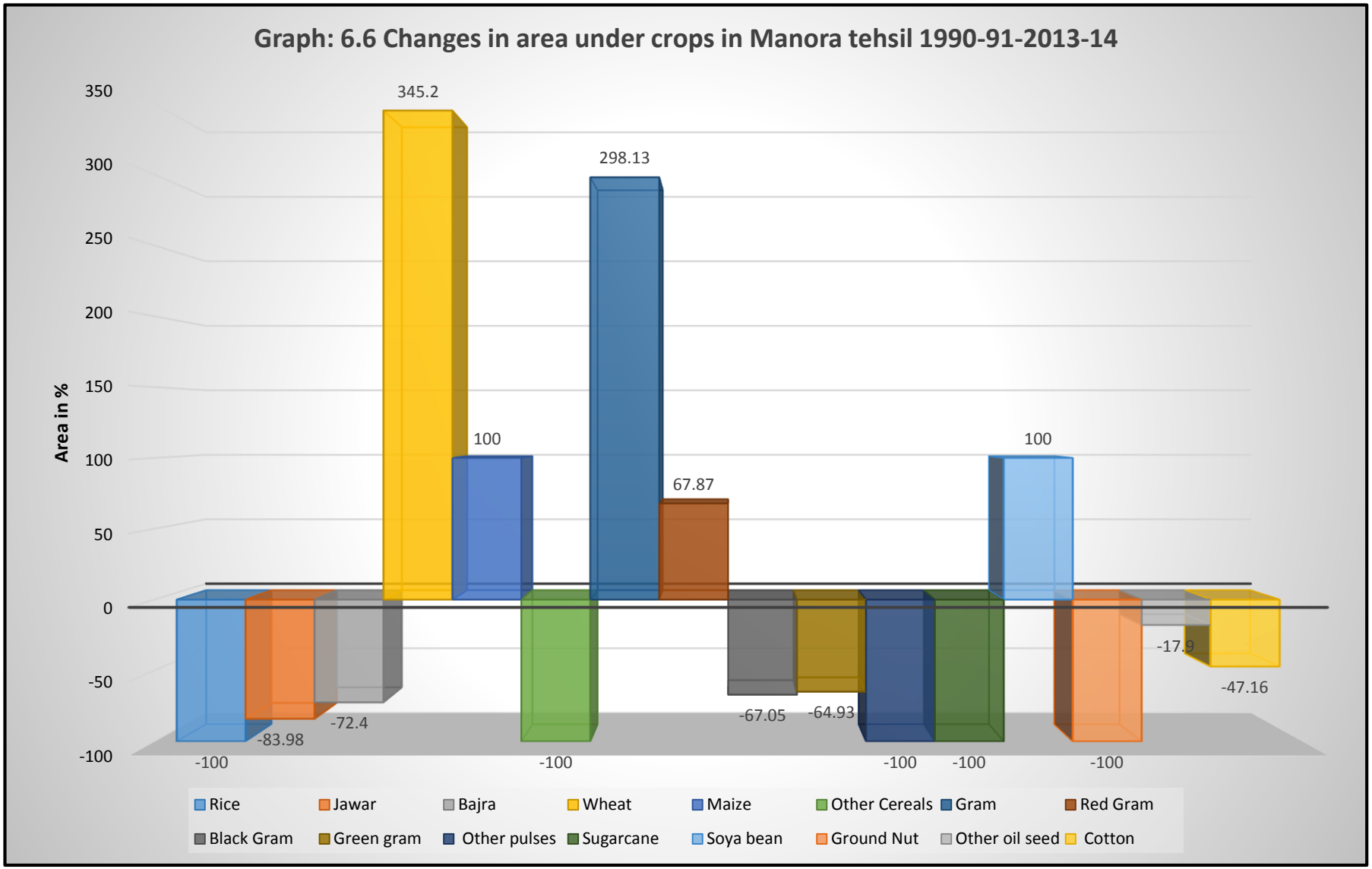
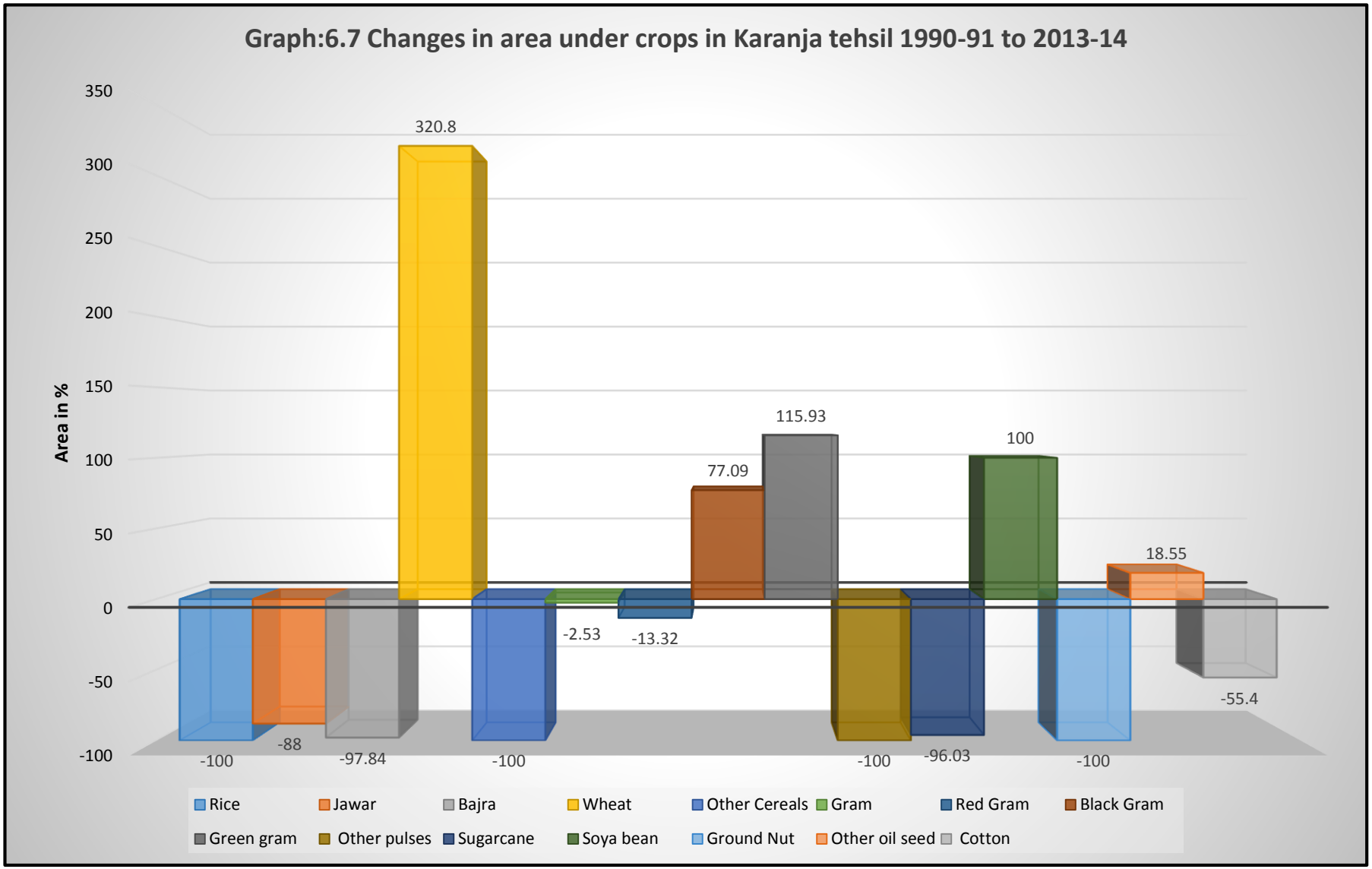

Graph: 6.6 Changes in area under crops in Manora tehsil 1990-91-2013-14
Area in %
350
300
250
200
150
100
50
0
-50
-100
345.2
298.13
100
67.87
100
-83.98
-72.4
-67.05
-64.93
-17.9
-47.16
-100
-100
-100
-100
-100
Rice
Jawar
Bajra
Wheat
Maize
Other Cereals
Gram
Red Gram
Black Gram
Green gram
Other pulses
Sugarcane
Soya bean
Ground Nut
Other oil seed
Cotton

Table: 6.7 Changes in Area under crops in Karanja Tehsil 1990-91 to 2013-14.

Sr. No.	Crops	1990-1991 Area in Hectare	% to NSA	2013-2014 Area in Hectare	% to NSA	% Change + or -	Change in area in Hectare + or -
1	Rice	318	0.48	00	00	-100	-318
2	Jawar	22912	34.54	2750	3.45	-88.00	-26162
3	Bajra	464	0.70	10	0.01	-97.84	-454
4	Wheat	1101	1.66	4633	5.81	320.80	3532
5	Maize	00	00	00	00	00	00
6	Other Cereals	07	0.01	00	00	-100	-7
7	**Total Cereals**	**24802**	37.39	**7393**	9.28	-70.19	-17409
8	Gram	5008	7.55	4881	6.13	-2.53	-127
9	Red Gram	3980	6.00	3450	4.33	-13.32	-530
10	Black Gram	1327	2.00	2350	2.95	77.09	1023
11	Green gram	1519	2.29	3280	4.12	115.93	1761
12	Other pulses	663	1.00	00	00	-100	-663
13	**Total pulses**	**12497**	18.84	**13961**	17.52	11.71	1464
14	**Total food crops**	**37299**	56.23	**21354**	26.80	-42.75	-15945
15	Sugarcane	**126**	0.19	**05**	0.01	-96.03	-121
16	Fruits & Veg.	**219**	0.33	**00**	00	-100	-219
17	Condiments & spices	**146**	0.22	**00**	00	-100	-146
18	**Soya bean**	--	--	45710	57.37	100	45710
19	**Ground Nut**	836	1.26	00	00	-100	-836
20	Other oil seed	345	0.52	409	0.51	18.55	64
21	**Total Oil seeds**	**1181**	1.78	**46119**	57.88	3805.08	44938
22	**Cotton**	**27356**	41.24	12200	15.31	-55.40	-15156
23	Fodder crops	**07**	0.01	00	00	-100	-7
24	**Total Cropped area**	**66334**	100	**79678**	100	20.12	13344

Source: Compiled by author.


Graph:6.7 Changes in area under crops in Karanja tehsil 1990-91 to 2013-14
Area in %
350
300
250
200
150
100
50
0
-50
-100
320.8
77.09
115.93
100
18.55
-55.4
-100
-88
-97.84
-100
-2.53
-13.32
-100
-96.03
-100
Rice
Jawar
Bajra
Wheat
Other Cereals
Gram
Red Gram
Black Gram
Green gram
Other pulses
Sugarcane
Soya bean
Ground Nut
Other oil seed
Cotton

1. Rice:

Rice crop requires hot and humid climate and rainfall above l10 cm. It is not an important crop in the study region. Most of the rice is raised up with the help of rainfall and irrigation facilities. Usually it is taken as Kharif crop. In the course of 1990-91 out of the gross (Table: 6.2 to 6.7) cropped area below 1 % area was found under rice in Risod, Manora and Karajna Tehsil. More than 1% gross cropped area was under rice in Malegaon, Mangrulpir tehsil and 3.5 % in Washim Tehsil. After the period of more than two decade Rice area shows 100 % negative change in study region in year 2013-14. After the introduction of Soya bean crop in 1995, farmer given first choice to Soya bean crops. Soya bean (BT) crop is rain fed and its harvests period is 90 to 105 days. It needs minimum Rainfall, cultivation through automated machinery reduces labor expenses, less need of pest control measures are responsible for the negative change in Rice area.

2. Jawar:

Jawar is sown in Kharif and Rabbi Season. Jawar is dominant food crop in all Tehsil of the study region. Jawar crop ranks first in cereal crops. Table 6.2 to 6.7 shows, out of the gross cropped area above 30 % area was noted in Washim 34.25%, Risod 34.54 %, Malegaon 37.74%, Mangrulpir 34.97 %, Manora 30.36% and Karanja 34.54 % in 1990-91. After the period of more than two decade Jawar crop area shows 80% to 96.75 % negative change in area on 1990-91 in study region in year 2013-14 in all tehsil. Washim (-94.46 %), Risod (-96.75 %), Malegaon (-86.61%), Mangrulpir (-81.25%), Manora (-83.98%) and Karanja (-88.00%) negative (Graph: 6.2 to 6.7) change in area under Jawar crop in 2013-14.

3. Bajra:

Bajra crop is sown in Kharif season. Bajra is the fourth ranking crop in the cereals crop. In the study region during 1990-91 the proportion of Bajra crop in the gross cropped area (Table: 6.2 to 6.7) was below 1% in all tehsil, except Manora tehsil. In Washim (0.12 %) Risod (0.70%), Malegaon (0.02%),

Mangrulpir (0.0.81%), Manora (1.68%) and Karanja (0.70%). table 6.2 to 6.7 shows 100% Negative change in area under Bajra crop was recorded in all tehsil of study area on 1990-91 in 2013-14.

4. Wheat:

Wheat is sown in rabbi season. Area under (Table: 6.2 to 6.7) wheat increased from 16529 hectare to 30505 hectare in more than two decade 1990-91 to 2013-14. It is important third ranking cereal crop. Out of the total gross cropped area below 2 % area was noted under wheat crop in Risod and Karanja tehsil. Above 2 % area under Wheat crop was noted in Washim tehsil 2.92%, Malegaon 2.18 %, Mangrulpir 2.05 % and Manora 2.25 % in 1990-91. Above 3 % positive change in area under wheat crop was recorded in the study area on 1990-91 in 2013-14. Washim (6.18 %) Risod (3.92%), Malegaon (4.64%), Mangrulpir (6.40%), Manora (8.97%) and Karanja (5.81 %) tehsils in 2013-14. Increase in irrigation facilities and more demand and (Graph: 6.2 to 6.7) assured market prices are responsible for positive change in area under Wheat crop.

5. Other cereals:

Other cereals are sown in Kharif season and are not important in the study region. During 1990-91 the proportion (Table: 6.2 to 6.7) of other cereals in gross cropped area was below 1% in all Tehsil of Washim District. Table 6.2 to 6.7 shows the normal positive change in other cereals was noted in Washim, Risod and Mangrulpir tehsil and remaining all tehsil shows 100 % negative change from 1990-91 to 2013-14.

6. Gram:

Gram is cultivated in Rabbi Season. Table 6.2 to 6.7 shows area under Gram crop different from Tehsil to Tehsil. Out of the gross cropped area below 5% gross cropped area was occupied by Gram in Malegaon (3.91 %), Mangrulpir (4.51%), and Manora (3.77%) Tehsil. More than 5 % area occupied by Gram in Washim (7.55%), Risod (12.98%), and Karanja (7.55%) Tehsil in1990-91. More than two decade Gram crop become first largest

pulses crop in the area. High yielding verity seeds, less water requirements, more demand in market, assured prices, it become farmer's second choice crops. So it shows (Graph: 6.2 to 6.7) positive change in gram area in all tehsil in 2013-14.

7. Red Gram:

Red Gram is sown in Kharif season. It is rank second among the pulses crops. The share of Red Gram in the gross cropped (Table: 6.2 to 6.7) area was below 6% in Risod (5.98%) and Manora (5.06%) tehsil. Above 6% area occupied this crop in Washim (7.52%), Malegaon (7.12%), Mangrulpir (6.02%) and Karanja (6.00%) tehsil in 1990-91. After the period of more than two decades positive change shows in Washim tehsil (11.14%) and area increased up to 97.08%, Risod tehsil (10.04%) and area increased up to 189.45%, Malegaon tehsil (10.39%) and area increased up to 75.60%, Mangrulpir tehsil (7.62%) and area increased up to 70.51%, Manora tehsil (7.61%) and area increased up to 67.87% and Karanja tehsil shows negative change in area under this crop (4.33%) and area decreased up to 13.32% in 2013-14. Physical and cultural determinants (Graph: 6.2 to 6.7) are responsible for the negative and positive change in area from 1990-91 to 2013-14.

8. Black Gram:

Black Gram is sown in Kharif season. It is rank third among the pulses crops. The share of Black Gram in the gross cropped (Table: 6.2 to 6.7) area was below 3% in Risod (2.00%) and karanja (2.00%) tehsil. Above 4% area occupied this crop in Washim (4.50%), Malegaon (4.03%), Mangrulpir (5.08%) and Manora (3.60%) tehsil in 1990-91. After the period of more than two decades negative changes shows in Washim tehsil (1.85%) and area decreased up to 45.18%, Risod tehsil (1.05%) and area decreased up to 12.41%, Malegaon tehsil (3.09%) and area decreased up to 7.69%, Mangrulpir tehsil (4.00%) and area increased up to 6.05%, Manora tehsil (1.07%) and area decreased up to 67.05% and Karanja tehsil shows positive

change in area under this crop (2.95%) and area increased up to 77.09 % in 2013-14. Physical and cultural elements of agriculture are responsible for the negative and positive (Graph: 6.2 to 6.7) change in area from 1990-91 to 2013-14.

9. Green Gram:

Green Gram is sown in Kharif season. It is rank fourth among the pulses crops. The share of Green Gram (Table: 6.2 to 6.7) in the gross cropped area was below 3% in Risod (2.29%) and Karanja (2.29%) tehsil. Above 4% area occupied this crop in Washim (4.80%), Malegaon (4.00%), Mangrulpir (4.00%) and Manora (3.40%) tehsil in 1990-91. After the period of more than two decades negative changes shows in Washim tehsil (2.18%) and area decreased up to 39.50%, Risod tehsil (1.00%) and area decreased up to 26.84%, Malegaon tehsil (2.96%) and area decreased up to 7.69%, Mangrulpir tehsil (3.54%) and area increased up to 19.17%, Manora tehsil (1.07%) and area decreased up to 64.93% and Karanja tehsil shows positive change in area under this crop (4.12%) and area increased up to 115.93 % in 2013-14. Physical and cultural elements of agriculture are responsible for the negative and positive (Graph: 6.2 to 6.7) changes in area under crops from 1990-91 to 2013-14.

10. Other Pulses:

Other pulses are (Table: 6.2 to 6.7) Moth, cowpea, Pawata and Hulga are sown in Kharif season. The share of other pulses in the gross cropped area was below 1% in Washim (0.77%) tehsil. Above 1% area occupied this crop in Risod (1.00%), Malegaon (4.00%), Mangrulpir (1.00%), Manora (1.31%) and Karanja (1.00%) tehsil in 1990-91. After the period of more than two decades positive changes shows in Washim tehsil (0.90%) and area increased up to 55.71%, Risod tehsil (0.00%) and area decreased up to 100%, Malegaon tehsil (0.00%) and area decreased up to 100%, Mangrulpir tehsil (0.93%) and area increased up to 25.39%, Manora tehsil (0.00%) and area decreased up to 100% and Karanja tehsil shows negative change in area under

this crop (0.00%) and area decreased up to 100 % in 2013-14. Physical and cultural elements are responsible for the negative and positive changes in area under crops from 1990-91 to 2013-14.

11. Sugar Cane:

Sugarcane is heavy water consuming crops and it cultivated on irrigation facility. Sugarcane area is recently decreasing in the study area. In 1990-91 the area under Sugarcane was below 1% in all Tehsil. Lack of Irrigation facility area has decreased in the study region in 2013-14. After the period of more than two decades negative changes shows in Washim tehsil (0.06%) and area decreased up to 27.78%, Malegaon tehsil (0.01%) and area decreased up to 98.41%, Mangrulpir tehsil (0.01%) and area decreased up to 86.96%, Manora tehsil (0.00%) and area decreased up to 100%, Karanja tehsil (0.01%) and area decreased up to 96.03% and Risod tehsil shows positive change in area under this crop (0.12%) and area increased up to 97.10 % in 2013-14. Physical and cultural elements of agriculture are responsible for the negative and positive changes in area under crops from 1990-91 to 2013-14.

12. Fruits and Vegetables:

Out of the gross cropped area below 1% area was recorded under Fruits and Vegetables in Washim, Risod, Malegaon, Mangrulpir, Manora and Karanja Tehsil in 1990-91.

13. Condiment and spices:

Out of the total gross cropped area below 1% gross cropped area was under condiments and spices in Washim, Risod, Malegaon, Mangrulpir, Manora and Karanja Tehsil in 1990-91.

14. Soya Bean:

Soya bean is rain fed crop and it is sown in Kharif season in study area. It is very important cash crop. It requires less rainfall and its harvest period is 90 to 105 days. It is High yielding variety (HVY) (BT) crop which have very high strength against pest and other diseases. It is sown by tractor powered automatic sowing implements, so need of labour become very low and it save

more labour expenses. Agriculture department of Maharashtra, Area Yield and Production report (1990-2000) shows the introduction of Soya bean crop from1995, before the 1990-91this crop is absent in this area. In the period of more than eighteen years it become very important cash oilseed crop and it occupies more than 52% gross cropped area in Washim district in 2013-14. It occupies more than 40 % area in all tehsil (Table: 6.2 to 6.7). In Washim tehsil (59.71%) Risod tehsil (48.79%), Malegaon tehsil (59.33%), Mangrulpir tehsil (45.07%), Manora tehsil (42.63%) and Karanja (57.37%) area under Soya Bean crops in 2013-14 (Graph: 6.2 to 6.7).

15. Ground Nut:

Ground nut is first oil seeds crops in the study area in 1990-91. It occupies more than 1 % area in Washim district. Physical and cultural determinants of agriculture are responsible for the Tehsil wise variation in Ground nut area. It occupies less than 1 % area in (Table: 6.2 to 6.7) in Washim tehsil (0.13%) Risod tehsil (0.27%), Malegaon tehsil (0.24%). Above 1% to more than 4% area under this crop in Karanja tehsil (1.26%), Mangrulpir (2.47%) and Manora (4.06%) area under Ground nut crops in 1990-91 (Graph: 6.2 to 6.7).Ground nut shows 100% negative change in area under this crops in 2013-14.

16. Other Oil Seeds:

Other oil seeds are (Table: 6.2 to 6.7) are sown in Kharif season. The share of other oil seeds in the gross cropped area was below 2% in Washim (1.35%) tehsil. In other tehsil area occupied by this crop in Risod (0.68%), Malegaon (1.00%), Mangrulpir (1.07%), Manora (1.17%) and Karanja (0.52%) tehsil in 1990-91. After the period of more than two decades negative and positive changes shows in Washim tehsil (0.06%) and area decreased up to 93.79%, Risod tehsil (0.20%) and area decreased up to49.89%, Malegaon tehsil (0.30%) and area decreased up to 64.00%, Mangrulpir tehsil (1.18%) and area increased up to 49.03%, Manora tehsil (0.86%) and area decreased up to 17.90% and Karanja tehsil shows positive

change in area under this crop (0.51%) and area increased up to 18.55 % in 2013-14. Physical and cultural elements are responsible for the negative and positive changes in area under crops from 1990-91 to 2013-14.

17. Cotton:

Cotton is cultivated in kharif season. Cotton has favorable condition in the study region. Cotton is very important cash crop in study area. It is rank first among the all crops. The share of Cotton (Table: 6.2 to 6.7) in the gross cropped area was below 35% in Washim (31.80%) and Malegaon (33.88%) tehsil. Above 35% to more than 40 % area occupied this crop in Risod (36.98%), Mangrulpir (36.02%) and Manora (41.12%), Karanja (41.24%) tehsil in 1990-91. After the period of more than two decades negative changes shows in Washim tehsil (1.27%) and area decreased up to 94.69%, Risod tehsil (0.37%) and area decreased up to 98.31%, Malegaon tehsil (2.11%) and area decreased up to 92.51%, Mangrulpir tehsil (6.73%) and area decreased up to 74.85%, Manora tehsil (19.47%) and area decreased up to 47.16% and Karanja tehsil shows negative change in area under this crop (15.31%) and area decreased up to 55.40 % in 2013-14. Physical and cultural elements of agriculture are responsible for the negative and positive (Graph: 6.2 to 6.7) changes in area under crops from 1990-91 to 2013-14.

18. Other fibres:

Other fibers are not important in the study area. Out of the total gross cropped area below 1% area was under other fibers crops in all Tehsil of the Washim district during 1990-91.

6.5 Crops Combination Regions:

Crop combination shows the group of important crops in the constituent area. It delivers a good basis for agricultural regionalization. At the moment more attention has been focused on combinational analysis of various components in geographical studies. Which are given a scientific management to the geographical problems.

Geographers given more attention on, to classify the places of different combinations of dominant activities, which relate to agricultural production and land use. A number of methods have been invented to delineate the setup of crop combinations, which play crucial role in any particular system. Physical constraints are responsible for the demarcation of any area, and favourable climatic or edaphic condition promotes the suited crop for area. However, the regions were named after the major crops for example the cotton belt etc. Johnson (1958) applied a mathematical technique in order to derive primarily crop combination.

6.5.1 Crop combination methods:

1. K. Doi's Crops Combination Method:

The weaver's technique was subsequently modified by **K. Doi (1957)[1].**

Table No. 6.8 K. Doi's crop combination's critical value table.

No. of crops	Theoretical percentages area under each crops combination									
1	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**
2	0.00	5.38	11.27	18.38	27.64	-	-	-	-	-
3	0.00	2.68	5.46	8.66	12.25	16.67	-	-	-	-
4	0.00	1.73	3.59	5.63	7.93	10.57	13.83	-	-	-
5	0.00	1.29	2.68	4.19	5.96	7.75	10.00	12.93	-	-
6	0.00	1.04	2.14	3.34	4.65	6.13	7.85	10.00	-	-
7	0.00	0.86	1.78	2.77	3.85	5.06	6.46	8.17	-	-
8	0.00	0.74	1.52	2.37	3.29	4.32	5.49	6.91	8.84	-
9	0.00	0.64	1.33	2.07	2.87	3.76	4.78	5.99	7.60	-
10	0.00	0.57	1.18	1.84	2.55	3.33	4.23	5.29	6.67	-
11	0.00	0.52	1.06	1.65	2.29	2.99	3.79	4.73	5.94	6.68
12	0.00	0.47	0.97	1.50	2.08	2.71	3.33	4.29	5.35	6.27
13	0.00	0.43	0.88	1.37	1.90	2.49	3.14	3.91	4.49	5.68

Source: K. Doi (1957).

Doi's technique used to be considered as the easiest method for combination analysis prior to the application of computer programming facilities. The Doi's formula may be expressed as: (Σd^2). The combination having the lowest (Σd^2) will be the crop combination. In K. Doi's technique, it is not required to calculate (Σd^2) for each combination but the crops combination is actually established by one sheet table (Table No. 6.8) which represents the critical values for various elements at different ranks against cumulative percentage of elements at higher ranks. The use of one sheet table requires only the summing up of actual percentages under different crops instead of finding differences between actual percentages and theoretical distribution.

2. The maximum positive deviation method devised by Rafiullah (1956):

The maximum positive deviation method devised by Rafiullah (1956) to cover the weakness of Weaver's method. It reduces the number of crops in the combination and simplifies the crops association. Which can be helpful in demarcation of agricultural regions of the study area. The different methods are adopted to show the reality of crops combination in region. In this attempt, K. Doi's and Rafiullah's technique is used. The maximum positive deviation method formula is as:

$$d = \sqrt{\frac{\Sigma Dp^2 - Dn^2}{N^2}}$$

Where: d is the deviation,

Dp: is the positive difference,

Dn: is the negative difference from the median value of the theoretical curve value of the combination, and **N** is the number of functions (crops) in the combination. The combination with the largest maximum value ('d') will be the combination to be selected. In the present work, an attempt is made to delineate the crops combination regions by applying above two methods. To

illustrate Rafiullahs maximum positive deviation method an illustration can be given from the study area of Washim district of Maharashtra.

In which the % share of crops in the cropped area in a year 1990-91as follows: Cotton 43%, Jawar 29%, Gram 7%, Red gram5%, Wheat 4%, Green Gram3%, Black Gram 2%, and Ground nut 1%, an illustration can be calculated as:

Table: 6.9 Washim district crop combination by "Maximum positive deviation method": 1990-91

Head	**Monocultur**	**Two crop combinati**		**Three crop combination**			**Four crop combination**			
Theoretical Base Curve	50	25	25	16.66	16.66	16.66	12.5	12.5	12.5	12.5
Strength of elements	43	43	29	43	29	7	43	29	7	5
Deviation	07	-18	4	-26.34	-12.34	9.66	-30.50	-11.50	-3.50	8.5
$(DP-Dn)^2$	49	340		939.37			1147			
$\frac{(DP-Dn)^2}{n^2}$	49	85		**104.37**			71.68			

Continue …

Five crop combination					**Six crop combination**					
10	10	10	10	10	8.33	8.33	8.33	8.33	8.33	8.33
43	29	7	5	4	43	29	7	5	4	3
-33	-19	-3	5	6	-34.67	-20.67	1.33	3.33	4.33	5.33
1520					1678.85					
60.8					46.63					

Source: Calculated by Author.

The table No. 6.9 shows the crops combination in Washim district. In 1990-91 Washim district has three crop combination in this region by Raffiullhas maximum positive deviation method.

6.5.2 Crop Combination in six tehsil by Method:

By K. Doi technique four and five crops combination regions discovered in study area. The Tehsils into different combinations (1990-91and 2013-14) are given Table No. 6.10 and 6.11 both represented in Map: 6.1 and 6.2.

Table No. 6.10 Crop Combination in six tehsil By K. Doi Method in Washim District 1990-91

Sr. No	Crops combination	No. of Tehsils	Name of Tehsils			
1	Two crops	04	Malegaon	Mangrulpir	Manora	Karanja
			J.C.	C.J.	C.J.	C.J
2	Three crops	02	Washim		Risod	
			J. C. G.		C.J.G.	

Source: Calculated by author.

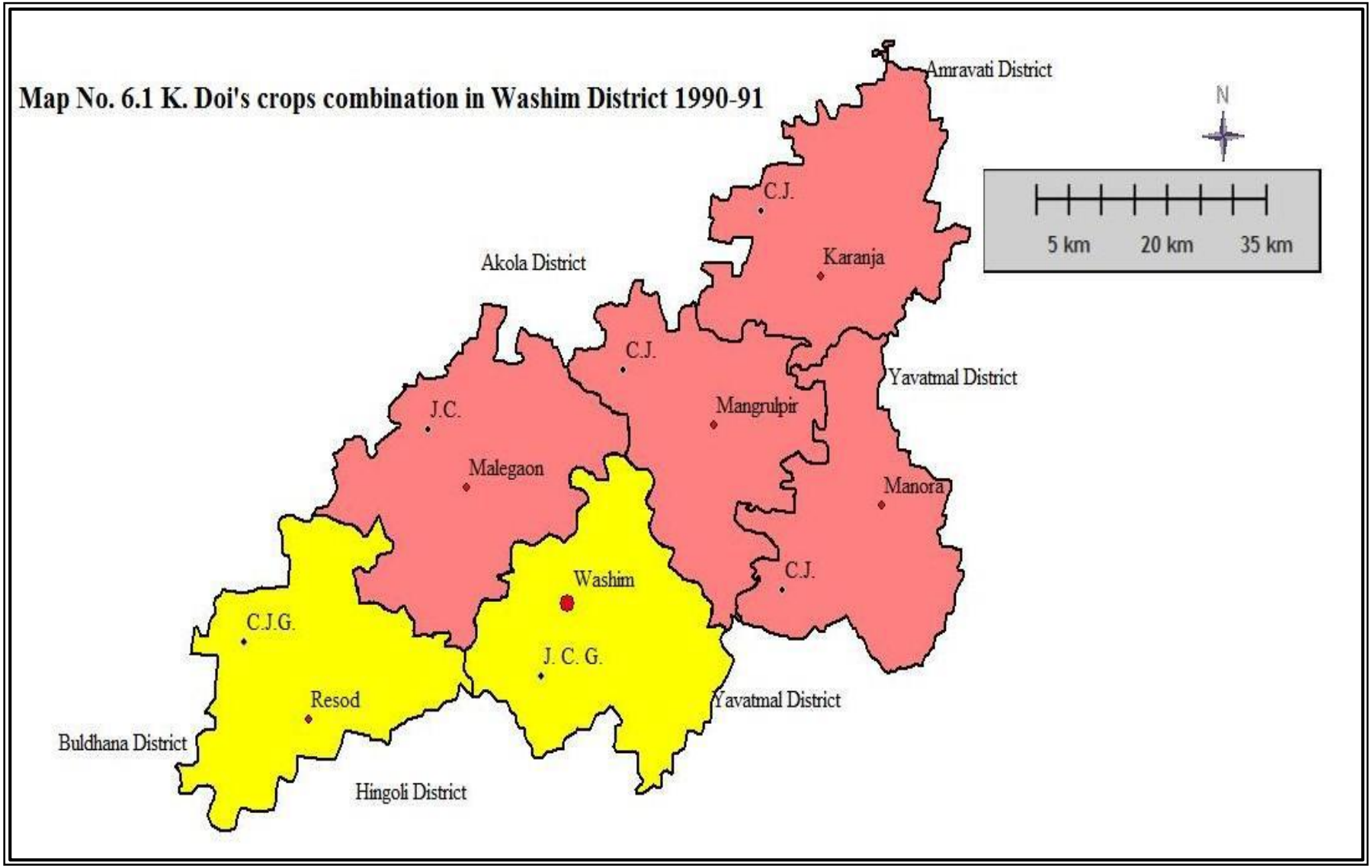
Table No. 6.11 Crop Combination in six tehsil By K. Doi Method in Washim District 2013-14

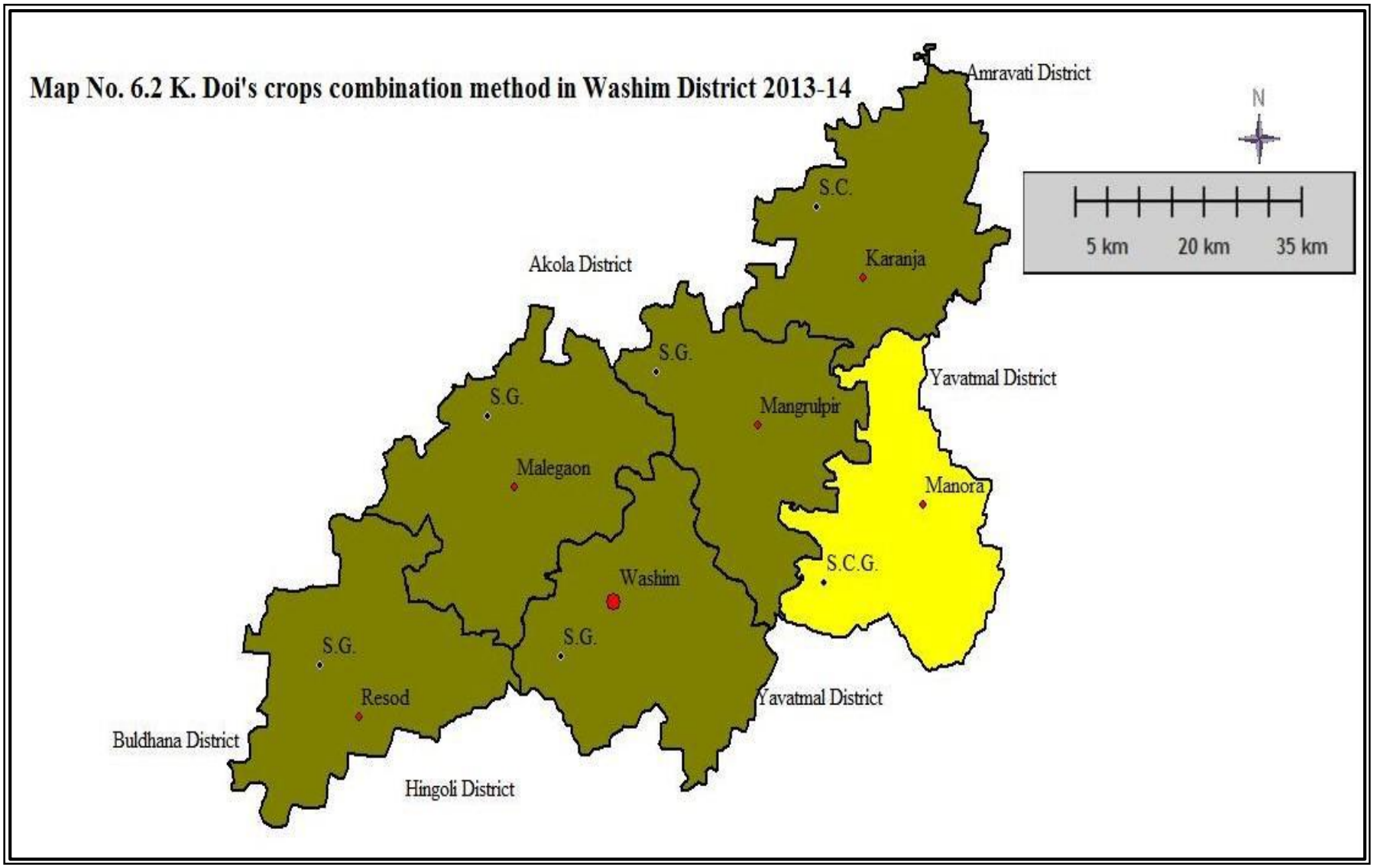
Sr. No	Crop combination	No. of Tehsils	Name of Tehsils				
1	Two crops	05	Washim	Risod	Malegaon	Mangrulpir	Karanja
			S. G.	S.G.	S.G.	S.G.	S.C.
2	Three Crops	01	Manora				
			Soya bean, Cotton, Gram				

Source: Computed by Author.

Note: S= Soya bean, G= Gram, RG= Red Gram, W= Wheat, C= Cotton, J= Jawar, GN= Groundnut, GG= Green Gram,

In Washim district in 1990-91 two and three crops combination regions are detected (Table No. 6.10, Map: 6.1). Two crops combination detected in Malegaon (J.C.), Mangrulpir (C. J.), Manora (C.J.), Karanja (C.J.) tehsils and three crops combination in Washim (J.C.G), Risod (C.J.G.), Tehsils.


Map No. 6.1 K. Doi's crops combination in Washim District 1990-91
Amravati District
N
5 km
20 km
35 km
C.J.
Karanja
Akola District
C.J.
Yavatmal District
J.C.
Mangrulpir
Malegaon
Manora
C.J.
Washim
C.J.G.
J. C. G.
Yavatmal District
Resod
Buldhana District
Hingoli District


Map No. 6.2 K. Doi's crops combination method in Washim District 2013-14
Amravati District
N
S.C.
Karanja
5 km
20 km
35 km
Akola District
S.G.
S.G.
Yavatmal District
Mangrulpir
Malegaon
Manora
S.C.G.
Washim
S.G.
S.G.
Resod
Yavatmal District
Buldhana District
Hingoli District

Favourable physical and cultural factors and all crops are edaphic. The Jawar and cotton are the dominant crop. The largest coverage of both crops stands as first in 1990-91(Map: 6.1).

After the period of more than two decade, in 2013-14 also two crops and three crops combination detected in six Tehsils. Two crops combination detected in Washim (S.G.), Risod (S.G.), Malegaon (S.G), Mangrulpir (S.G.), Karanja (S.C.) tehsils and three crops combination in Manora (S.C.G.) tehsil (Table:6.11, Map:6.2). During the period of investigation soya bean and Gram occupies the place of cotton and Jawar in five tehsils but in Manora tehsil cotton on second place and soya bean on first place, these changes are noted in the crop combination regions of the study region.

Table No. 6.12 Crops combination by "Maximum positive deviation" in Washim District 1990-91

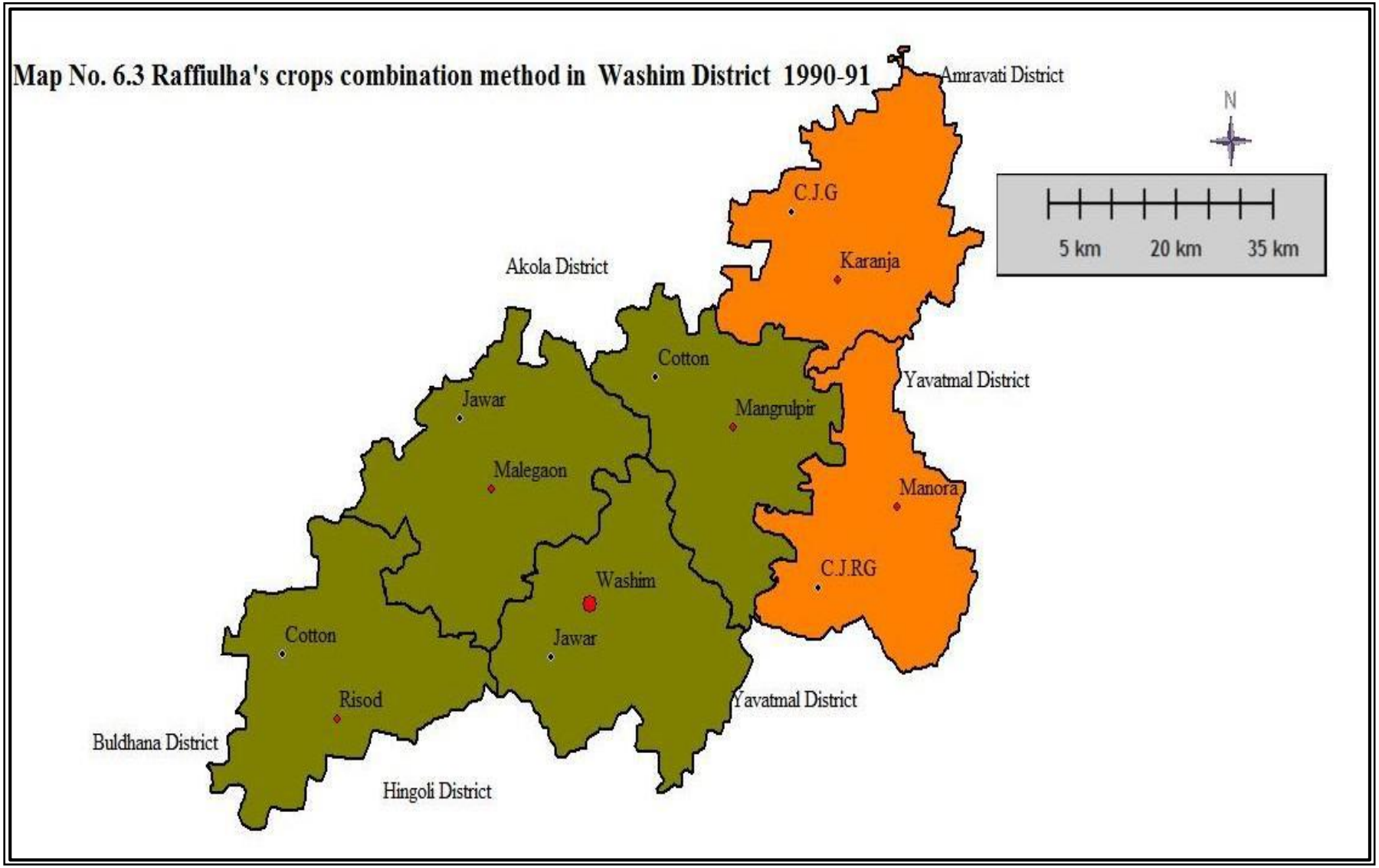
Sr. No	Crop combination	No. of Tehsils	Name of Tehsils			
1	Monoculture	04	Washim	Risod	Malegaon	Mangrulpir
			Jawar	Cotton	Jawar	Cotton
3	Three crop	02	Manora		Karanja	
			C. J. RG		Cotton, Jawar, Gram	

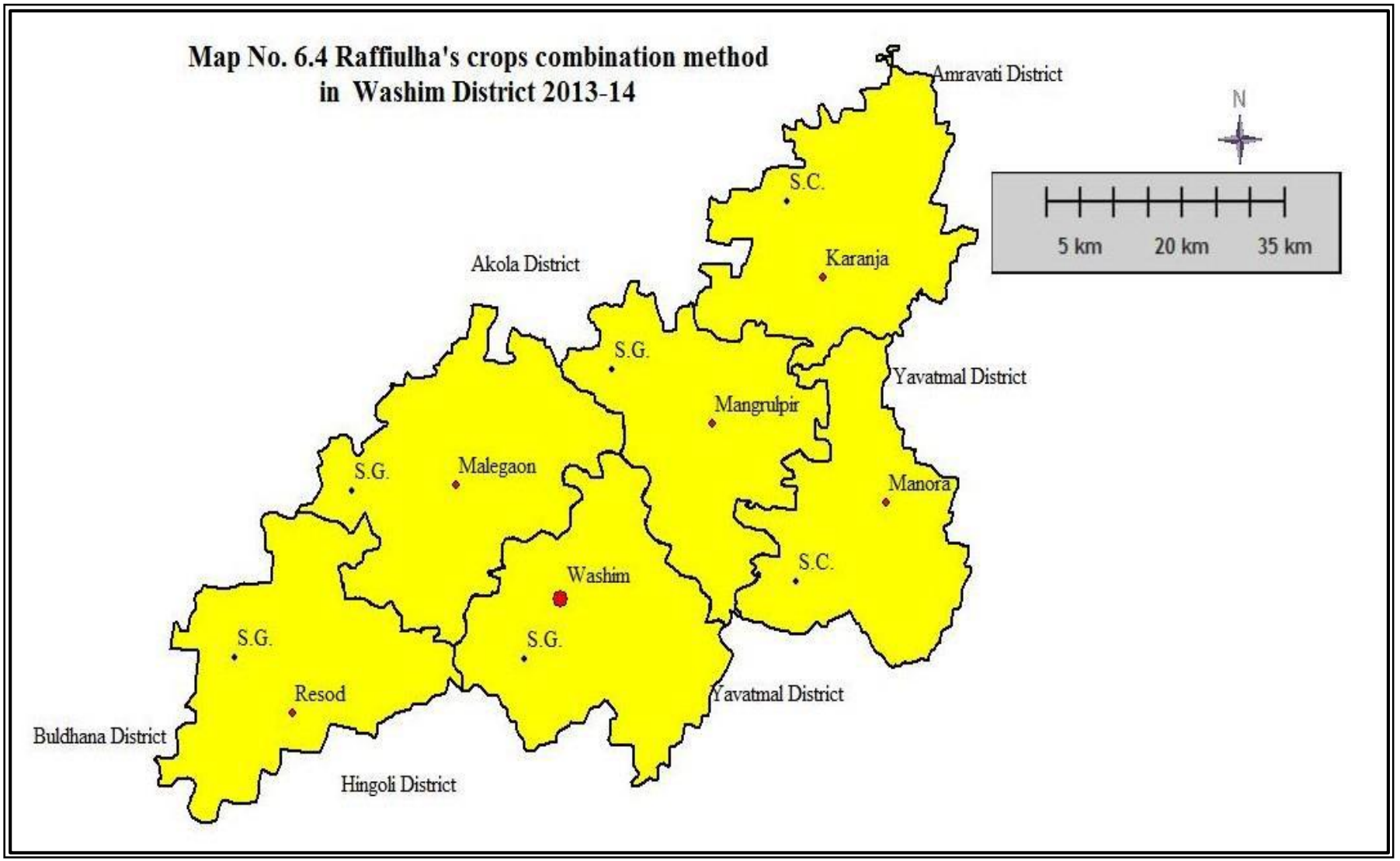
Source: Computed by author

Table: 6.13 Crops combination by "Maximum positive deviation" in Washim District 2013-14

Sr. No	Crops combination	No. of Tehsils	Name of Tehsils		
1	Two Crops	06	Washim	Risod	Malegaon
			Soya bean, Gram	Soya bean, Gram	Soya bean, Gram
			Mangrulpir	Manora	Karanja
			Soya bean, Gram	Soya bean, Cotton	Soya bean, Cotton

Source: Computed by the Author.


Map No. 6.3 Raffiulha's crops combination method in Washim District 1990-91
Amravati District
N
C.J.G
5 km
20 km
35 km
Karanja
Akola District
Cotton
Yavatmal District
Jawar
Mangrulpir
Malegaon
Manora
C.J.RG
Washim
Cotton
Jawar
Yavatmal District
Risod
Buldhana District
Hingoli District


Map No. 6.4 Raffiulha's crops combination method
in Washim District 2013-14
Amravati District
N
S.C.
5 km
20 km
35 km
Akola District
Karanja
S.G.
Yavatmal District
Mangrulpir
S.G.
Malegaon
Manora
S.C.
Washim
S.G.
S.G.
Resod
Yavatmal District
Buldhana District
Hingoli District

In Rafiullah's method, the differences of actual values are calculated from the median value of the theoretical standard. The maximum positive deviation method detected critical combination in 1990-91. The results are plotted in Table: 6.12 and Map: 6.3. Monoculture crop combination is detected in four Tehsils are Washim (J.), Risod (C.), Malegaon (J.), and Mangrulpir (C.) tehsil. Three crops combination detected in Manora (C.J.RG.) and Karanja (C.J.G.) tehsil. Jawar and Cotton is the principal crops, crops combination with Jawar, red gram and gram (Map: 6.3).

In 2013-14 definite changes has been observed in Table: 6.13 and Map: 6.4 two crop combination was detected in all tehsil, are Washim (S.G.), Risod (S.G.), Malegaon (S.G.), Mangrulpir (S.G.), Manora (S.C.) and Karanja (S.C.) Tehsils (Map: 6.4). After the assessment of all crops combination Maps, evidently shows the maximum positive deviation method includes a lesser number of crops for the region as whole and thus, avoids the combination. K. Doi's method also delineate specific combinations.

Table: 6.14 Crops Combination by K. Doi & Rafiullah's Methods.

Sr. No.	Tehsils	K. Doi	Rafiullha's	K. Doi	Rafiullha's
		1990-91	1990-91	2013-14	2013-14
1	Washim	3	1	2	2
2	Risod	3	1	2	2
3	Malegaon	2	1	2	2
4	Mangrulpir	2	1	2	2
5	Manora	2	3	3	2
6	Karanja	2	3	2	2

Source: Computed by author

By Rafiullhas maximum positive deviation method, it includes only those combinations are factual representatives of the primary crops are obtained. The previous analysis of crop combination by above two methods and cartographic appearance clearly shows that the region is relatively small for diverse cropping pattern. Table No. 6.14 shows that in two Tehsils where by Doi's method detected three crops combination, by Rafiullha shows first four

tehsil detected monoculture, and by Doi's other four tehsil detected two crops combination and Rafiullhas other two tehsil detected three crops combination is practiced in 1990-91. The crop combination analysis also contradict the commonly detained view of study area produces cotton and Jawar in 1990-91. After the period of more than two decades this crops combination changes in to two crops combination by both method as cotton and Jawar to Soya bean and Gram in four tehsil and Soya bean and cotton in two tehsil in 2013-14.

6.6 Changes in Crops Concentration:

The crop concentration means the variations in the density of any individual crop in an area or region at a given point of time. The concentration of a crop in an area largely depend upon its terrain, temperature, moisture and edaphic conditions. Each crop has maximum, minimum and optimum temperature. It has tendency to have high concentration in the areas of ideal agro-climatic conditions and the density declines as the geographical conditions become adverse. Many eminent scholars have calculated the crops concentration values for different agricultural crops. **Florence P.S. (1948)**[2] compared the share of an enterprise or a region with that of the entire Nation with the help of a Location quotient method. This is very simple method and the results were less satisfactory because of social and economic situation were not considered for measuring the importance of an enterprise. **Chisholm M. (1962)**[3] made an attempt to measure the relative regional concentration with the help of coefficient of localization where compression are made between enterprises by calculating the differences between local (Regional) and national proportion of the area under a given enterprise and specified enterprise. The differences for each region is worked out with the help of following formula:

$$Ec - Tc / En - Tn$$

The differences thus derived will either be positive or negative. First, add the positive differences together and then divide it by 100 to find the coefficient which, however, will range between 0 and 1. Similar treatment is

to be given to negative differences. By doing so, indices of relative concentration or absence of enterprise are obtained, respectively. Indeed, we get areas of enterprise of high concentration (+1) or relative absence (-1).

In order to determine the regional concentration of crops **Bhatia S.S. (1965)[4]** used the following location quotient Method as:

$$\text{Index for determining Concentration of crops 'a'} = \frac{\text{Area of crop 'a' in the component areal unit}}{\text{Area of all crops in the Component areal unit}} \div \frac{\text{area of crop 'a' in the entire country}}{\text{area of all crops in the entire country}}$$

By applying the above formula suggested by Bhatia is used to determine concentration of crops in Washim district. The above technique, if the index value is greater than unity, the component areal unit accounts for share greater than it would have had if the distribution were uniform in the entire region, and therefore the areal unit has a concentration of great agricultural significance. In general higher the crop concentration index, higher is the level of interest in the production of that crop. The pattern of crop concentration by different crops under consideration is worked out. The level of crop concentration are calculated for 1990-91 and 2013-14. The crop concentration is grouped under five heads.

Table: 6.15 Categories of Concentration

Sr. No.	Magnitude of Concentration	Index Value of Concentration %
1	Very High	Above -1.1
2	High	0.76 - 1
3	Moderate	0.51- 0.75
4	Low	0.26-0.50
5	Very Low	0.25

Source: computed by author

Table: 6.16 principal crops concentration in Washim tehsil

1990-91 to 2013-14

Sr. No.	Crops	Years	Magnitude of Concentration				
			V. Low	Low	Mod.	High	V. High
			< 0.25	.26-.50	.51-.75	.76- 1	>1.1
1	Jawar	1990-91	--	--	--	--	1.17
		2013-14	--	0.50	--	--	--
2	Cotton	1990-91	--	--	0.72	--	--
		2013-14	0.16	--	--	--	--
3	Black Gram	1990-91	--	--	--	--	2
		2013-14	--	0.50	--	--	--
4	Red Gram	1990-91	--	--	--	--	1.4
		2013-14	--	--	--	--	1.3
5	Green Gram	1990-91	--	--	--	--	1.3
		2013-14	--	--	--	1	--
6	Gram	1990-91	--	--	--	--	1.16
		2013-14	--	--	--	0.88	--
7	Wheat	1990-91	--	0.50	--	--	--
		2013-14	--	--	--	--	1.2
8	Soya bean	1990-91	--	--	--	--	--
		2013-14	--	--	--	--	1.14

Source: Calculated by Author.

Above table: 6.16 shows the crops concentration in Washim tehsil in 1990-91. Principal crops cultivated in tehsil shows their performance. Farmers are more interested in Jawar, Black Gram, Red Gram, Green Gram and Gram occupies very high concentration. It means farmers are more interested in this crops production. Distribution of this crops is highly uniform in Washim tehsil in 1990-91. Cotton and Wheat occupies moderate and low concentration means the farmers are not interested in their production in Washim tehsil. In 2013-14 Jawar, Black Gram, Green Gram and Gram lost their position and Red gram gain their position with Soya bean and Wheat.

Table: 6.17 principal crops concentration in Risod tehsil

1990-91 to 2013-14

Sr. No.	Crops	Years	Magnitude of Concentration				
			V. Low	Low	Mod.	High	V. High
			< 0.25	.26-.50	.51-.75	.76- 1	>1.1
1	Jawar	1990-91	--	--	--	--	1.17
		2013-14	--	--	--	--	335
2	Cotton	1990-91	--	--	--	0.83	--
		2013-14	--	--	--	--	61.6
3	Black Gram	1990-91	--	--	--	1	--
		2013-14	--	0.50	--	--	--
4	Red Gram	1990-91	--	--	--	1	--
		2013-14	--	--	--	--	1.25
5	Green Gram	1990-91	--	--	0.66	--	--
		2013-14	--	0.50	--	--	--
6	Gram	1990-91	--	--	--	--	2
		2013-14	--	--	--	--	1.94
7	Wheat	1990-91	0.25	--	--	--	--
		2013-14	--	--	0.60	--	--
8	Soya bean	1990-91	--	--	--	--	--
		2013-14	--	--	--	0.92	--

Source: Calculated by Author.

The above table; 6.17 shows the changes in principal crops concentration in Risod tehsil in 1990-91 to 2013-14. Jawar save its very high position, and cotton improve its position from high to very high in next year. Black Gram at high in base year and it lost its position at low. Red gram improve from high to very high. Green gram loss from moderate to low and Gram bear its position at very high and Wheat improve from very low to moderate. Soya bean absent at base year and it occupies high concentration in 2013-14.

Table: 6.18 principal crops concentration in Malegaon tehsil

1990-91 to 2013-14

Sr. No.	Crops	Years	**Magnitude of Concentration**				
			V. Low	Low	Mod.	High	V. High
			< 0.25	.26-.50	.51-.75	.76- 1	>1.1
1	Jawar	1990-91	--	--	--	1.03	--
		2013-14	--	--	--	--	2
2	Cotton	1990-91	--	--	0.69	--	--
		2013-14	--	0.33	--	--	--
3	Black Gram	1990-91	--	--	--	--	2
		2013-14	--	--	--	--	1.5
4	Red Gram	1990-91	--	--	--	--	1.4
		2013-14	--	--	--	--	1.2
5	Green Gram	1990-91	--	--	--	1	--
		2013-14	--	--	--	1	--
6	Gram	1990-91	0.50	--	--	--	--
		2013-14	--	--	0.70	--	--
7	Wheat	1990-91	0.50	--	--	--	--
		2013-14	--	--	--	0.80	--
8	Soya bean	1990-91	--	--	--	--	--
		2013-14	--	--	--	--	1.13

Source: Calculated by Author.

The above table: 6.18 shows the changes in principal crops concentration in Malegaon tehsil in 1990-91 to 2013-14. Jawar improve his position from high to very high, and cotton lost its position from moderate to low in next year. Black Gram save its position at very high. Red gram save his position at very high. Green gram save its position at high and Gram improve its position at very low to moderate and Wheat improve from very low to high. Soya bean absent at base year and it occupies very high concentration in 2013-14.

Table: 6.19 principal crops concentration in Mangrulpir tehsil 1990-91 to 2013-14

Sr. No.	Crops	Years	Magnitude of Concentration				
			V. Low	Low	Mod.	High	V. High
			< 0.25	.26-.50	.51-.75	.76- 1	>1.1
1	Jawar	1990-91	--	--	--	--	1.17
		2013-14	--	--	--	--	2
2	Cotton	1990-91	--	0.36	--	--	--
		2013-14	--	0.43	--	--	--
3	Black Gram	1990-91	--	--	--	--	2.5
		2013-14	--	--	--	--	1.5
4	Red Gram	1990-91	--	--	--	--	1.2
		2013-14	--	--	--	0.87	--
5	Green Gram	1990-91	--	--	--	--	1
		2013-14	--	--	--	--	1.5
6	Gram	1990-91	--	--	0.66	--	--
		2013-14	--	--	--	--	1.11
7	Wheat	1990-91	--	0.50	--	--	--
		2013-14	--	--	--	--	1.2
8	Soya bean	1990-91	--	--	--	--	--
		2013-14	--	--	--	0.86	--

Source: Calculated by Author.

The above table: 6.19 shows the changes in principal crops concentration in Mangrulpir tehsil in 1990-91 to 2013-14. Jawar save his position at very high and cotton its moderate position in next year. Black Gram save its position at very high. Red gram lost his position at very high to high. Green gram save its position at very high and Gram improve its position from moderate to very high. Wheat improve from low to very high. Soya bean absent at base year and it occupies high concentration in 2013-14.

Table: 6.20 principal crops concentration in Manora tehsil

1990-91 to 2013-14

Sr. No.	Crops	Years	Magnitude of Concentration				
			V. Low	Low	Mod.	High	V. High
			< 0.25	.26-.50	.51-.75	.76- 1	>1.1
1	Jawar	1990-91	--	--	--	1.03	--
		2013-14	--	--	--	--	2
2	Cotton	1990-91	--	--	--	0.95	--
		2013-14	--	--	--	--	3.16
3	Black Gram	1990-91	--	--	--	--	1.5
		2013-14	--	0.50	--	--	--
4	Red Gram	1990-91	--	--	--	1	--
		2013-14	--	--	--	0.87	--
5	Green Gram	1990-91	--	--	--	1	--
		2013-14	--	0.50	--	--	--
6	Gram	1990-91	--	--	0.70	--	--
		2013-14	--	0.5	--	--	--
7	Wheat	1990-91	--	0.50	--	--	--
		2013-14	--	--	--	--	1.6
8	Soya bean	1990-91	--	--	--	--	--
		2013-14	--	--	--	0.80	--

Source: Calculated by Author.

The above table: 6.20 shows the changes in principal crops concentration in Manora tehsil in 1990-91 to 2013-14. Jawar improve his position from high to very high, and cotton lost its position from very high too high in next year. Black Gram improve its position from low to high. Red gram save his position at high. Green gram lost its position from high to low and Gram lost its position from moderate to low and Wheat improve from low to very high. Soya bean absent at base year and it occupies high concentration in 2013-14.

Table: 6.21 principal crops concentration in Karanja tehsil

1990-91 to 2013-14

Sr. No.	Crops	Years	**Magnitude of Concentration**				
			V. Low	Low	Mod.	High	V. High
			< 0.25	.26-.50	.51-.75	.76- 1	>1.1
1	Jawar	1990-91	--	--	--	--	1.17
		2013-14	--	--	--	--	1.5
2	Cotton	1990-91	--	--	--	0.95	--
		2013-14	--	--	--	--	2.5
3	Black Gram	1990-91	--	--	--	1	--
		2013-14	--	--	--	1	--
4	Red Gram	1990-91	--	--	--	1	--
		2013-14	--	0.50	--	--	--
5	Green Gram	1990-91	--	--	0.66	--	--
		2013-14	--	--	--	--	2
6	Gram	1990-91	--	0.35	--	--	--
		2013-14	--	--	--	--	1.16
7	Wheat	1990-91	0.25	--	--	--	--
		2013-14	--	--	--	1	--
8	Soya bean	1990-91	--	--	--	--	--
		2013-14	--	--	--	1.09	--

Source: Calculated by Author.

The above table: 6.21 shows the changes in principal crops concentration in Karanja tehsil in 1990-91 to 2013-14. Jawar save their position at very high and Cotton improve it's from high to very high. Black Gram save its position at high. Red gram lost his position from high to low. Green gram and Gram improve its position from low and moderate to very high. Wheat improve from very low to high. Soya bean absent at base year and it occupies high concentration in 2013-14.

6.7 Trends in Crops Diversification:

Crops diversification is fundamental indicator of development in agricultural activities. The crops contest each other for occupying more area. The stronger the competition, higher the degree of diversification and smaller the competition, the greater the index values towards the crop specialization.

In general, if any concern area occupies large number of growing crops, the diversification magnitude will be higher and vice-versa. As per the crop concentration, crop diversification also very helpful to understand the overall cropping pattern in study area. On the same way many agricultural expert and other attempted to measure the diversification magnitudes. **Bhatia S.S. (1965)**[5] has evolved a simple formula, by taking into account the cropped area, to make an objective measurement of crop diversification. As follows:

$$\text{Index of crop diversification} = \frac{\text{Percent of sown area under ' x ' crops}}{\text{Number of ' x ' crops}}$$

Where, ' x ' crops are those crops, that individually occupy 10 % or more of the cultivated area in a regional unit.

Jasbir Singh (1976)[6] has slightly modified Bhatia's formula is given below:

$$\text{Index of crop diversification} = \frac{\text{\% of total harvested area under 'n' crops}}{\text{Number of ' n ' crops}}$$

The modified formula of Bhatia seems to be best suited in the case of the present study region, the crops occupied more than 1 % (5%) of the total cultivated area. In Washim district have plateau and Ajanta mountain ranges area, there are seems to be impartially significant hectare age potential and

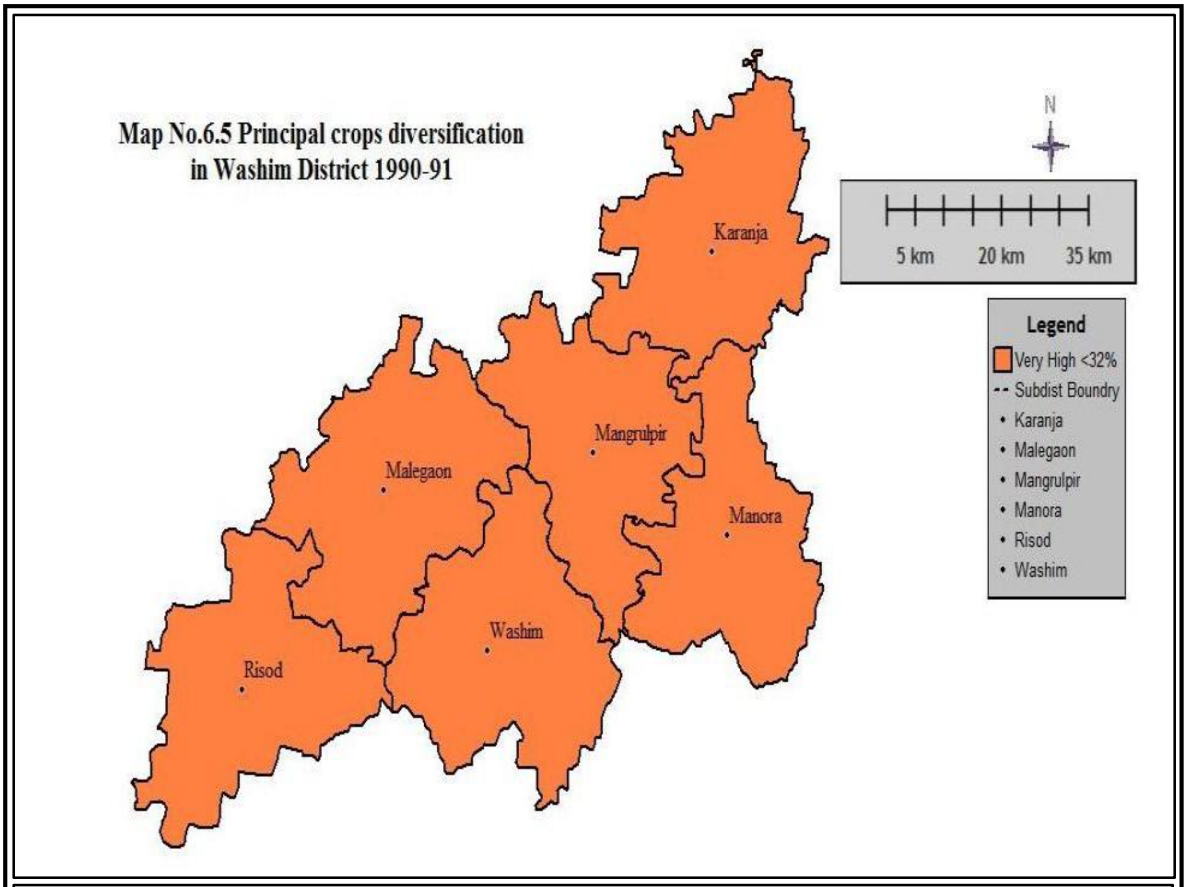
strong competition between the crops, which create higher levels of diversification symptoms of crop diversification are calculated for the period of 1990-91 to 2013-14. Table: 6.22 shows the indications of crop diversification which are grouped into following four categories.

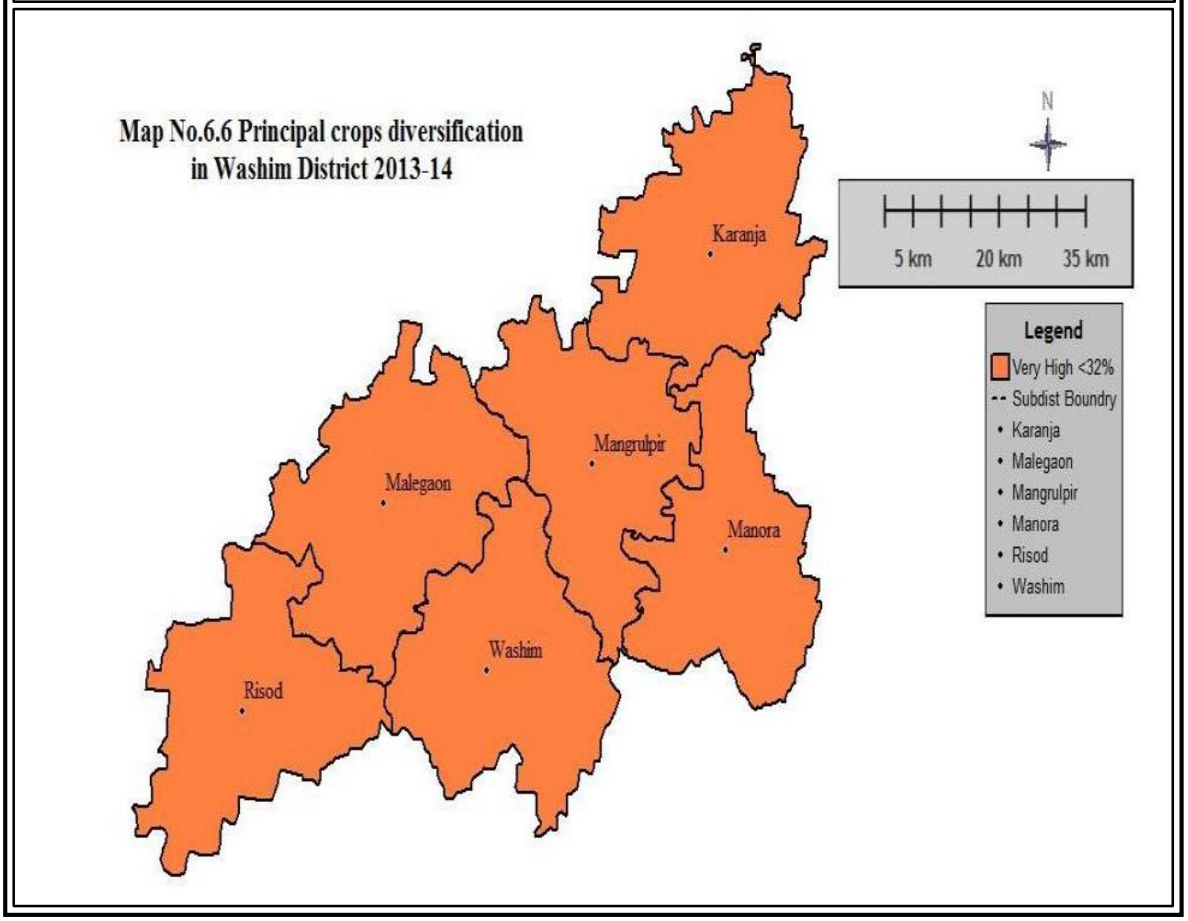
Table: 6.22 principal crops diversification in Washim district 1990-91 to 2013-14

Sr. No.	Tehsil	Years	Magnitude & index values of diversification			
			Very low	Low	High	V. High
			> 52 %	42-52 %	32-42%	< 32 %
1	Washim	1990-91	--	--	--	10.8
		2013-14	--	--	--	12.36
2	Risod	1990-91	--	--	--	12.17
		2013-14	--	--	--	16.37
3	Malegaon	1990-91	--	--	--	9.8
		2013-14	--	--		12.45
4	Mangrulpir	1990-91	--	--	--	8.94
		2013-14	--	--	--	10.94
5	Manora	1990-91	--	--	--	8.9
		2013-14	--	--	--	12.33
6	Karanja	1990-91	--	--	--	10.83
		2013-14	--	--	--	12.43
7	Washim District	1990-91	--	--	--	10.8
		2013-14	--	--	--	12.36

Source: Calculated by Author.

Above table: 6.22 shows the changes in principal crops diversification in Washim district in 1990-91 to 2013-14. Map: 6.5, 6.6 shows the crops diversification from base year to 2013-14. In Washim tehsil have in base year very high and in 2013-14 it occupies very high diversification. Risod tehsil have very high diversification and it continue in 2013-14. In Malegaon tehsil have very high crops diversification and it at very high in 2013-2014 also.


Map No.6.5 Principal crops diversification
in Washim District 1990-91
N
5 km
20 km
35 km
Legend
Very High <32%
Subdist Boundry
Karanja
Malegaon
Mangrulpir
Manora
Risod
Washim
Karanja
Mangrulpir
Malegaon
Manora
Washim
Risod


Map No.6.6 Principal crops diversification
in Washim District 2013-14
N
5 km
20 km
35 km
Legend
Very High <32%
Subdist Boundry
Karanja
Malegaon
Mangrulpir
Manora
Risod
Washim
Karanja
Mangrulpir
Malegaon
Manora
Washim
Risod

In Mangrulpir tehsil it occupies very high diversification and it remains constant in 2013-14. In Manora tehsil in base year it occupies very high crops diversification and it at very high in 2013-14. In Karanja tehsil have occupies very high diversification and it at very high crops diversification in 2013-14. Washim district have very high level of crops diversification at base year and it occupies high crops diversification in 2013-14(Map: 6.5, 6.6). So there is need of intention on improve the soil fertility by crops rotation and using soil improvement measures.

6.8 Growth in Cropping Intensity:

It is the ratio of net area sown to the total cropped area. Total cropped area represents the total area sown once and /or more than once in a particular year, i.e. the area is counted as many times as there are sowing in a year. This total area is known as gross cropped area. The term Land use efficiency is defined as the extent to which the net sown area has been cropped. **Jasbir Singh (1972)**[7] The total cropped area or gross area sown as percentage of net area sown gives a measure of land use efficiency which really means the intensity of cropping. Intensity of cropping refers to the number of crops grown on the same area in one year. Higher the intensity of cropping higher the land use efficiency. Land use efficiency is calculated by following formula as:

$$\text{Intensity of Cropping} = \frac{N\,j}{No} \times 100$$

Where,

N j = Total cropped area

No = Net area sown

To inspect the changes in land use efficiency over a period of time, a number of statistical techniques have been established and used. Agriculture

department, Govt. of India used a formula**,** which is more acceptable and commonly used. The following formula is used to compute the land use efficiency co-efficient.

$$\text{Change in intensity of cropping} = \frac{\Sigma aij}{\Sigma aio} \div \frac{Nj}{No} \times 100$$

Where,

aij = area under the i^{th} crop in the j^{th} year

aio = area under the i^{th} crop in the base year

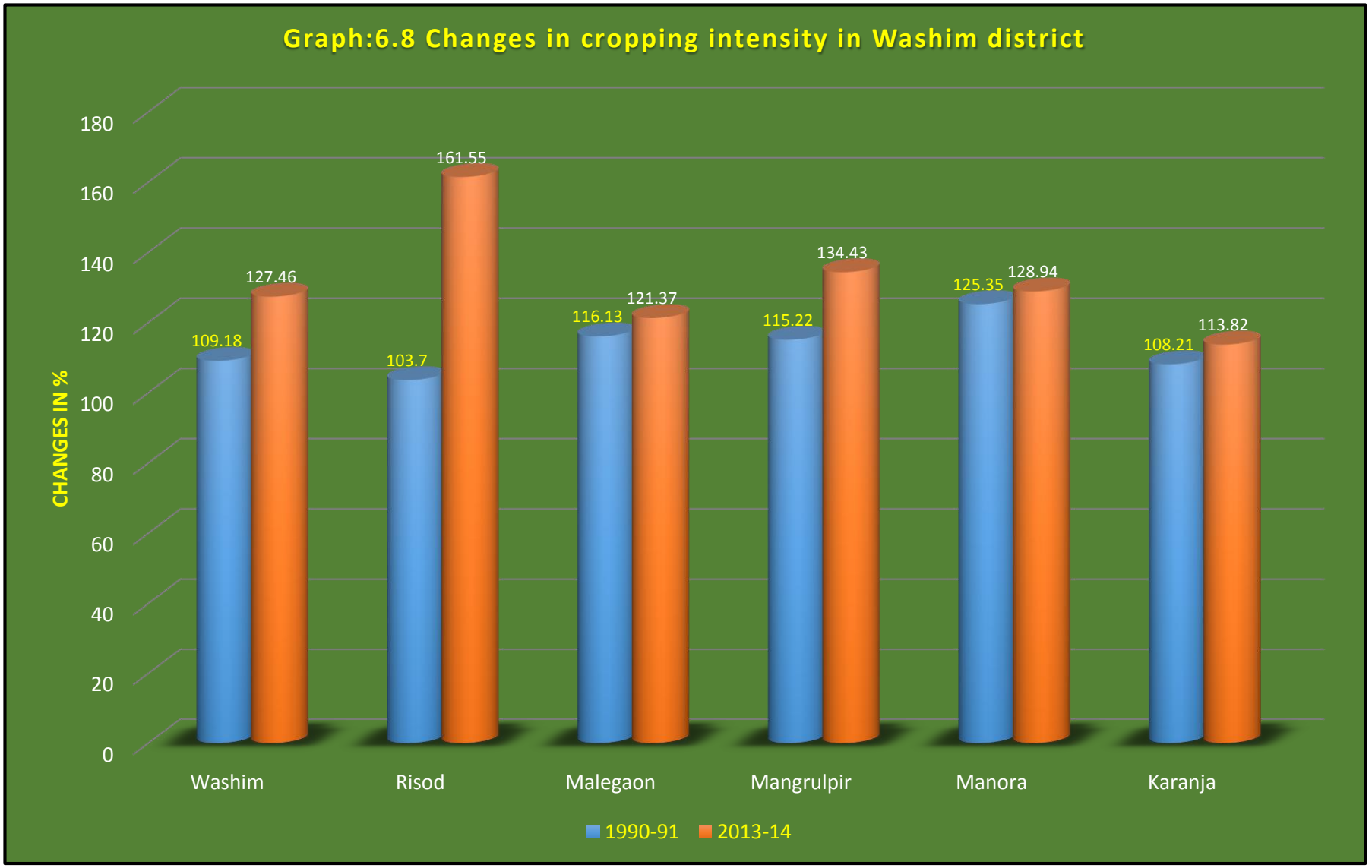
Nj = net area sown in the j^{th} year

No = net area sown in the base year.

Table: 6.23 Changes in cropping Intensity of Washim District

Tehsil	1990-1991			2013-14			1990-91 to 2013-14 Changes in land use intensity
	Net sown area	Total Cropped area	Cropping intensity	Net sown area	Total cropped area	Cropping intensity	
Washim	68790	75105	109.18	78383	99912	127.46	18.28
Risod	66822	69296	103.70	71488	115491	161.55	57.85
Malegaon	60262	69985	116.13	69370	84193	121.37	5.24
Mangrulpir	50258	57912	115.22	58023	78001	134.43	19.21
Manora	49899	62551	125.35	54132	69800	128.94	3.59
Karanja	61298	66334	108.21	70000	79678	113.82	5.61
Washim District	357329	401183	112.27	401396	527159	131.33	19.06

Source: compiled by author


Graph:6.8 Changes in cropping intensity in Washim district
CHANGES IN %
180
160
140
120
100
80
60
40
20
0
109.18
127.46
103.7
161.55
116.13
121.37
115.22
134.43
125.35
128.94
108.21
113.82
Washim
Risod
Malegaon
Mangrulpir
Manora
Karanja
1990-91
2013-14

The extent of cropping intensity has been done on the net area sown is presented in Table: 6.23 and Graph: 6.8. The impact of irrigation facilities and scale of cultivators per 100 hectares of the cultivated area, nature of soil, assured rainfall and size of holding were the most important factors, which are determine the variations in the area, and distribution of cropping intensity. In the study region there is high difference between net sown area and total cropped area because of rich soil condition and plateau land, assured rain fall medium size of land holdings etc. determining the six Tehsils cropping intensity. It is detected that study region have average 112.27 % of cropping intensity in1990-91 and it improve up to 131.33 in 2013-14. Washim tehsil improve its cropping intensity up to 18.28 on 1990-91 in 201-14. Risod tehsil improve its cropping intensity up to 57.85 on 1990-91 in 2013-14. It is because of ICAR introduce Krushi Vigyan Kendra at Karda in Risod tehsil. This centre examined soil types in Washim district and publish soil fertility index of Washim district. This centre give the advice about new high yielding verity (HVY) seeds, use of chemical inputs and improvements in irrigation are responsible for bumper increase in cropping intensity. In Malegaon tehsil cropping intensity increased up to 5.24% in 2013-14. Mangrulpir tehsil improve its cropping intensity up to 19.21 % in 2013-14. Manora and Karanja tehsil improve their intensity up to 3.59 and 5.61 % in 2013-14.

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Chapter-VII

Changes in Agricultural Output

Chapter-VII

Changes in Agricultural Output

7.1 **Introduction:**

Previous chapter discuss the changes in agricultural cropping pattern, Crop combination, crop concentration, cropping intensity has been investigated. This chapter investigates the developments in crops production, yield of principal crops, crops productivity and general productivity have been assess. Our hypothesis is that, changes in crops production may be induced either by the changes in area under crops or changes in yield per hectare or in together. Therefore, comparative significance of together of these factors has been assessed.

Agriculture is the principal source of food grains and vegetables for the human beings. Major portion of the food for the people is delivered by Agriculture in our country. Consequently, Agriculture resources are considered as basic natural resources. The situation of study region is almost associated to the country. In Washim district 82.32% of the total population is reside in the rural areas and depends upon Agriculture. Washim district is included in Amravati division. It is partly developed regions of Maharashtra state.

The overall production of food grains was 625197 metric ton in 2010-11.The production of food grains was increased from 316908 metric ton in1990-91 to 625197 metric ton in 2010-11 (DSER, 2011). On every level wide efforts have been made to increase Agricultural production by plan. But the agriculture could not be made vibrant and still is categorised by low productivity. The another fact of great importance is, food products, other than food grains, must have been race contrary to food grains for a comparatively fixed net cultivated area. Now a days there is no additional land, which can be brought under agriculture.

7.2 Changes in yield of principal Crops:

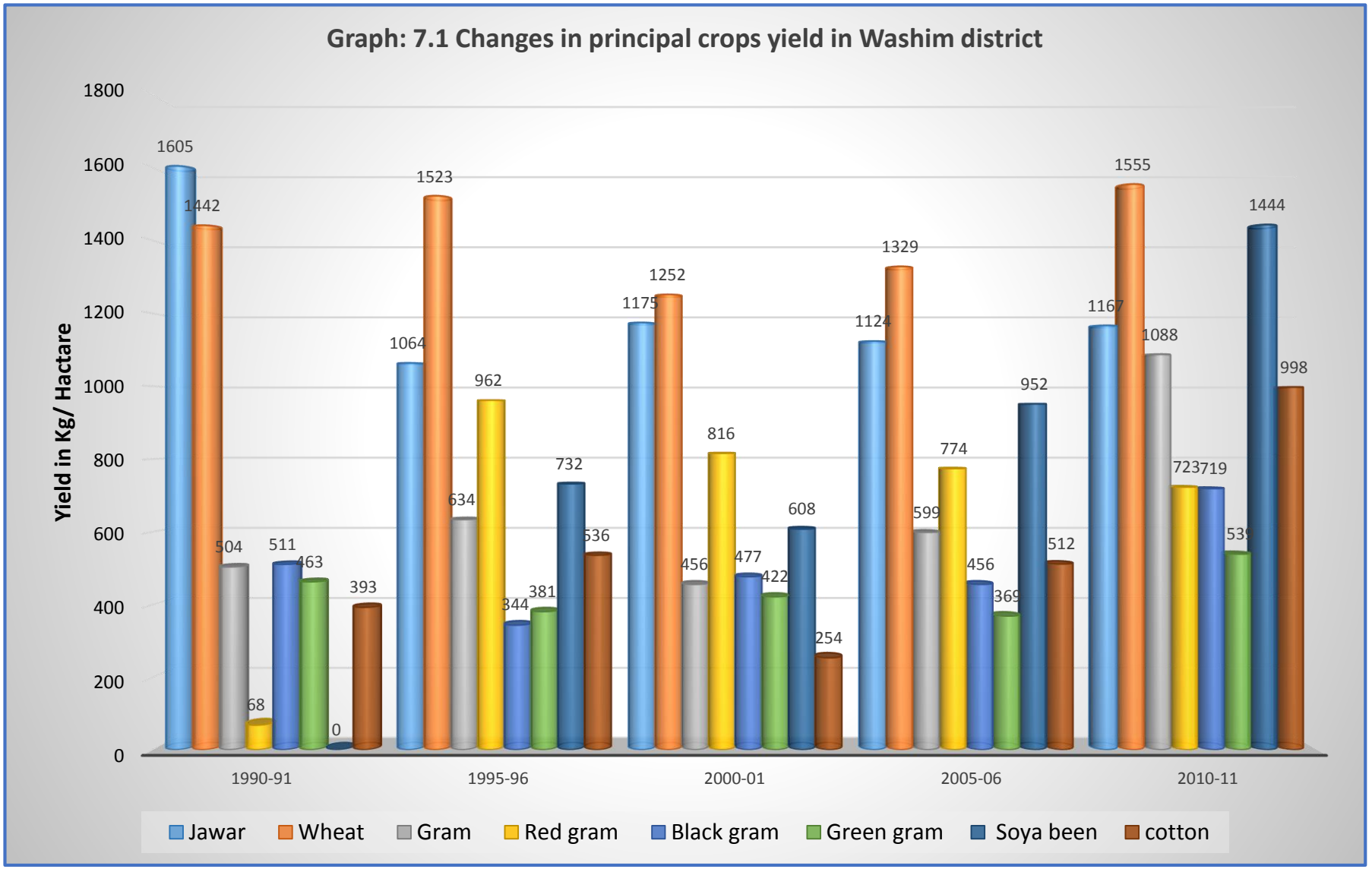
An assessment of general trends in yield per hectare, on the basis of historical time series data. It is useful for planning in perspective agricultural development in study area. Statistical analysis of yield per hectare in principal crops are given a vision to understand the efficiency of various economic powers working in the region. An effort is made to identify the developments in yield of Kharif or Rain fed season crops are Jawar, Bajri, cotton, Black gram, Green gram, Red gram and Soybean. Irrigated or Rabbi Crops are Gram, Wheat, Jawar etc. physical and socio economic factors influences an yield of crops per hectares. They are the nature of soil, rainfall and weather conditions, irrigation facilities, improved seeds (HYV), power supply, crop protection measures and other inputs are adopted with knowledge of agricultural production technic.

Table No. 7.1 Changes in Average Yield of principal Crops

Sr. No.	Crops	Years and yield in kg./ hectare				
		1990-91	1995-96	2000-01	2005-06	2010-11
1	Jawar	1605	1064	1175	1124	1167
2	Wheat	1442	1523	1252	1329	1555
3	Gram	504	634	456	599	1088
4	Red gram	68	962	816	774	723
5	Black gram	511	344	477	456	719
6	Green gram	463	381	422	369	539
7	Soya been	00	732	608	952	1444
8	cotton	393	536	254	512	998

Source: Department of Agriculture, Govt. of Maharashtra

Table No. 7.1 shows per hectare yield of Jawar was 1605 kg in 1990-91 it decreased up to 1167 kg in 2013-14 and 1227 kg is average yield of Jawar crop.


Graph: 7.1 Changes in principal crops yield in Washim district
Yield in Kg/ Hactare
1800
1600
1400
1200
1000
800
600
400
200
0
1990-91
1995-96
2000-01
2005-06
2010-11
1605
1442
504
68
511
463
0
393
1064
1523
634
962
344
381
732
536
1175
1252
456
816
477
422
608
254
1124
1329
599
774
456
369
952
512
1167
1555
1088
723
719
539
1444
998
Jawar
Wheat
Gram
Red gram
Black gram
Green gram
Soya been
cotton

The yield of Wheat increased from 1442 kg to 1555 kg per hectare in period of more than two decades. The yield of Gram in the study area ranges from 504 kg to1088 kg per hectare (Graph: 7.1). The average yield of Red gram is68 kg in 1990-91 is increased up to 723 kg in 2010-11.The yield of Black gram is 511 in base year and is increased up to 719 kg in 2010-11. Green gram shows the positive change in per hectare yield from463 kg to 539 kg in 2010-11. Soya bean is a bumper yield crop shows growth from 732 kg to 1444 kg per hectare in 2010-11. Cotton is the edaphic crop of the region and its performance also progressive but it is a labour friendly crop which wants more man power and more days for harvest so the farmer's choice is less man power crops. Soya bean is rain fed crop and its harvest period is 90-105 days and it became popular crop between farmers. The favourable physical and socio economic factors are responsible for growth in yield of all crops in study area.

7.3 Development in agricultural Production:

An increasing population, there is a need to increase food grins production. Plan by plan and cumulative effort of farmers and agricultural expert there is an increase in food grains production to some extent. The production of principal food grains is 260085 metric ton in1990-91, it increased up to 265010 metric ton in 2010-11. The period of more than two decades 1.89% increase in food grains production. Gross cropped area is 401183 in 1990-91, it is increased up to 527159 hectares in 2013-14. But area under food grains crops is increased from 212587 to 213605 in 2013-14. Even between food grains pulses (73337 hectare to 166314 hectare) have recorded bumper growth in area but cereals decreased rapidly (139250 hectare to 47291 hectare) in area. The increase in food grain production redirects the combined effects of increase in area and productivity per hectare. The growth in production is associated with the growth in per hectare yield of crops. In this attempt to present spatial as well as temporal variation in yield of principal crops and its impact on growth (Table No. 7.2) of production.

Table No. 7.2: Decadal Changes in principal Crops Production in Washim district 1990-91 to 2010-11

Crops	Production 1990-91	Production 2000-01	% of change on 1990-91	Production 2010-11	% of change On 1990-91
Jawar	220735	89900	-59.27	25477	-88.45
Wheat	12570	12400	-1.35	63440	404.91
Total Cereals	**233305**	**102300**	**-56.15**	**88917**	**-61.88**
Gram	12004	7300	49.18	85719	614.08
Red-Gram	1653	34300	1975	45916	2728.77
Black-Gram	7254	26800	269.45	25920	257.32
Green- Gram	5869	18600	217	18538	215.86
Total Pulses	**26780**	**87000**	**225**	**176093**	**557.53**
Total Food grains	**260085**	**189300**	**-27.21**	**265010**	**1.89**
Soybean	Nil	86900*	100	296812*	241.55*
Cotton	56823	53500	-5.84	63375	11.53
Total production	**316908**	**329700**	**4.03**	**625197**	**97.28**

Source: compiled by author.

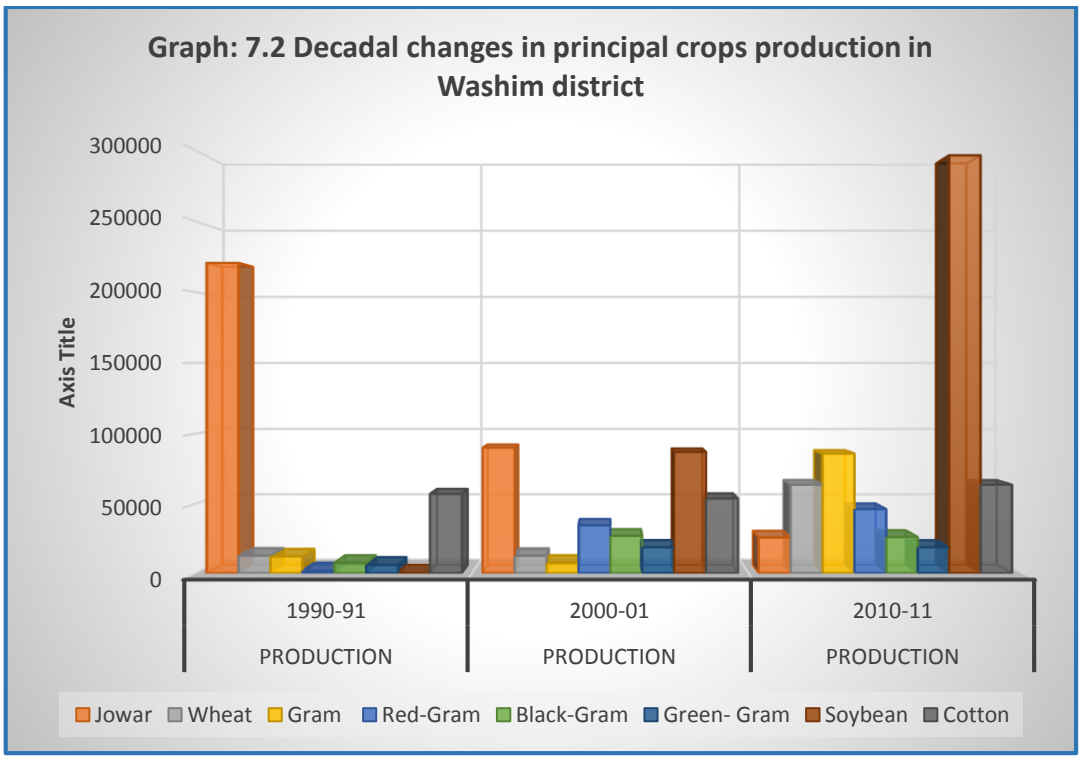


Table No. 7.3: Changes in principal Crops Production in Washim district

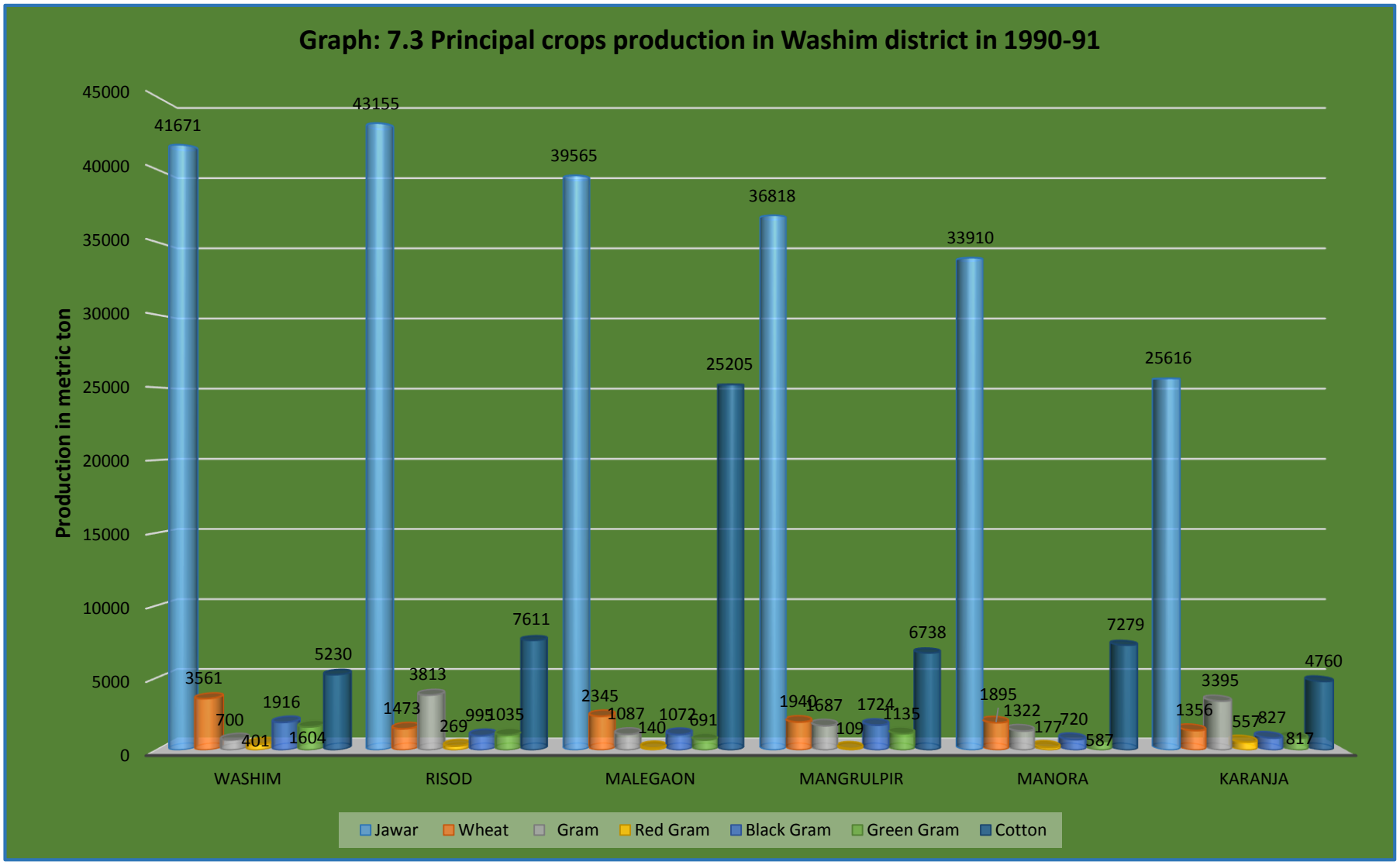
Tehsils	Years	Jawar	Wheat	Gram	Red Gram
		Production in metric ton			
1	2	3	4	5	6
Washim	1990-91	41671	3561	700	401
	%	75.65	6.46	1.27	0.73
	2010-11	4513	27439	21053	8188
	%	3.20	19.47	14.94	5.81
	Change in %	-89.16	671	2908	1942
Risod	1990-91	43155	1473	3813	269
	%	73.95	2.52	6.53	0.46
	2010-11	2147	13382	41280	9909
	%	1.56	9.71	29.94	7.19
	Change in %	-95	808	982	3584
Malegaon	1990-91	39565	2345	1087	140
	%	56.44	3.34	1.55	0.20
	2010-11	5397	11603	14655	9555
	%	4.94	10.61	13.41	8.74
	Change in %	-86.35	395	1248	6725
Mangrulpir	1990-91	36818	1940	1687	109
	%	73.41	3.87	3.36	0.22
	2010-11	2496	3273	2488	5267
	%	3.20	4.19	3.19	6.75
	Change in %	-93	69	48	4732
Manora	1990-91	33910	1895	1322	177
	%	73.89	4.12	2.88	0.38
	2010-11	5462	4356	2850	5868
	%	7.99	6.38	4.17	8.59
	Change in %	-84	130	116	3215
Karanja	1990-91	25616	1356	3395	557
	%	68.62	3.63	9.09	1.49
	2010-11	5462	3385	3393	7124
	%	6.01	3.72	3.73	7.84
	Change in %	-79	150	-0.05	1179
District Total	1990-91	220735	12570	12004	1653
	%	69.65	3.97	3.79	0.52
	2010-11	25477	63440	85719	45916
	%	4.07	10.15	13.71	7.34
	Change in %	-88.45	405	614	2678

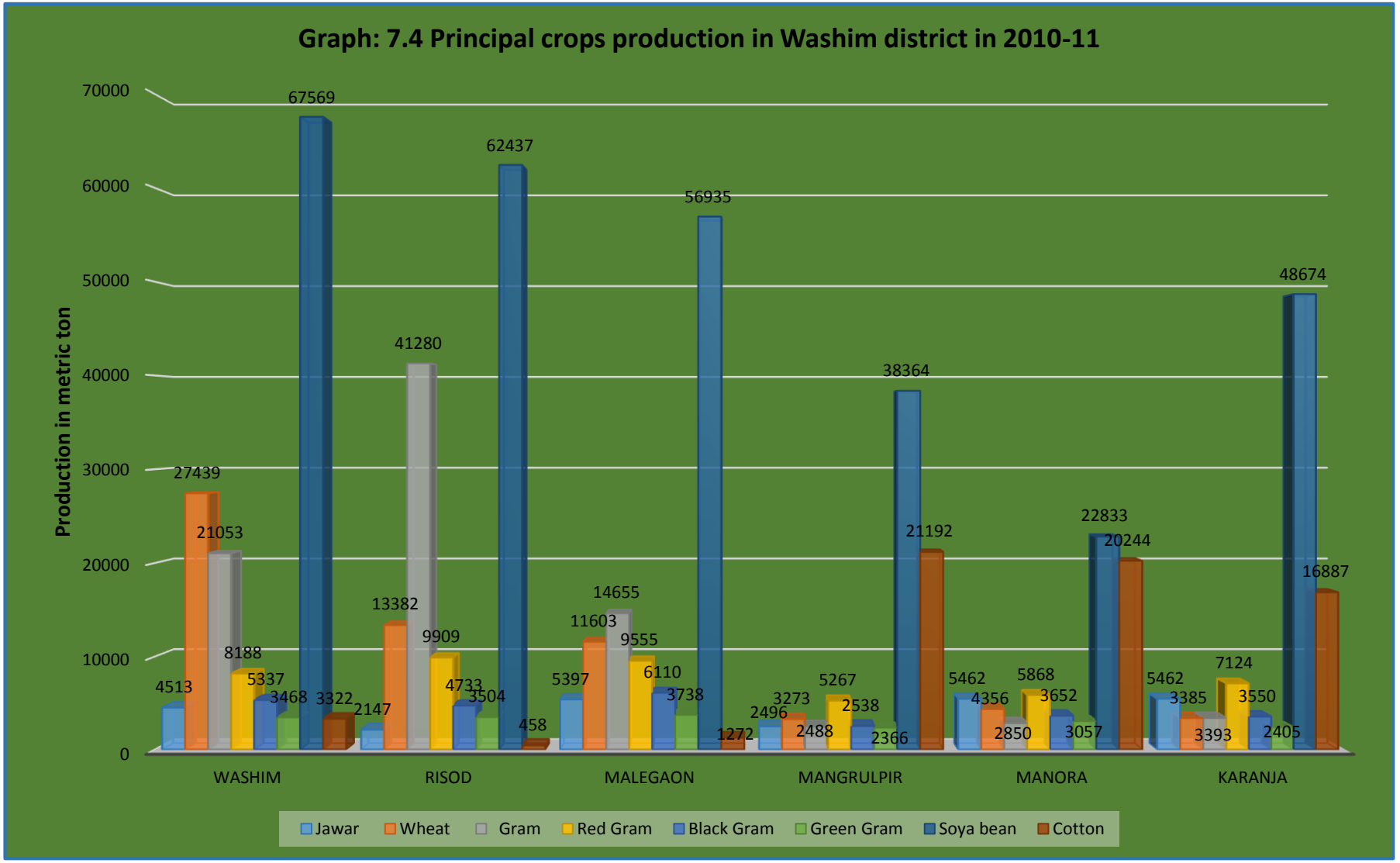
Continue …

Table No. 7.3 Changes in principal Crops Production in Washim District

Tehsils	Years	Black Gram	Green Gram	Soya bean	Cotton	Total Production
		Production in metric ton				
7	8	9	10	11	12	13
Washim	1990-91	1916	1604	Nil	5230	55083
	%	3.48	2.91	-	9.49	-
	2010-11	5337	3468	67569	3322	140889
	%	3.79	2.46	47.96	2.36	-
	Change %	178	116	100	-3.48	156
Risod	1990-91	995	1035	Nil	7611	58351
	%	1.70	1.77	-	13.04	-
	2010-11	4733	3504	62437	458	137850
	%	3.4	2.54	45.29	0.33	-
	Change %	376	239	100	-94	136
Malegaon	1990-91	1072	691	Nil	25205	70105
	%	1.53	0.98	-	35.95	-
	2010-11	6110	3738	56935	1272	109265
	%	5.59	3.42	52.10	1.16	-
	Change %	470	441	100	-95	56
Mangrulpir	1990-91	1724	1135	Nil	6738	50151
	%	3.44	2.26	-	13.43	-
	2010-11	2538	2366	38364	21192	77984
	%	3.25	3.03	49.19	27.17	-
	Change %	47	108	100	215	55
Manora	1990-91	720	587	Nil	7279	45890
	%	1.57	1.28	-	15.86	-
	2010-11	3652	3057	22833	20244	68322
	%	5.34	4.47	33.42	29.63	-
	Change %	407	421	100	178	49
Karanja	1990-91	827	817	Nil	4760	37328
	%	2.21	2.19	-	12.75	-
	2010-11	3550	2405	48674	16887	90880
	%	3.91	2.64	53.56	18.58	-
	Change %	329	194	100	255	143
District Total	1990-91	7254	5869	Nil	56823	316908
	%	2.29	1.85	-	17.93	-
	2010-11	25920	18538	296812	63375	625197
	%	4.15	2.96	47.47	10.14	-
	Change %	257	216	100	12	97.28

Source: compiled by Author


Graph: 7.3 Principal crops production in Washim district in 1990-91
Production in metric ton
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
41671
3561
700
401
1916
1604
5230
43155
1473
3813
269
995
1035
7611
39565
2345
1087
140
1072
691
25205
36818
1940
1687
109
1724
1135
6738
33910
1895
1322
177
720
587
7279
25616
1356
3395
557
827
817
4760
WASHIM
RISOD
MALEGAON
MANGRULPIR
MANORA
KARANJA
Jawar
Wheat
Gram
Red Gram
Black Gram
Green Gram
Cotton


Graph: 7.4 Principal crops production in Washim district in 2010-11
Production in metric ton
70000
60000
50000
40000
30000
20000
10000
0
WASHIM
RISOD
MALEGAON
MANGRULPIR
MANORA
KARANJA
4513
27439
21053
8188
5337
3468
67569
3322
2147
13382
41280
9909
4733
3504
62437
458
5397
11603
14655
9555
6110
3738
56935
1272
2496
3273
2488
5267
2538
2366
38364
21192
5462
4356
2850
5868
3652
3057
22833
20244
5462
3385
3393
7124
3550
2405
48674
16887
Jawar
Wheat
Gram
Red Gram
Black Gram
Green Gram
Soya bean
Cotton

1. Jawar:

Jawar was major important and second occupant of the area but also the major constituent of the cereal production. Its total production was 220735 metric ton in 1990-91, which is 69.65 % of the total production of cereals while it occupies 29.24 % area in Washim district (Table: 7.3). During the period of more than two decades from 1990-91 to 2010-11 total production of Jawar is decreased from 220735metric ton to 25477 metric ton. Thus, Jawar recording decrease in production near to 88.45 %. In total production of Jawar ibelow 60 % Jawar output from Malegaon (56.44 %) Tehsils, whereas, 68 % to 77% Jawar production was obtained in tehsils, Washim 75.63 %, Risod 75.95 %, Mangrulpir 73.41 %, Manora 73.89 % and Karanja 68.62% in 1990-91. In 2010-11 area under this crops and production is decreased near to 86.91 % in all Tehsils. Below 8% production of Jawar was decreased in all Tehsils during the period of investigation, it indicates negative change in area and production (Graph: 7.3, 7.4).

2. Wheat:

Wheat crops shows positive increase in area and production in all tehsil of Washim district (Graph: 7.3, 7.4). The wheat is second largest contributor in cereals crops. Wheat ranks second in growth of output. Its total production increased from 12570 metric ton in1990-91 to 63440 metric ton in 2010-11 (Table: 7.3). The area under wheat crop is increased from 16529 hectare to 30505 hectare in 2013-14. In total production of Wheat above 671 % in Washim, 808 % in Risod, 395 % in Malegaon, 150 % in Karanja, 130 % in Manora and 69 % in Mangrulpir tehsil in 2010-11.

3. Gram:

Gram is first ranking crops in pulses crops in all tehsil of Washim district.it shows positive increase in area and production (Graph: 7.3, 7.4). Gram production increased from 12004 metric ton to 85719 metric ton in period of investigation. Its area increased from 26679 to 94001 hectare in period of

investigation (Table: 7.3). Gram crops shows bumper increase in area and production in all tehsil of Washim district.

4. Red Gram:

Red gram is the second largest crops in pulses and it shows positive change in area and production (Graph: 7.3, 3.4). It increased in area and production in period of investigation. Red gram production increased from 1653 metric ton to 45916 metric ton during the period of investigation in Washim district. Area under this crops also increased from 22025 to 46183 hectare in period of investigation in Washim district (Table: 7.3).

5. Black Gram:

Black gram is the third ranking crops in pulses and it shows positive change in area and production in Washim district in period of investigation (Graph: 7.3, 7.4). Production of this crop is increased from 7254 to 25920 metric ton and area increased from 9890 to 11882 hectare within period of investigation. In tehsil Washim 178 %, Risod 376 %, Mangrulpir 47 %, Manora 407% and Karanja 329 % in period of investigation, it shows high increase in production Washim district from 1990-91 to 2010-11(Table: 7.3).

6. Green Gram:

Green gram is the fourth ranking crops in pulses and it (Table: 7.3) shows positive change in area and production in Washim district in period of investigation (Graph: 7.3, 7.4). Production of this crop is increased from 5869 to 18538 metric ton and area decreased from 12883 to 12622 hectare within period of investigation. Production growth in tehsil Washim 116 %, Risod 239 %, Mangrulpir 108 %, Manora 421% and Karanja 194 % in period of investigation, it shows high increase in production in Washim district from 1990-91 to 2010-11.

7. Cotton:

Cotton is the first ranking crops in fibres and it shows negative change in area and positive change in production in Washim district, in period of investigation, except Washim, Risod and Malegaon tehsil (Table: 7.3).

Production of this crop is increased from 56823 to 63375 metric ton and area decreased from 174274 to 34511 hectare within period of investigation. In tehsil Washim -3.48 %, Risod -94 %, Malegaon -95%, Mangrulpir 215 %, Manora 178% and Karanja 255 % in period of investigation, it shows high increase in production in Washim district from 1990-91 to 2010-11(Graph: 7.3, 7.4).

8. Soya bean:

Soya bean is the first ranking crops in oilseeds and it shows positive change in area and production from 1994-95 to 2010-11 in Washim district (Graph: 7.3, 7.4). Production of this crop is 296812 metric ton and it is 47.47 % in total production of Washim district. Area under this crop is 278830 hectare, means it occupies 52.89 % area of the total Washim district within period of investigation. Production in tehsil Washim 47.96 %, Risod 45.29 %, Malegaon 52.10 %, Mangrulpir 49.19%, Manora 33.42% and Karanja 53.56 % in period of investigation, it shows high increase in production in Washim district. Malegaon is the highest area under this crop which is 53.56% in 2013-14 (Table: 7.3).

7.4 Agricultural Productivity efficiency level:

The quantity of production and inputs are used for the production of that output is known as agricultural productivity. The concept of productivity seems to be a relative term and cannot be uniformly applied far and wide. Occasionally it is considered to be equal of efficient or overall efficiency of a productive unit, whereas it others as ratio of output to resources increased - Noor Mahammad (1980). Agriculture has always occupied on important place in Indian Economy. The availability of cultivable land per man has been decreased during 68 years. The growth in crop production is an essential march in India agriculture. After the independence to feed more population, more land come under the crops cultivation. So the areal spread of crop land has almost reached at its limit. Therefore it needs, to increase the agricultural productivity.

The measurement of agricultural productivity is more complicated than of an industry or any other economic activity. It has so many problems of concept and definition. Sometimes it is considered to be synonyms efficiency of productive unit, while the others as profitable ratio of input and output in any economic activity. But these evidently differing explanations have a common characteristic i.e. some one's ability to produce more cost-effectively and efficiently. Agricultural productivity is an occupation of different factors like physical, socio-economic, organizational and technical support. Thus, productivity is a function of interplay of physical and cultural inputs and it expresses itself through per hectare productivity and total production. Productivity also depends on attitudes of the farmers toward work and their aims for better standard of living. The level of productivity, means the degree of economic, cultural, technical and administrators' are able to exploit the biotic resources of the area for agricultural production – Jasbir Singh (1984).

The agricultural productivity is a vibrant concept. It's active in its spatial and temporal perspective. The improvement of irrigation facilities, mechanization, use of chemical fertilizers, and high yield verity seed etc. led to improve agricultural productivity per unit area. The agricultural productivity has been studied by numerous approaches and it may be grouped as:

1. Output per unit area.
2. Production per unit farm labour.
3. Input-output ratio (Khusro, 1964).
4. To assess agricultural production as grain equivalents (Buck, 1967).
5. Ranking of coefficient method (Kendal, 1939, Stamp L.D. 1960, M. Shaffi 1990).
6. Carrying capacity of land
7. Composite multi-variable in day.

Above first three approaches needs such statistics which cannot be easily obtainable. All of them ranking co-efficient and agriculture efficiency can be

better than others. Productivity pattern indicate the dominance of a particular group of crops and their contribution in the general agricultural productivity. After the investigation eight principle crops of study region are Jawar, Wheat, cotton, Gram, Red Gram, Green Gram, Black Gram and soya bean have been detected. The spatial distribution of yields brought out the regional dominance of these crops.

The ranking coefficient method is used to determine the agricultural productivity pattern of study area. It is quite simple and easy to use. In this technique the component aerial unites are ranked in relation to per hectare yield of crops and arithmetical average rank called the ranking coefficient for each unit is obtained. It is obvious that a component aerial unit with relatively high yields will have low ranking coefficient, it indicating high agricultural productivity and vice versa.

Jasbir Singh (1997) has made an attempt in this direction while analysing the productivity efficiency patterns and dynamics of important crops in south Asia. The proposed simple algorithm was as under.

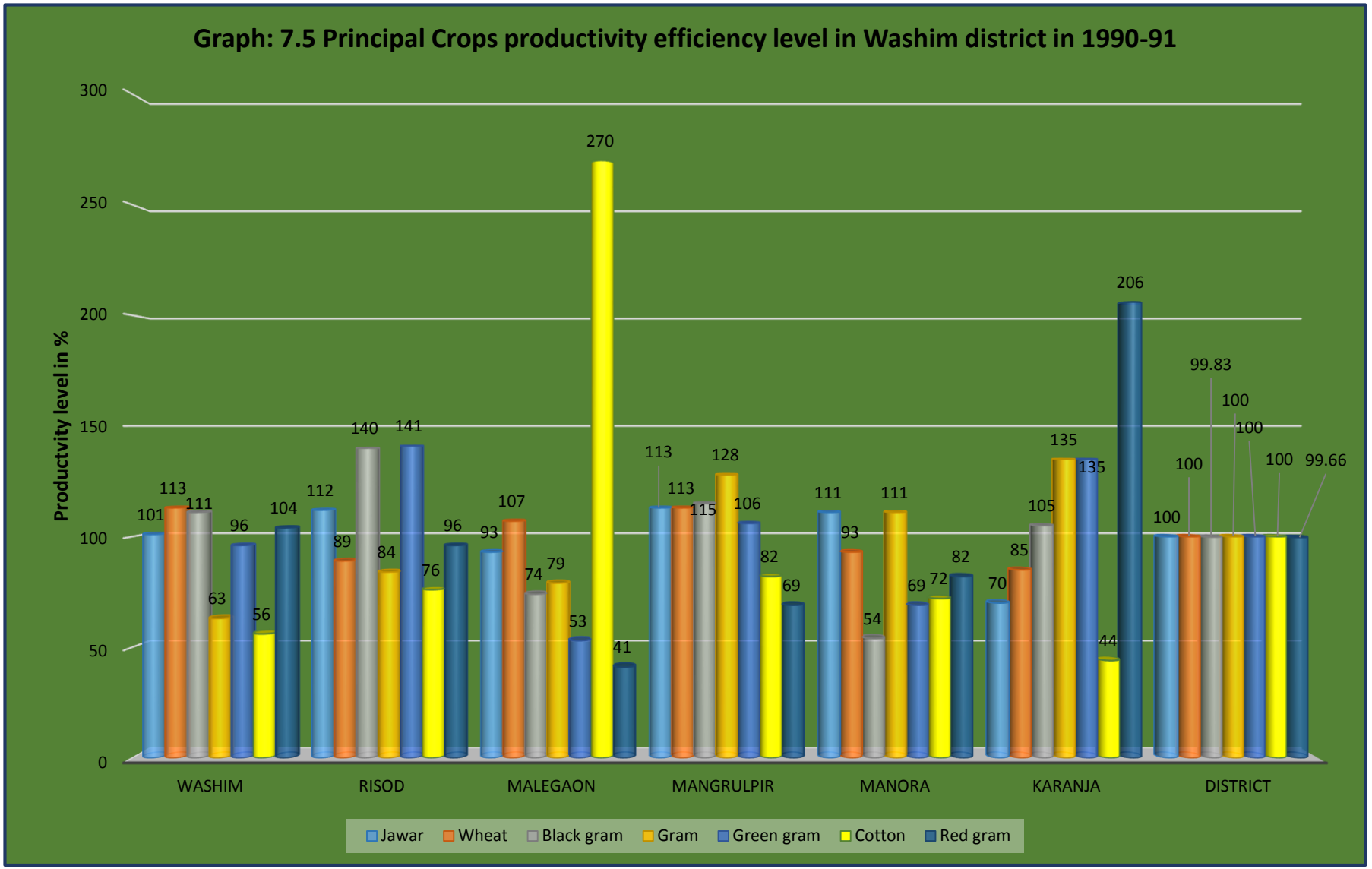
$$\text{Crop productivity efficiency Level of crop 'a' in unit A} = \frac{\text{Average yield of crop 'a' per hectare in unit 'A'}}{\text{Average yield of crop 'a' per hectare in region.}} \times 100$$

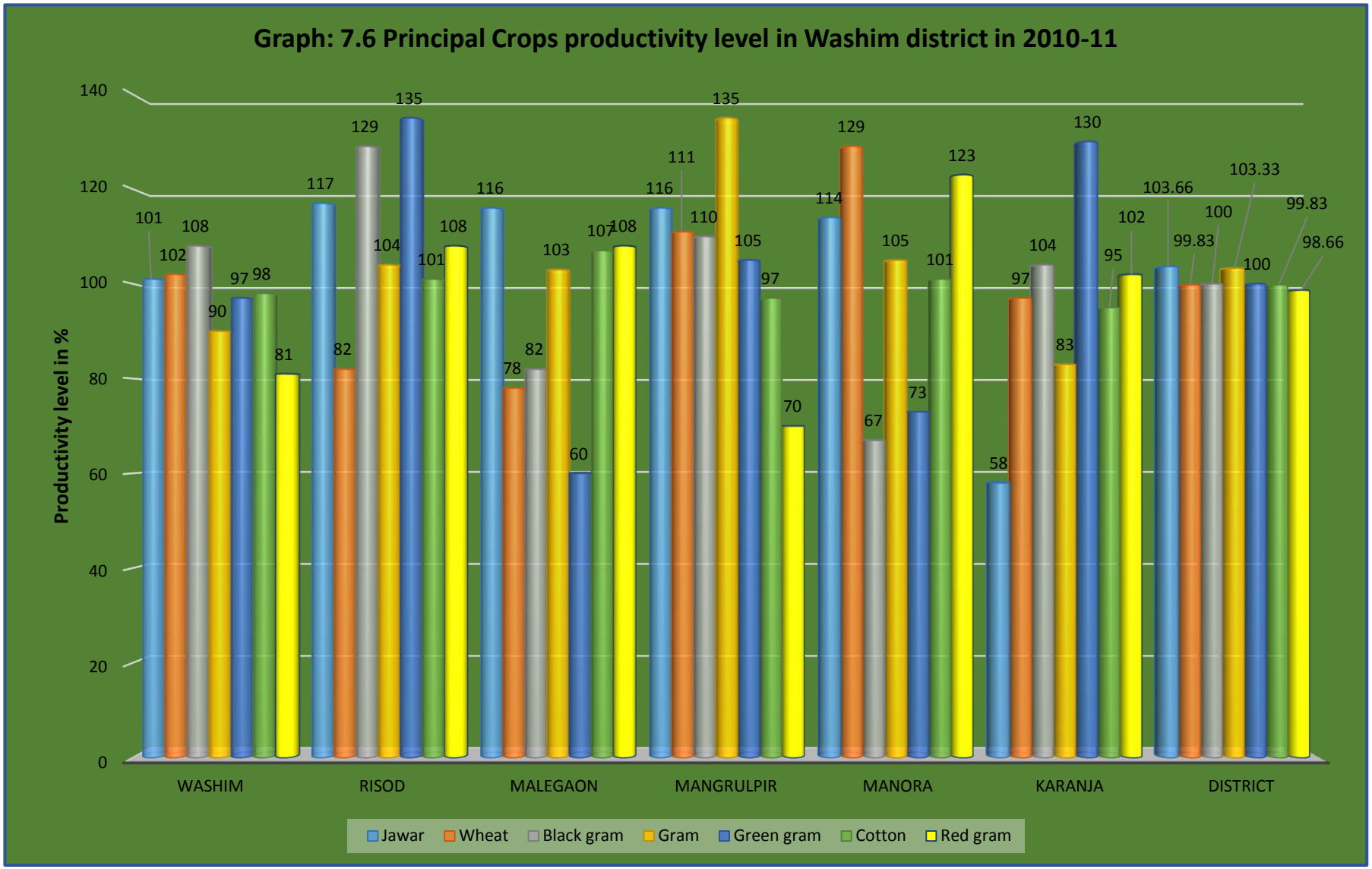
Logically this technique seems to be reliable and dependable in the case of crops holding monoculture, predominant, dominant and major status in cropland occupancy. The procedure is free of lengthy and cumbersome. This method is used to determine agricultural productivity pattern in Washim district. In Washim district, there are six component aerial unit. The magnitude of level of production determined as, very low below 50%, Low 51-75 %, Moderate 76-100%, High 101-125%, and Very high more than 126%.

Table No. 7.4 Crops productivity efficiency level in Washim district 1999-91 to 2010-11

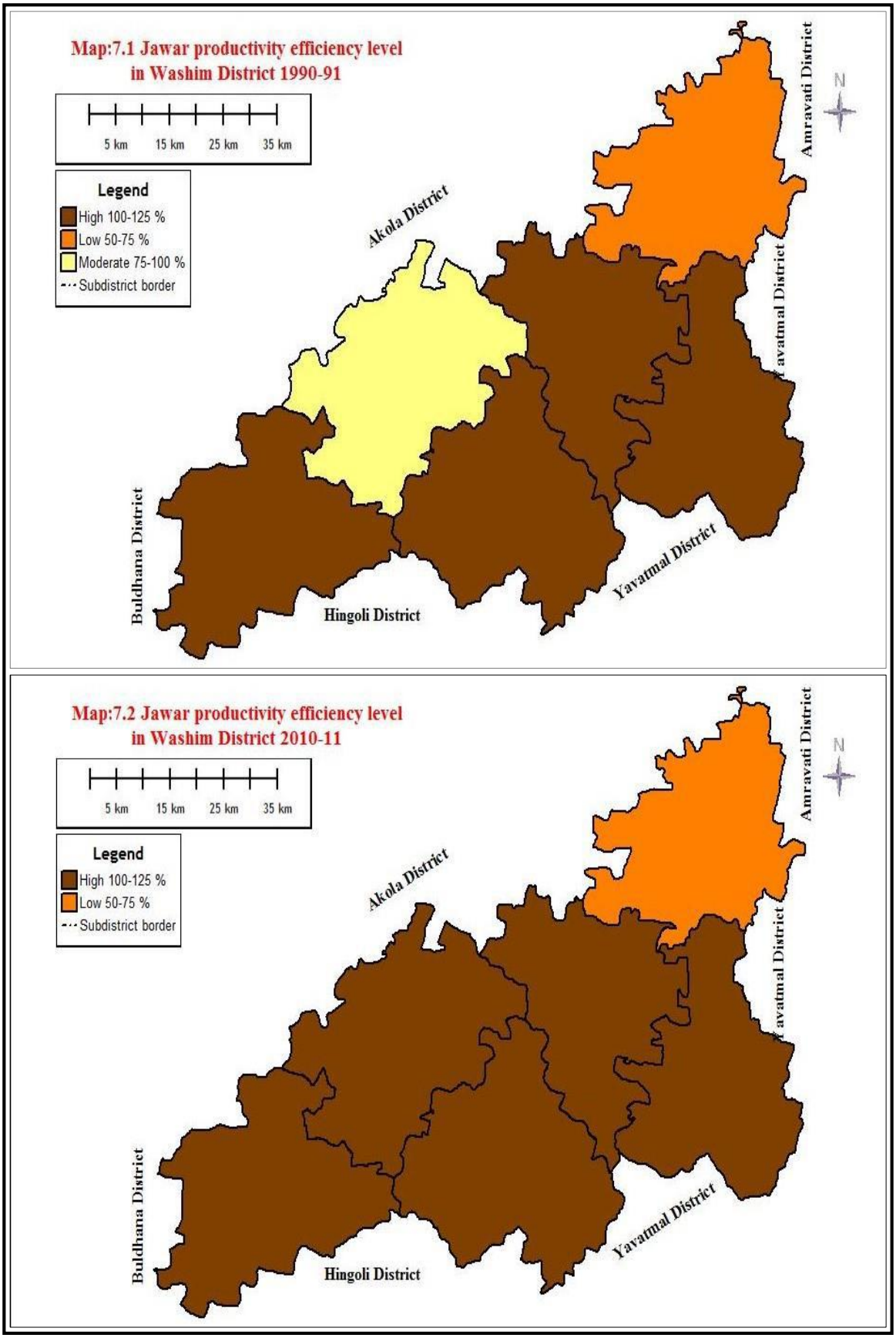
Sr. No.	Tehsil	Years	Crops and Crop productivity efficiency level							
			Soya bean	Jawar	Wheat	Black gram	Gram	Green gram	Cotton	Red gram
1	Washim	1990-91	116*	101	113	111	63	96	56	104
		2010-11	110	101	102	108	90	97	98	81
2	Risod	1990-91	91*	112	89	140	84	141	76	96
		2010-11	111	117	82	129	104	135	101	108
3	Malegaon	1990-91	109*	93	107	74	79	53	270	41
		2010-11	87	116	78	82	103	60	107	108
4	Mangrulpir	1990-91	96*	113	113	115	128	106	82	69
		2010-11	86	116	111	110	135	105	97	70
5	Manora	1990-91	87*	111	93	54	111	69	72	82
		2010-11	86	114	129	67	105	73	101	123
6	Karanja	1990-91	Nil	70	85	105	135	135	44	206
		2010-11	118	58	97	104	83	130	95	102
7	Washim district	1990-91	99.8	100	100	99.83	100	100	100	99.66
		2010-11	99.66	103.66	99.83	100	103.33	100	99.83	98.66

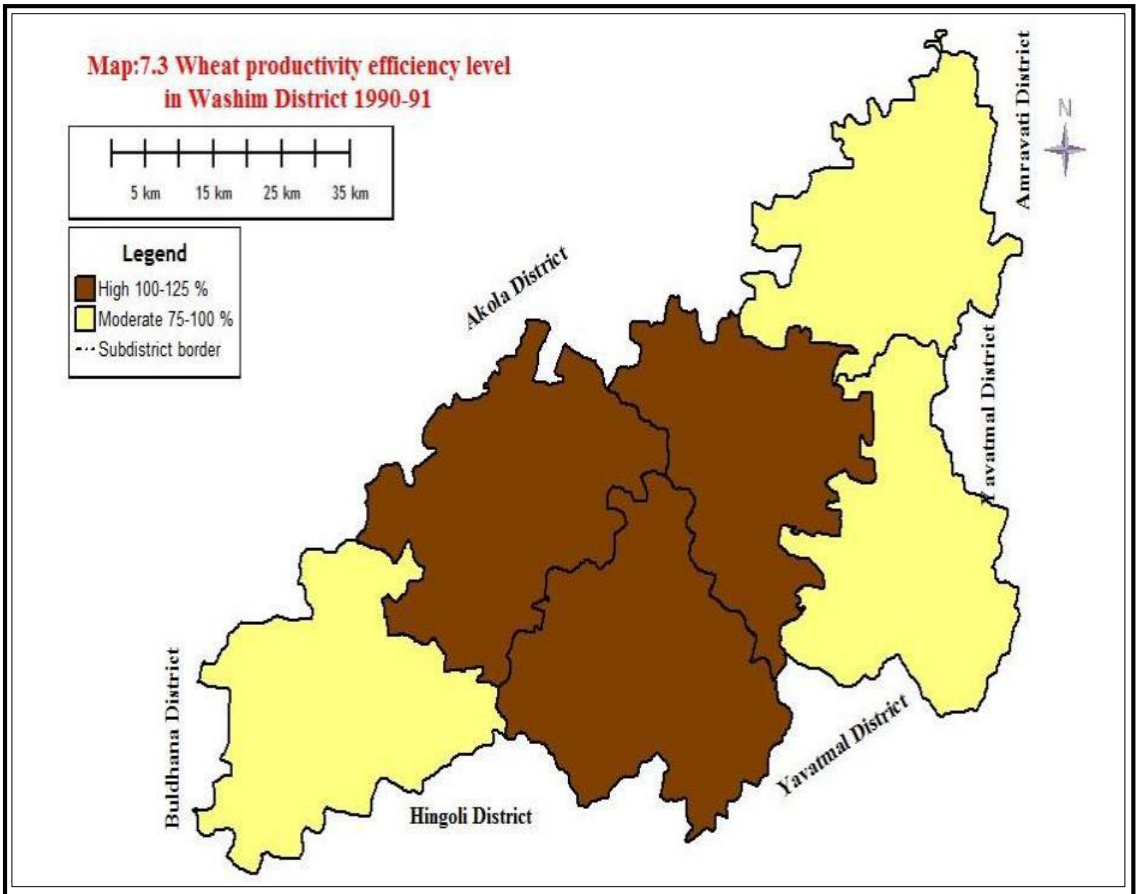
Source: compiled by author. Note: % to average yield of Soya bean crops in 1994-95*

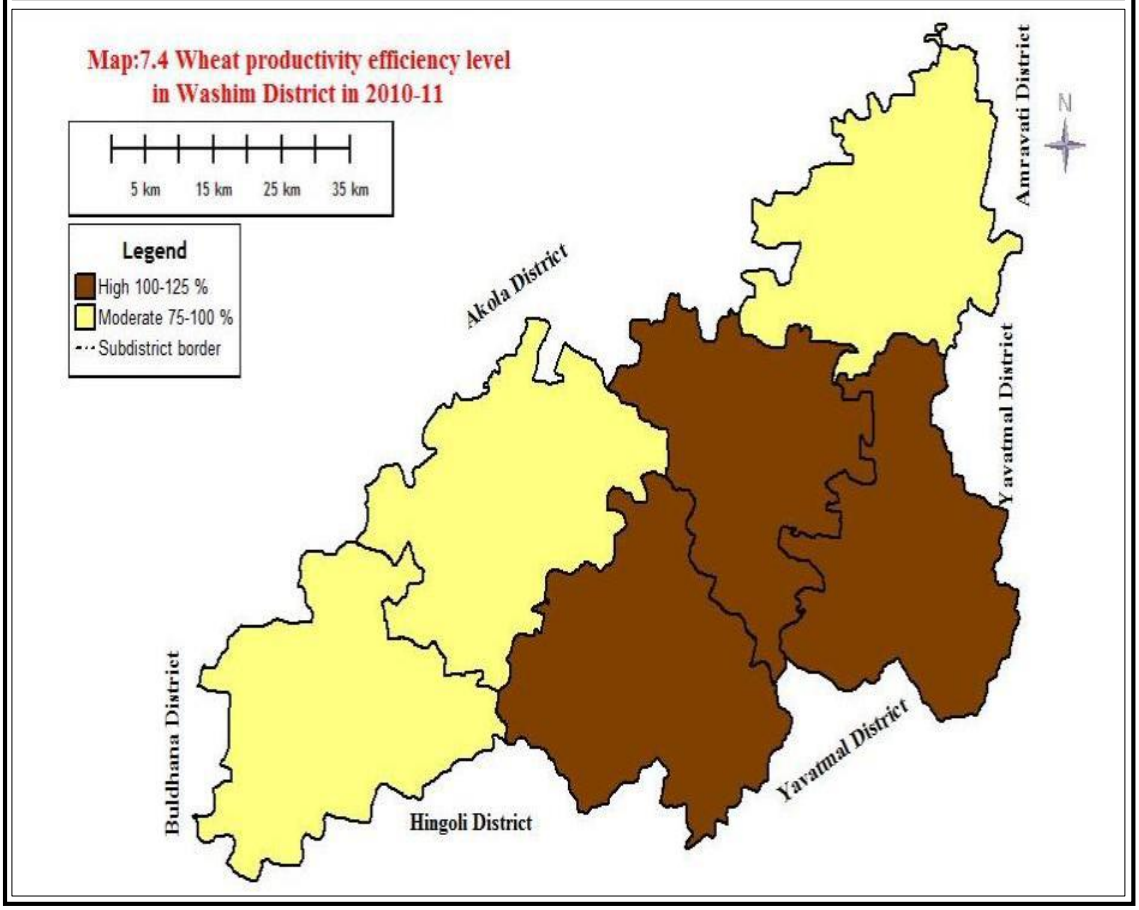

Graph: 7.5 Principal Crops productivity efficiency level in Washim district in 1990-91
Productvity level in %
300
250
200
150
100
50
0
101
113
111
63
96
56
104
112
89
140
84
141
76
96
93
107
74
79
53
270
41
113
113
115
128
106
82
69
111
93
54
111
69
72
82
70
85
105
135
135
44
206
100
100
99.83
100
100
100
99.66
WASHIM
RISOD
MALEGAON
MANGRULPIR
MANORA
KARANJA
DISTRICT
Jawar
Wheat
Black gram
Gram
Green gram
Cotton
Red gram


Graph: 7.6 Principal Crops productivity level in Washim district in 2010-11
Productivity level in %
140
120
100
80
60
40
20
0
WASHIM
RISOD
MALEGAON
MANGRULPIR
MANORA
KARANJA
DISTRICT
101
102
108
90
97
98
81
117
82
129
104
135
101
108
116
78
82
103
60
107
108
116
111
110
135
105
97
70
114
129
67
105
73
101
123
58
97
104
83
130
95
102
103.66
99.83
100
103.33
100
99.83
98.66
Jawar
Wheat
Black gram
Gram
Green gram
Cotton
Red gram

7.5 Changes in principal crops Productivity efficiency level:




Map:7.3 Wheat productivity efficiency level
in Washim District 1990-91
5 km
15 km
25 km
35 km
Legend
High 100-125 %
Moderate 75-100 %
Subdistrict border
Akola District
Amravati District
Yavatmal District
Buldhana District
Hingoli District
Yavatmal District
N


Map:7.4 Wheat productivity efficiency level
in Washim District in 2010-11
5 km
15 km
25 km
35 km
Legend
High 100-125 %
Moderate 75-100 %
Subdistrict border
Akola District
Amravati Distriet
Yavatmal Distriet
Buldhana Distriet
Hingoli District
Yavatmal District
N

1. Jawar:

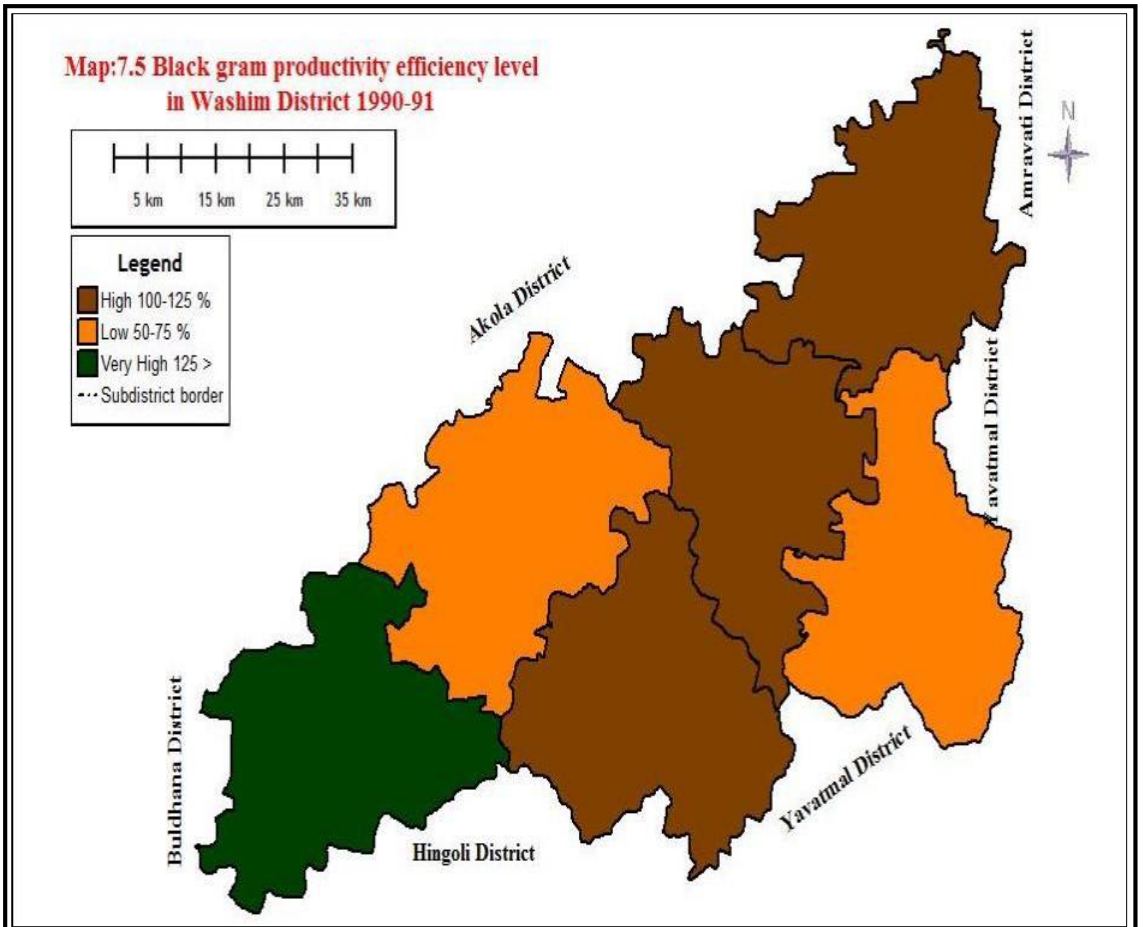
Method of **Crops Productivity Efficiency Level** by Jasbir Singh (1997) is used to calculate the CPEL in Washim district. Principal crops CPEL is presented in table: 7.4, Graph: 7.5, 7.6 and Map: 7.1, 7.2 is shows the Jawar productivity efficiency level in 1990-91 in study area. By tehsil Washim, Risod, Mangrulpir and Manora tehsil detected high Jawar crops CPEL and it occupies 30 to 35 % area in both tehsil. Other Malegaon and Karanja tehsil detected moderate and low Jawar crop CPEL and it occupies 34 to 38 % area in both tehsil.

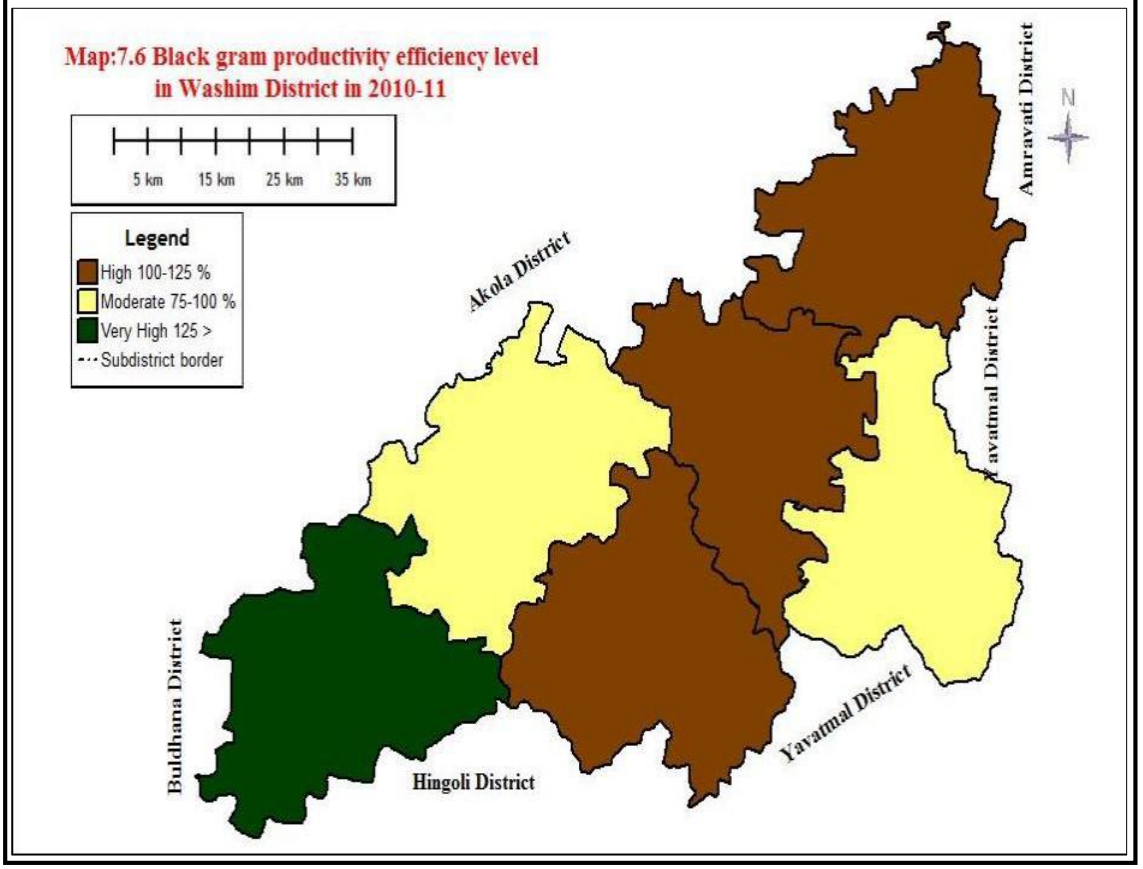
In 2010-11by tehsil Washim, Risod, Malegaon, Mangrulpir and Manora tehsil detected high Jawar crops CPEL and it occupies 0.67 to 4.80 % area in both tehsil. The area under Jawar crop is decreased near to 26 to 34 % in both tehsil. Karanja tehsil detected moderate and low Jawar crop CPEL and it occupies 3.45 % area and it decreased near to 30% in 2010-11.

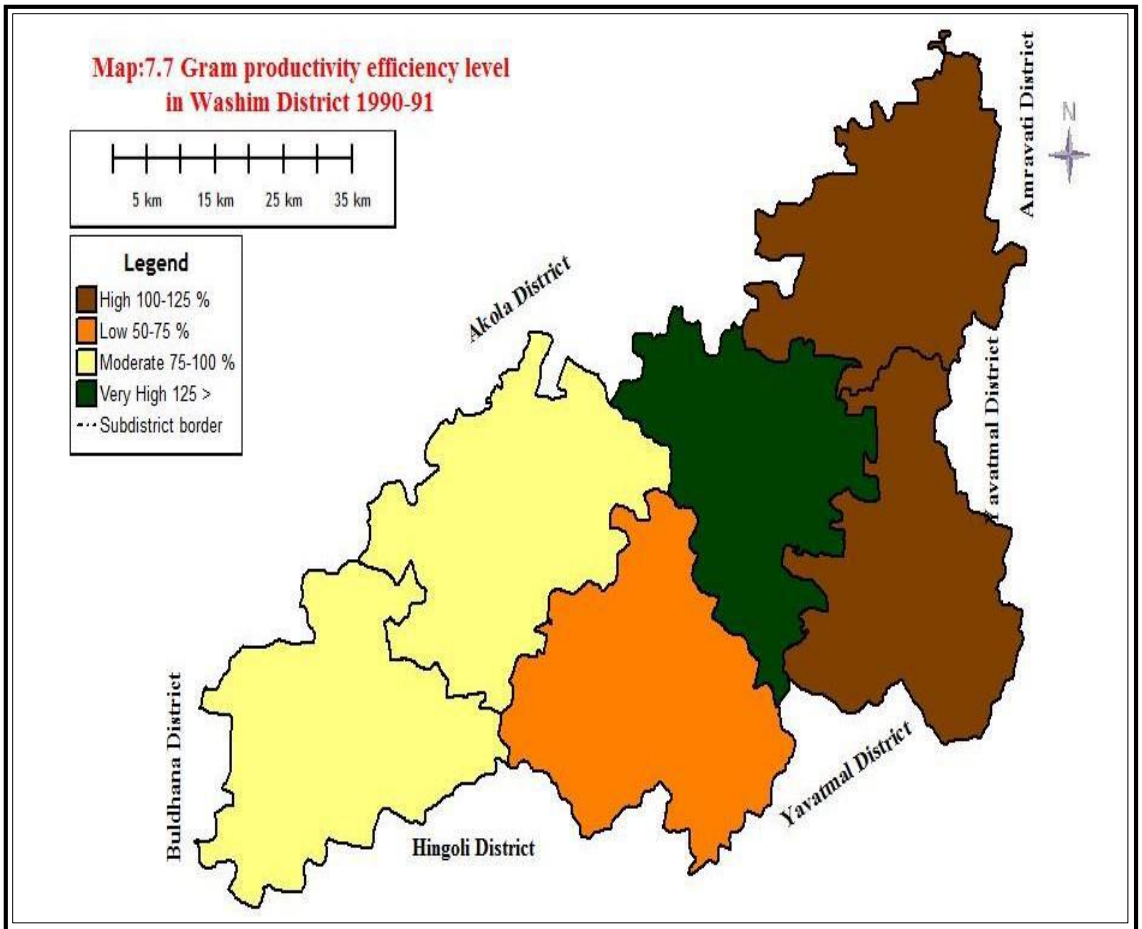
2. Wheat:

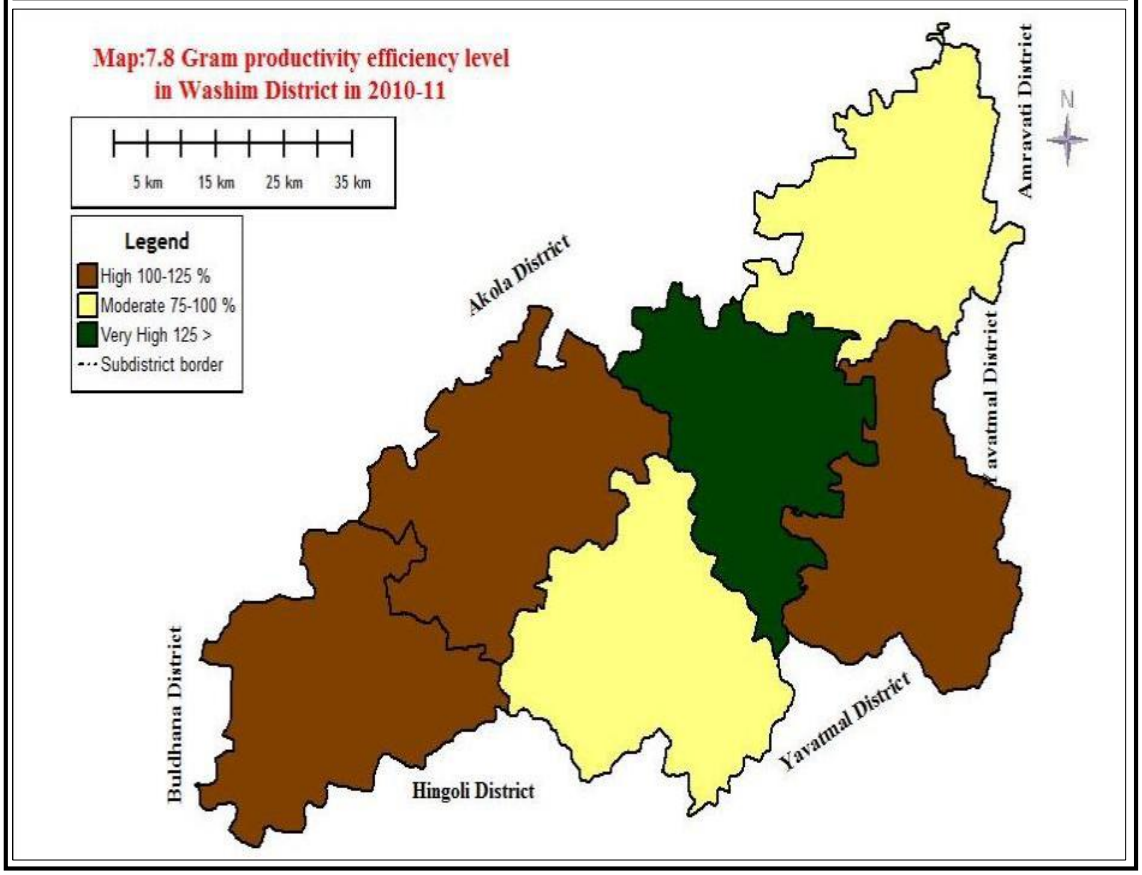
Wheat crops CPEL is presented in table: 7.4, Graph: 7.5, 7.6 and Map: 7.3, 7.4 is shows the Wheat productivity efficiency level in 1990-91 in study area. By tehsil Washim, Malegaon and Mangrulpir tehsil detected high Wheat crops CPEL and it occupies 2.92%, 2.18% and 2.05 % area in both tehsil. Other Risod, Manora and Karanja tehsil detected moderate Wheat crop CPEL and it occupies 1.66%, 2.25% and1.66 % area in both tehsil.

In 2010-11by tehsil Washim, Mangrulpir and Manora tehsil detected high Wheat crops CPEL and it occupies 6.18%, 6.40% and 8.97 % area in both tehsil. The area under Wheat crop is increased near to 4% to 6 % in both tehsil. Risod, Malegaon and Karanja tehsil detected moderate Wheat crop CPEL and it occupies 3.95%, 4.64% and5.81 % area and it increased near 2% to 4 % in 2010-11.


Map:7.5 Black gram productivity efficiency level
in Washim District 1990-91
5 km
15 km
25 km
35 km
Legend
High 100-125 %
Low 50-75 %
Very High 125 >
Subdistrict border
N
Amravati District
Akola District
Yavatmal District
Buldhana District
Hingoli District


Map:7.6 Black gram productivity efficiency level
in Washim District in 2010-11
5 km
15 km
25 km
35 km
Legend
High 100-125 %
Moderate 75-100 %
Very High 125 >
Subdistrict border
N
Amravati District
Akola District
Yavatmal District
Buldhana District
Hingoli District


Map:7.7 Gram productivity efficiency level
in Washim District 1990-91
5 km
15 km
25 km
35 km
Legend
High 100-125 %
Low 50-75 %
Moderate 75-100 %
Very High 125 >
Subdistrict border
Akola District
Amravati District
Yavatmal District
Buldhana District
Hingoli District
N


Map:7.8 Gram productivity efficiency level
in Washim District in 2010-11
5 km
15 km
25 km
35 km
Legend
High 100-125 %
Moderate 75-100 %
Very High 125 >
Subdistrict border
Akola District
Amravati District
Yavatmal District
Buldhana District
Hingoli District
N

3. Black Gram:

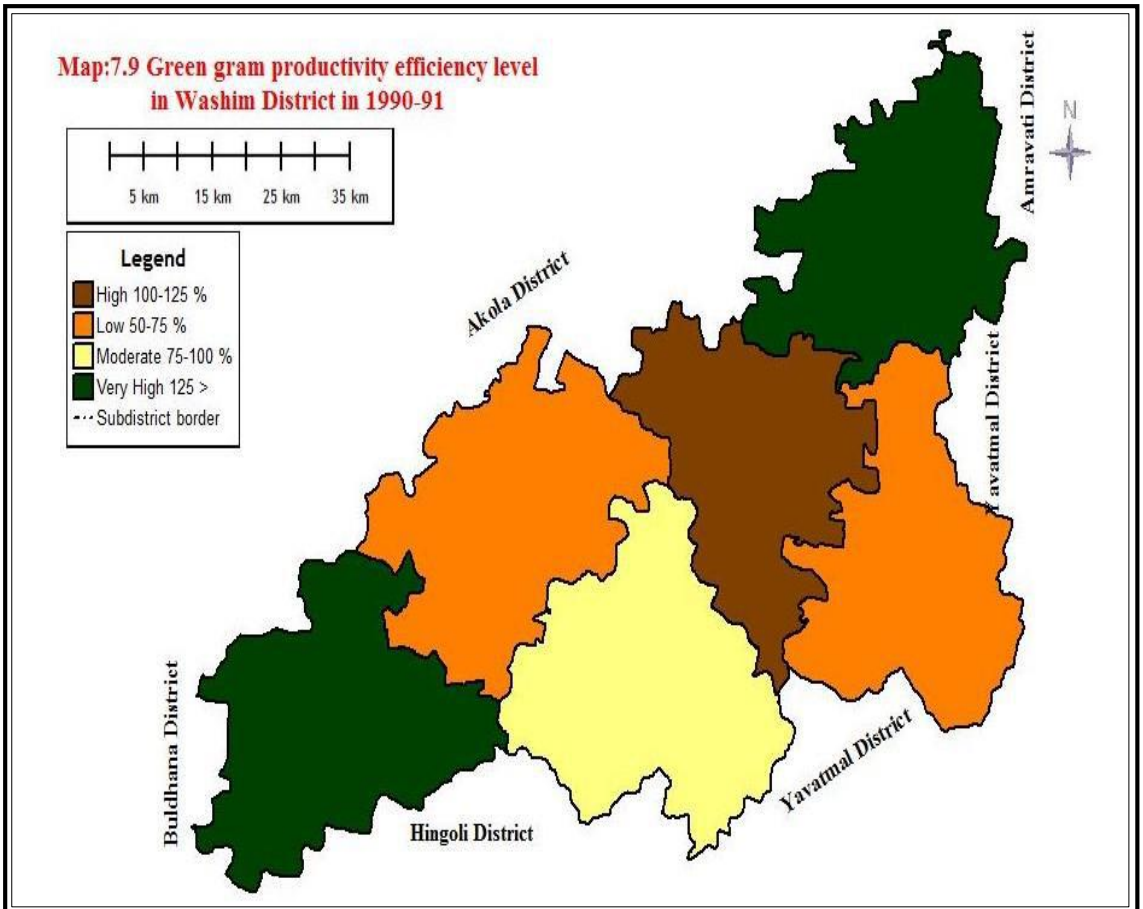
Black Gram crops CPEL is presented in table: 7.4, Graph: 7.5, 7.6 and Map: 7.5, 7.6 is shows the Black gram productivity efficiency level in 1990-91 in study area. By tehsil Washim, Mangrulpir and Karanja tehsil detected high Black gram crops CPEL and it occupies 4.50%, 5.08% and 2.00 % area in both tehsil. Other Risod, Malegaon and Manora tehsil detected Very high in Risod, and other two tehsil low Black gram CPEL and it occupies 2 %, 4.03% and 3.50 % area in both tehsil.

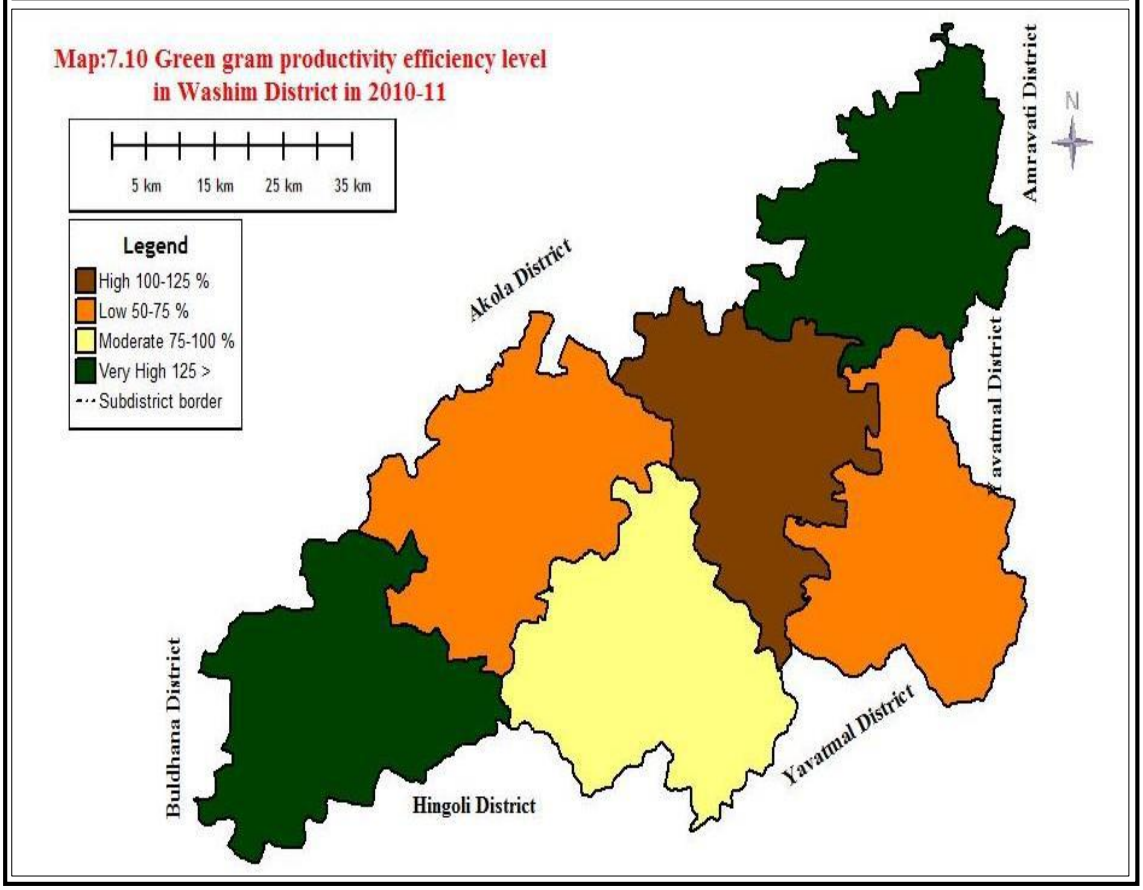
In 2010-11by tehsil Washim, Mangrulpir and Karanja tehsil detected high Black gram CPEL and it occupies 1.85%, 4% and 2.95 % area in both tehsil. The area under Black gram is decreased near to 0.3% to 0.5 % in both tehsil. Risod, Malegaon and Manora tehsil detected very high and moderate Black gram CPEL and it occupies 1.05%, 3.09% and 1.07% area and it decreased near 1% to 2 % in 2010-11.

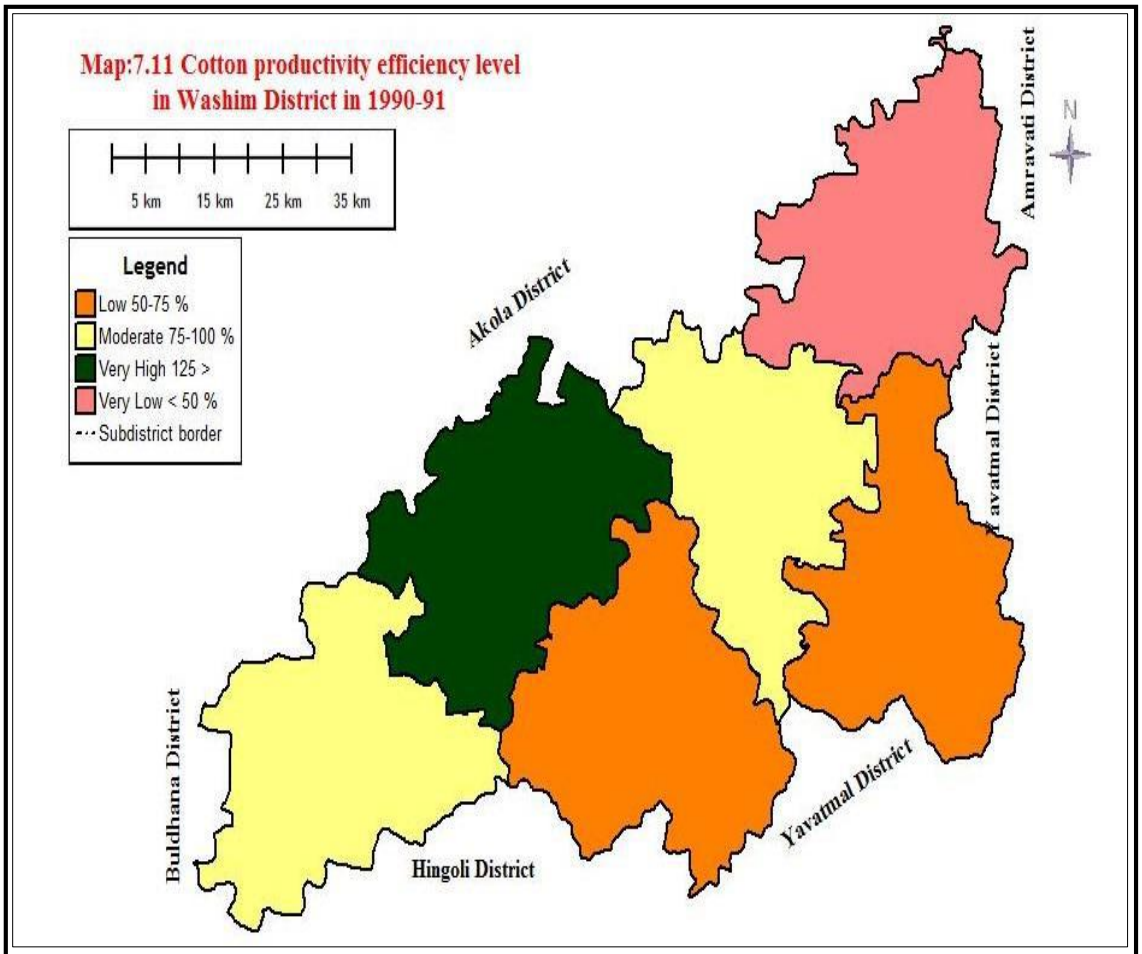
4. Gram:

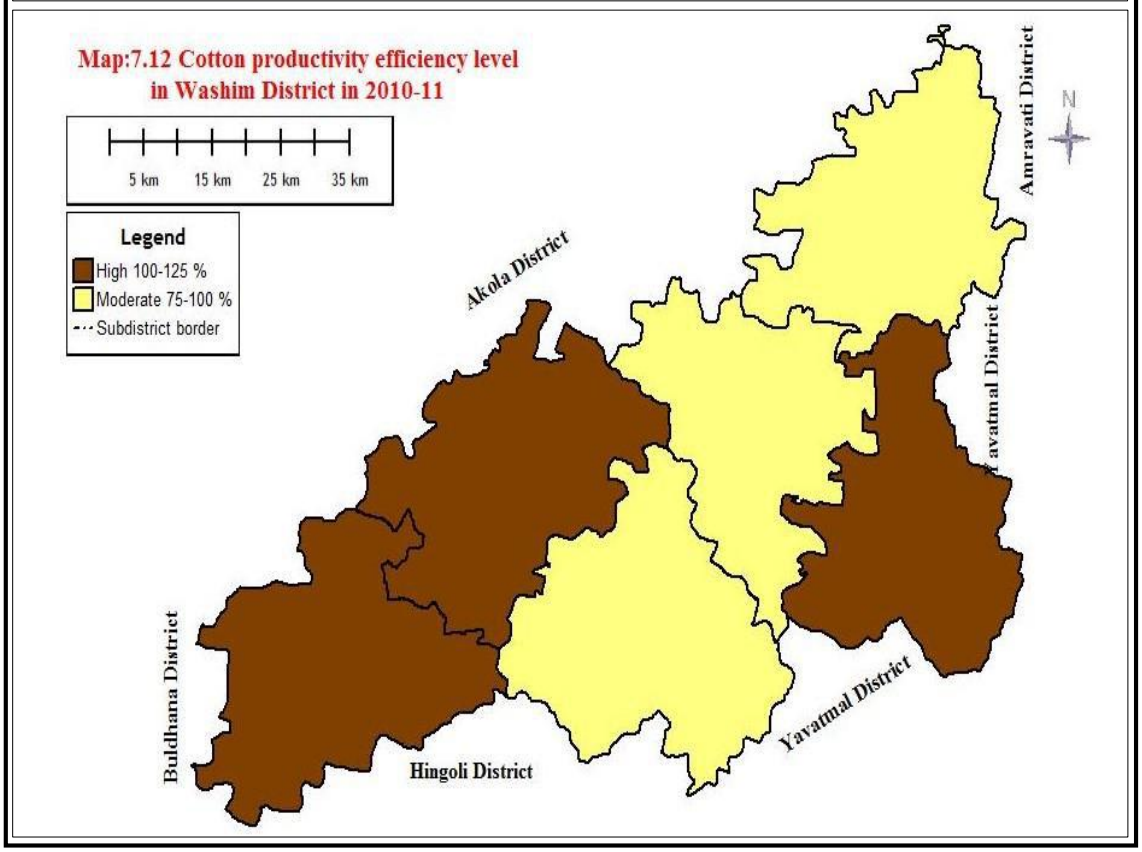
Gram crops CPEL is presented in table: 7.4, Graph: 7.5, 7.6 and Map: 7.7, 7.8 is shows the Gram productivity efficiency level in 1990-91 in study area. By tehsil Mangrulpir, Manora and Karanja tehsil detected Very high and high Gram crops CPEL and it occupies 4.51%, 3.77% and 7.55 % area in both tehsil. Other Washim, Risod and Malegaon tehsil detected Low and moderate Gram crop CPEL and it occupies 7.55%, 12.98% and 3.91 % area in both tehsil.

In 2010-11by tehsil Risod, Malegaon, Mangrulpir and Manora tehsil detected high and Mangrulpir remains constant at very high Gram crops CPEL and it occupies 33.63%, 12.92%, 19.10% and 13.46 % area in both tehsil. The area under Gram crop is increased near to 20.71, 9.01, 14.59 and Manora 10 % in both tehsil. Washim and Karanja tehsil detected moderate Gram crop CPEL and it occupies 15.12% and 6.13 % area and it increased near 7.57 % and in Karanja tehsil it decreased near to 1.42 % in 2010-11.


Map:7.9 Green gram productivity efficiency level
in Washim District in 1990-91
5 km
15 km
25 km
35 km
Legend
High 100-125 %
Low 50-75 %
Moderate 75-100 %
Very High 125 >
Subdistrict border
Akola District
Amravati District
Yavatmal District
Buldhana District
Hingoli District
N


Map:7.10 Green gram productivity efficiency level
in Washim District in 2010-11
5 km
15 km
25 km
35 km
Legend
High 100-125 %
Low 50-75 %
Moderate 75-100 %
Very High 125 >
Subdistrict border
Akola District
Amravati District
Yavatmal District
Buldhana District
Hingoli District
N


Map:7.11 Cotton productivity efficiency level
in Washim District in 1990-91
5 km
15 km
25 km
35 km
Legend
Low 50-75 %
Moderate 75-100 %
Very High 125 >
Very Low < 50 %
Subdistrict border
Akola District
Amravati District
Yavatmal District
Buldhana District
Hingoli District
N

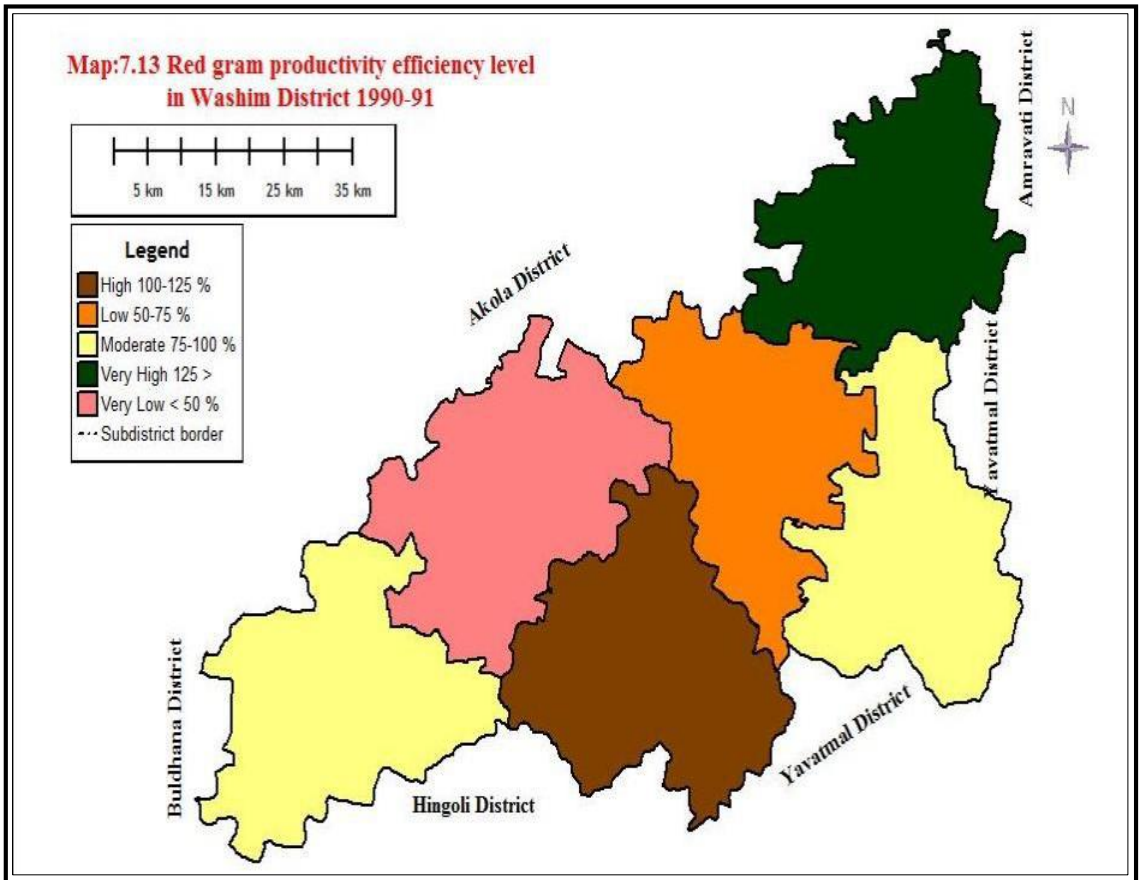

Map:7.12 Cotton productivity efficiency level
in Washim District in 2010-11
5 km
15 km
25 km
35 km
Legend
High 100-125 %
Moderate 75-100 %
Subdistrict border
Akola District
Amravati District
Yavatmal District
Buldhana District
Hingoli District
N

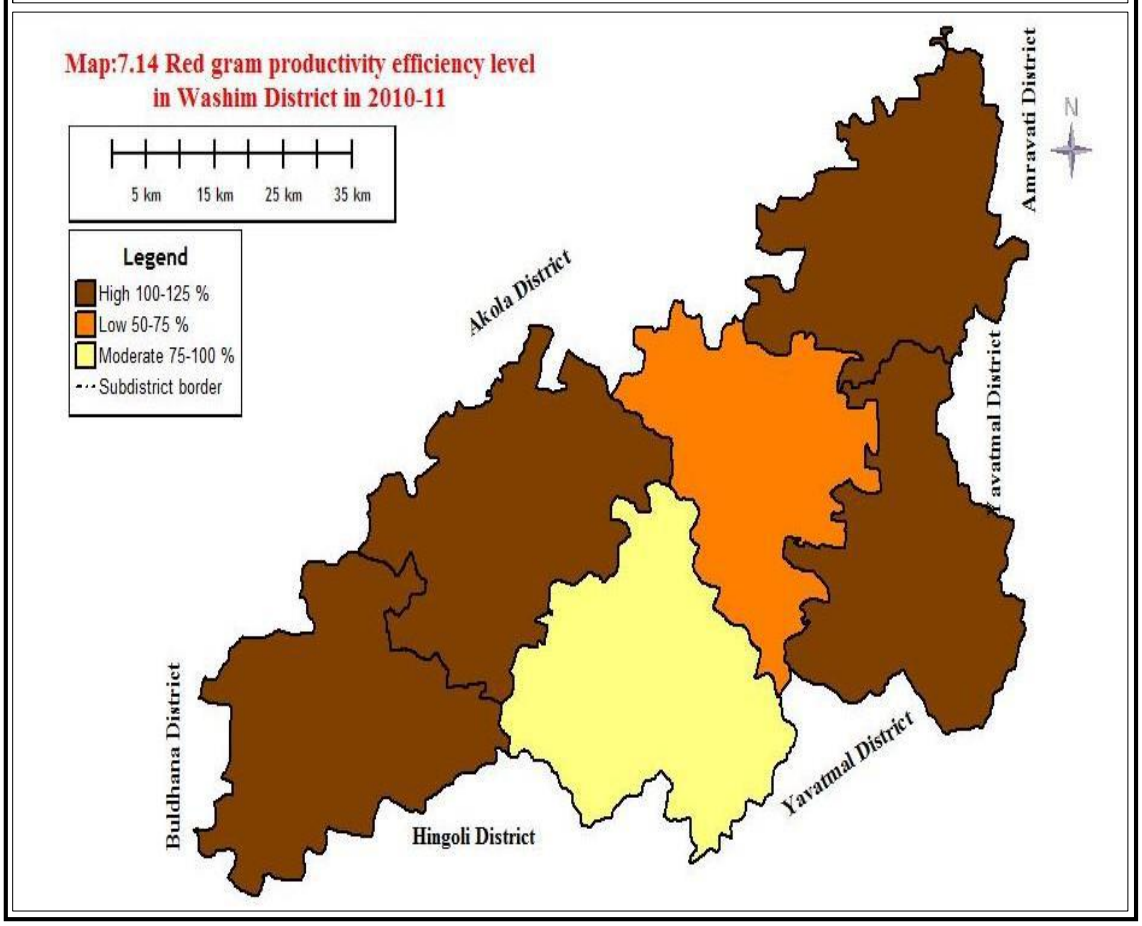
5. Green Gram:

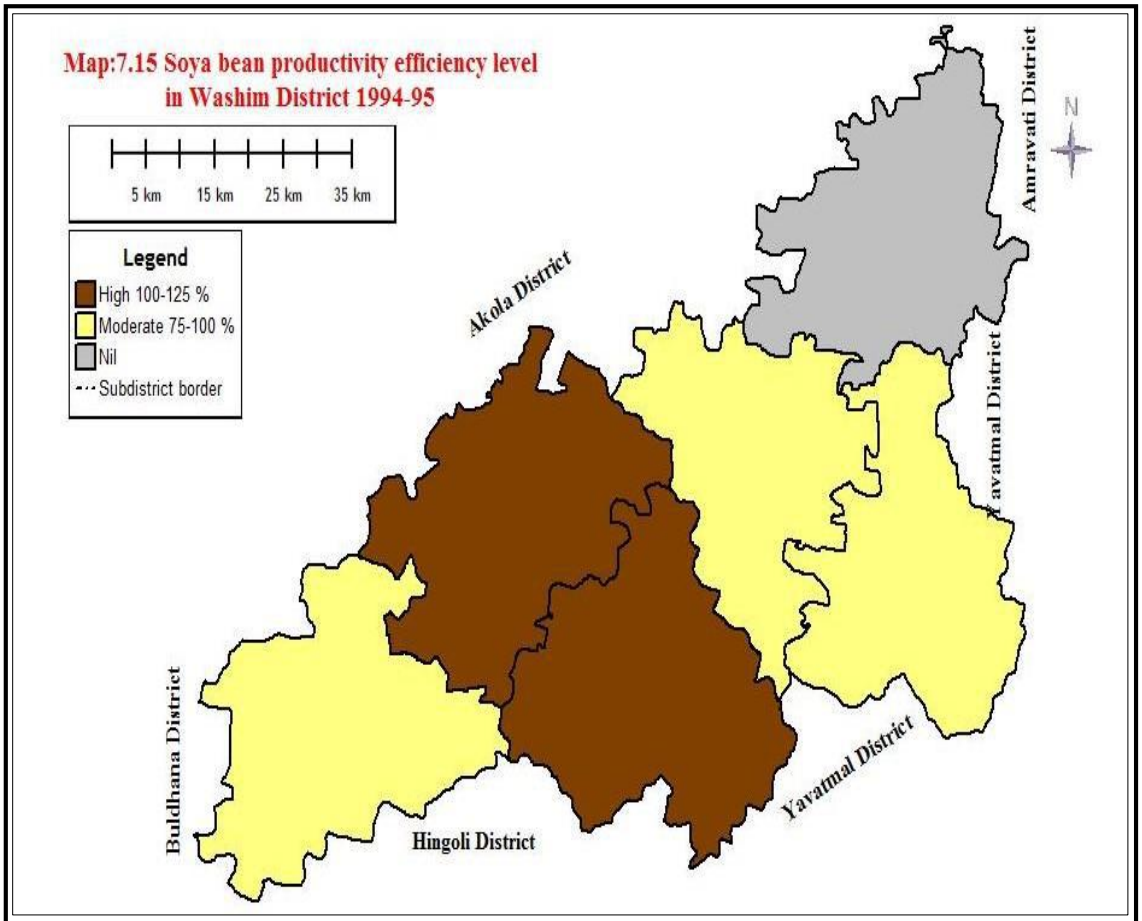
Green gram crops CPEL is presented in table: 7.4, Graph: 7.5, 7.6 and Map: 7.9, 7.10 is shows the Green gram productivity efficiency level in 1990-91 in study area. By tehsil Risod, Mangrulpir and Karanja tehsil detected Very high, high and very high Green gram crops CPEL and it occupies 2.29%, 4% and 2.29 % area in both tehsil. Other Washim, Malegaon and Manora tehsil detected moderate, low and low Green gram CPEL and it occupies 4.80%, 4% and 3.40 % area in both tehsil. In 2010-11by tehsil Risod, Mangrulpir and Karanja tehsil remains constant and both detected same, Green gram crops CPEL and it occupies 1%, 3.54% and 4.12 % area in both tehsil. The area under Green gram crop is decreased near to 1.29%, 1.46% and in Karanja tehsil it is increased up to 1.83 %.Washim , Malegaon and Manora remains constant on their position of Green gram CPEL and it occupies 2.78%, 2.96% and 1.07 % area and it decreased near 2.62%, 1.04% and 2.33 % in 2010-11.

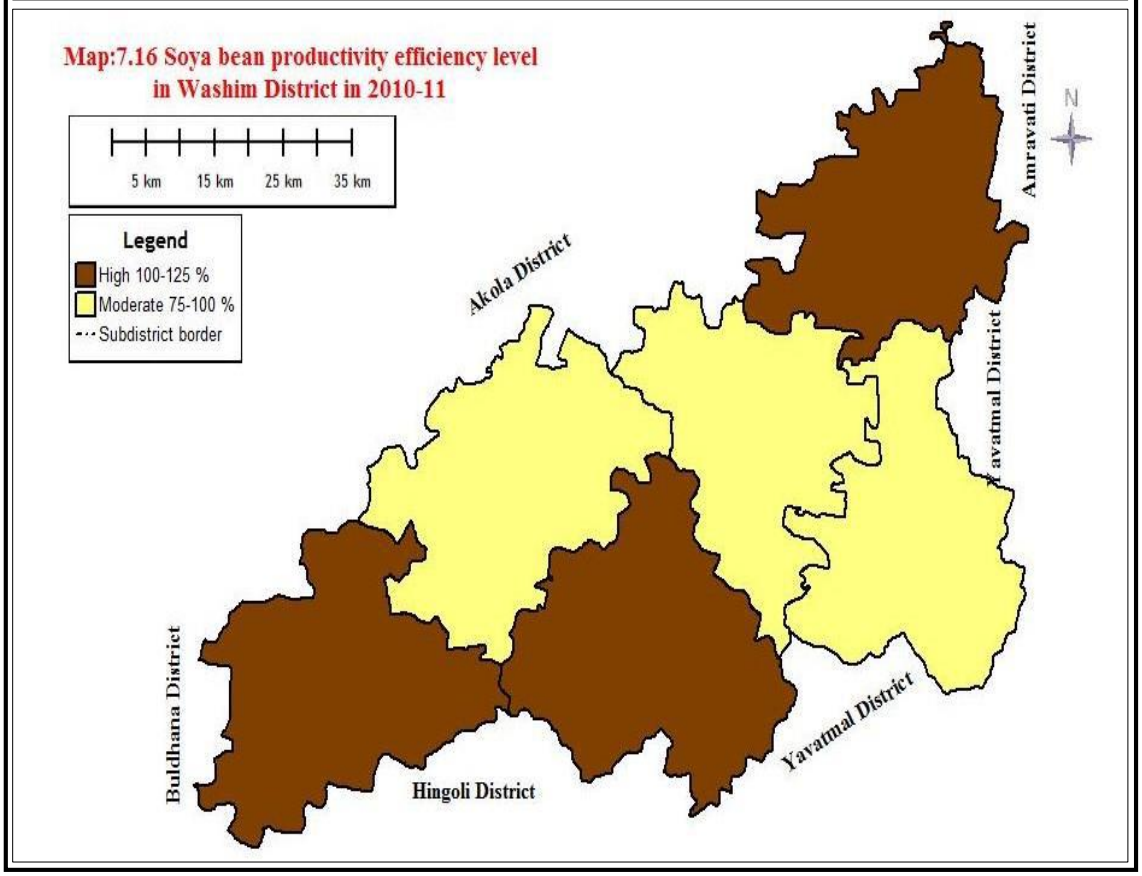
6. Cotton:

Cotton crops CPEL is presented in table: 7.4, Graph: 7.5, 7.6 and Map: 7.11, 7.12 is shows the Cotton productivity efficiency level in 1990-91 in study area. By tehsil Washim, Risod and Malegaon tehsil detected low, Moderate and high Cotton CPEL and it occupies 31.8%, 36.98% and 33.88 % area in both tehsil. Other Mangrulpir, Manora and Karanja tehsil detected moderate, low and very low cotton crop CPEL and it occupies 36.02%, 41.12% and 41.24 % area in both tehsil. In 2010-11by tehsil Washim, Risod and Malegaon tehsil improve their position at Moderate, high and high Cotton crop CPEL and it occupies 1.27%, 0.37% and 2.11% area in both tehsil. The area under cotton crop is decreased up to 30.53%, 36.61% and 31.77 % in both tehsil. Mangrulpir, Manora and Karanja tehsil detected moderate, high and moderate, Manora and Karanja tehsil improve their position at high and moderate cotton crop CPEL and it occupies 6.73%, 19.47% and 15.31 % area and it decreased up to 29.29%, 21.65% and 25.93 % in 2010-11.


Map:7.13 Red gram productivity efficiency level
in Washim District 1990-91
5 km
15 km
25 km
35 km
Legend
High 100-125 %
Low 50-75 %
Moderate 75-100 %
Very High 125 >
Very Low < 50 %
Subdistrict border
Akola District
Amravati District
Yavatmal District
Buldhana District
Hingoli District
Yavatmal District
N


Map:7.14 Red gram productivity efficiency level
in Washim District in 2010-11
5 km
15 km
25 km
35 km
Legend
High 100-125 %
Low 50-75 %
Moderate 75-100 %
Subdistrict border
Akola District
Amravati District
Yavatmal District
Buldhana District
Hingoli District
Yavatmal District
N


Map:7.15 Soya bean productivity efficiency level
in Washim District 1994-95
5 km
15 km
25 km
35 km
Legend
High 100-125 %
Moderate 75-100 %
Nil
Subdistrict border
Akola District
Amravati District
Yavatmal District
Buldhana District
Hingoli District
Yavatmal District
N


Map:7.16 Soya bean productivity efficiency level
in Washim District in 2010-11
5 km
15 km
25 km
35 km
Legend
High 100-125 %
Moderate 75-100 %
Subdistrict border
Akola District
Amravati District
Yavatmal District
Buldhana District
Hingoli District
Yavatmal District
N

7. Red Gram:

Red gram CPEL is presented in table: 7.4, Graph: 7.5, 7.6 and Map: 7.13, 7.14 is shows the Red gram productivity efficiency level in 1990-91 in study area. By tehsil Washim, Risod and Malegaon tehsil detected, high, moderate and very low Red gram CPEL and it occupies 7.52%, 5.98% and 7.12 % area in both tehsil. Mangrulpir, Manora and Karanja tehsil detected low, moderate and high Red gram CPEL and it occupies 6.02%, 5.06% and 6.00 % area in both tehsil.

In 2010-11by tehsil Washim, Risod and Malegaon tehsil detected moderate, high and high Red gram CPEL and it occupies 11.14%, 10.04% and 10.39 % area in both tehsil. Washim loss their position high, it gain moderate and Risod and Malegaon improve their position at high. The area under Red gram crop is increased up to 3.62%, 4.06% and 3.27 % in both tehsil. Mangrulpir, Manora and Karanja tehsil detected low, high and high Red gram CPEL and it occupies 7.62%, 7.61% and 4.33 % area and it increased up to in Mangrulpir, Manora and decreased in Karanja tehsil by 1.67 % in 2010-11.

8. Soya bean:

Soya bean CPEL is presented in table: 7.4, Graph: 7.5, 7.6 and Map: 7.15, 7.16 is shows the Soya bean productivity efficiency level in 1994-95 in study area. By tehsil Washim, Risod and Malegaon tehsil detected high, moderate and high Soya bean CPEL in both tehsil. Other Mangrulpir, Manora and Karanja tehsil detected moderate Soya bean CPEL in both tehsil.

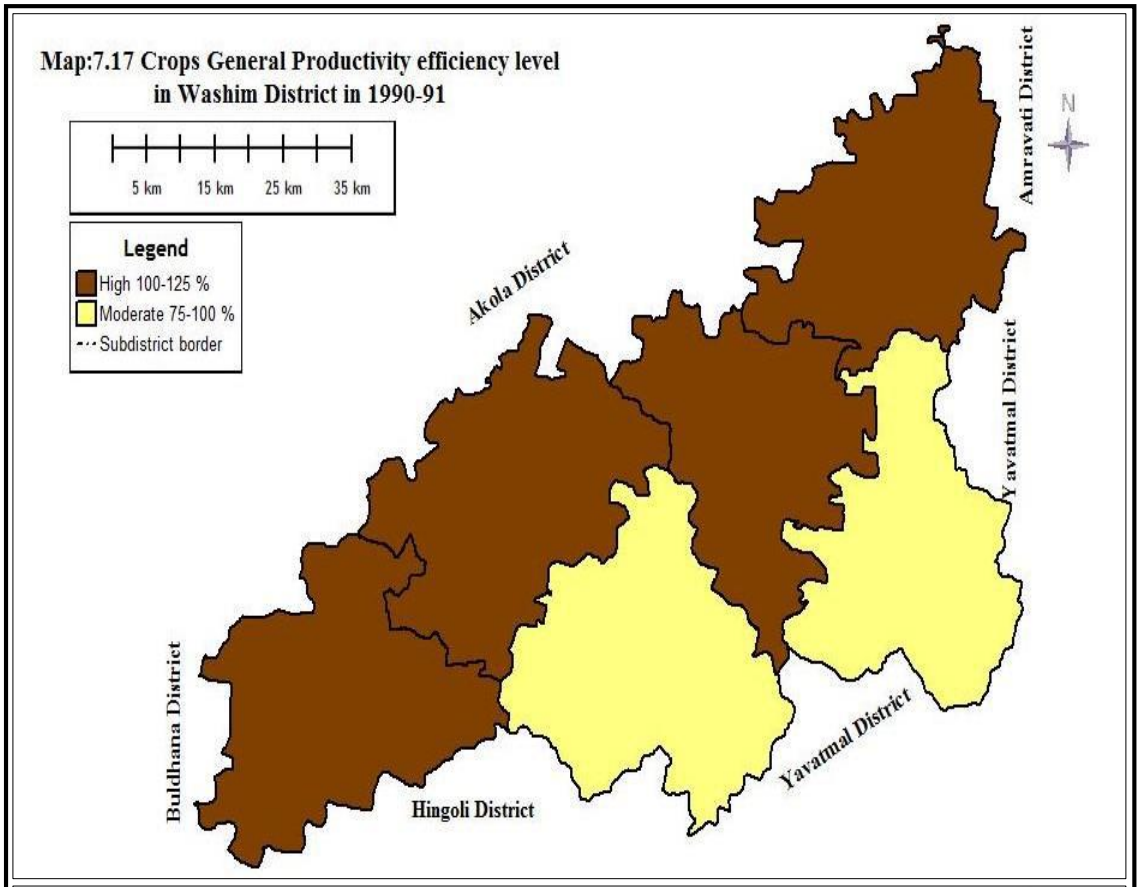
In 2010-11by tehsil Washim, Risod and Malegaon tehsil detected high, high and moderate Soya bean CPEL and it occupies 59.71%, 48.58% and 59.33 % area in both tehsil. The area under Soybean crop is increased 100 % in both tehsil on 1990-91. Mangrulpir, Manora and Karanja tehsil detected moderate, moderate and high Soya bean CPEL respectively and it occupies 45.07%, 42.63% and 57.37 % area and it increased 100 % on 1990-91 in 2010-11.

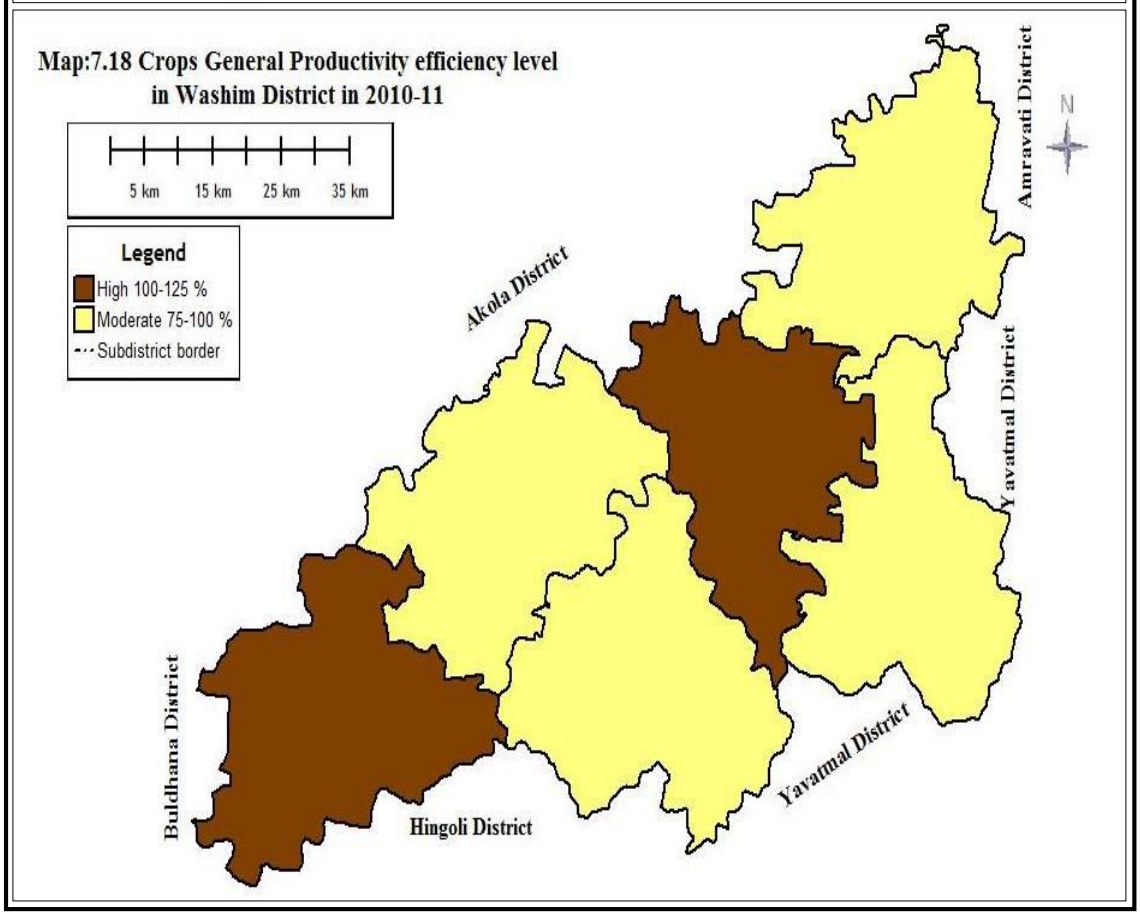
7.6 Changes in general productivity efficiency Level:

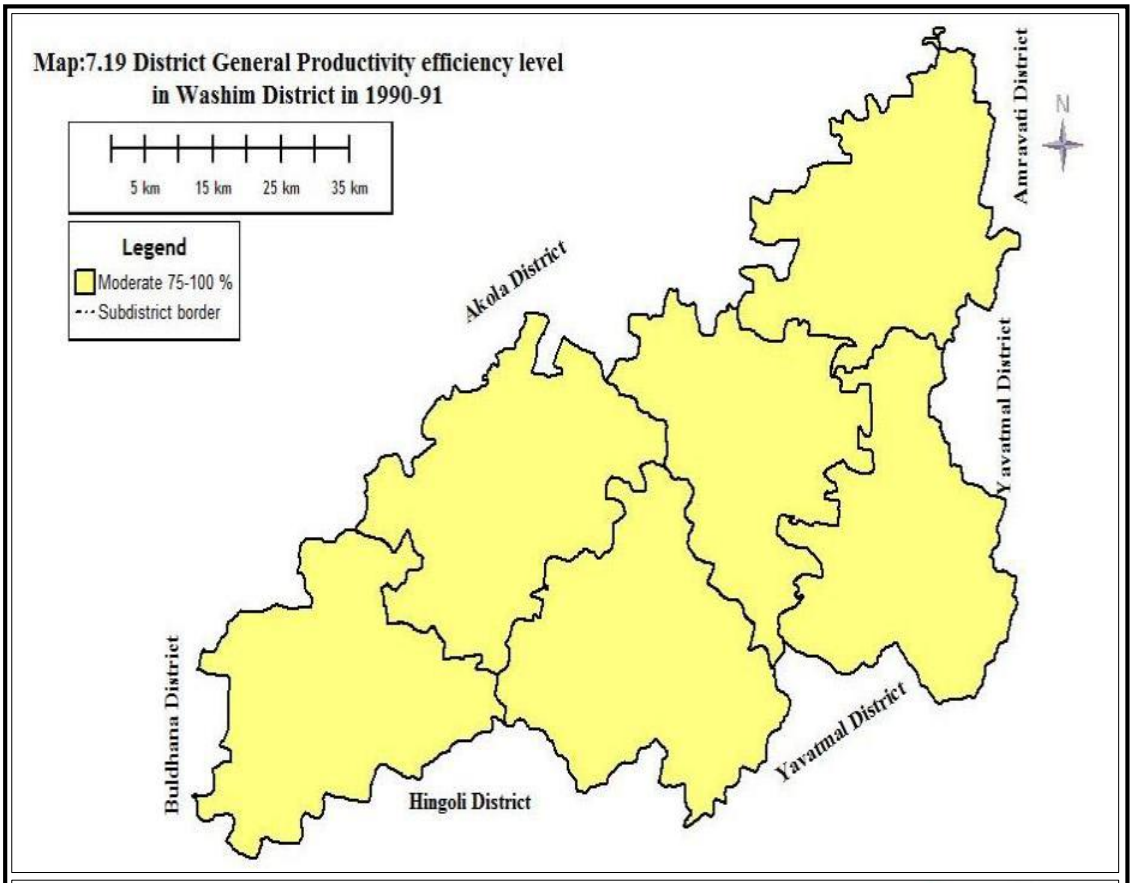
Table: 7.5 Changes in General productivity efficiency level of crops in Washim district 1990-91 to 2010-11

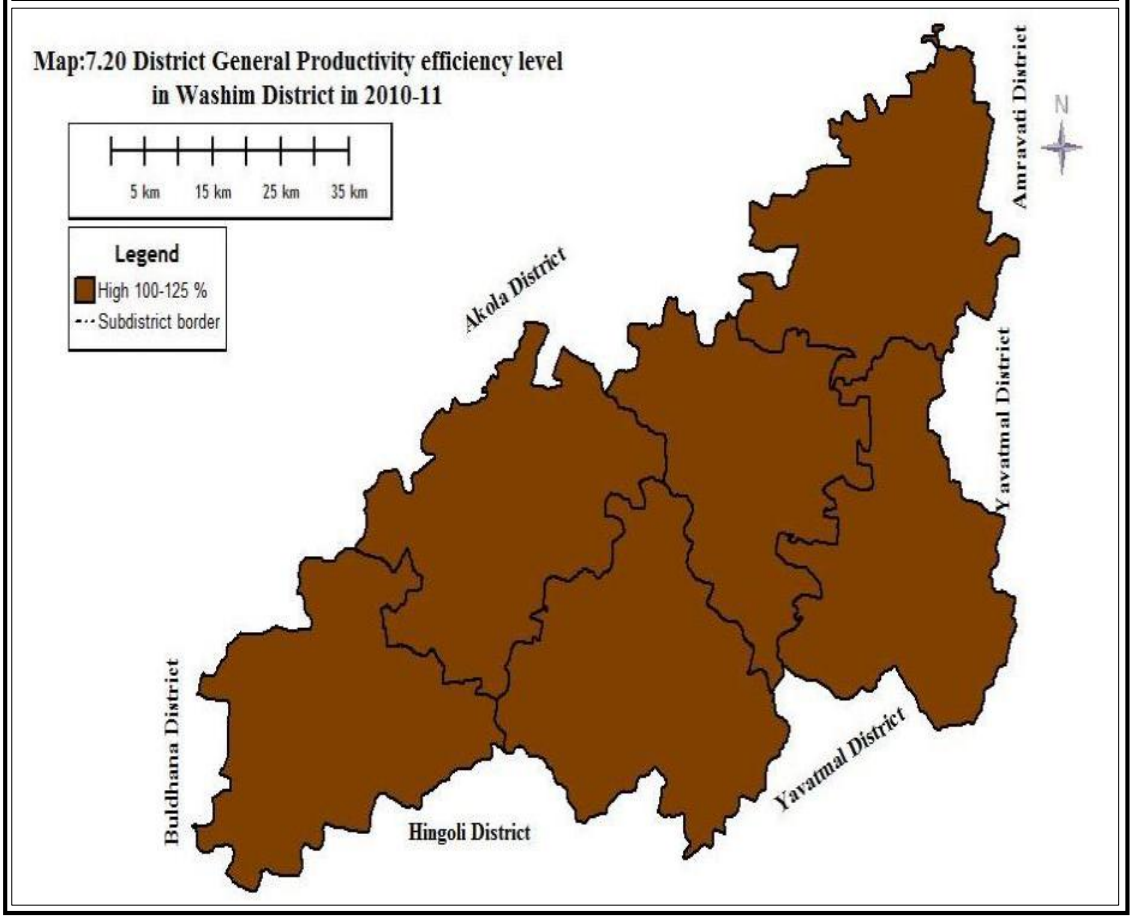
Sr. No.	Tehsil	Years	Crops and Crop productivity efficiency level								
			Soya bean	Jawar	Wheat	Black gram	Gram	Green gram	Cotton	Red gram	General CPEL
1	Washim	1990-91	116*	101	113	111	63	96	56	104	95
		2010-11	110	101	102	108	90	97	98	81	98.37
2	Risod	1990-91	91*	112	89	140	84	141	76	96	103.62
		2010-11	111	117	82	129	104	135	101	108	110.87
3	Malegaon	1990-91	109*	93	107	74	79	53	270	41	103.25
		2010-11	87	116	78	82	103	60	107	108	92.62
4	Mangrulpir	1990-91	96*	113	113	115	128	106	82	69	102.75
		2010-11	86	116	111	110	135	105	97	70	103.75
5	Manora	1990-91	87*	111	93	54	111	69	72	82	84.87
		2010-11	86	114	129	67	105	73	101	123	99.75
6	Karanja	1990-91	Nil	70	85	105	135	135	44	206	111.42
		2010-11	118	58	97	104	83	130	95	102	98.37
7	Washim district	1990-91	99.8	100	100	99.83	100	100	100	99.66	99.78
		2010-11	99.66	103.66	99.83	100	103.33	100	99.83	98.66	100.62

Source: calculated by author. Note: CPEL: crops productivity efficiency level.


Map:7.17 Crops General Productivity efficiency level
in Washim District in 1990-91
5 km
15 km
25 km
35 km
Legend
High 100-125 %
Moderate 75-100 %
Subdistrict border
Akola District
Amravati District
Yavatmal District
Buldhana District
Hingoli District
Yavatmal District
N


Map:7.18 Crops General Productivity efficiency level
in Washim District in 2010-11
5 km
15 km
25 km
35 km
Legend
High 100-125 %
Moderate 75-100 %
Subdistrict border
Akola District
Amravati District
Yavatmal District
Buldhana District
Hingoli District
Yavatmal District
N


Map:7.19 District General Productivity efficiency level
in Washim District in 1990-91
5 km
15 km
25 km
35 km
Legend
Moderate 75-100 %
Subdistrict border
Akola District
Amravati District
Yavatmal District
Buldhana District
Hingoli District
Yavatmal District
N


Map:7.20 District General Productivity efficiency level
in Washim District in 2010-11
5 km
15 km
25 km
35 km
Legend
High 100-125 %
Subdistrict border
Akola District
Amravati Distriet
Yavatmal Distriet
Buldhana Distriet
Hingoli District
Yavatmal District
N

The overall or general productivity efficiency level was moderate in Washim and Manora tehsil and it is continue in 2011. The high general productivity efficiency level detected in Risod, Malegaon, Mangrulpir and Karanja tehsil in 1991. It continue in Risod and Mangrulpir tehsil, Malegaon and Karanja reverse at moderate in 2010-11(Table: 7.6, Map: 7.17, 7.18). Manora tehsil remain constant at moderate general productivity efficiency level in 2010-11. Area or district overall productivity efficiency level of crops was moderate in 1990-91 and it gain high general productivity efficiency level in 2010-11 (Table: 7.6, Map: 7.19, 7.20).

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Chapter-VIII

Micro Level Study of Sample Villages

Chapter-VIII

Micro Level Study of Sample Villages

8.1 Introduction:

Within the earlier Chapters, the efforts were made to assess the spatial analysis of agricultural land use pattern with an exploratory approach using quantitative measures and finally identified the agricultural regions in the Washim district. In detail study of six villages in the district is practically hard and time consuming and not possible. The investigator has aimed to study the sample villages, representative of region concerned for detailed and intensive study with a view to assess the present land use patterns, its difficulties and predictions.

The objectives stated for this detailed study of sample villages are as:

1. To assess and study the spatial pattern of agricultural land use for 2013-2014 and explain the agricultural land use patterns in six sample villages.
2. To examine the changes in agricultural land use pattern and find out the responsible factors.
3. To detect the problems of agricultural and suggest measures for proper and competent land use to sample villages.

8.2 Sources of data:

Previous year's Agricultural land use data readily available in the Land Records of concerned villages. For every individual crop have been obtained for selected villages for the year 2013-14 in both Kharif and Rabbi Crops. The data of different crops was managed and converted into % to net sown area and have been used for representing. In order to know the serial changes in crop area, the data of every individual crop were collected, and converted into % to net sown area and explained. The remote data have been produced by planning questionnaire. The field survey in person served to discover the representative picture of broad soil types. The appropriate cartographic

method used for viewing soil types, land use and agricultural land use patterns for the sample villages. The village Sarpanch, farmers and Talhati were the prime source of discovering the facts related to study aspects.

8.3 Methodology:

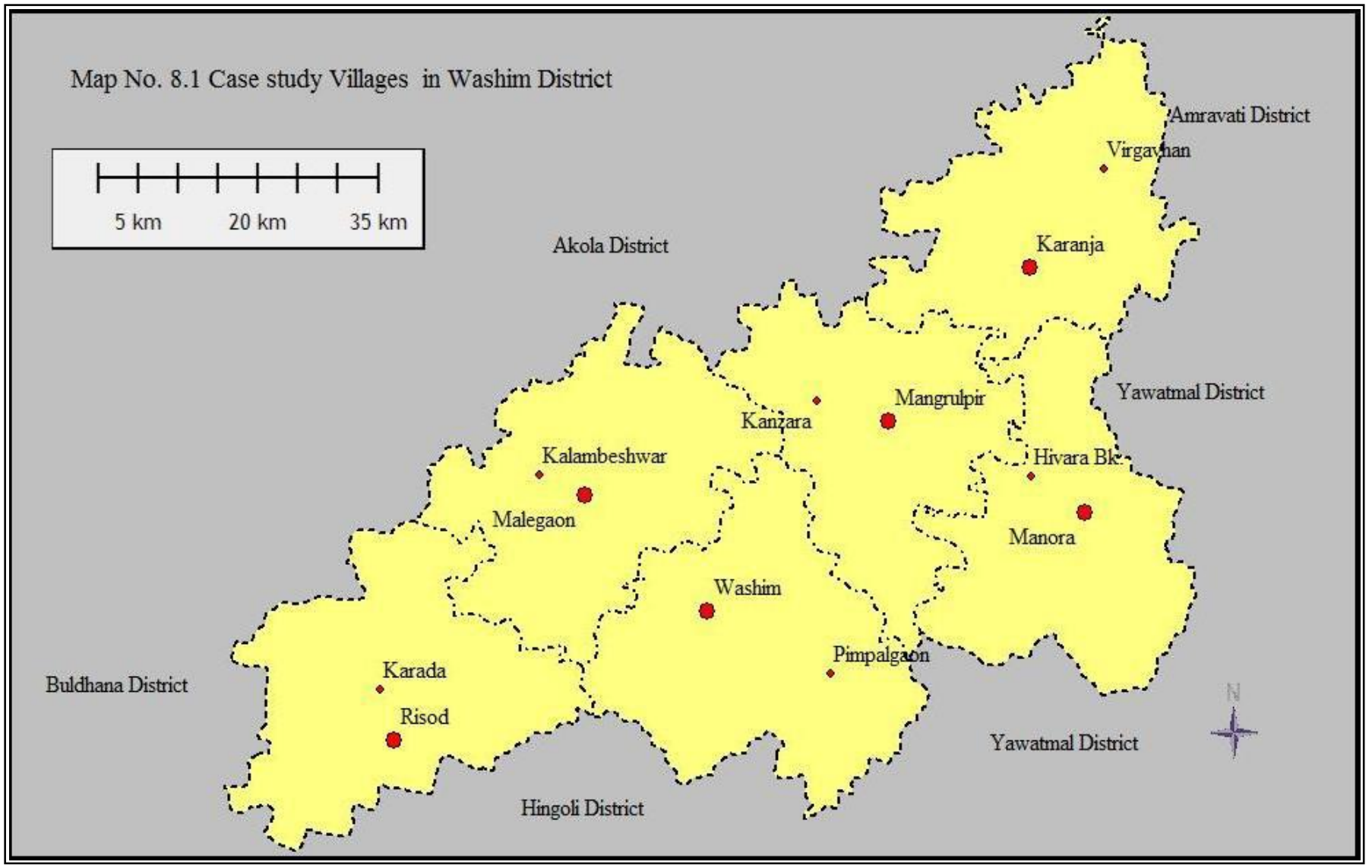
A Sample is accepted as one of the method of selecting symbolic unit of the region. It is suitable for obtaining precise information of agricultural land use patterns and problems of land use. The preferred results can be obtained by detailed study of representative units. There is a satisfying fact that survey of selected samples is substantial help if an area is of uniform in physical and socio-economic situations. Sampling method provides realistic results at low cost and within minimum time. Samplings are random, stratified and purposive. The selection mostly depends on purpose of research.

Table No. 8.1 Sample Villages in Washim District 2011

Sr. no.	Name of the villages	Area (hectares)	Population (2011)	Density/ Km^2
1	Pimpalgaon	1082	2518	233
2	Karda	963	2115	220
3	Kalambeshwar	972	1896	195
4	Kanzara	514	2135	415
5	Hiwara (Bk.)	619.64	1523	246
6	Virgavhan	417.34	722	173

Source: census of India 2011

The limitations of the analysis of all villages in the study area, the selection has given on six villages. These villages were selected by random sampling method and studied at micro level. The sample villages measured as representative of the district concerned, reflecting up the agricultural situation in 2013-2014. Map No. 8.1 shows the location of sample villages in the Washim district and above Table No. 8.1 shows the population area and density of selected villages.


Map No. 8.1 Case study Villages in Washim District
5 km
20 km
35 km
Amravati District
Virgavhan
Karanja
Akola District
Yawatmal District
Mangrulpir
Kanzara
Kalambeshwar
Hivara Bk.
Malegaon
Manora
Washim
Pimpalgaon
Karada
Buldhana District
Risod
Yawatmal District
Hingoli District
N

8.4 Features to be studied:

For the consequent and extensive analysis of agricultural land use patterns in sample villages, the following features have been considered for investigation.

1. Introduction.
2. Soil.
3. Changes in general land use.
4. Changes in agricultural land use.
5. Land use and population.
6. Social and economic situation of farmers.

8.5 Method of inquiry:

A questionnaires have been prepared to obtain the details about agricultural land use and social as well as economic conditions of the farmers.

The questionnaire covers the features as, crops structure, farm implements, sowing methods, selection of seeds and family background, village administration to throw light on another sources of income, farming system, farmer's attitude towards the agriculture etc. The interviews were conducted on field and first come first preference given to visiting sample land holdings. In addition these, which data not readily available and other pertinent information on agricultural land use have been collected from Sarpanch and Talhati. Both has been found helpful to throw light on the features accepted for investigation.

8.6 Agricultural Seasons:

In general Kharif and Rabbi are two common seasons in agricultural calendar in the study area. The Kharif is most important season growing nearly 92.61 % (2013-14) area under crops. The crops in kharif are generally sown in June or July and harvested in November or December which include Cotton, Jawar, Black Gram, Soybean, Green Gram, Red Gram and Bajra. The Rabbi begins in November and the crops are Gram, wheat, Jawar, safflower, Sunflower and linseed.

8.7 Soil:

National Soil Sample Survey and District Soil Survey have prepared soil maps showing broad groups of soil types for Washim District. This map does not give accurate and realistic picture of soil types at the village level. So the researcher in order to make detailed study of soil types of sample villages based on personal field to field observations during the field work. The local soil classification has been adopted in the present study. This classification covers Pathari soil, Madhyam soil and Black soil (shallow black soil, medium deep black soil and deep black soil).

8.8 Livestock:

Livestock is an integral part of agriculture most of the agricultural operations, such as ploughing, harrowing, transport etc. are carried out with the help of draught animals. Cows and buffaloes are a sources of milk. Besides the livestock provide much of the organic manure used on the farms. Therefore in addition of crops drought and milk stock are raised and maintained by an individual farmer. The goat is the major supplier of meat in the selected villages, in addition it yield s milk and is a valuable source of leather. The rearing of goat is relatively less arduous and cheaper when compared to other livestock. Livestock play an important role in the village economy. Livestock raising has superiority over crop cultivation with respect of growth, stability and resource conservation. The proportion of cattle population varies from village to village.

8.9 Agricultural Implements:

Mechanism of agriculture implies the application of mechanical power in place of human and animal power involving greater investment of capital in agriculture. Simply means the use of tractors, power operated pump sets, threshers, etc. their impact of improving farm production. Farm performance per unit of agricultural land has been considerable. The number of agricultural implement in different villages are grouped in to three development categories as: 1. Developed 2. Developing 3. Under developed.

8.10 Micro level study of sample Villages:

The spatial and temporal analysis of agricultural land use patterns have been studied in sample villages. The spatial analysis is exclusively based on field work in person during the year 2013-14 to investigate the general and agricultural land use patterns. The longitude and latitude of sample villages have been identified by using GIS and Remote Sensing technique. The detailed and intensive study of sample villages as:

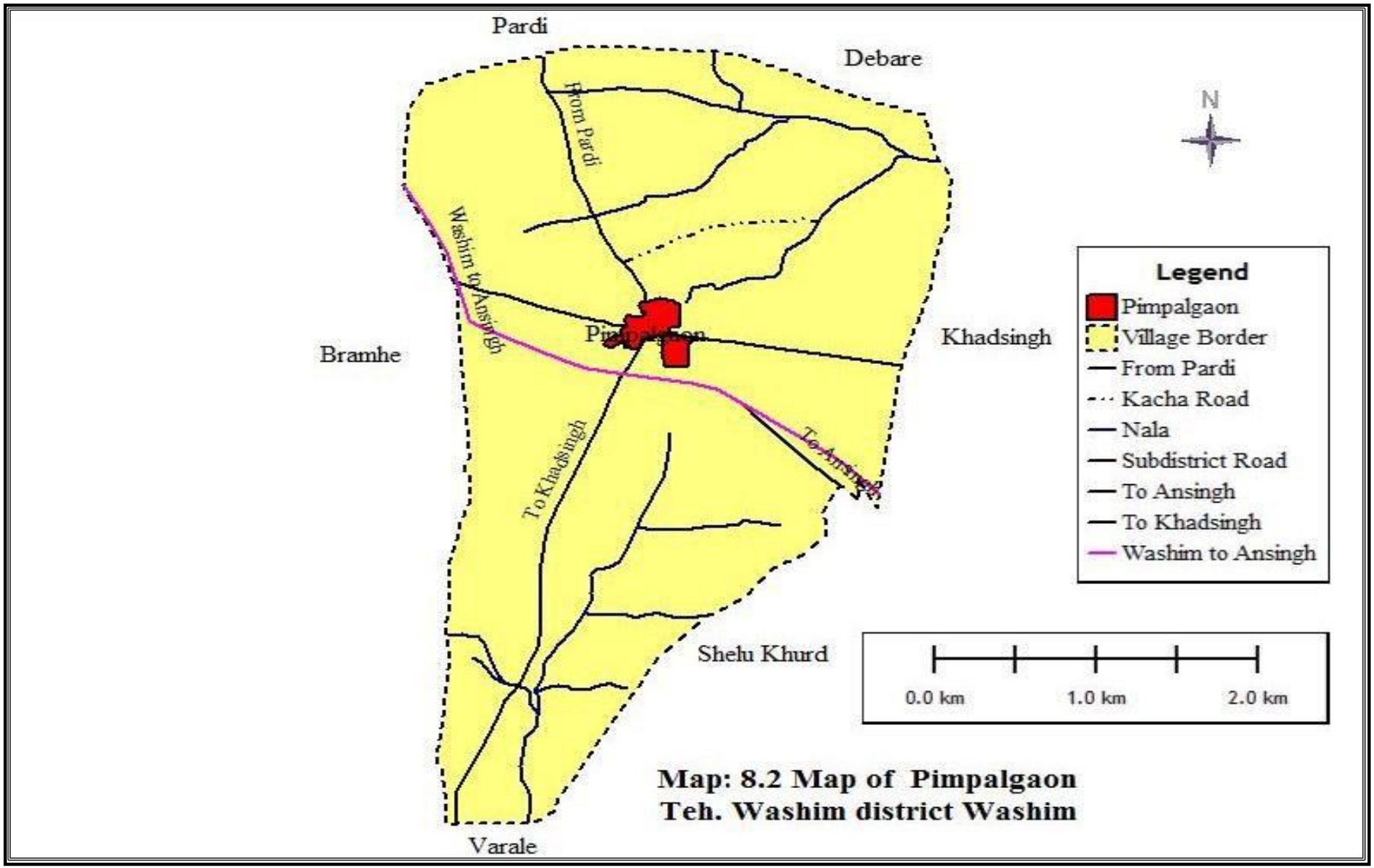
8.10.1 Micro level study of Pimpalgaon:

1. Introduction:

The Village Pimpalgaon has an area 1082 hectares. It is located in the south East in Washim tehsil of Washim district. The population resides 2518 persons in 2011 with density of 2.33 persons per hectare. The Map: 8.2 the surrounding villages can be noticed. It is situated on $20^0$1"26' to 20^0 4"6' North latitude and 77^0 16"8' to 77^0 17"23' East longitude. The village is representative of partly development of agricultural activity. The general slope is towards the northeast and south which is evident from the flow of water in Nalas (Map: 8.2). The gaothan is situated in northern part in the village area on the north side of state highway. The tar roads appear leading to Varale, Pardi and Khadsingh. State highway No. 67 passes through this village from Washim to Anshingh.

2. Soils:

The soil of Pimpalgaon is coarse shallow with minute variations in texture and color. There are three types of soils, sandy clay, clay loam and loam. Sandy clay is relatively inferior to clay loam and loam. Due to low fertility of sandy soil, hardy crops like, Green gram, local Jawar is cultivated. Another soil, clay loam and loamy is fertile than sandy clay. This soil type is suitable for growing cotton, wheat, gram and Jawar.



Map: 8.2 Map of Pimpalgaon
Teh. Washim district Washim

3. Changes in Livestock:

Table No. 8.2 shows the livestock changes in Pimpalgaon. Cows are increased by 8.05 %, Bulls are decreased by 8.33%, Buffalos are increased by 10 %, Goat are increased by 50 % and poultry birds increased by 25 % from 2001 to 2014.

Table No. 8.2 Livestock in Pimpalgaon

Sr. No.	Years	Cows	Bulls	Buffalo	Goat	Poultry
1	2000-2001	180	120	80	150	200
2	2013-2014	325	110	88	225	250
3	% Change +/-	8.05	-8.33	10	50	25

Source: Based on survey.

4. Changes in Agricultural implements:

Improvements in agricultural implements shows table No. 8.3, use of Machine powered implements is increased so the number of wooden plough, Iron plough, and oil engine decreased. Use of electric pumps, tractors, and tractor driven implements is increased.

Table No. 8.3 Agricultural Implements in Pimpalgaon

Wooden plough	Iron Plough	Engine	Electric Pump	Tractor	Carts	Harrow	Seed Drills	Auto seed drills	Thresher
2000-2001									
48	100	03	95	12	45	08	125	10	06
2013-2014									
25	85	02	110	20	35	10	75	15	12
Change + or -									
-23	-15	-1	15	8	-10	02	-50	05	06

Source: based on survey.

5. Changes in General Land use:

The general land use types of Pimpalgaon are shown in Table: 8.4. Out of the total area of 1082 hectares, 900 hectares land is under cultivation accounting for 83.18 per cent to total geographical area.

Table No. 8.4 Changes in General Land use in Pimpalgaon

Sr. No.	Land use types	Area in hectares		% to total area		% change + or -
		2001	2011	2001	2011	
1	Net sown area	900	900	83.18	83.18	00
2	Cultivable waste	102	102	9.43	9.43	00
3	Fallow land	14	14	1.29	1.29	00
4	Land not available for cultivation	66	66	6.10	6.10	00
5	Forest	Nil	Nil	Nil	Nil	Nil
6	Total cropped area	1225	1218	113.22	112.57	-0.65
7	Total geographical area	1082	1082	100	100	-
8	Irrigation	45	63	4.16	5.82	1.66

Source: Based on survey, Gaon Kamgar Talhati Pimpalgaon.

This cultivated land spreads over the area. The area not available for cultivation is 6.10 per cent to total geographical area followed by cultivable waste 9.43 per cent and fallow land 0.37 per cent. Village has enough land under plough. The double crops are worth mentioning accounting for 30.41 per cent land to total geographical area. The personal visit, observations and interviews of farmers of Pimpalgaon revealed that the well irrigation is very important in village, hence it covers 5.82 percent area to total area.

Table: 8.4 shows the trends of different land use types of Pimpalgaon during the span of more than one decades 2000-01-2013-14. It is apparent that the net sown area decreased. The total decrease in net sown area is 0.65 per cent. Other land use types in Pimpalgaon have constant in their percentage. The area under land not available for cultivation is constant, fallow land 0.18 per cent and cultivable waste 9.43 per cent in Pimpalgaon.

6. Changes in Agricultural Land use:

Pimpalgaon has 900 hectares under cultivation. Out of this, 29.57 % area was double cropping. Irrigated area is found 5.82 per cent land to total area. The crops are sown in two seasons, kharif and rabbi. Cotton, Jawar, Bajri, pulses, Wheat, Gram and soya bean. Amongst these, cotton and Jawar are raised on large area accounting for 31.02 % and 34.2 % to net sown area in 1990.91. In 2013-14 cotton and jawar decrease the area under these crops near to 3.39 % and 0.65.

Table 8.5 Changes in Agricultural Land use in Pimpalgaon

Sr. No.	Crops	% to NSA		% change + or -
		1990-91	2013-14	
1	Cotton	31.02	3.39	-27.63
2	Rice	3.05	Nil	Nil
3	Jowar	34.2	0.65	-33.55
4	Bajra	1.2	Nil	Nil
5	Wheat	2.90	10.91	8.01
6	Black-Gram	4.25	1.42	-2.83
7	Green-Gram	4.20	1.43	-2.77
8	Red-Gram	7.22	14.68	7.46
9	Gram	7.30	15.07	7.77
10	Soybean	Nil	51.46	51.46
11	Orange	-	0.65	0.65
12	Mango	-	0.13	0.13

Source: Based on survey, Gaon kamgar talathi Pimpalgaon.

Wheat accounts for 2.90 % to net sown area are raised in rabbi season and it shows increase in area under this crops up to 10.91 % in 2013-14. Other crops raised in rabbi season are, gram covers 7.30 and 15.07 % land to net sown area in Pimpalgaon. Table: 8.5 shows the changes in agricultural land use pattern in Pimpalgaon from 1990-91 to 2013-14.

Two crops, cotton and Jawar have decreasing trend during study period. It is clear from Table: 8.5 that the rate of decrease in percent of cotton is comparatively low than the Jawar. This indicates the dominance of, cotton and Jawar in 1990-91.The overall decrease in % under cotton is 27.63 % to net sown area. Cotton had grown on 31.02 % to net sown area in 1990-91 while it was 3.39 % to net sown area in 2013-14. This significant decrease in % under this crop is attributed to changes in agricultural land use pattern. New improved varieties of Soya bean for sowing and therefore cotton is lost his first rank in Pimpalgaon. The similar trend is also observed in case of Jawar for the span of more than two decades. Soya bean increased by 51.46 % and has wide distribution in the village. Among other crops, jowar presents remarkable decline trend in Pimpalgaon that of other crops, pulses, other cereals and oilseed total decline of local Jawar is 33.55 per cent due to low yield per hectare and high expenses for production. The area under Black gram and Green gram is decreased near to 2.80 % in the village but Red gram and Gram shows increase in area under this crops up to 7.56 % in 2013-14.

7. Changes in Land use and Population:

Table No. 8.6 Changes in Land use and Population in Pimpalgaon

Sr. No.	Land use categories	Area in hectares		Land/ head		Change
		2001	2011	2001	2011	+ or -
1	Total village area	1082	1082	0.48	0.43	-0.05
2	Land for cultivation	900	900	0.40	0.36	-0.04
3	Total kharif crops area	896	898	0.39	0.36	-0.03
4	Total rabbi crops area	329	320	0.14	0.13	-0.01
5	Gross cropped area	1225	1218	0.54	0.48	-0.06

Source: Compiled by Author

Table No. 8.6 shows the land use and population. It is clear from this table that population has relative pressure on land available for cultivation and there for land available for cultivation shows 0.40 in 2001and 0.36 hectare per head of population in 2011. Moreover, it has been observed that area of kharif crops

have more land per head of population than the rabbi crops in the village. It is 0.0.39 hectare per head in area under kharif while 0.13 hectare per head of population is in rabbi in 2011.

This fact explains that kharif area has dominance pressure of population in Pimpalgaon. The demographic characteristics are shown in Table 8.7 the population density increases in Pimpalgaon through time. The density increased by 23 persons per 100 hectare during the period of 2001 to 2011.

Table 8.7 Changes in Demographic Characteristics of Pimpalgaon

Sr. No.	Categorise	Years		Change + or -
		2001	2011	
1	Total Population	2274	2518	10.72
2	Density of Population	210	233	10.95
3	Literacy percentage	74.40	68.14	-3.21
4	Per capita land	0.40	0.36	-0.04
5	% of farm workers to total workers	92.78	89.76	-3.02

Source: Census of India, Washim District 2001, 2011

Table 8.8 Changes in Occupational Structure of Pimpalgaon

Sr. No.	Categories	Years		% to population		Change + or -
		2001	2011	2001	2011	
1	Cultivators	599	519	50.30	39.08	-11.22
2	Agri. Labourers	506	673	42.48	50.68	8.20
3	Marginal workers	07	07	0.58	0.53	-0.05
4	Other workers	82	88	6.9	6.63	-0.27
5	Total workers	1191	1328	52.10	52.74	0.64
6	Non workers	1083	1190	47.62	47.26	-0.36
7	Total population	2274	2518	100 %	100 %	10.73

Source: census of India, Washim district 2001, 2011

It was registered 210 persons per km^2 in 2001 while it is noticed 233 persons per km^2 in 2011 due to population growth. The working force has also showed upward trend and decreased by 3.02 per cent to total workers. The

decrease in working force uncovers the decreasing pressure of population on land in Pimpalgaon but per capita land in the village is very low (0.36 hectare per person). Literacy aspect in Pimpalgaon presents decrease by 3.21% in 2011. The cultivators have decreased 50.30 per cent and 39.08 per cent but agricultural laborers have increased 42.48 % to 58.68 % to total workers from 2001 to 2011. These facts explain the dominance of agriculture activity in the village (Table: 8.8) Pimpalgaon.

8. Socio Economic situation of Farmers:

The majority of farmer's, economic situation is good. This village 65.85 % farmers have wells and 70.73 % farmers have electric pump sets. Therefore farmers improve their agricultural operation. Small farmers do not possess tractors but they hire the agricultural implements, buy improved seeds. They are even able to invest, money on implements and has improving agriculture. The needed capital is available to farmers through bank loans (87.80%). There is no need to each and every farmer perches agricultural implements but some farmers buy the agricultural implements (12.19%) through bank loans. All farmers purchase improved varieties of seeds, fertilizers, pesticides and insecticides. Other aspect, size of holding affects agriculture. It was noticed that majority of farmers have less than two hectares land disintegrated in various pieces and therefore efficient land use is lacking. Small size land holders are not possessed of improved implements. It is found that small farmers are borrowing implements from others. Moreover, somewhat have adverse effect on existing agricultural land use pattern in Pimpalgaon. But 60.97 % farmers says agriculture is not forfeitable for them.

9. Conclusion:

Agriculture in Pimpalgaon is partly developed due to many reasons, as more than 60 per cent land is clay loam and loam, where yield per hectare is moderate, economic condition of big farmers are good, and therefore farmers purchase improved implements, seeds, and pesticides. Soya bean, cotton and Red gram are major crops in Kharif and Wheat and Gram crops in Rabbi

Season. Other crops are of little significance as they altogether cover nearly less than 10 % land to net sown area in the village. Red gram is sown, mixed with Soya bean. It is noticed that agricultural labors are increased from 2001 to 2011. Irrigation is practiced on 5.82 per cent area to total area. Available of agricultural inputs, communication but shortage of irrigation, are indicates the partly development of the village.

8.10.2 Micro level study of Karda Village:

1. Introduction:

The Village Karda has an area 963 hectares. It is located in the middle part in Risod tehsil of Washim district. The population resides 2115 persons in 2011 with density of 2.20 persons per hectare. The Map: 8.3 the surrounding villages can be noticed. It is situated on 20^0 1' 11 to 20^0 1'15 East latitude and 76^0 45'31 to 76^0 46'47 North longitude. The village is representative of partly development of agricultural activity. The general slope is towards the north which is evident from the flow of water in Nallas and River Penganga flows from northern boundary of village (Map: 8.3). The gaothan is situated in middle part in the village area on the west side of district road.

2. Soil type:

The personal observations during field work three soils types are observed, sandy clay, clay loam and loam. These soil types are locally known as Pathari, madhyam and Kali soils

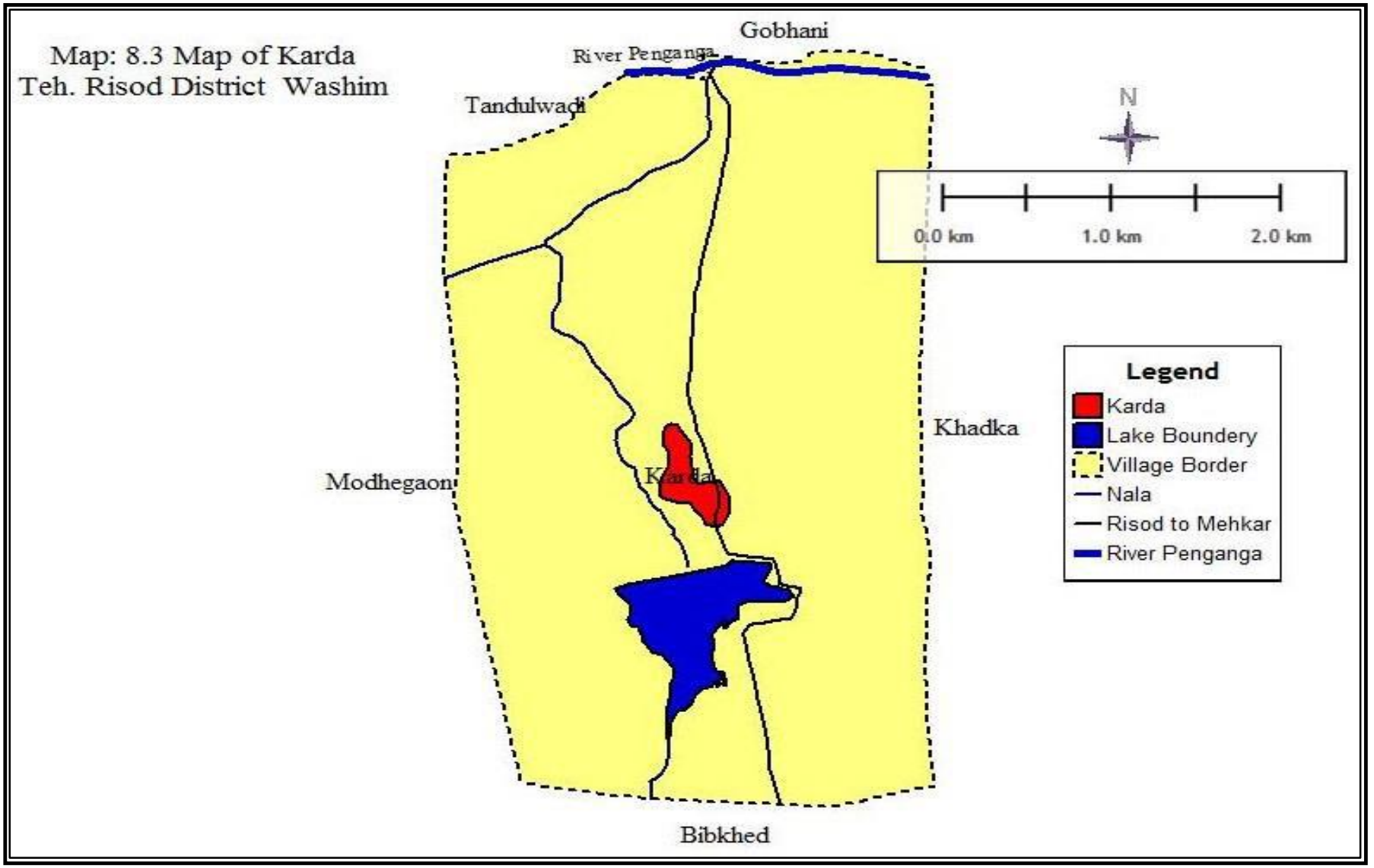
3. Changes in Livestock:

Table: 8.9 Livestock in Karda

Sr. No.	Years	Cows	Bulls	Buffalo	Horses	Goat	poultry
1	2000-2001	185	80	60	06	60	50
2	2013-2014	196	76	61	03	55	75
3	Change +/-	11	-04	01	-03	-05	25

Source: Based on survey.

Table 8.9 shows the changes in livestock in village Karda. Cows, Bulls and Buffalo are in majority and they shows the increasing trend in number of cows and other shows decreasing trend with in fourteen years. The poultry birds are mainly local and they are raised near house and they are increased.


Map: 8.3 Map of Karda
Teh. Risod District Washim
Gobhani
River Penganga
Tandulwadi
N
0.0 km
1.0 km
2.0 km
Legend
Karda
Lake Boundery
Village Border
Nala
Risod to Mehkar
River Penganga
Khadka
Modhegaon
Karda
Bibkhed

4. Changes in Agricultural Implements:

Table: 8.10 Agricultural Implements in Karda

Wooden plough	Iron Plough	Engine	Electric Pump	Tractor	Carts	Harrow	Seed Drills	Auto seed drills	Thresher
2000-2001									
89	75	06	36	05	25	03	45	02	02
2013-2014									
40	55	03	49	08	15	08	36	06	06
Change + or -									
-49	-20	-03	13	03	-10	05	-09	04	04

Source: based on survey.

The table: 8.10 shows the increase in improved agricultural implements with in fourteen years. Traditional implements decreased rapidly because agricultural operation cost become low with modern implements. Small farmers brought the implements on hire.

5. Changes in General Land use:

Table 8.11 Changes in General Land use Pattern in Karda

Sr. No.	**Land use types**	**Area in hectares**		**% to total area**		**% change + or -**
		2001	**2014**	**2001**	**2014**	
1	Net sown area	680	680	70.61	70.61	00
2	Cultivable waste	190	190	19.73	19.73	00
3	Fallow land	03	03	0.31	0.31	00
4	Land not available for cultivation	90	90	9.35	9.35	00
5	Forest	Nil	Nil	Nil	Nil	00
6	Total cropped area	1107	1083	114.95	112.46	-2.49
7	Total geographical area	963	963	100	100	00
8	Irrigation	45	60	4.67	6.23	1.56

Source: Based on survey, Gaon Kamgar Talhati, Karda

The land use types under different categories are shown in Table 8.11. Karda has 680 hectares (70.61 % to total geographical area) under cultivation. The land not available for cultivation is 9.35 % to total geographical area. The fallow land covers 0.31 % to total geographical area. Cultivable waste, accounting for 19.73 % to total geographical area. It is observed that the fallowed land has deliberately kept under this category in order to region fertility. The double crop area in Karda is significant as 41.85 % to total geographical area. Whereas 6.23 % to total geographical area is under irrigation. There are normal changes in general land use with in fourteen years. Table: 8.11 present changes in general land use pattern in Karda from 2000-2001 to 2013-14. The area in % under net sown area has been constant. The net sown area had 70.61 % to total geographical area in 2000-2001 which was constant in 2013-14. The land not available for cultivation was 9.35 per cent during fourteen years. Cultivable waste was not brought under plough therefore this land shows constant (19.73 % to total geographical area). The fallow land has constant by 0.31 per cent to total geographical area. Forest cover is almost absence in Karda.

6. Changes in Agricultural Land use Pattern:

Cultivable 70.61 % area is under cultivation and 65.69 per cent farm workers in Karda. Agriculture in Karda is partly developed. Soil type is largely influenced on existing agricultural land use pattern. Generally, fertile land is devoted to cotton and Jawar (Table: 8.12). Both cotton and hybrid Jawar are dominant crops covering 36 % and 34 % to net sewn area respectively. Among rabbi crops, wheat occupies larger areal extent of 21 % to net sown area in clay loam soils, while gram is covering 16.61 % to net sown area. Individually cover less than 1.00 per cent to net sown area.

Table 8.12 shows changes in agricultural land use pattern in Karda for the span of fourteen years (2000-01 to 2013-14). The village has dominance of agricultural activity involving 91.38 % working force to total workers in agriculture. This indicates slight positive change in improving agriculture.

But overall progress of agricultural land use is changed. It is clear from Table 8.12 that cotton and Jawar have 00 per cent and 0.32 per cent to net sown area respectively.

Table 8.12 Changes in Agricultural Land use in Karda

Sr. No.	Crops	% to NSA		% change + or -
		1990-91	2013-14	
1	Cotton	36.25	Nil	Nil
2	Rice	0.45	Nil	Nil
3	Jawar	34.25	0.32	-33.93
4	Bajra	0.70	Nil	Nil
5	Wheat	1.68	21.00	19.32
6	Gram	3.06	16.65	13.59
7	Black-Gram	2.00	1.68	-0.32
8	Green-Gram	2.29	Nil	Nil
9	Red-Gram	5.68	9.90	4.22
10	Soybean	Nil	46.37	46.37
11	Safflower	-	0.64	0.64
12	Maize	-	0.32	0.32

Source: Based on survey, Gaon Kamgar talhati Karda

The rate of increase of Soya bean is high 46.37% (Table 8.12). This fact explains positive attitude of farmers to prefer high yielding varieties of soya bean in the place of local Jawar and cotton therefore areal extent has remarkably declined in Karda. The table 8.12 shows significant decline under local Jawar and cotton. Changes in area under crops shows positive trends in gram, wheat, red gram and soya bean.

7. Changes in Land use and Population:

Table 8.13 summarizes the per capita share of land to various categories of land use in Karda. The per capita land is 0.54 hectare. The per capita land available for cultivation is 0.38 hectare.

Table 8.13 Changes in Land use and Population in Karda

Sr. No.	Land use categories	Area in hectares		Land/ head		Change + or -
		2001	2011	2001	2011	
1	Total village area	963	963	0.54	0.45	-0.09
2	Cultivable area	680	680	0.38	0.32	-0.06
3	Total kharif crops area	680	680	0.38	0.32	-0.06
4	Total rabbi crops area	427	403	0.24	0.19	-0.05
5	Gross cropped area	1107	1083	0.62	0.51	-0.11

Source: Compiled by Author

Table 8.14 Changes in Demographic Characteristics of Karda

Sr. No.	Categorise	Years		% Change + or -
		2001	2011	
1	Total Population	1773	2115	19.29
2	Density of Population	184	220	19.56
3	Literacy percentage	74.70	73.90	-0.80
4	Per capita land	0.54	0.45	-0.09
5	% of farm workers to total workers	91.38	65.81	-25.57

Source: Census of India, Washim District 2001, 2011

Table 8.15 Changes in Occupational Structure of Karda

Sr. No.	Categories	Years		% to population		% Change + or -
		2001	2011	2001	2011	
1	Cultivators	684	441	72.77	41.88	-30.89
2	Agri. Labourers	175	252	18.62	23.93	5.31
3	Marginal workers	75	283	7.98	26.87	18.89
4	Other workers	76	67	8.08	6.36	-1.72
5	Total workers	940	1053	53.02	49.79	-3.23
6	Non workers	833	1062	46.98	50.21	3.23
7	Total population	1773	2115	100	100	19.29

Source: census of India, Washim district 2001, 2011

Further it is reduced to 0.38 hectare per capita and in area under kharif crops and 0.24 in rabbi crops area. This fact reflects dominance of kharif hectares in the village. The population has steadily increased from 2001 (Table 8.13). It was 1773 persons in 2001 while 2115 persons in 2011 with density of 1.84 and 2.20 persons per hectare respectively. Literacy has not found increase significantly. 65.81 per cent working force is engaged in agriculture. This suggests dominance of agriculture. The occupational structure of Karda is presented in Table 8.15 showing population engaged in various occupations proportion to total population and total workers. Both except cultivators and agricultural laborers are increased in number between 2001 and 2011. Cultivators have decreased from 684 to 441 while agricultural laborers have registered an increase from 175 to 252 in Karda. Total decrease of cultivators is 30.89 per cent to total population. The increase in number under agricultural laborers indicates involvement in single agricultural activity.

8. Socio Economic condition of Farmers:

The majority of farmer's, economic situation is good and therefore farmers significantly improve their agricultural operation. Small farmers do not possess tractors but they hire the agricultural implements, buy improved seeds. They are even able to invest, money on implements and has improving agriculture. The needed capital is available to farmers through bank loans. There is no need to each and every farmer perches agricultural implements but big farmers buy the agricultural implements through bank loans. All farmers purchase improved varieties of seeds, fertilizers, pesticides and insecticides.

9. Conclusion:

The Karda village has basically dominance of agriculture involving 65.81 per cent working force to total workers. Agriculture of village is supported by number of cultivators and agricultural laborers which increased during the span of ten years. Soya bean, red gram and black gram are grown as major crops in kharif crops. Soya bean occupies 46.37 per cent to net sown area

while red gram raised on 9.91 per cent to net sown area. Wheat accounts 21 per cent to net sown area and gram 16.65 % on clay loam soils. Most of the farmers are familiar with improved seeds and fertilizers. The farmers in Karda are conservative in their attitude. Village become handicapped without irrigation. So village is partly developed.

8.10.3 Micro level study of Kalambeshwar village:

1. Introduction:

Kalambeshwar located in the Middle West part in Malegaon tehsil of Washim district, having 972 hectares area and population of 1896 (2011) with density of 1.95 persons per hectare. It is situated on $20^0$15'15 to 20^0 16’48 North latitude and 76^0 58'5 to $76^0$59’8 East longitude on nearly 471 meters above sea level. The location of this village is given in Map 8.4. It is surrounded by Varangi and Dahi in the east, mungla and Pangri in west, Golsangvi in north and Vadap in South. The gaothan is at center within the village area (Map 8.4). The general slope is toward north-west. It is evident from the Nallas and River Katepurna flowing towards north. Kalambeshwar has 86.30 % working force engaged in agriculture and 12.58 % area is irrigated to total geographical area.

2. Soils:

Village belongs to medium black soil zone. The soil of Kalambeshwar can be classified into three types, sandy loam, clay loam, and loam. The clay soil type is suitable for Red gram is successfully raised. Clay loam is suitable for Cotton and Jowar are cultivated in this soil type. This soil is relatively fertile than sandy loam. Generally clay and clay loam soils can be categorized as deep black soils. The sandy loam is low fertility where hardy crops are grown which yielding is low per hectare.

3. Changes in Livestock:

Table: 8.16 Livestock in Kalambeshwar

Sr. No.	Years	Cows	Bulls	Buffalo	Horses	Goat	Poultry
1	2000-2001	233	96	65	01	195	82
2	2013-2014	196	74	49	00	165	65
3	Change +/-	-37	-22	-14	00	-30	-17

Source: Based on survey.

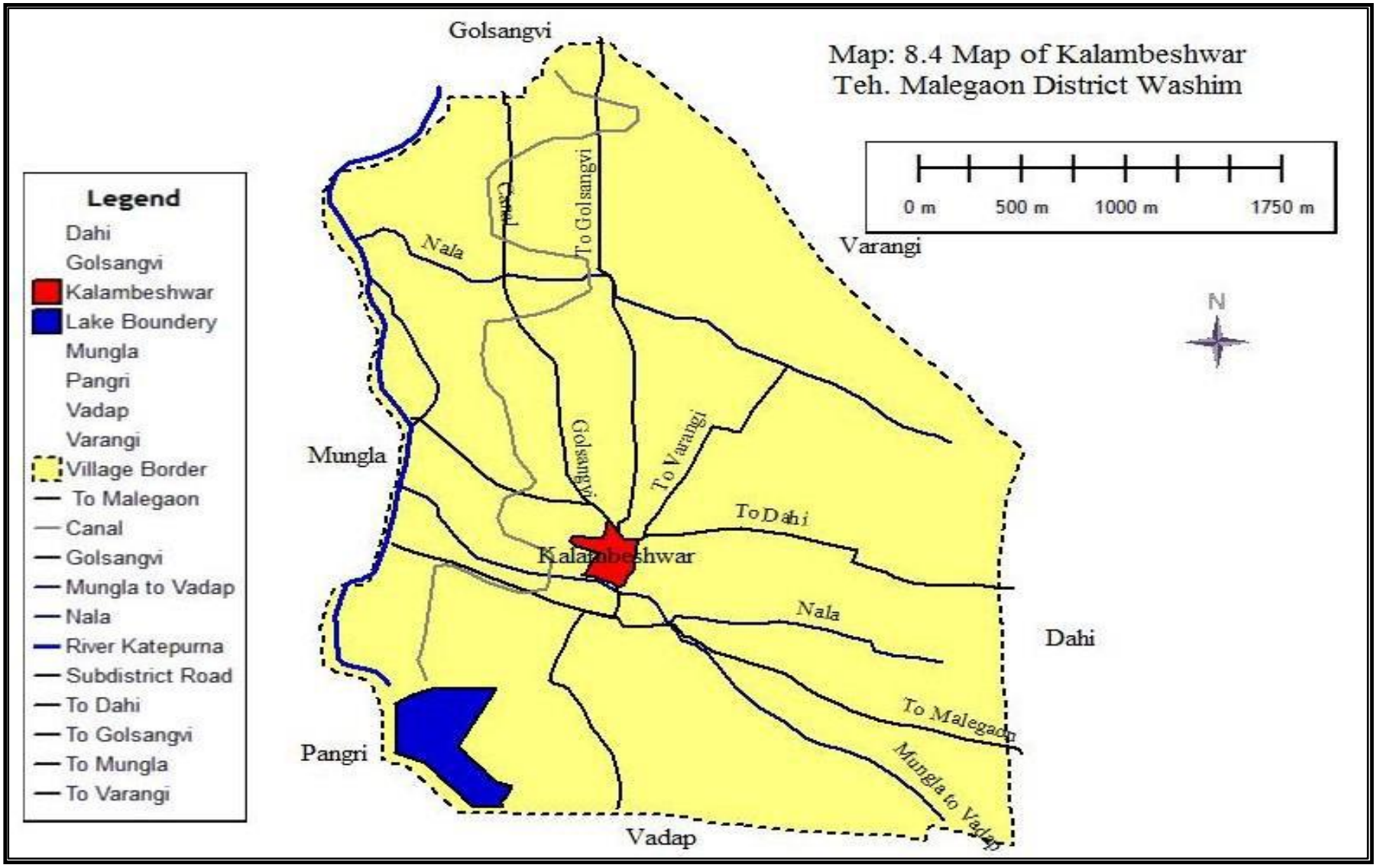

Map: 8.4 Map of Kalambeshwar
Teh. Malegaon District Washim
Legend
Dahi
Golsangvi
Kalambeshwar
Lake Boundery
Mungla
Pangri
Vadap
Varangi
Village Border
To Malegaon
Canal
Golsangvi
Mungla to Vadap
Nala
River Katepurna
Subdistrict Road
To Dahi
To Golsangvi
To Mungla
To Varangi
0 m
500 m
1000 m
1750 m
N
Golsangvi
Varangi
Mungla
Dahi
Pangri
Vadap
Kalambeshwar
Canal
To Golsangvi
Nala
Golsangvi
To Varangi
To Dahi
Nala
To Malegaon
Mungla to Vadap

Table 8.16 shows the livestock of village is decreasing rapidly because of area under cultivable waste is decreasing and use of tractors and improved implements were used in farm operation.

4. Changes in Agricultural implements:

Table: 8.17 Agricultural Implements in Kalambeshwar

Wooden plough	Iron Plough	Engine	Electric Pump	Tractor	Carts	Harrow	Seed Drills	Auto seed drills	Thresher
2000-2001									
63	85	06	58	08	41	03	80	03	05
2013-2014									
23	56	05	65	12	36	06	59	06	07
Change + or -									
-40	-30	-01	07	04	-05	03	-21	03	02

Source: based on survey.

Table 8.17 shows the agricultural implements. Traditional implements decreasing rapidly because use of improved agricultural implements is increased. Agricultural operation become more machine powered so the use of traditional implements become costly.

5. Changes in General Land use:

Table 8.18 shows the % of land under different categories. It is observed that village is cultivated 96.60 % lands while forests are almost absence except shrubs and disperse trees along Nallas. Land not available for cultivation accounts for 2.67 % to total geographical area, followed by cultivable waste (0.75 % to total geographical area) and fallow land (1.74 % to total geographical area) in Kalambeshwar. Table 8.18 shows the changes in general land use pattern from 2000-01 to 2013-14. It is noticed that net sown area is increased during period of fourteen years. It has increased by 1.75 % to total geographical area. The net sown area had been 94.48 per cent in 2001 which recorded 96.60 % to total geographical area in 2013-14.

Table 8.18 Changes in General Land use Pattern in Kalambeshwar

Sr. No.	Land use types	Area in hectares		% to total area		% change + or -
		2001	2014	2001	2014	
1	Net sown area	922	939	94.85	96.60	1.75
2	Cultivable waste	12	07	1.23	0.72	-0.51
3	Fallow land	12	Nil	1.23	Nil	00
4	Land not available for cultivation	26	26	2.67	2.67	2.67
5	Forest	Nil	Nil	Nil	Nil	00
6	Total cropped area	1352	1544	146.63	167.46	20.83
7	Total geographical area	972	972	100	100	100
8	Irrigation	117	116	12.68	12.58	-0.10

Source: Based on survey, Gaon Kamgar Talhati, Kalambeshwar.

The cultivable waste and fallow land is remain constant. The percentage of land not available for cultivation has constant.

6. Changes in Agricultural Land use:

The cropping pattern of Kalambeshwar is outcome of soil types, slight variations in rainfall amount and modern approach of agricultural practice. The kharif is the most important season when nearly 94.85 per cent crops are sown and produced. Cotton, jowar, tur, mug, groundnut, soya bean are cultivated. Soya bean stands as first ranking crop occupying maximum percentage among crops (42.32 per cent to net sown area) in Kalambeshwar. It is sown on clay and clay loam soils producing high yield per hectare. 10.81 per cent land to net sown area is under Red gram and stands second in hectares in Kharif. Green gram (2.57 %), wheat (15.61 %) and Gram (22.35 %).

The changes in agricultural land use patterns are shown in table 8.19. It is visible from Table 8.19 that Soya bean had been predominant crop in 2013-14. The overall increase of Soya bean is 42.32 % in Kalambeshwar during the span of twenty-four years.

Table 8.19 Changes in Agricultural Land use in Kalambeshwar

Sr. No.	Crops	% to NSA		% change + or -
		1990.91	2013-14	
1	Cotton	33.20	0.63	-32.57
2	Rice	1.40	Nil	Nil
3	Jawar	37.32	0.63	-36.69
4	Bajra	0.03	Nil	Nil
5	Wheat	2.20	15.61	13.41
6	Gram	4.02	22.35	18.33
7	Black-Gram	4.03	1.75	-2.28
8	Green-Gram	4.10	2.57	-1.53
9	Red-Gram	7.15	10.81	3.66
10	Soybean	Nil	42.32	42.32
11	Orange	-	2.33	2.33

Source: Based on survey, Gaon Kamgar Talhati Kalambeshwar

The adaptation of new high yield in Soya bean seeds by farmers have brought such change. That is why notable reduction has found under local Jawar and cotton. Soya bean has introduced after 1995 for the initial stage on 3.72 per cent to net sown area, which registered and attained maximum 42.32 % to net sown are in 2013-14. The hectares under pluses show decline trend in Kalambeshwar. The hectares of gram had 4.02 per cent in 1991 and it increased 22.35 % to net sown area in 2013-14. Other oilseeds also have been reduced during the twenty-four years.

7. Changes in Land use and Population:

Table 8.20 presents per capita share for different land use categories in Kalambeshwar. It is observed that per capita share is 0.70 hectare for village and 0.61 hectare for land available for cultivation. This is comparatively higher than earlier two sample villages showing improvement in agriculture. It was found that area under kharif has 0.66 hectares per capita land whereas it is 0.0.31 for area under rabbi. This explains the significance of agricultural

in kharif season than rabbi. Double cropped area show dominance in the cropping pattern of the village. Table 8.21 demographic characteristics of Kalambeshwar. The village has increased population in number during the span of fourteen years. It has registered 1383 persons in 2001 and it is 1896 persons in 2011, with density of 1.42 persons per hectare and 1.96 persons per hectare respectively. The density of population like other villages was found increasing in study period. Still the village has crossed sixty per cent literacy. 86.30 per cent working force to total workers is engaged in agriculture.

Table 8.20 Changes in Land use and Population in Kalambeshwar

Sr. No.	Land use categories	Area in hectares		Land/ head		Change
		2001	2011	2001	2011	+ or -
1	Total village area	972	972	0.70	0.51	-0.19
2	Land for cultivation	922	939	0.67	0.61	-0.06
3	Total kharif crops area	910	939	0.66	0.61	-0.05
4	Total rabbi crops area	422	622	0.31	0.33	0.02
5	Gross cropped area	1332	1561	0.96	0.82	-0.14
6	Total population	1383	1896	-	-	37.09 %

Source: Compiled by Author

Table 8.21 Changes in Demographic Characteristics of Kalambeshwar

Sr. No.	Categorise	Years		Change
		2001	2011	+ or -
1	Total Population	1383	1896	37.09
2	Density of Population	142	196	38.03
3	Literacy percentage	61.40	66.40	5.00
4	Per capita land	0.70	0.51	-0.19
5	% of farm workers to total workers	96.44	86.30	-10.14

Source: Census of India, Washim District 2001, 2011

Table 8.22 Changes in Occupational Structure of Kalambeshwar

Sr. No.	Categories	Years		% to population		Change + or -
		2001	2011	2001	2011	
1	Cultivators	468	211	69.33	24.71	-44.62
2	Agri. Labourers	183	526	27.11	61.59	34.48
3	Marginal workers	07	92	1.04	10.77	9.73
4	Other workers	19	22	2.81	2.58	-0.23
5	Total workers	675	854	48.80	45.02	-3.78
6	Non workers	708	1042	51.20	54.98	-3.78
7	Total population	1383	1896	100	100	37.09

Source: census of India, Washim district 2001, 2011

Cultivators decreased rapidly by 44.62 % in 2011 and agricultural laborers increasing rapidly by 34.48 in percentage to total workers. The decline of cultivators from 2001 to 2011 is 44.62 % to total workers. The more change is found in marginal workers and other workers, total worker and non-worker decreased in Kalambeshwar

8. Social and Economic situation of Farmers:

It was noticed during the field work and interviews with farmers regarding socio-economic facilities available to farmers in Kalambeshwar. Soil type is the main aspect reflecting on cropping pattern. The village has more than 50 per cent clay loam soils and therefore yield are very high. Majority farmers have good economic condition. Availability of loan, fertilizer, pesticides and improved agricultural implements on hire it is reduce the agricultural operation cost, positive attitude of society have resulted existing land use pattern.

9. Conclusion:

Agriculture is the main occupation of Kalambeshwar, involving 86.30 per cent working forces to total workers in it. It is noticed that clay loam and clay soils are suitable for raising crops, Soya bean, red gram, Wheat and Gram jowar and therefore large areal extent has found under Soya bean (42.32 % to

net sown area) and Red gram (10.81 % to net sown area). Gram and Wheat has found major crop covering 22.35 and 15.61 % to net sown area in Kalambeshwar and stands first in rank in rabbi season respectively, grown on clay loam soil. Well irrigation has not extended in the village as the water table is deep and expensive to dig wells and therefore farmers have not extended which is 12.68 % to total area in Kalambeshwar. Agriculture of village is partly developed without water it become handicapped.

8.10.4 Micro level study of Kanzra village:

1. Introduction:

Kanzra is located in North West part in Mangrulpir Tehsil of Washim district and is representative village of developing agricultural region (Map 8.5). According to 2001 census population is 1800 persons and density of 3.50 persons per hectare while Kanzra registered 2135 persons in 2011 with density of 4.14 persons per hectare. The village occupies 514 hectares area. The gaothan is in central part on a Nalla (Map 8.5). The village is surrounded by Chikhli and pardi in north, Ajgaon and pimpri in east, Gogri and kherde in west. It is situated on 20^0 18' 34 to 20^0 21' 38 North latitude and 77° 15' 57 to 77^0 16' 57 East longitude. The general slope of Nalla is towards the North east (Map 8.5). Shelubajar to Mangrulpir district highway crosses the village area in Northern side. Area under irrigation is 11.86 % to total geographical area. Village is partly developed and it became handicapped by Irrigation.

2. Soils:

The personal observations during field work uncover three soil types in the villages, clay loam, and sandy clay soils.

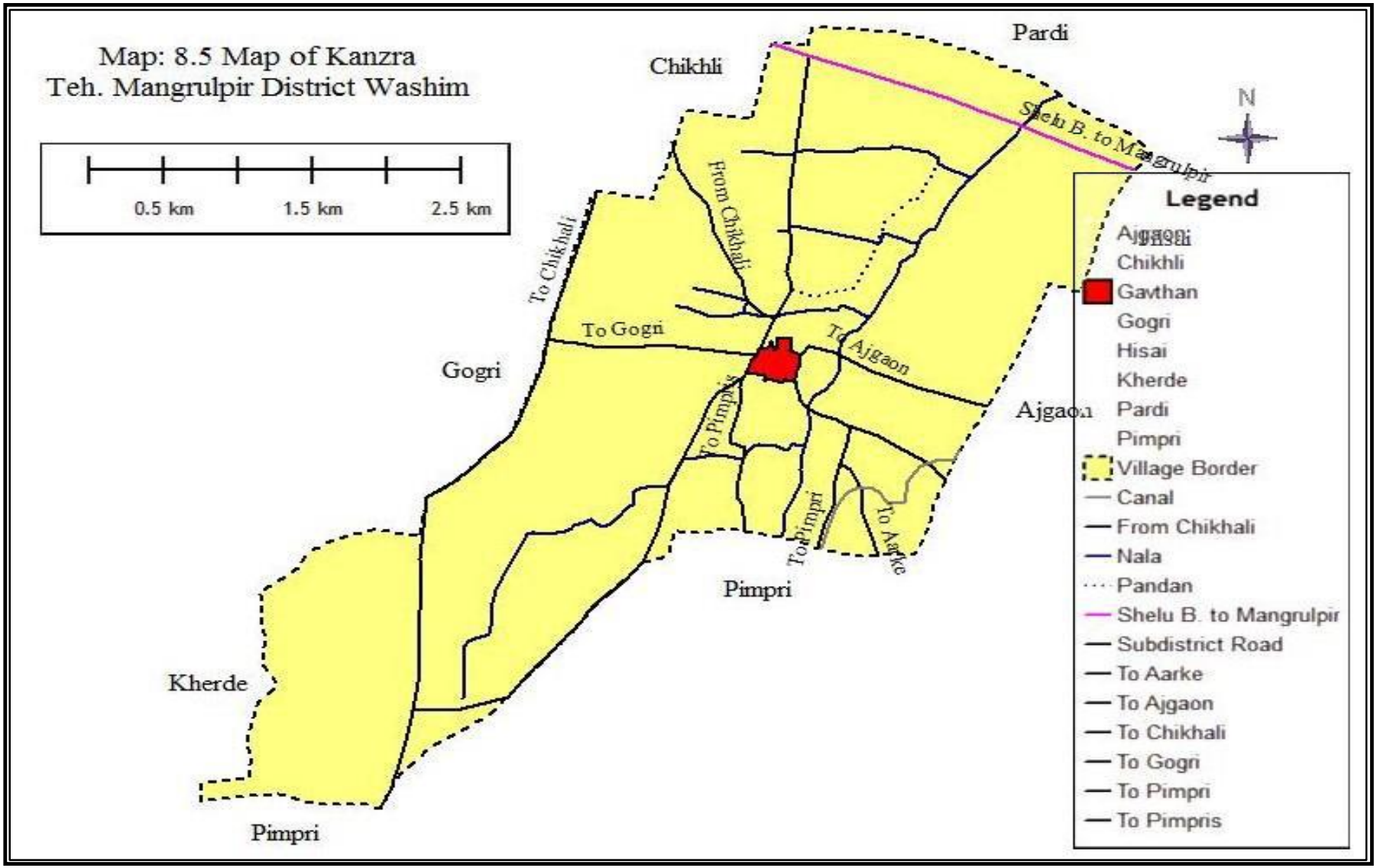
3. Changes in Livestock:

Table: 8.23 Livestock in Kanzra

Sr. No.	Years	Cows	Bulls	Buffalo	Horses	Goat	Poultry
1	1990-1991	360	80	63	02	98	96
2	2013-2014	385	90	48	00	120	59
3	Change +/-	25	10	-15	00	22	-43

Source: Based on survey.

Table 8.23 shows livestock changes in village from 2001 to 2014 with increasing trend in Cows and Bulls are used for manure and agricultural operation. Goats are increased because it is useful for manure and need of market. It gives money time to time for house hold expenses.


Map: 8.5 Map of Kanzra
Teh. Mangrulpir District Washim
0.5 km
1.5 km
2.5 km
Pardi
Chikhli
Shelu B. to Mangrulpir
N
From Chikhali
To Chikhali
To Gogri
To Ajgaon
Gogri
Ajgaon
To Pimpri
To Pimpri
To Aarke
Pimpri
Kherde
Pimpri
Legend
Ajgaon
Pardi
Chikhli
Gavthan
Gogri
Hisai
Kherde
Pardi
Pimpri
Village Border
Canal
From Chikhali
Nala
Pandan
Shelu B. to Mangrulpir
Subdistrict Road
To Aarke
To Ajgaon
To Chikhali
To Gogri
To Pimpri
To Pimpris

4. Changes in Agricultural implements:

Table: 8.24 Agricultural Implements in Kanzra

Wooden plough	Iron Plough	Engine	Electric Pump	Tractor	Carts	Harrow	Seed Drills	Auto seed drills	Thresher
2000-2001									
82	75	05	75	15	43	6	98	9	9
2013-2014									
32	75	03	80	35	26	12	53	12	8
Change + or -									
-50	00	-2	05	20	-17	06	35	03	-1

Source: based on survey.

The table 8.24 shows the agricultural implements in village and changes therein. Traditional agricultural implements decreasing rapidly. Available improved agricultural implements are sufficient for village. Use of modern agricultural implements is increased rapidly with in ten years.

5. Changes in general Land use:

The general land use pattern of Kanzra is given in Table 8.25. Kanzra has 397 hectare accounting 77.24 % to total geographical area under cultivation. Forest is almost absences except disperse shrubs and trees along Nalla. The cultivated land in Kanzra is well spread over the village area, with major concentration in fertile soils. Fallow land and land not available for cultivation account for 8.95 % and 5.45 % to total geographical area respectively. Double cropping accounts for 36.57 % total geographical area.

Table 8.25 present the changes in general land use pattern from 2000-2001 to 2013-14 in Kanzra. It is noticed from table 8.25 that net sown area in the village shows upward trend. It has 77.24 % to total geographical area in 2000-01 while it is 85.02 % to total geographical area in 2013-14. The overall increase in net sown area is 7.78 % to total geographical area. Among other categories of land use types have shown more or less decline trend in Kanzra.

Table 8.25 Changes in General Land use of Kanzra

Sr. No.	Land use types	Area in hectares		% to total area		% change + or -
		2001	2011	2001	2011	
1	Net sown area	397	437	77.24	85.02	7.78
2	Cultivable waste	52	12	10.12	2.33	-7.79
3	Fallow land	46	06	8.95	1.17	-7.78
4	Land not available for cultivation	28	28	5.45	5.45	5.45
5	Forest	Nil	Nil	Nil	Nil	00
6	Total cropped area	523	625	101.75	121.69	19.94
7	Total geographical area	514	514	100	100	00
8	Irrigation	70	65	13.61	12.64	-0.97

Source: Based on survey, compiled by author

All these land use types are declined not more than 7 % to total geographical area. Decrease in Fallow land (7.78 % to total geographical area) and cultivable waste (7.79 % to total geographical area). The land not available for cultivation has comparatively more stable in Kanzra. The irrigated area is 13.61 % to total area and it is reduced by 0.09 % within ten years.

6. Changes in Agricultural land use:

The cropping pattern of Kanzra is the result of physical, social and economic conditions prevalent in the village. Two seasons are noticed one Kharif and other rabbi. Kharif season is dominant as nearly 85 per cent crops are sown in this season. The crops in kharif are sown in June and July depending on commencing southwest monsoon. Cotton, Red gram, Green gram, Soya bean, local jowar are grown in this season. Among these crops, Soya bean stands first occupying 63.64 per cent land to net sown area. It is generally cultivated on clay loam and clay soils in Kanzra. Clay loam soils give comparatively high yield per hectare than clay and sandy loam and therefore Soya bean in Kanzra is raised mainly on clay loam. Red gram occupies 11.73 per cent land to net sown area on clay and clay loam soils. Red gram is sown mixed with Soya bean (6x1). Jawar accounts for 1.59 per cent

to net sown area in north part on sandy clay soils. Rabi season commences from October when wheat, gram and linseed are cultivated. Among rabbi crops, Gram is major crop covering 17.29 per cent land to net sown area.

Table 8.26 Changes in Agricultural Land use Kanzra

Sr. No.	Crops	% to NSA		% change + or -
		1990-91	2013-14	
1	Cotton	36.52	Nil	Nil
2	Rice	1.20	Nil	Nil
3	Jawar	34.21	1.59	-32.62
4	Bajra	0.81	Nil	Nil
5	Wheat	2.06	3.77	1.71
6	Gram	4.50	17.29	12.79
7	Black-Gram	5.06	2.19	-2.87
8	Green-Gram	4.10	0.99	-3.11
9	Red-Gram	6.21	11.73	5.52
10	Soybean	Nil	63.64	63.64
11	Safflower	0.99	0.79	-0.20
12	Orange	Nil	0.99	0.99
13	Turmeric	Nil	0.39	0.39

Source: Based on survey, Gaon kamgar Talhati, Kanzra.

The changes in major crop land use patterns are shown in Table: 8.26. It is clear from table 8.26 that soya bean hectares had a steadily upward trend after 1995. The overall increase of Soya bean in Kanzra is 63.64 per cent to net sown area during the span of fourteen years. This fact explains the continuous domination of single soya bean crop in Kanzra. Red gram and Gram also shows upward trend of total increase of 5.52 per cent and 12.79 % to net sown area. Other crops occupies less than 1 % area. Cotton and Jawar losses their rank and soya bean become rank first with 63.64 % area to total area.

7. Changes in Land use and Population:

Table 8.27 shows the per capita share of land to various categories of land use in Kanzra. Per capita land is 0.28 hectare for the village. It was further reduced to kharif and rabbi crops area. The area under kharif has 0.22 hectare per capita land while in rabbi it is 0.07 hectare. This fact explains the dominance of agricultural activity in kharif season. Like other villages, population of Kanzra shows upward trend of population from 2001 to 2011. The population in number increased during span of ten years is 235.

Table 8.27 Changes in Land use and Population in Kanzra

Sr. No.	Land use categories	Area in hectares		Land/ head		Change
		2001	2011	2001	2011	+ or -
1	Total village area	514	514	0.28	0.24	-0.04
2	Land for cultivation	397	437	0.22	0.20	-0.02
3	Total kharif crops area	397	437	0.22	0.20	-0.02
4	Total rabbi crops area	126	188	0.07	0.08	0.01
5	Gross cropped area	523	625	0.29	0.29	00
6	Total population	1800	2135	-	-	18.61 %

Source: Based on survey, compiled by author

Table 8.28 Changes in Demographic Characteristics of Kanzra

Sr. No.	Categorise	Years		% Change + or -
		2001	2011	
1	Total Population	1800	2135	18.61
2	Density of Population	350	414	18.57
3	Literacy percentage	77.00	79.53	2.53
4	Per capita land	0.22	0.20	-0.02
5	% of farm workers to total workers	89.39	94.57	5.18

Source: Census of India, Washim district 2001, 2011

Table 8.29 Changes in Occupational Structure of Kanzra

Sr. No.	Categories	Years		% to population		Change + or -
		2001	2011	2001	2011	
1	Cultivators	281	266	33.49	33.58	0.09
2	Agri. Labourers	469	483	55.90	60.98	5.08
3	Marginal workers	28	10	3.34	1.63	-1.71
4	Other workers	87	33	10.37	4.17	-6.20
5	Total workers	839	792	46.61	37.10	-9.51
6	Non workers	961	1343	53.39	62.90	9.51
7	Total population	1800	2135	100	100	18.61

Source: census of India, Washim district 2001, 2011

The density of population is 3.50 persons per hectare. 94.57 per cent workers are engaged in agriculture, both cultivators and agricultural laborers. Literacy is increased by 2.53 per cent during study period. This indicates slight awareness among the villagers. Agricultural laborers have increased in Kanzra. It had 55.90 per cent to total workers in 2001 while it is 60.98 per cent to total workers in 2011. Cultivators have found upward trend in Kanzra. It increased by 0.09 per cent to total workers.

8. Socio Economic condition of Farmers:

Personal interviews with farmers unfold socio-economic facilities available in Kanzra. The overall situation of Kanzra is same as earlier villages. Majority of Farmers offered improved seeds, implements in agricultural practice while small land holders cannot be afford because they are economically poor. Majority of the farmers (93.55 %) attitude towards the agriculture is positive and 87.10 % farmer's economic situation is good. 38.70 % farmers have well irrigation, 45.16 % have electric pump set, 93.55 % have bank loan, 19.35 % done soil test, and 100 % farmers using HVY seeds, fertilizers, and crop protection measures, 9.37 % farmers using canal irrigation in Kanzra village.

9. Conclusion:

Kanzra has dominant agricultural activity involving 94.57 per cent working force to total workers in agriculture. It is observed that high yielding crops are raised on fertile soils while low yielding crops are cultivated on sandy loam soils. In 1990-91 Cotton, Jawar, Red gram, are dominant crops and raised on 36.02 %, 34.97 % and 6.02 % to net sown area respectively on clay loam and clay soils in Kanzra. In 2013-14 Soya bean, Gram and Red gram are dominant crops and raised on 63.64 %, 17.29 % and 11.65 % to net sown area respectively on clay loam and clay soils in Kanzra. It is indicates that the agricultural land use is changed with in twenty-four years. Red gram is sown mixed with Soya bean. It is noticed that Gram is major crop in rabbi having raised on 17.29 % to net sown area on clay soil in Kanzra. Other crops do not show any significance in the cropping pattern. Comparatively this village has irrigated area of 11.86 % to net sown area indicating positive change in the attitude of farmers in improving agricultural pattern.

8.10.5 Micro level study of Hiwara (Bk.) village:

1. Introduction:

Hiwara Bk. is located in Northwest part in Manora tehsil of Washim district (Map 8.1) with an area of 620 hectare. According to 2001 census the population is 1315 persons and 1523 persons in 2011 with density of 2.12 persons per hectare and 2.46 persons per hectare respectively. The village is situated on 20° 15"24 to 20° 17" 24'North latitude and 77° 29"47 to 77°30"52'East longitude. The general slope of village is towards south which is evident from the flow of Nalas are meet to River Arunavati which is flows on southern border of village (Map 8.6). The surrounding villages are noticeable from Map 8.6. It is confined by Chandoli and Javale (kh.) in south, Asole Bk. in east, Parva in north and Javale Bk. in west. The gaothan is located in the southern part of village area.

2. Soil:

The soil of Hiwara Bk. is of medium black with minute variations in texture and color. There are two soil types, clay loam and loam. Loam soil type is fertile than that of clay in the village where cotton and Jawar are grown successfully.

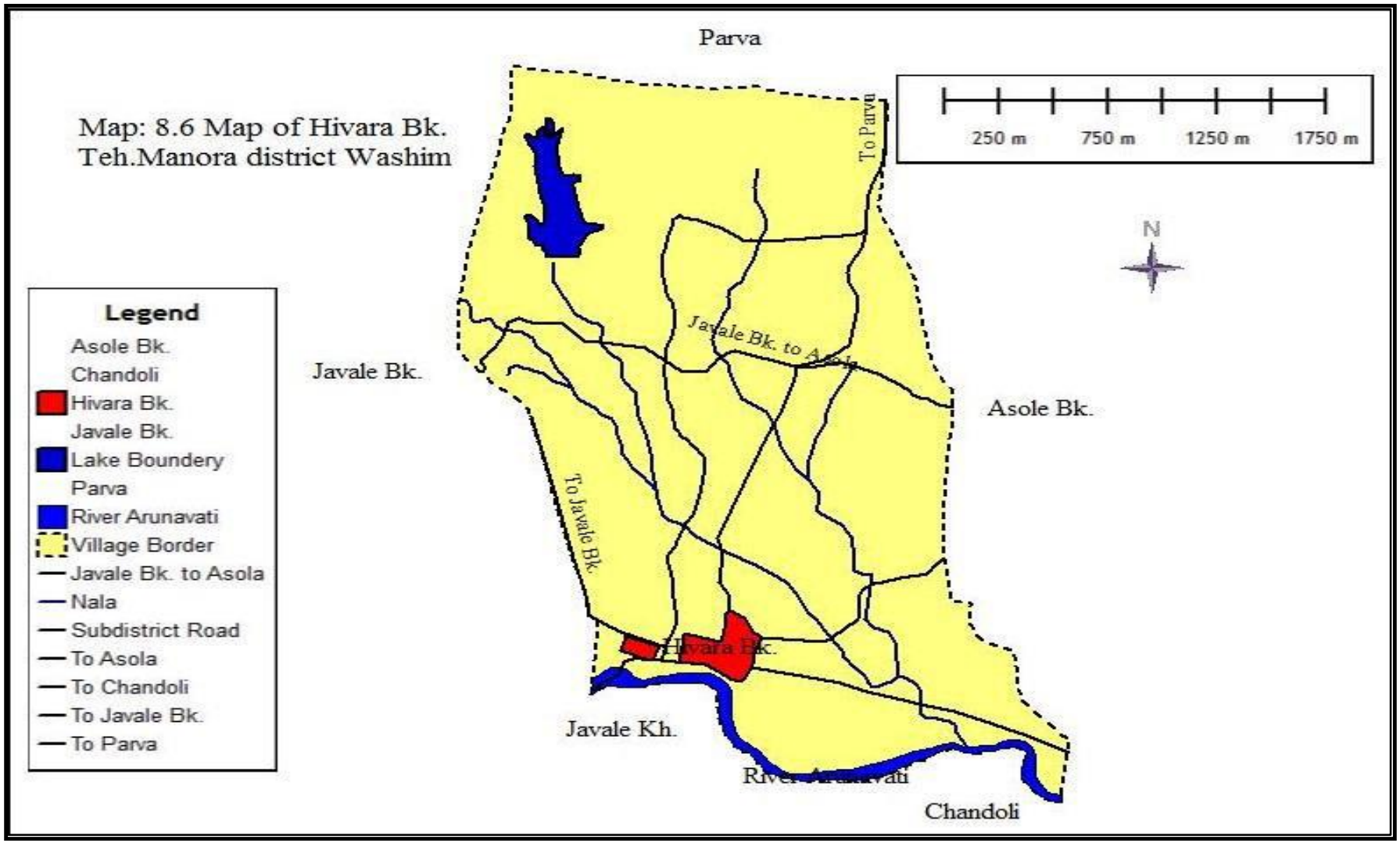
3. Changes in Livestock:

Table: 8.30 Livestock in Hivara (Bk.)

Sr. No.	Years	Cows	Bulls	Buffalo	Horses	Goat	Poultry
1	2000-2001	260	140	60	05	210	160
2	2013-2014	210	120	55	01	198	150
3	Change +/-	-50	-20	-05	-04	-12	-10

Source: Based on survey.

The table 8.30 shows the livestock situation of village. Local cows, bulls and Goats are large in number. It indicates that the awareness about natural manure. All livestock is used for manure except bulls. But now a days it shows decreasing trend in livestock population in village because shortage of fodder and more area goes under cultivation to feed more population.


Map: 8.6 Map of Hivara Bk.
Teh.Manora district Washim
Parva
To Parva
250 m
750 m
1250 m
1750 m
N
Legend
Asole Bk.
Chandoli
Hivara Bk.
Javale Bk.
Lake Boundery
Parva
River Arunavati
Village Border
Javale Bk. to Asola
Nala
Subdistrict Road
To Asola
To Chandoli
To Javale Bk.
To Parva
Javale Bk.
Javale Bk. to Asola
Asole Bk.
To Javale Bk.
Hivara Bk.
Javale Kh.
Chandoli

4. Changes in Agricultural implements:

Table: 8.31 Agricultural Implements Hivara (Bk.):

Wooden plough	Iron Plough	Engine	Electric Pump	Tractor	Carts	Harrow	Seed Drills	Auto seed drills	Thresher
2000-2001									
60	30	08	45	06	25	02	89	02	03
2013-2014									
26	25	02	55	10	15	03	50	08	06
Change + or -									
-34	-05	-06	10	04	-10	01	-39	06	03

Source: based on survey.

The table 8.31 presents agricultural implements in village. Traditional agricultural implements shows the decreasing trend and improved agricultural implements shows increase in their numbers. It shows the positive attitude of farmers towards the agriculture. Area of village and number of implements are sufficient for the village.

5. Changes in General Land use:

Table: 8.32 Changes in General Land use in Hivara (Bk.)

Sr. No.	Land use types	Area in hectares		% to total area		% change + or -
		2001	2011	2001	2011	
1	Net sown area	446	446	71.93	71.93	00
2	Cultivable waste	103	103	16.61	16.61	00
3	Fallow land	04	04	0.64	0.64	00
4	Land not available for cultivation	67	67	10.80	10.80	00
5	Forest	Nil	Nil	Nil	Nil	00
6	Total cropped area	654	666	105.48	107.42	1.94
7	Total geographical area	620	620	100	100	00
8	Irrigation	130	140	20.97	22.58	1.83

Source: compiled by author, Gaon Kamgar Talhati Hivara (BK.)

Geographical area is 620 hectares. Of the total 446 hectares land is under crops accounting 71.93 per cent to the total geographical area. The land not available for cultivation accounts for 10.80 % to total geographical area Fallow land is occupying 0.64 % to total geographical area whereas cultivable land accounting for 16.61 % to total geographical area. Comparatively Hiwara Bk. has significant land under the heads of cultivable waste (16.61%) and fallow land (0.64 %). There is no change in general land use in Hivara Bk. This is due to extensive fertile tract that has been brought under cultivation by farmers in the village. This village has high potential in irrigation. Now a days 22.58 % area under irrigation. It is twice than the other villages.

6. Changes in Agricultural Land use:

Hiwara Bk. has 446 hectares under cultivation, accounting for 71.93 % to total geographical area. The village is noticed 22.58 % irrigated land to net sown area. The agricultural land use in Hiwara Bk. mainly depends on rainfall amounts and availability of resources at local level. Generally, like other villages, this village experiences two crop seasons, kharif and rabbi. Among these kharif has an immense importance due to larger areal extent is brought under cultivation in this season. The crops such as Soya bean, Cotton, jowar Red gram, Green gram Wheat and Gram are successfully grown. Among these crops, Soya bean ranks first occupying 56.02 % to net sown area, sown on clay, clay loam and loam soil in Hiwara (Bk.).

Agricultural Land use in 1990-91 is as cotton 41.13%, Rice 0.79, Jawar 30.56 %, Bajra 1.68 %,Wheat 2.23 %, Balck Gram 3.62 % Green gram 3.36 %, Red gram 5.08 % and other crops are 11.58 %. In 2013-14 cotton 6.13 % Rice Nil, Jawar 0.98 %, Bajra Nil, Wheat 13.44 %, Black gram 0.59 %, Green gram 0.19 %, Red gram 10.65 %, Soya bean 56.02 % Santra 2.25 % and other crops 9.75 % in village Hivara (Bk.). In 2013-14 agricultural land use is changed principal crops Cotton, Jawar and pulses loss their rank and soya bean, red gram, wheat, Gram are became most important crops in agricultural land use in 2013-14.

Table 8.33 Changes in Agricultural Land use in Hivara (Bk.)

Sr. No.	Crops	% to NSA		% change + or -
		1990-91	2013-14	
1	Cotton	41.13	6.13	-35
2	Rice	0.79	Nil	00
3	Jawar	30.56	0.98	-29.58
4	Bajra	1.68	Nil	00
5	Wheat	2.23	13.44	11.21
6	Black Gram	3.62	0.59	-3.17
7	Green Gram	3.36	0.19	-3.17
8	Red Gram	5.08	10.65	5.57
9	Soybean	Nil	56.02	100
11	Santra	-	2.25	2.25
12	Mosambi	-	1.70	1.70
13	Dalimb	-	0.60	0.60
14	Chili	-	0.50	0.50

Source: Based on survey, Gaon Kamgar Talhati Hivara (Bk.)

7. Changes in Land use and Population:

In this village 67.97 % working force to total workers is engaged in agriculture. It indicates the pressure of population on land. Table 8.34 presents the share of per capita in Hiwara (Bk.) Per capita land to total area is of 0.47 hectare which reduced to 0.41 hectare per head of population, it was observed that per capita land is high than that of rabbi crops. Area under kharif crops has 0.33 hectare and 0.29 hectare per head population in area under rabbi crops. It explains the dominance of kharif crops in Hiwara Bk. and these kharif crops are of immense significance to this village as major crops are grown in this season.

Table 8.35 reveals the demographic characteristics. Population figure from this table shows increase during the span of fourteen years.

Table 8.34 Changes in Land use and Population in Hivara (Bk.)

Sr. No.	Land use categories	Area in hectares		Land/ head		Change + or -
		2001	2011	2001	2011	
1	Total village area	620	620	0.47	0.41	-0.06
2	Land for cultivation	446	446	0.33	0.29	-0.04
3	Total kharif crops area	446	446	0.33	0.29	-0.04
4	Total rabbi crops area	198	220	0.15	0.14	-0.01
5	Gross cropped area	644	666	0.49	0.44	-0.05
6	Total population	1315	1523	-	-	15.82 %

Source: Compiled by Author

Table 8.35 Changes in Demographic Characteristics of Hivara (Bk.)

Sr. No.	Categorise	Years		Change + or -
		2001	2011	
1	Total Population	1315	1523	15.82 %
2	Density of Population	212	246	16.03 %
3	Literacy percentage	79.2	77.34	-1.86 %
4	Per capita land (Hectare)	0.47	0.41	-0.06
5	% of farm workers to total workers	89.21	67.97	-21.24 %

Source: Census of India, Washim District 2001, 2011

Table 8.36 Changes in Occupational Structure of Hivara (Bk.)

Sr. No.	Categories	Years		% to population		Change + or -
		2001	2011	2001	2011	
1	Cultivators	161	153	31.02	19.37	-11.65
2	Agri. Labourers	302	384	58.19	48.61	-9.58
3	Marginal workers	11	191	2.12	24.18	22.06
4	Other workers	56	52	10.79	6.58	-4.21
5	Total workers	519	790	39.47	51.87	12.40
6	Non workers	796	733	60.33	48.13	-12.40
7	Total population	1315	1523	100	100	15.82

Source: census of India, Washim district 2001, 2011

It has 1315 persons in 2001 while it recorded 1523 persons in 2011 with density of 2.12 persons and 2.46 persons per hectare respectively. The total increase of density of population is 0.34 hectare persons in study period. Literacy shows highest percentage than that of other sample villages (77.34 % to total population) indicating positive change in increasing awareness regarding agricultural practice. Table 8.36 presents the breakup of occupational structure in Hiwara Bk. It is found that village has dominance of agricultural laborers from 2001 to 2011. Its number in 2001 was 58.19 % and 48.61 in 2011. Cultivators are reduced by 11.65 % during the span of fourteen years. Among other categories, workers accounted little number. Marginal workers accounting for 24.18 % in 2011.

8. Socio Economic condition of Farmers:

Majority of farmers in village is economically sound. All farmers were raised improved varieties of soya bean, cotton, Wheat, Red gram and Gram extensively while rest farmers sown these varieties on limited areal extent in fields. Small farmers use improved implements and improved seeds due to bank loan available to them. It is observed that small land holding farmers borrow or hire agricultural implements from others. It unfolds during the interview that capital is the great handicap in the development of agriculture. Moreover, these small land holders are interested to make substance development in proper utilization of land. Our survey unfolds the situation of farmers as, 36.84 % farmers have Wells, 44.74% have electric pump sets, 34.2, 100 % have bank loan, 100% farmers attitude towards the agriculture is positive, and 100 % farmers use HVY seeds, improved implements, fertilizers and 23.68 % farmers done the soil testing of their farms. 13.16 % farmers use canal and 10.5 % farmers use River water for irrigation. Area under irrigation in this village is increasing up to 19.35 %. It indicate that the village is partly developed agriculture but market prices and irrigation water make farmers handicapped

9. Conclusion:

This village is representative of developed agricultural region involving 67.97 % population engaged in agricultural practice. It is noteworthy that farmers of this village are aware of new development in the field of agriculture. Soybean 56.02, cotton 6.13 % wheat 13.44 %, Gram 5.69 and red gram 10.65 are common crops grown extensively on clay loam and clay soils. Larger size land holders are greatly advanced in improving agricultural land by producing high yield of cotton and soya bean. While other farmers who owned 2 to 5 hectares land cultivated same agriculture land use. By increasing availability of capital and providing latest information to farmers on agriculture. Hiwara Bk. may serve proper land use for increasing yield per hectare.

8.10.6 Micro level study of Virgavhan village:

1. Introduction:

The village Virgavhan is located in north east part in Karanja tehsil of Washim district with an area of 417.34 hectares in the Washim district (Map 8.1). It is noticed from Map 8.7 that this village is confined by mohgavhan in south, loni in east, naregaon in west, and Hivara in north. It is located on 20°33”57’ to 20^0 35”24’ North latitude and 77°34” 22' to 77º35”29’ East longitude. The general slope is towards North which is easily noticed from the water flow of Nalla (Map 8.7). The gaothan is located in northern part of village area. The village had 680 population in 2001 and 722 in 2011 with density of 1.63 persons and 1.73 persons per hectare respectively. Irrigated area was 8.15% in Virgavhan.

2. Soils:

Three types of soils are observed in Virgavhan. These are, sandy clay, clay loam and loam. Cotton and Jawar are successfully grown on this soil.

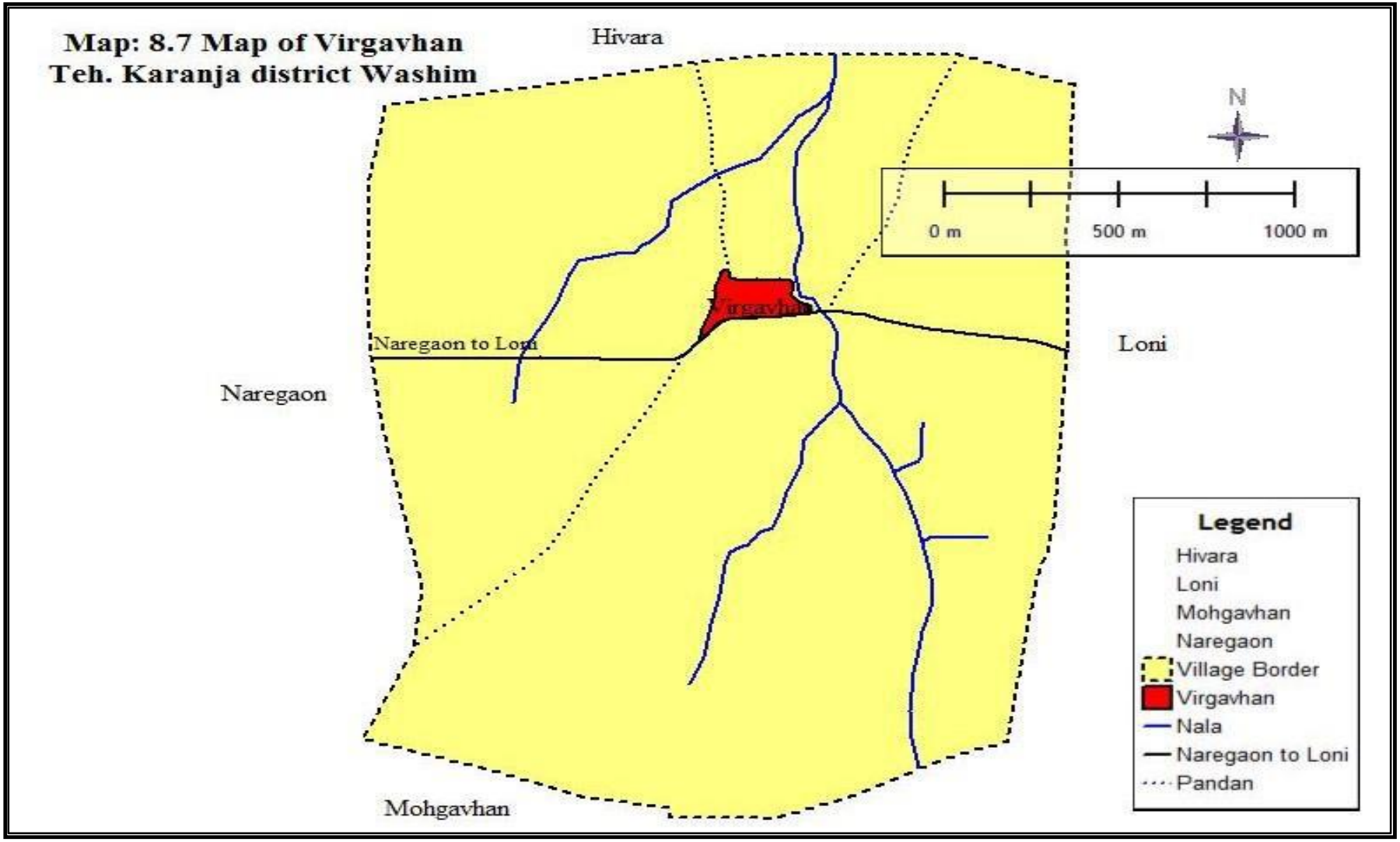
3. Changes in Livestock:

Table: 8.37 Livestock in Virgavhan

Sr. No.	Years	Cows	Bulls	Buffalo	Horses	Goat	Poultry
1	2000-2001	88	120	65	02	77	80
2	2013-2014	60	90	45	01	62	60
3	Change +/-	-28	-30	-20	-01	-15	-20

Source: Based on survey.

The table 8.37 shows the livestock situation of village. Local cows, bulls and Goats are large in number. It indicates that the awareness about natural manure. All livestock is used for manure except bulls. But now a days it shows decreasing trend in livestock population in village because shortage of fodder and more area goes under cultivation to feed more population.


Map: 8.7 Map of Virgavhan
Teh. Karanja district Washim
Hivara
N
0 m
500 m
1000 m
Virgavhan
Naregaon to Loni
Loni
Naregaon
Mohgavhan
Legend
Hivara
Loni
Mohgavhan
Naregaon
Village Border
Virgavhan
Nala
Naregaon to Loni
Pandan

4. Changes in Agricultural implements:

Table: 8.38 Agricultural Implements Virgavhan

Wooden plough	Iron Plough	Engine	Electric Pump	Tractor	Carts	Harrow	Seed Drills	Auto seed drills	Thresher
2000-2001									
65	42	03	42	04	32	03	56	02	04
2013-2014									
35	38	02	40	06	28	05	36	06	05
Change + or -									
-30	-04	-01	-02	02	-04	02	-20	04	01

Source: based on survey.

The table 8.38 presents agricultural implements in village. Traditional agricultural implements shows the decreasing trend and improved agricultural implements shows increase in their numbers. It shows the positive attitude of farmers towards the agriculture. Area of village and number of implements are sufficient for the village.

5. Changes in General Land use:

Table 8.39 shows general land use types in Virgavhan. This village has 385 hectares land under cultivation (92.33 % to total geographical area). Crops are raised on extensive area despite soil types. The major concentration of cultivated land is observed in central and western parts where clay and clay loam soils are dominant and productive to yield high crops.

Among other categories of land use types, cultivable waste accounts 3.12 % land in the village. It occupies 3.12 % to total geographical land not available for cultivation accounts for 4.56 % to total geographical area. Fallow land is accounting 00 % to total geographical area. Forest as defined by forest department is almost absence except disperse trees and shrubs. Irrigation is 8.15 per cent to net sown area. Table 8.39 summarized the general land use types from 2000-2001 to 2013-14 in Virgavhan. The most remarkable fact

that net sown area is constant during the span of ten years while other land use categories also constant.

Table 8.39 Changes in General Land use Patterns in Virgavhan

Sr. No.	Land use types	Area in hectares		% to total area		% change + or -
		2001	2011	2001	2011	
1	Net sown area	385	385	92.33	92.33	00
2	Cultivable waste	13	13	3.12	3.12	00
3	Fallow land	Nil	Nil	Nil	Nil	00
4	Land not available for cultivation	19	19	4.46	4.56	00
5	Forest	Nil	Nil	Nil	Nil	00
6	Total cropped area	474	483	113.67	115.83	2.16
7	Total geographical area	417	417	100	100	00
8	Irrigation	28	34	6.71	8.15	1.44

Source: Based on survey, Gaon Kamgar Talhati Virgavhan

It has 92.33 % to total geographical area under net sown area. This fact unfolds the awareness of farmers to bring more land under cultivation. Other land use types have shown constant trend during the study period. The land not available for cultivation by 4.46 % to total geographical area. Cultivable waste is 3.12 % to total geographical area in Virgavhan.

6. Changes in Agricultural Land use:

Like other sample villages, two agricultural seasons are prevailed in Virgavhan. Among these, season kharif is of great importance because more than 80 per cent crops are sown and produced in this season. Soya bean, Cotton, Jawar, Red gram, Green gram, Black gram and local Jawar are kharif crops and are sown in June on commencing southwest monsoon. Among kharif crops Soya bean stands as first accounting 49.79 per cent to net sown area. This crop is mainly sown on clay and clay loam soils and therefore has high yield per hectare than that of other crops in Virgavhan.

Agricultural Land use in 1990-91 is as cotton 41.25 %, Rice 0.48, Jawar 34.48 %, Bajra 0.75 %,Wheat 1.65 %, Black Gram 2 % Green gram 2.28 %,

Red gram 5.98 % and other crops are 11.00 %. In 2013-14 cotton 10.8 % Rice Nil, Jawar nil, Bajra Nil, Wheat 13.50 %, Black gram 0.59 %, Green gram 0.19 %, Red gram 9.49 %, Gram 4.23%, Soya bean 49.69 % Santra 6.20 % and other crops 10 % in village Virgavhan. In 2013-14 agricultural land use is changed principal crops Cotton, Jawar and pulses loss their rank and soya bean, red gram, wheat, Gram and santra are became most important crops in agricultural land use in 2013-14.

Table 8.40 Changes in Agricultural Land use in Virgavhan

Sr. No.	Crops	% to NSA		% change + or -
		1990-91	2013-14	
1	Cotton	41.25	10.80	-30.45
2	Rice	0.48	Nil	00
3	Jowar	34.48	Nil	00
4	Bajra	0.75	Nil	00
5	Wheat	1.65	13.50	11.85
6	Gram	7.56	4.23	-3.33
7	Black-Gram	2.00	1.82	-0.18
8	Green-Gram	2.28	1.53	-0.75
9	Red-Gram	5.98	9.49	3.51
10	Soybean	Nil	49.79	49.79
11	Santra	-	6.20	6.20

Source: Based on survey, Gaon Kamgar Talhati Virgavhan

7. Changes in Land use and Population:

Table 8.41 presents per capita share of land to various categories of land use in Virgavhan. The per capita land is 0.58 hectare in the village and per capita land for cultivated land is 0.57 hectare. This land further reduced into kharif and rabbi area. The area under kharif crops show 0.57 hectare per head of population while 0.13 hectare is observed in the area under rabbi (Table 8.41).

It unfolds the dominance and population concentration on kharif area than that of rabbi.

Table 8.41 Changes in Land use and Population in Virgavhan

Sr. No.	Land use categories	Area in hectares		Land/ head		Change + or -
		2001	2011	2001	2011	
1	Total village area	417	417	0.61	0.58	-0.03
2	Land for cultivation	385	385	0.57	0.57	00
3	Total kharif crops area	385	385	0.57	0.57	00
4	Total rabbi crops area	89	98	0.13	0.13	00
5	Gross cropped area	474	483	0.70	0.67	-0.03
6	Total population	680	722	-	-	6.18 %

Source: Compiled by Author

Table 8.42 Changes in Demographic Characteristics of Virgavhan

Sr. No.	Categorise	Years		Change + or -
		2001	2011	
1	Total Population	680	722	6.18
2	Density of Population	163	173	6.13
3	Literacy percentage	91.30	82.54	-8.76
4	Per capita land	0.61	0.58	-0.03
5	% of farm workers to total workers	96.01	89.37	-6.64

Source: Census of India, Washim District 2001, 2011

Table 8.43 Changes in Occupational Structure of Virgavhan

Sr. No.	Categories	Years		% to population		Change + or -
		2001	2011	2001	2011	
1	Cultivators	108	194	30.77	43.89	13.12
2	Agri. Labourers	229	201	65.24	45.47	-19.77
3	Marginal workers	00	17	0.00	3.85	3.85
4	Other workers	05	24	1.42	5.43	4.01
5	Total workers	351	442	51.62	61.22	9.60
6	Non workers	329	280	48.38	38.78	-9.60
7	Total population	680	722	100	100	6.18

Source: census of India, Washim district 2001, 2011

The demographic characteristic are show in Table 8.42. It is clear from this table that population increases during the period of study. It was noticed 680

persons in 2001 which is attained to 722 persons in 2011. The density is also increased by 0.61 persons per hectare. It had 1.63 persons in 2001 and in the 2011 it is found 1.73 persons per hectare. Literacy percentage shows downward trend during the period of fourteen years. It decreased by 8.76 %. Cultivators increased by 13.12 % and agricultural laborers decrease by 19.77 % during study period. It is noticed that 43.89 % cultivators and 45.47 % agricultural laborers have been registered in 2010-11. Marginal workers and other workers engaged other than farm workers and workers accounts for 1.42 % and 5.43 % to total workers in Virgavhan.

8. Socio Economic condition of Farmers:

Majority of people in village is economically sound. All farmers were raised improved varieties of cotton, Red gram, Soya bean, Black gram, Green gram, Wheat and Gram extensively while rest farmers sown these varieties on limited areal extent in fields. All farmers have improved implements and improved seeds due to bank loan available to them. It is observed that small land holding farmers borrow or hire agricultural implements from others. It unfolds during the interview that capital is the great handicap in the development of agriculture. Moreover, these small land holders are interested to make substance development in proper utilization of land.

9. Conclusion:

This village is representative of developed agricultural region involving 89.37 % in agricultural practice. It is noteworthy that farmers of this village are aware of new development in the field of agriculture. Soybean, wheat, Gram and red gram are common crops grown extensively on clay and clay soils. Larger size land holders are greatly advanced in improving agricultural land by producing high yield of Soya bean, cotton, Wheat, Gram, santra and red gram. By increasing availability of capital and providing latest information to farmers on agriculture. This village also partly developed, market prices and insufficient irrigation facility are the drawback of agricultural development in Virgavhan.

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Chapter-IX

Summary Observations and Implication

9.1 Introduction:

9.2 Summery and major Findings:

9.3 The Observations Analysis and Findings:

9.4 Problems in Agricultural Development:

9.5 Implications:

9.6 Concluding Remark:

Chapter-IX

Summary Observations and Implication

9.1 Introduction:

The existing research has been carried out to assess, analyze, describe and interpret the changing pattern of agricultural land use in Washim district. With a view to investigate the influence of certain physical and socio-economic variables on land use patterns and to provide in detailed study for deciding proper and efficient land use to meet the demand of food for the increasing population in the District and to demarcate agricultural regions for planning.

9.2 Summary and Major Findings:

The Washim district of Maharashtra encompassing from 19° 61' to 21° 16' North latitude and 76° 70' to 77°14’ East longitude. The district comprises 789 villages of Washim, Risod, Malegaon, Mangrulpir, Manora and Karanja tehsils of Washim district. It has the length of about 148 km. from North-East to South-West and the width of 63 km. from North to South and covers an area of 5131 Sq. Km covered 1.65 per cent area in Maharashtra. The total population of 1196714 persons, according to the census of India 2011 and density was 233 persons per Km^2. Washim district is a part of Balaghat plateau and it is geologically formed from Deccan trap basalt. Its elevation from mean sea level is from 330 to 525 meters. Soil of the region made from Deccan trap basalt. The major part of district is covered by medium black soil 72.4 %, deep black soil 10.6%, and shallow or less fertile soil is 17%.

Physiography of the entire region presents remarkable homogeneity in character with moderate slope towards the North, north east, south, south west and South east, so the area became runoff zone. Ajanta ranges is located at middle part of the district in some part of Malegaon, Mangrulpir and Manora tehsil in elongated shape. Washim district is not pure flat land but it has rivers, valleys, hills and plateau have medium to deep black soils (Map: 2.4), yielding high production per hectare on base year. The River Penganga, Vembala, Aran,

Katepurna, Morna, Nirguna, Chandrabhaga, Pus and Arunavati constitute the drainage system in the study region. All rivers are rain fed and seasonal in character. Transported fine grains and clays by the rivers are deposited in the downstream regions and form alluvial a prone where varied crops are grown. The tributaries of Penganga River are Chandrabhaga, Pus, Adan Vembala, Arunavati Rivers are equally significant for agriculture. The tributaries of Purna River are Katepurna, Morna and Nirguna.

The typical monsoon type climate with small variation in rainfall and range of temperature prevail. The region experiences intense heat in summer and fairly cold winter. The summers are dry which cannot help the growth of crops and vegetation. The mean monthly temperature is 8 to 10°c in January and 45 to 48^0 c in May. The average annual rainfall has 850 mms with slight variations in its amounts over the area. The success of agricultural operations growth of crops and their production depends on regular and sufficient rainfall during the rainy season. Rainfall receives between June and October with an average rainfall of 750 to 1000 mms. The rainfall amount becomes low after November with occasional stormy spells. The soil types are key parameter in the area. Three types of soils found, coarse shallow, medium black and deep black soils with varied texture, color, structure and fertility (Table:2.2, 2.3, 2.4, 2.5).

9.3 The observations analysis and findings:

a) Socio-Economic Environment:

The Washim districts primarily agricultural in its occupational structure with 93.35 % working force to total workers is engaged in agriculture. The types of soils play a vital role in agricultural land use patterns in the area. Even slight variation in rainfall amount affects agricultural land use in the area under evaluation.

The socio-economic variables have influenced the spatial distribution of agricultural land use patterns in the Washim district. The spatial distribution of population reveals the significant variations within the area. The major concentration of population is associated with medium to deep black soil zones

in central, eastern and southern parts of the region. The density variations in the area range from 206 persons per square kilometer to 275 persons per square kilometer. The eastern and central parts have dense population due to fertile soils. With growing population in the area, the pressure on land has been increasing and therefore per capita land has significantly decreased from 1991 to 2011. It had 0.57 hectare per capita land in 1991 and it decreased 0.43 hectare per capita land in 2011. The relative importance of agricultural activity has been pointed out by working force is 93.35 % to total workers in the area, comprising 30.99 % of cultivators and 62.36 % agricultural laborers.

The size of land holding has been adversely affected by continuous disintegration of land holdings due to division and sub-division of family. The average size of holding is 2.43 hectares. Improved implements are still in use. The total irrigated area is 6.21 % to net sown area in the Washim district. Well, Canal and River irrigation are the sources of water supply to crops. The highest area under irrigation is recorded in Mangrulpir tehsil 8.03 % to net sown area. The accessibility by means of transport, within the area is easy, a dense road network, covering major district road, other district road occur in the area. Six Agricultural produce market centers (APMC) and ten sub market centers serve to collection and distribute the agricultural products to people within and outside the area.

b) Changes in General land use:

This land utilization study unfolds different uses in the Washim district. The net sown area manifests spatial variations within the area, with concentration in the central and southeastern parts in fertile tract having high yield per hectare. Very few patches scattered in areal extents on coarse shallow soils have low concentration of net sown area with resultant low yield of crops per hectare. Washim tehsil has recorded the maximum net sown area (84.56 % to total geographical area) and the minimum is observed in Manora tehsil (69.18 % to total geographical area) in the southeast part in the area. It is noticed that the central tract of the area is 73 to 84 % of net sown area in each tehsil. The

changes in land utilization demonstrates changes during the more than two decade covering the years 1990-91 to 2013-14 in the Washim district.

The net sown area in the region is 79.16 % to the total geographical area. It is relatively more in % than to net sown area of Maharashtra (59.49 %) to total geographical area. The total increase in net sown area during the study period is 4.27 % to the total geographical area due to the increasing awareness among the farmers of the region to the improved varieties of seeds, fertilizers and pesticides for getting higher yields. Other categories of land use have been found to decline steadily (Table 5.2). The highest land under cultivable waste has declined to 9.42 % to total geographical area followed by fallow land (8.1 % to total geographical area) and 2.24 % to total geographical area) in the Washim district.Table No.5.3 shows a valuation of the accumulated change between the five major land use types, each group is computed at Tehsil level. The proportion of land involved in change from one land use type to another in Washim district, accounted to 7.06 %, which is definitely a low proportion of land involved in the process of land alteration.

Area of very low dynamism is less than 5 % is found in two Tehsils, namely Malegaon (4.92 %), and Karanja (3.90%). The area of low magnitude (5% to 9%) of land use change in Washim (8.1 %) and Manora (5.62 %) Tehsils. The area of moderate change is recorded in Risod (9.16 %) and Mangrulpir (11.97 %) tehsil. It is show that these areas have shown considerable amount of stability in their land use pattern. From the above analysis, it is found that the very low changes in two Tehsils are Malegaon and Karanja because lack of irrigation and industrialization in both Tehsils. Area of low changes found in Washim and Manora Tehsil due to development in irrigation to some extent for agriculture and favourable physical conditions. The area of moderate change is recorded in Risod and Mangrulpir tehsil.

c) Changes in agricultural land use:

The trends in cropping pattern have been assessed in term of changes in percentage share of individual crops in net sown area at two points of time.

Base year 1990-91 and 2013-14 last year's data of area under single crops have been measured and used for find out their share in net sown area. The cropping pattern in the study area is dominated by the commercial or cash crops and it reveals a wide gap in the percentage of principal crops. Table 6.1 shows in the period of 1990-91, the total net sown area was 401183 hectares. Out of total NSA 174274 hectares area was under Cotton, Jawar 117306 hectares, Gram 26679 hectare, Red Gram 22025 hectares, area under Black Gram 9890 hectare, Green Gram12883 hectare and wheat 16529 hectares of total area to net sown area was under other cereals, pulses 2140 hectares and fruit, vegetables and condiments and spices occupied and 3049 hectares cultivated area. As much as 212587 (52.99 %) hectares of the total net sown area was under food crops. Table 6.1 indicates that some crops of the study area added area and enhanced their comparative position in the crops involved, while others came down gradually. Area under Cotton decreased from 43.44% of the net sown area in 1990-91 to 6.55 % in 2013-14 and percentage growth during the investigation period recorded -80.20 %, whereas difference in % share declined up to -36.89 % in the study region.

Throughout the investigation period amount of Gram increased from 6.55% to 252.34%. Wheat area had shown increase in their area whereas, area under Jawar decreased by 86.91%, Red Gram increased up to 109.68 %, and Green Gram -2.02% and Black gram increased up to 20.14 % in their area while area under other cereals increased up to 0.06% and pulses shows decrease in area. Total oil seeds area is increased from 2.59 % to 52.69 % in this period. Fodder crops shows negative change during the investigation period. Sugarcane area showed decrease from 0.11% to 0.04 %, whereas percentage of growth observed -51.70% while difference in percentage share recorded -0.07 % in the area (Graph: 6.1) from 1990-91 to 2013-14. The average percentage growth rate and difference in percentage share of crops area to NSA are recorded 31.40 % and 7.50 % respectively.

The physical and cultural conditions of area and Farmers influences the crop hectare age and cropping pattern of region. In study area after the 1995 HVY crop soya bean was introduced, which effects the agricultural cropping pattern of district. Soya bean occupies place of cotton, pulses and Jawar. Its percentage share grows up to 52.42 % area to NSA in 2013-14. It ranks first among all crops in study region. Most of the cultivation of food and non-food crops are rain fed. Irrigation being done only for limited rabbi crops area in the region. Kharif is the most important season for Crops grown in area as well as their production.

d) Crop's Combination:

Table No. 9.1 Crops Combination by K. Doi & Rafiullah's Methods.

Sr. No.	Tehsils	K. Doi 1990-91	Rafiullha's 1990-91	K. Doi 2013-14	Rafiullha's 2013-14
1	Washim	3	1	2	2
2	Risod	3	1	2	2
3	Malegaon	2	1	2	2
4	Mangrulpir	2	1	2	2
5	Manora	2	3	3	2
6	Karanja	2	3	2	2

Source: Computed by author

By Rafiullhas maximum positive deviation method, it includes only those combinations are factual representatives of the primary crops are obtained. The analysis of crop combination by above two methods and cartographic appearance clearly shows that the region is relatively small for diverse cropping pattern. Table No. 6.14 shows that in two Tehsils where by Doi's method detected three crops combination, by Rafiullha shows first four tehsil detected monoculture, and by Doi's other four tehsil detected two crops combination and Rafiullhas other two tehsil detected three crops combination is practiced in 1990-91. The crop combination analysis also contradict the commonly detained view of study area produces cotton and Jawar in 1990-91. After the period of more than two decades this crops combination changes in to two crops

combination by both method as cotton and Jawar to Soya bean and Gram in four tehsil and Soya bean and cotton in two tehsil in 2013-14.

e) Crops Concentration and Diversification:

Table: 6.16 shows the crops concentration in Washim tehsil in 1990-91. Principal crops cultivated in tehsil shows their performance. Farmers are more interested in Jawar, Black Gram, Red Gram, Green Gram and Gram occupies very high concentration. It means farmers are more interested in this crops production. Distribution of this crops is highly uniform in Washim tehsil in 1990-91. Cotton and Wheat occupies moderate and low concentration means the farmers are less interested in their production in Washim tehsil. In 2013-14 Jawar, Black Gram, Green Gram and Gram lost their position and Red gram gain their position with Soya bean and Wheat.

The table; 6.17 shows the changes in principal crops concentration in Risod tehsil in 1990-91 to 2013-14. Jawar save its very high position, and cotton improve its position from high to very high in next year. Black Gram at high in base year and it lost its position at low. Red gram improve from high to very high. Green gram loss from moderate to low and Gram bear its position at very high and Wheat improve from very low to moderate. Soya bean absent at base year and it occupies high concentration in 2013-14.

The table: 6.18 shows the changes in principal crops concentration in Malegaon tehsil in 1990-91 to 2013-14. Jawar improve his position from high to very high, and cotton lost its position from moderate to low in next year. Black Gram save its position at very high. Red gram save his position at very high. Green gram save its position at high and Gram improve its position at very low to moderate and Wheat improve from very low to high. Soya bean absent at base year and it occupies very high concentration in 2013-14.

The table: 6.19 shows the changes in principal crops concentration in Mangrulpir tehsil in 1990-91 to 2013-14. Jawar save his position at very high and cotton its moderate position in next year. Black Gram save its position at very high. Red gram lost his position at very high to high. Green gram save its

position at very high and Gram improve its position from moderate to very high. Wheat improve from low to very high. Soya bean absent at base year and it occupies high concentration in 2013-14.

The table: 6.20 shows the changes in principal crops concentration in Manora tehsil in 1990-91 to 2013-14. Jawar improve his position from high to very high, and cotton lost its position from very high too high in next year. Black Gram improve its position from low to high. Red gram save his position at high. Green gram lost its position from high to low and Gram lost its position from moderate to low and Wheat improve from low to very high. Soya bean absent at base year and it occupies high concentration in 2013-14.

The table: 6.21 shows the changes in principal crops concentration in Karanja tehsil in 1990-91 to 2013-14. Jawar save their position at very high and Cotton improve it's from high to very high. Black Gram save its position at high. Red gram lost his position from high to low. Green gram and Gram improve its position from low and moderate to very high. Wheat improve from very low to high. Soya bean absent at base year and it occupies high concentration in 2013-14.

The changes in principal crops diversification in Washim district. Map: 6.5, 6.6 shows the crops diversification from base year to 2013-14. In Washim tehsil have in base year very high and in 2013-14 it occupies very high diversification. Risod tehsil have very high diversification and it continue in 2013-14. In Malegaon tehsil have very high crops diversification and it at very high. In Mangrulpir tehsil it occupies very high and it remains constant in 2013-14. In Manora tehsil in base year it occupies very high crops diversification and it at very high in 2013-14. In Karanja tehsil have occupies very high diversification and it at very high crops diversification. Washim district have very high level of crops diversification at base year and it also occupies very high crops diversification in 2013-14 also.

So there is need of intention on improve the soil fertility by crops rotation and using soil improvement measures.

The extent of cropping intensity has been done on the net area sown is presented in Table: 6.23 and Graph: 6.8. The impact of irrigation facilities and scale of cultivators per 1000 hectares of the cultivated area, nature of soil, assured rainfall and size of holding were the most important factors, which are determine the variations in the area, and distribution of cropping intensity.

In the study region there is high difference between net sown area and total cropped area because of rich soil condition and plateau land, assured rain fall medium size of land holdings etc. determining the six Tehsils cropping intensity. It is detected that study region have average 112.27 % of cropping intensity in1990-91 and it improve up to 131.33 in 2013-14. Washim tehsil improve its cropping intensity up to 18.28 on 1990-91 in 201-14. Risod tehsil improve its cropping intensity up to 57.85 on 1990-91 in 2013-14.

f) Crops yield production and productivity:

Table: 7.1 shows per hectare yield of Jawar was 1605 kg in 1990-91 it decreased up to 1167 kg in 2013-14 and 1227 kg is average yield of Jawar crop. The yield of Wheat increased from 1442 kg to 1555 kg per hectare in period of more than two decades. The yield of Gram in the study area ranges from 504 kg to1088 kg per hectare (Graph: 7.1). The average yield of Red gram is 68 kg in 1990-91 is increased up to 723 kg in 2010-11.The yield of Black gram is 511 in base year and is increased up to 719 kg in 2010-11. Green gram shows the positive change in per hectare yield from 463 kg to 539 kg in 2010-11. Soya bean is a bumper yield crop shows growth from 732 kg to 1444 kg per hectare in 2010-11.

The production of principal food grains is 260085 metric ton in1990-91, it increased up to 265010 metric ton in 2010-11. The period of more than two decades 1.89% increase in food grains production. Gross cropped area is 401183 in 1990-91, it is increased up to 527159 hectares in 2013-14. But area under food grains crops is increased from 212587 to 213605 in 2013-14. Even between food grains pulses (73337 hectare to 166314 hectare) have recorded bumper growth in area but cereals decreased rapidly (139250 hectare to 47291

hectare) in area. The increase in food grain production redirects the combined effects of increase in area and productivity per hectare. The growth in production is associated with the growth in per hectare yield of crops. In this attempt to present spatial as well as decadal variation in yield of principal crops and its impact on growth (Table: 7.2) of production.

The overall or general productivity was moderate in Washim tehsil and it is continue in 2011. The high general productivity efficiency level detected in Risod, Malegaon, Mangrulpir and Karanja tehsil in 1991. It continue in Risod and Mangrulpir tehsil, Malegaon and Karanja reverse at moderate in 2010-11(Table: 7.6, Map: 7.17, 7.18). Manora tehsil remain constant at moderate general productivity efficiency level in 2010-11.Study area or district overall productivity efficiency level of crops was moderate in 1990-91 and it gain high general productivity efficiency level in 2010-11 (Table: 7.6, Map: 7.19, 7.20).

g) The micro level study of sample villages:

The sample study of randomly chosen villages unfolds in detail and inclusive analysis of agricultural land use pattern. The selected villages in present study map some common characteristics. It is observed that agriculture is the basic source of livelihood and therefore more than 93.35% working force to total workers are engaged in agriculture activity. Kharif is most important season in all sample villages when nearly 83.27 % to total arable land is brought under cultivation. Soya bean, Gram, Red gram and Wheat are dominant in cropping pattern and soya bean stand first and Gram second in sample villages. The agricultural land use of individual villages undertaken for study map variations due to different soil types and slight variations in rainfall amount, besides, decision making of farmers. It is found that Kalambeshwar and Hivara (Bk.) are relatively more advanced in agricultural land use than that of other sample villages because of their location in deep black fertile area in Washim district, where medium to deep black soils are predominant and hence fertile producing high yield per hectare. The villages namely, Karda, Kanzra, Pimpalgaon and Virgavhan have shown medium partly development due to extensive coverage

by shallow and medium deep soils. It is observed that fertile soils are utilized for cultivating soya bean, Gram, Red gram and wheat, Jawar while, Green gram, local Jawar, groundnut are raised on shallow soil. The field survey, inter-views and soil analysis unfold the association between soil types and crops for six sample villages. Further it is observed that sample villages have brought maximum land under cultivation and therefore has less scope for expansion of arable land.

The only possibilities of raising production is the intensification of land use by sowing improved varieties of seeds, expansion of well irrigation, application of IPM and INM technologies' chemical fertilizers, soil testing, in addition to awareness plan for spread of modernization in agriculture.

9.4 Problems in agricultural development:

Low productivity is the major problem faced by the farmers. Although 93% of the working population is engaged in agriculture. About 52% of agricultural land is devoted to oil seed crops. There are many reasons for this sorry state of affairs. The main reasons are as:

1. Washim district agriculture is predominantly a commercial type produce, oil seed (soya bean) sold in the market, but market prices of his produce is very low in relation to his production cost (2013-14).
2. Agriculture has been carried out in Washim district for the last thousands of years as a result of which the soil in district is exhausted or improvised.
3. There has been large scale soil erosion in different part of the district due to reckless falling of tress, overgrazing and faulty agricultural practices.
4. Land holdings are very small (2.43 hectare). In certain areas they are too small to be economically viable. They can't produce enough food even for the farmers own family.
5. 94% area of the district still a wait for irrigation facilities without irrigation agriculture becomes uncertain.

6. Many farmers are too poor to purchase fertilizers, better seeds and to arrange for other basic inputs. Thus they feel handicapped so far as improvement in agriculture is concerned.
7. Most of the farmers are uneducated and don't easily accept new methods of agriculture.
8. Washim district agriculture basically depends upon monsoons. The uncertain and unreliable rainfall by monsoons play's havoc with agriculture.
9. Most of farmers don't own the land which they are cultivating. They are tenants cultivating the land on lease from the land-owners. As such they do not take much interest in improving the land.
10. Cost effective Marketing facilities and means of transportation are still lacking in many parts of districts.

9.5 Implications:

a) Improve Irrigation:

Conclusions emerging from the analysis of various aspects of agricultural development in Washim district provide important directions for reorientation in the agricultural development strategy to be pursued in future. In this respect, the study suggest the following measures.

1. The entire district is underlain by the Deccan Trap Basalt where only dug wells are most feasible structures for ground water development. The sites for bore well need to be selected only after proper scientific investigation.
2. Bore wells generally tap deeper fractures, which may not be sustainable. Besides, the bore wells should only be used for drinking water supply and not for irrigation.
3. The southern parts of the district comprising parts of Risod and Washim tehsil have high ground water development potential. In these areas the ground water can be developed through dug wells, dug-cum-bored wells and bore wells.

4. Drought and deeper water levels area has been observed in southwestern parts of Risod tehsil. Thus future water conservation and artificial recharge structures needs to be prioritized in these parts of the district.
5. The scope exists for constructing of suitable artificial recharge structures in the district. The structures recommended for the hilly-Basaltic area in the central parts in parts of Malegaon, Mangrulpir, Washim and Malegaon are: contour bunds, gully plugs, Nala bunds and check dams etc.
6. For other Basaltic areas, the Nala bunds, check dams and KT weirs are suggested. The existing dug wells may also be used for artificial recharge of ground water provided source water is free of silt and dissolved impurities.
7. The existing village ponds need to be rejuvenated to act both as water conservation and artificial recharge structures.
8. For the progress of agricultural growth in Washim district an undoubtedly linked to the pace of development of irrigation in future. For the gains in productivity, from expansion in irrigation and its output stabilizing in pact would be inextricably depend upon the degree of its dispersal across the crops and operational efficiency of the irrigation systems.
9. Restore the conventional methods of water conservation like Jhods, Ponds, and Tanks etc.
10. Introduce rain water harvesting (i.e. farm tanks).
11. Proper water conservation measures should be used. Farmer should be made aware and trained with the techniques of water conservation.
12. Government schemes should be implement properly.
13. Farmers should be trained as water manager for the better utilization of irrigation.
14. To promote farmers for the artificial recharge to ground water aims at augmentation of ground water resource by modifying the natural movement of surface water utilizing suitable civil constructions technique like check dams, gully plug, contour trenching, subsurface dyke, recharge pit, recharge

dug well are some of the suitable structures required for recharging ground water reservoirs in the area.

b) Agricultural inputs, credit and technology:

1. The simultaneous focus on achieving the integrated and efficient management of all the inputs (i.e. irrigation, fertilizer etc.) and farming systems.
2. For intensive cultivation of land through progressive adoption of new technologies and use of inputs (i.e. fertilizer, seeds, irrigation, etc.) have continue support of the adequate and unhindered flow of credit to agriculture. This need will become increasingly crucial as the trends towards commercialization and diversification of agriculture intensifies in future.
3. The irrigation and agriculture technology development with the efficient infrastructural development, particularly good roads, communication and markets which create an enabling environment in which farmers receive their due share in prices paid by the ultimate consumer.
4. To help the small and marginal farmers, either to expand their operational holding by leasing in additional land or leasing out their land to others without losing its ownership.
5. The agricultural officer's special attention needs to be paid to promote farmers for balanced use of fertilizers, organic manures and integrated pest management.
6. Every farm and farmers soil testing is became compulsory and made soil health card with soil health remedies.

c) Soil conservation:

1. **A forestation:** The best way to conserve soil is to increase area under forest.
2. **Checking overgrazing:** Overgrazing of forest and grass lands by animals, especially by goats and sheep should be properly checked.
3. **Constructing dams:** Much of the soil erosion by river floods can be avoided by constructing dams across the Nalas.

4. **Changing agricultural practices:** Like crop pattern, strip cropping, use of early maturing varieties, contour ploughing, Terracing and contour banding, ploughing the land in right direction etc.

9.6 Concluding Remark:

The present work is a gainful and very hard in analysis of changes in agricultural land use pattern in the Washim district at the tehsil and village level. This study may attract the attention of planners, agriculturists in particular and laymen in general. This workout focuses the past and present characteristics of agricultural land use pattern of the area. Such investigations would be an immense importance as guidelines for proper and efficient agricultural land use for increasing production. Finally it felt that similar studies should be undertaken at the tehsil and village level considering tehsil and village as representative for further study for the other regions of Maharashtra, as for the detailed understanding of the agricultural land use and its problems in future.

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Appendix- A

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Changes in General Land Use Pattern in Beed District of Maharashtra

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Abstract:

The analysis of general land use pattern denotes that the utilisation of land surface in various activities in a region. The general land use of the district is classified as, Net sown area, land not available for cultivation, Cultivable waste, Fallow land and forest land. The above classification is used for present study. In this paper, an attempt has been made to study the changes in general land use in Beed District of Maharashtra. Beed District is located in central part of Maharashtra and covers 10686 sq. km. area. The entire study is based on secondary data. It covered the period of one decade i.e. from 1999-2000 to 2009-2010 is selected for spatial and temporal changes in land use. The tahsil is a basic unit of investigation .Cartographic techniques are employed to strengthen the analysis of study. The study reveals that during the last decade drastic changes have taken place in general land use pattern of Beed District.

Key Words: Land use pattern, Net sown area, fallow land, cultivable waste.

Introduction:

Land use study has a great importance because it can provide a picture about intensively used, under used and unused land of the area. The concept of general land use is related to the use to which land is put in a certain reason at a given period of time. Land use is a result of combinations of both natural genesis and human influences which have been brought to bear unit in the past and of those which are still active in the present (Vink A.P.A. 1975). The changing man-environment relationship also plays an important role in defining the land use of the particular region. The basic objective of the land use pattern is to use the available land which is limited. The pattern of land use is complex and dynamic. The analyses of land use find out the structure of land utilization for different purposes in an area. In this paper, an attempt has been made to study the changes in general land use in Beed district.

Study Region:

Beed district is situated in the central part of Maharashtra and lies between 18^0 27' and 19^0 27' north latitude and 74^0 49' and 76^0 44' east longitude. It is surrounded by Aurangabad and Jalna districts to the north, Parbhani district to the north-east, Latur district to the south-east, Osmanabad district to the south and Ahmednagar district to the west. Beed is the headquarters town of the district. It has an area of 10686 km^2 which constitutes 2.47 percent of the total area of the state. Amongst the 35 districts in the state it ranks 10^{th} in terms of area. Physiographic setting of the district is broadly divisible to three division, viz., the low lying northern division or lowland Beed, the higher part in the south forming part of the Balaghat plateau or highland Beed, and third low lying undulating area south-west and west of highland. Beed comprising almost the whole of Ashti tahsil lying mostly in the Sina basin. The district is monotonously covered by Deccan trap basaltic lava flows. The soils of the district are essentially derived from the Deccan trap.

Objective:

This paper has been study the decadal changes in General land use pattern of Beed district (1999-2000 to 2009- 2010).

Database and Methodology:

The data is collected from secondary sources namely, socio economic review, District census Hand-back, District Gazetteer, Seasons and Crop reports published by Government of Maharashtra and department of Agriculture. The data obtained for the study period of 1999-2000 and 2009-20010.The available data, converted in the percentage to the total geographical area. The percentage is categories in different groups. The volume of change of these categories for a decade was computed and interpreted. Tehsil is selected as a basic unit of investigation.

Change in General Land use Pattern:

Land use is the surface utilization of all developed and vacant lands on a specific space at a given time. Land is used for Agriculture, forest, pastures,

transportation, and settlement, industrial and commercial purposes. Whereas, uncultivable waste land, barren and fallow land are unused lands. The Present land use has been divided into five major category viz.1) Net sown Area, 2) Area not available for cultivation 3) other uncultivated land 4) Fallow land 5) Forest.

Net Sown Area:

The net sown area is the land which is being actually tilled for raising the crops. The temporal variation in net sown area of 1999-2000 and 2009- 2010 is shown in Fig.-1and 2. In 1999-2000, the net sown area was 81 per cent of the total geographical area and after ten years, in 2009-2010 it was recorded as 78 per cent and it was less than the year1999-2000 i.e. 3 per cent. The fluctuation in the net sown area is observed in study period. Seven tehsils observed positive change and four tehsils observed negative change in the study region. The highest increase has observed with 13.47 per cent in Ambejogai tahsil and lowest change observed in Parali tahsil (1.47 per cent).Very high negative change has observed in Beed tahsil(-42.91 percent). Moderate negative change is observed in Dharur and Patoda tahsils which is -17.51 and -9.41 percent and so on.

Area not Available for Cultivation:

This broad category comprises of a number of different types of land which are not available for cultivation under the existing circumstances. This type of land use represents the land occupied by roads, railways, industries, water bodies, gardens, play Grounds, Grave land and settlements. The land under this category in 1999-2000 was 5.75 per cent and 6.65 per cent in 2009-2010 of the total geographical area. The area under land not available for cultivation was increased up to the 0.9 percent in2009-2010.

Fig.1 General Landuse pattern of Beed District:1999-2000

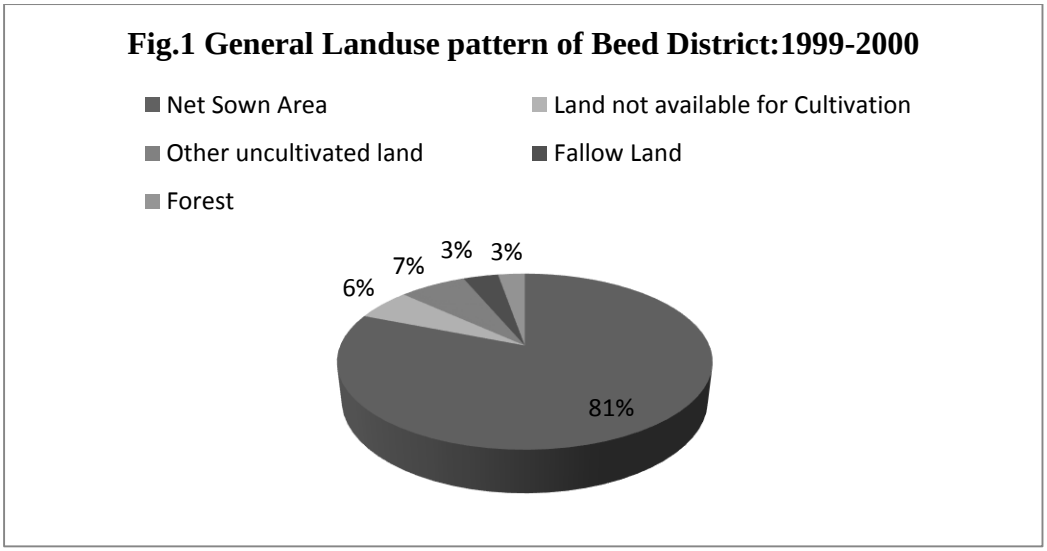
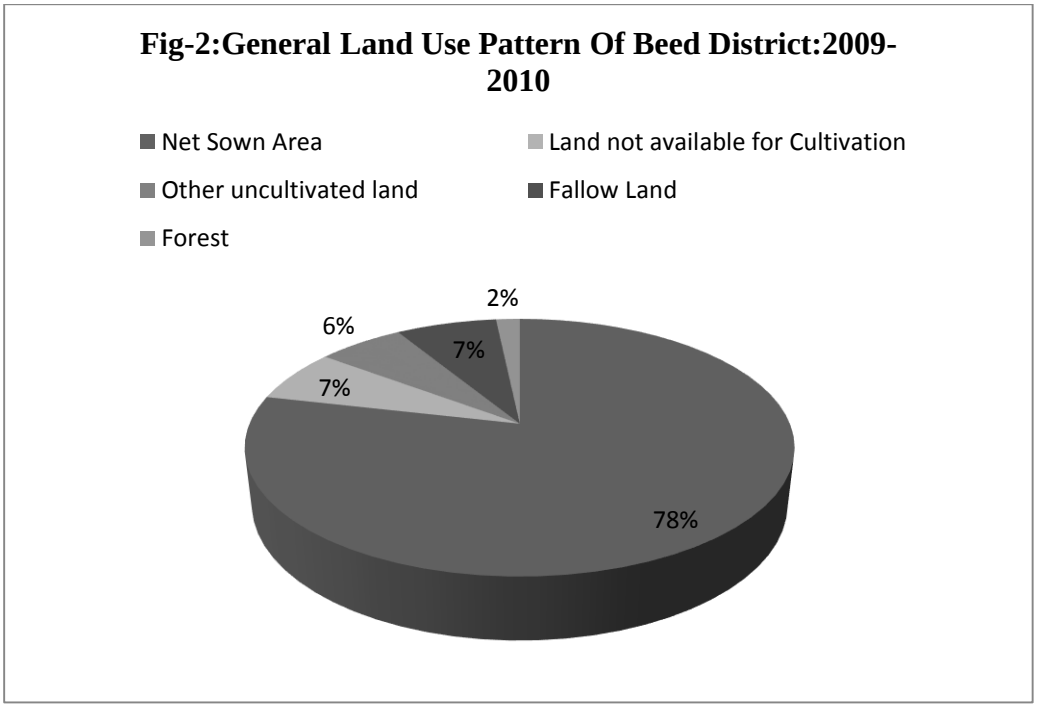


Fig-2:General Land Use Pattern Of Beed District:2009-2010



Cultivable Waste Land:

The area under other uncultivable land in Bid district was 6.88 per cent in 1999-2000 and 6.05 in 2009-2010. The highest percentage area under cultivable waste land is recorded in Wadvani and Dharur tahsil with 11.77and 11.73 per cent and lowest area has observed in Gevrai tahsil with 2.08 percent in 1999-2000. The area under other uncultivable waste land in all above tahsils are decreased except Beed and Gevrai tehsil.

Table-1 General Land Use Pattern of Beed District (Area in %)

Tehsils	Net Sown Area			Land not available for Cultivation			Other uncultivated land		
	1999-2000	2009-2010	Change	1999-2000	2009-2010	Change	1999-2000	2009-2010	Change
Ashti	83.53	89.20	5.67	6.20	4.91	-1.29	4.00	3.29	-0.71
Patoda	78.25	68.84	-9.41	6.99	5.06	-1.93	5.93	3.10	-2.83
Shirur Ka.	80.31	83.82	3.51	7.01	14.16	7.15	5.93	1.48	-4.45
Gevrai	87.36	87.10	-0.26	3.63	0.62	-3.01	2.08	6.47	4.39
Majalgaon	85.26	93.21	7.95	6.30	3.54	-2.76	5.97	1.83	-4.14
Wadvani	72.52	77.83	5.31	7.26	6.71	-0.55	11.77	13.82	1.85
Beed	85.93	43.02	-42.91	3.04	16.82	13.78	4.99	22.68	17.69
Kaij	82.54	89.47	6.93	5.89	4.15	-1.74	5.29	3.56	-1.73
Dharur	72.98	55.47	-17.51	7.24	7.99	0.75	11.73	3.63	-8.1
Parali	87.14	88.61	1.47	3.01	6.64	3.63	8.13	3.03	-5.1
Ambejogai	74.95	88.42	13.47	6.77	2.63	-4.14	9.89	3.72	-6.17
District Average	80.97	78.63		5.75	6.65		6.88	6.05	

Source: computed by Author, As per Socio-Economic Review and Statistical Abstract of Beed District 1999-2000, 2009-2010

Continue…

Table-1 General Land Use Pattern of Beed District (Area in %)

Tahsils	Fallow Land			Forest		
	1999-2000	2009-2010	Change	1999-2000	2009-2010	Change
Ashti	4.41	0.87	-3.54	1.83	1.70	-0.13
Patoda	5.84	20.96	15.12	2.97	2.02	-0.95
Shirur Ka.	3.76	0.05	-3.71	2.97	0.47	-2.5
Gevrai	5.80	5.80	0.00	1.11	0.00	-1.11
Majalgaon	1.93	0.82	-1.11	0.51	0.58	0.07
Wadvani	3.29	1.62	-1.67	5.14	0.00	-5.14
Beed	2.53	12.21	9.68	3.48	5.25	1.77
Kaij	3.78	0.74	-3.04	2.47	2.05	-0.42
Dharur	2.90	32.54	29.64	5.13	0.33	-4.8
Parali	1.12	1.12	0.00	0.59	0.59	0.00
Ambejogai	4.28	1.12	-3.16	4.08	5.40	1.32
District Total	3.60	7.07		2.75	1.67	

Fallow Land:

This includes all land which was taken up for cultivation but is temporarily out of cultivation for a period of not less than one year and not more than five years. The highest increase has observed in Dhrur tahsil (29.64 per cent) and lowest increase was observed in Parli and Gevrai tahsil with 0.00 per cent. Ashti, Shirur Ka., Majalgaon, Wadvani, Kaij and Ambejogai Six tahsils have observed negative change and five tahsils have observed positive change in the region (0.00 to29.64%). Fig.1 and 2 display the total area under fallow land in Beed district. Total land under fallow land was 3.60 and 7.07 per cent in 1999-2000 and 2009-2010 respectively.

Forest Area:

Forest land includes all land classified as a forest under any legal enactment dealing with forests or administered as forests, whether state owned or private,

whether wooded or simply maintained as a forest land. Fig.1 and 2 clearly indicate that there is a continuous decline in the forest land. The area under forest 2.75 per cent during 1999-2000 and it was declined by 1.08 per cent in 2009-2010.

Conclusion:

The pattern of land use is complex and it shows the fluctuations in the study period. The district has decrease in percentage of area under net sown and decrease in cultivable waste during the study period. This shows the efforts of farmers to bring the maximum land under cultivation. The main problem of land use in the Beed district is that, the area under forest is decreased at alarming rate. If it goes on decreasing land under forest the district will certainly face the problem of ecological disturbance. To sustain land resource potential, decision on land use should be made in such way that the responses of environment are put into the most beneficial use for human society.

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Appendix-B

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A Study of Agri-Tourist's Satisfaction At "Sanskriti Agri-Tourism" Daulawadgaon In Ashti Tahsil of Beed District, Maharashtra

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Abstract:

Agri-Tourism is a concept where farmers offer tours to their agriculture farm and providing Entertainment, Education and fun-filled experiences for the urban peoples. Agri. tourism is a way of sustainable tourist development and multi-activity in rural areas through which the visitor has the opportunity to get aware with agricultural areas, agricultural occupations, local products, traditional food and the daily life of the rural people, as well as the cultural elements and traditions. Moreover, this activity brings visitors closer to nature and rural activities in which they can participate, be entertained and feel the pleasure of tourism. An attempt is made to assess the level of satisfaction of Agri-tourists at Sanskriti Agri-Tourism at Daulawadgaon.

The destination is located in Ashti tahsil of Beed District of Maharashtra and border place of Ahmednagar district a historical place is well connected by road and rail. The study is based on primary and secondary data. With the help of questionnaire a random sample survey of 200 Agri-Tourists have been interviewed at the time of three seasons namely Hurda party (parched corn tender pods), Aamras party and Dalbatti. The views of Agri-Tourists were converted into numerical values. The factor wise level of satisfaction index has been computed. The category wise percentage reveals that the facilities provided at Sanskriti Agri-tourism are noted excellent (34%), good (39%), satisfactory (23.5%) and unsatisfactory (3.5%). Therefore the level of satisfaction of the tourist is high. Only 3.5% tourist told that facilities are not satisfactory. But Agri-Tourists were appreciated with the excellent physical condition of the destination. Generally the Agri-Tourists were satisfied with the existing facilities provided by Sanskriti Agri-tourism at Daulawadgaon.

Key words:

Agri-Tourism, Agri-Tourists satisfaction, satisfaction index, Tourism destination.

Introduction:

Agricultural Tourism is the Holidays concept of Visiting a working farm or any agricultural, horticultural, or agribusiness operations for the purpose of enjoyment, education, or active involvement in the activities of the farm or operation. The term 'Agri-Tourism' is a new face of tourism. Agri-tourism is farm based business that is open to the public. These specialized Agri-tourism destinations generally offer things to see, things to do, and produce or gifts to buy, and are open to the public. Agri-tourism is defined as **"**Travel that combines agricultural or rural settings with products of agricultural operations – all within a tourism experience". According to Mr. Pandurang Tavare (ATDC, Pune) - "Agro-Tourism is that Agri-Business activity, when a native farmers or person of the area offers tours to their agriculture farm to allow a person to view them growing, harvesting, and processing locally grown foods, such as Coconuts, Pineapple, Sugar cane, Corn, or any agricultural produce which the person would not encounter in their city or home country. Often the farmers would provide a home-stay opportunity and education".

Researchers have been attempted to identify the consumer satisfaction and dissatisfaction and service quality in the marketing literature. There has been a study flow of output highlight the tourist's satisfaction in the last 20 years (Cho 1998, Mountino 1987, Ryan 1995). There has been increasing attention has given to consumer satisfaction in the marketing literature; however, few studies have been undertaken for tourists satisfaction assessment (Cho 1988). Satisfaction is a psychological outcome emerging through experiences, whereas, service quality

is commercial with attributes of service itself (Crompton and Mackey 1989). In tourism several of people came in contact with each other i.e. tourist travelled from, residents, entrepreneurs and administrators. It is quite necessary to keep cordial with them. But it depends on the behaviour of the people and the destination where they get the services. Whether the tourists have satisfied by the provided services of the destination at reasonable rate? This is to be easily and conveniently assessed by the method of level of satisfaction. Tourist satisfaction assessment regarding certain attractiveness and specific activities in respect of tourist is useful in making changes and modification in tourists programme and facilities. The residents and tourists are co-related to each other. The popularity of destination is mainly depending on good co-operation and the treatment of local people.

Objective:

The objective of this paper is to compute the level of satisfaction for agri-tourism tourists at Sanskriti Agri-Tourism at Daulawadgaon in Ashti tahsil of Beed district (Maharashtra).

Study Area:

The Sanskriti Agri-tourism is one of the most important Agri-tourism in Ashti tahsil of Beed District of Maharashtra state. This destination is situated at $19^0\,2'$ and $19^0\,4'$ North latitude and $74^0\,55'$ and $74^0\,59'$ east longitude (S.O.I. Topo-sheet No.47 I/16). Altitude of this area is 720-740 meter above sea level. The climate of the tahsil is on the whole dry except during the south-west monsoon. The average annual rainfall in the tahsil is 698 mm. Sanskriti Agricultural Tourism is 25 km. away from the central bus station and central Rail way station of Ahmednagar. It is situated near state highway number 2 at Daulawadgaon Tq. Ashti Dist. Beed. From Ahmadnagar, State transport buses, private taxis are available to reach the destination from Ahmednagar (Taklikazi-Bhatodi-Daulawadgaon). This destination has good communication, mobile and landline

network of public and private service companies. The average flow of tourists on the holidays (November to April-2010) was 300 and other days 200 respectively.

Database and Methodology:

The study is entirely based on field work collected through questionnaires; random sample was chosen for interview. With the help of questionnaires; a random sample survey was conducted and a total 200 tourists have been interviewed for specific days. The obtained data were then converted in to numerical values, i.e.08-10 for excellent, 06-08 for good, 04-06 for satisfactory and 0-04 for unsatisfactory. The factor wise level of satisfaction has been computed. The factor wise average values are further computed. The obtained values were used for calculating Satisfaction index by using following formula.

$$Sli = \frac{\sum Mi\ Ni}{N}$$

Table No. 1: Factor wise Level of Satisfaction

Sr. No.	Factors	Level of Satisfaction				
		Excellent	Good	Satisfactory	Unsatisfactory	Total
1	Fruits & Crops	63	78	39	20	200
2	Agricultural information	71	74	38	17	200
3	Adventure Games	67	88	40	05	200
4	Food	90	81	28	01	200
5	Opinion about Destination	98	85	17	00	200
6	Personal safety	70	99	27	00	200
7	Gift to buy	106	61	23	10	200
8	Transportation	35	126	35	04	200
9	Rent	00	12	178	10	200
	Average	68	78	47	07	200
	Percentage	34	39	23.5	3.5	100

Source: computed by Author

Where:

Sli = satisfaction index for 'i' th factor

Mi = Numerical values for particular level of satisfaction for the 'i' th factor

Ni = No, of respondents deriving particular level of satisfaction for the 'i' th factor.

N = Total number of respondents for that factors all level of satisfaction.

Factor wise Level of Satisfaction:

Level of satisfaction is a state of mind. Nine important factors which influence the level of satisfaction are identified as could be given in the Table-1. To conduct a sample survey, a questionnaire was prepared and filled up by tourists. The tourists were asked to indicate the level of satisfaction they derived in respect of each factor by stating excellent, good, satisfactory and unsatisfactory. Factor wise level of the tourist is assessed by collecting the information given by them in Table-1. The category wise percentage reveals that the facilities provided at Sanskriti Agri-tourism are noted excellent (34%), good (39%), satisfactory (23.5%) and unsatisfactory (3.5%).

Factor wise Average Values of Satisfaction:

Therefore the level of satisfaction of the tourist is high. Only 3.5% tourist are of the view that facilities are not satisfactory. Factor wise average values are calculated. For that purpose the tourist were asked to assign points (out of maximum 10) for the particular level of satisfaction they derived from each factor.To ensure uniformity a forced distribution of points was adopted for convenience. Namely 8 to 10 for excellent, 6 to 8 for good, 4 to 6 for satisfactory and 0 to 4 points for unsatisfactory.

As shown in the pie diagram (figure 1), the weights of the nine factors are fairly close to each other ranging from 11% to 12% (except Rent). This suggests that the eight factors contributed for tourists' overall satisfaction, and the rent contribute the least.

Table -2: Factor wise average values of satisfaction

Sr. No.	Factors	average values of satisfaction			
		Excellent	Good	Satisfactory	Unsatisfactory
1	Fruits & Crops	8.95	6.75	5.20	2.20
2	Agricultural information	9.00	6.93	4.97	2.17
3	Adventure Games	8.91	7.09	5.10	2.00
4	Food	8.78	7.08	5.25	4.00
5	Opinion about destination	8.84	6.85	4.87	0.00
6	Personal safety	7.33	6.81	5.00	0.00
7	Gift to buy	8.15	7.02	5.15	2.00
8	Transportation	8.87	6.85	5.12	3.00
9	Rent	0.00	7.00	5.09	2.00

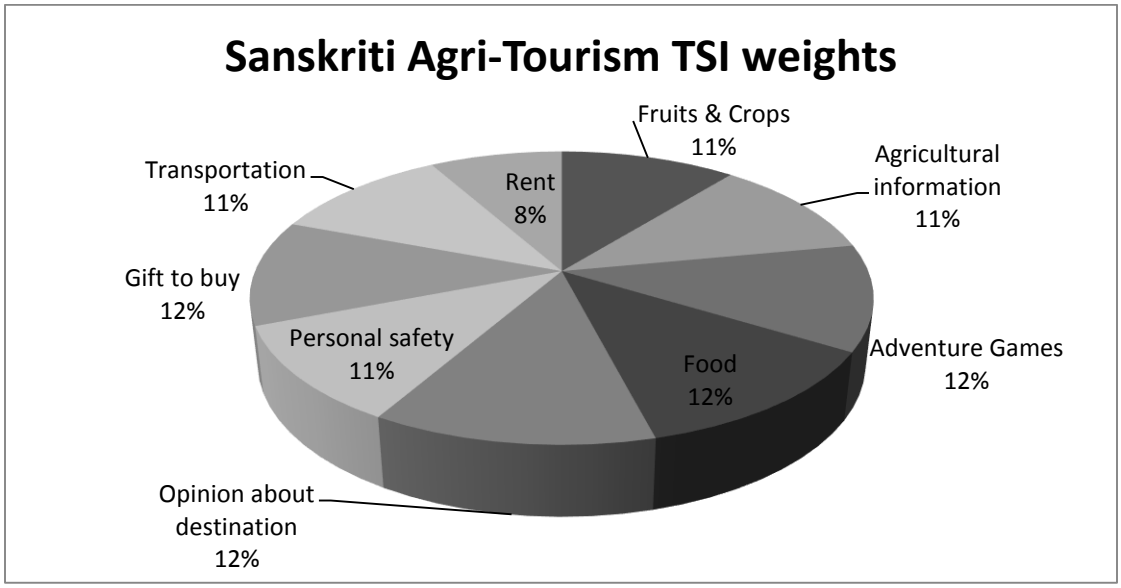
Source: computed by author

Table-3: Satisfaction index and Ranks

Sr.	indicators	Satisfaction Index	Ranks
1	Fruits & Crops	6.68	7
2	Agricultural information	6.88	5
3	Adventure Games	7.17	3
4	Food	7.57	2
5	Opinion about destination	7.65	1
6	Personal safety	6.61	8
7	Gift to buy	7.15	4
8	Transportation	6.82	6
9	Rent	5.05	9

Source: computed by author

Figure-1: Sanskriti Agri-Tourism TSI weights



However, the differences between the contributions are small. The average values for the different level of satisfaction for the different factors are given in table-2. From the above table it is observed that the satisfaction index for Fruits & Crops works out as 6.68, for agricultural information 6.88, for Adventure Games 7.17 for Food 7.57, for Opinion about Destination 7.65, for personal safety 6.61, for Gift to buy 7.15 for Transportation 6.82 for Rent 5.05. These satisfaction indices are weighted by given ranks to these factors (Table-3). It is observed that the opinion about Destination received rank 1st. Food and drinking water received rank 2nd. Agri-Tourism and Food is very intimately related concepts. The level of satisfaction of the tourists is high on this count. The variety and quality of food served by the Sanskriti Agri-Tourism in the Village is also up to the satisfaction of tourists. Adventure Games received the 3rd rank. Gift to buy received 4th rank; Agricultural information received 5th rank and so on, means high contribution to the level of satisfaction. Sanskriti Agri-Tourism is well connected by Rail and Road to other parts of Maharashtra.

Conclusion:

The level of satisfaction of the tourist by noting their views about the facilities provided to them is assessed. The factor wise satisfaction index is calculated reveals the fact that in general the tourists are satisfied with the existing facilities at Sanskriti Agri-Tourism.

Acknowledgement:

The author gratefully acknowledges the very helpful support given by Krishibhushan, Shri. B.N. Pisore, Director, Sanskriti Agri-Tourism At. Daulawadgaon Tq. Ashti Dist. Beed, Maharashtra.

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Appendix-C

डॉ. बाबासाहेब आंबेडकर मराठवाडा विद्यापीठ औरंगाबाद

पा. उध्दव एकनाथ चव्हाण संशोधक विद्यार्थी मार्गदर्शक - डॉ.पी.एच. म्हस्के

विषय : Changing Pattern of Agricultural Land Use in Washim District

गावाचे नाव : ---------- **तालुका** : ---------- **जिल्हा - वाशिम**

(अ)

१. शेतकऱ्याचे नाव : ---------- सर्व्हे न. गट न.

२. एकूण क्षेत्र : हे/आर बागायती क्षेत्र : हे/आर

३. सिचन हे.आर.: विहीर ☐☐ पाटपाणी ☐☐ नदी ☐☐

४. सिचन यंत्रणा : 1) विद्युत पंप ☐ 2) डिझेल इंजन ☐

५. शेती ओजारे : लोखंडी नांगर ☐ ट्रॅक्टर ☐ बैलजोडी ☐ इतर ☐

६. **खरीप पिक संरचना** (हे.आर) : सोयाबीन ☐☐ कापुस ☐☐ भात ☐☐ ज्वारी ☐☐

बाजरी ☐☐ मुग ☐☐ उडीद ☐☐ तुर ☐☐ चवळी ☐☐

मका ☐☐ भुईमुग ☐☐ सुर्यफुल ☐☐ मोहरी ☐☐ एरंडी ☐☐

अंबाडी ☐☐ इतर ☐☐

७.**रब्बी पिक संरचना** : (हे. आर.) ज्वारी ☐☐ गहु ☐☐ हरभरा ☐☐ करडई ☐☐

मोहरी ☐☐ सुर्यफुल ☐☐ ऊस ☐☐ सत्र ☐☐

मोसंबी ☐☐ आंबा ☐☐ पेरु ☐☐ केळी ☐☐ इतर फळे ☐☐

८. **संकरीत बियाणे** : सोयाबीन ☐ ज्वारी ☐ बाजरी ☐ गहु ☐ हरभरा ☐

भात ☐ मका ☐ मुग ☐ तुट ☐ उडीद ☐ चवळी ☐

मोहरी ☐ सुर्यफुल ☐ भुईमुग ☐ एरंडी ☐ करडई ☐ इतर ☐

(ब)

M F M F M F M F

१) कुटुंबातील एकूण सदस्य : 0 - 6 ☐☐ 6 - 18 ☐☐ 18 ते 60 ☐☐ एकूण ☐☐

M F M F

२) व्यावसाय : नोकरी ☐☐ शेती ☐☐

हे.आर.

३) एकूण क्षेत्र : 1 ☐☐ 2 ☐☐ 3 ☐☐ 4 ☐☐ 5 ☐☐ 6 ☐☐ 7 ☐☐ 8 ☐☐ 9 ☐☐ 10 ☐☐

४) बँकेत खाते ☐ कर्ज ☐ खाजगी ☐ सरकारी ☐

५) आर्थिक परिस्थिती : उत्तम ☐ हलाखीची ☐

६) शेती फायदेशीर आहे का ? ----------

७) रासायनिक खते प्रतिहेक्टर प्रमाण ☐ ८) पिक लागवड पध्दत : ----------

९) माती परिक्षण ☐ १०) रासायनिक औषधे ☐ ११) शेती ओजारे ☐

(शेतकऱ्याची सही) **(संशोधक सही)**