CHAPTER II

PHYSIOGRAPHY AND SOCIO-ECONOMIC PROFILE

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CHAPTER II

PHYSIOGRAPHY AND SOCIO-ECONOMIC PROFILE

Introduction:

The rational assessment of land and its scientific utilization has become important and it is possible only if the whole complex of land use is studied at the district, taluka or even village level by taking into account the local physical and socio-economic conditions (Morepatil, 1995). Therefore it has been attempted to study the physical as well as socio-economic factors to analyze the general and agricultural land use in Khed Tahsil of Pune district.

This chapter summarizes physiographic and socio-economic settings of the Khed Tahsil. The physical factors are namely location, historical study, relief, geology, climate, drainage, soil and vegetation and socio-economic determinants such as growth of population, density, sex-ratio, distribution of Schedule Tribes (ST) and Schedule Caste (SC) population, literacy, occupational structure, irrigation facilities, transportation network and markets are described in detail to study the association of these factors to the general and agricultural land use of the study area.

2.1 Study Area:

Khed Tahsil is one of the tahsils of Pune district, located between 18° 30’ N to 19° 05’ N latitude and 73° 32’ E to 74° 15’ E longitudes, occupies the north-western part of Pune district and comprising an area of 1424.25 sq. km that is 8.96 percent area of Pune district. It is situated on the east facing slopes of Sahyadri hill ranges and almost entire area of Khed Tahsil falls under the Bhama and Bhima River basin. It is surrounded by four tahsils of Pune district and two districts of Maharashtra. It is bounded by Ambegaon tahsil and Thane district on the North, Haveli tahsil on the South, Shirur tahsil on the East, Maval tahsil and Raigad district on the West. The study area is included in SOI topographic sheet divided numbers 47F/9, 47F/10, 47F/13, 47F/14, 47E/12, 47E/16, 47J/1 and 47J/2 on 1: 50,000 scale. As per 2011 population census, Khed Tahsil is divided into four agricultural circles, one Municipal Corporation (MC), five Census Towns and 184
villages. Rajgurunagar is the administrative headquarter of the Khed Tahsil. For the present study, Khed Tahsil is divided into four agricultural circles; these are Wada, Pait, Khed and Chakan.

2.2 Historical Study of Khed Tahsil:

The original name of Khed is ‘Khetaka’, but since it was difficult to pronounce, it is modified to ‘Khed’ (Gupte, Y. R., 1946). The fair of Bhopale Buva is considered as the most ancient place of Khed.

Famous historical places are Siddheshwar Temple, Koteshwar Temple, Tukai Devi, Vishnu Temple, Kalbhairav Temple and Chakreshwar Temple. Tukai Devi Temple is the oldest temple described as “The pillars are rude and massive; square about the middle, then eight sided, then four sided, and then a series of rings surmounted by a square abacus which is tapped by a heavy head - piece with four projections” (Gazetteer, 1883). The oldest Satwai Temple is built at the time of Tukai Devi’s Temple. Vishnu Temple was built by Chandiram Maharaj. Bhimashankar is famous for its Temple of Mahadeva, said to be one of the twelve Jyotirlinga’s of India. Bhimashankar temple was built by Nana Phadanvis. There are some references to Hattinpatti, Paijarpatti in local history. Dilavarkhan’s Tomb
and Mosque are surrounded by a wall enclosing a large plot of land most of which is under cultivation.

Alandi a historical and pilgrimage centre is located on the north bank of the Indrayani River and is famous for Dnyaneshwar Samadhi. Maratha history mentions Alandi as one of the historically significant places in its documents. "Bhueekot Killa" and “Chakreshwar Temple” at Chakan were built by Chatrapati Shivaji Maharaj.

### 2.3 Geology:

Land utilization of any region is the direct product of its geological structure and man is the main source behind moulding land use according to their need and the geological ingredients of the region (Mandal, 1982). The detail geological study helps to understand the land use of the study area. According to Hawaiian terminology, the basaltic flows are classified into ‘aa’ and ‘Pahoehoe’ types. Pahoehoe flows are smooth or rolling surfaces with local presence of ‘ropes’ or ‘cords’. The ‘aa’ flows are rough, juggled, spinose and clinker. There is a gradation from ‘aa’ type to blocky lava.

The basaltic lava flows belonging to the Deccan traps of Eocene to upper cretaceous is the only major geological formation occurring in Khed Tahsil. Geologically the entire study area is underlined by basalt rock and horizontally bedded lava flows commonly referred as “Deccan Trap”. The lava flows generally consist of “Pahoehoe” and “aa” type. Both “pahoeho” and “aa” types are found in the Bhima and Bhama basin within the tahsil. Most part of the tahsil is covered by the Indrayani formation which comprises a thick succession of five “aa” basaltic lava with 50 to 80 m thickness.

The north-western part of the Tasubai range is of megacryst compound pahoeho flow (50 -100 m) which is the upper Ratangarh formation consisting only of compound pahoeho flows in the central part of the Bhima Valley. The “aa” flow is more than the other basaltic flows and it is more beneficial for the percolation of water. The basaltic rocks in the area can be megascopically grouped into four categories. The north-western part of the Bhama basin consists of three flows of Deccan Trap Basalt having about 20 m thickness with pockets of amygdaloidal
structure. These flows are observed at Waki, Karnjihire, Askhed villages. These are comparatively soft, greenish grey to greenish or pinkish in colour. The thickness of weathered zone ranges from about 4 to 9 m. The horizontal amygdaloidal basalt flows are from 3.35 to 4.27 m in the Bhama basin at Bibi, Chas and Kaman. The major rock types are porphyritic basalts, amygdaloidal basalt and volcanic breccias. Compact and Porphyritic Basalts are exposed with big phenocrysts generally of plagioclase crystals at Waki village. There are two flows by uneven thickness of volcanic breccias at about 645 m.

Dark grey massive basalts and agglomerates are generally compact and hard. Pinkish agglomerates are exposed in the Bhima River bed. Dyke of 180 to 200 cm width and 200 m lengths has been observed at Waki. Bhama valley upto the Waki village has steep slopes with hard murum soil and exposed amygdaloidal basalt rock, stratified black trap rock at many places.

2.4 Relief :

Relief features are the predominant factors in determining the intensity of land use through the elevation, ruggedness and slope. Relief indirectly influences farming by modifying the climate and by affecting the case of cultivation, the degree of accessibility and the consequential changes in soil, erosion and patterns (Singh, 1974). The type of soil, thickness of soil, size and distribution of arable
land, selection of crops ultimately depend on the relief. Physiographically, Khed Tahsil represents heterogeneous characters. The western part of the study area is having an altitude of more than 900 m, the central part has an altitude between 550 to 900 m and the eastern part has less than 560 m elevation. Thus, on the basis of altitude Khed tahsil is divided into 3 physical divisions namely, Western hilly region, plateau region and Bhima-Bhama flood plain.

2.4.1 The North-western Hilly Region ( > 820 m ) :

Maharashtra Government has declared as the Khed Tahsil is a mountainous Tahsil. Khed Tahsil belongs to two distinct systems of hills. One is the main range of the Western Ghat, which runs from north to south and it borders the study area to the West. The four parallel belts of hill runs towards south-east from the main line of the Western Ghats. Northern Range (Bhimashankar Range), Shingeshwar Range and Southern Range (Tasubai Range) are the offshoots of the Western Ghat and stretches from north-west to south-east.

The Bhimashankar range is the northern boundary of the Wada Circle and the slope of this range is from north to south. This range has the escarpment with a cliff and a chain of waterfalls exist at Bhorgiri and Mandoshi on the north of Bhima River. The height of Shingeshwar Range is from 800 m to 1293 m. Shingeshwar is the highest peak at an altitude of 1293 m. in Shingeshwar range. Kude Peak (1206 m), Sambarkada (1129 m), Takera Dongar (1056 m), 1095 m, 1086 m, 1056 m are the other peaks. The slope of this region is south-west to north-east.

Southwestern boundary of the Khed Tahsil is bounded by the mountain range of Western Ghat offshoot, is known as Tasubai Range. It stretches from Bhamboli to Wandre in Pait Circle. The height of Tasubai Range is varies from 700 m to 1155 m. The highest peak in Tasubai Range is 1093 m. It is the southern boundary of Chakan and Pait circles. Bhamchandra Dongar is stretches from Bhamboli to Shive. 1093 m, 1062 m, 1148 m, 1127 m, 1116 m, 1023 m and 1009 m elevated peaks are located in this range.
The northern and western boundary consists of hilly terrain with ridges, cliffs, escarpments, depression, stony and rugged surface. Wandre Pass, Ambhu Pass are situated in the western boundary of the Khed Tahsil. Saddles, Valleys and the irregular dissected pediplains are observed in this Tahsil. Bhorgiri and Mandoshi are the famous waterfalls in Wada Circle. Bhama valley constitutes the east-west belt of Khed Tahsil. It is surrounded by Western Ghat on west, Bhima Valley on north and Indrayani Valley on the south. Thus the topography of the region varies greatly from north-west to south-east.

The study area has steep to moderate slopes where shallow soils with coarse material are observed. The rate of soil erosion is also very high. Size of farms is very small, only the small patches between the high elevated mountain ranges which are locally known as “Lavan”. Such area is also used for the paddy cultivation. These are the limiting factors for the agricultural land use in the north-west and northern hilly boundaries of the study area.

2.4.2 Plateaus (601 m to 820 m):

On the basis of altitude there are two types of plateaus. These are high level plateaus and middle level plateaus. Central part of the Khed Tahsil is covered by high level plateau areas. It is located between Tasubai Range and Shingeshwar Range where the height is from 701 m to 820 m. The plateaus of 600 m - 700 m
elevation are known as region of middle level plateaus. Such plateaus are located in the central and eastern part of the study area.

2.4.3 Valley Plain ( < 600 m ) :

The distribution of the plain area is comparatively less in the study area. This area is situated in the southern part of the Khed Tahsil. It is located at the confluence of Bhama and Bhima River where the height is 560 m above the mean sea level. These flood plains are formed in the eastern part of the Khed Tahsil mainly in Kalus, Pimpalgaon, Shelgaon, Bahul, Siddhgavhan, Koyali Tarfe Chakan, Waki Khurd and Waki Budruk villages. In these villages the black deep and fertile soil is observed which is suitable for the agricultural activity.

North-west part of the Khed Tahsil has descending height of 312 m at the foot of the main Western Ghats in the northwestern part of Bhalawadi, Velhavale, Tambatwadi and Wandra villages of Pait Circle.

2.5 Slope :

Slope of a land is one of the important physiographic aspects that influence the agricultural land use of an area. The direction of the slope of this study region is from north-west to south-east. The eastward slope in the study area is gentle but the slope in the western and northwestern part is steep. The slope of this area is upto 65°. It is clearly observed in Fig. no. 2.4.

2.5.1 Very Steep Slopes :

The Western Ghats and Bhimashankar Range have bare slopes and gullied topography. These are the limiting and controlling variables in terms of its land use pattern. It seems to be a severe soil erosion zone during monsoon. It is characterized by coarser texture of soil, thin soil cover and mere vegetation growth. The very strongly and steeply sloping zones are found in western part of Wada Circle. The northern boundary of the Wada Circle has the escarpment with a cliff. The southern part of the Wada Circle and the northern part of the Pait Circle are occupied by the offshoot of the Sahyadri Range, is known as Shingeshwar Dongar. The slope of this region is more than 50°.
Heduj Pass and Gadekhind Pass are in the Shingeshwar Range. The tores are observed in the western part of the tahsil mainly in Abhu, Torne Khurd and Wandre villages. The steep slope area is the limitation for the agricultural land use. Therefore, in such area the small patches of land between the two high elevated areas are used for the paddy cultivation.

**FIG. NO. 2.4: KHED TAHSIL - SLOPE MAP**

![Slope Map](image)

2.5.2 Moderately Steep Slopes:

Along the both bank of Vel River, the eastern and northern part of the Khed Circle has moderate slope. The central part of the Pait circle has also moderate slope. The average slope of this region is about 30° to 40°. Coarser texture soil is distributed due to surface wash and mass wasting process. The bare nature hill slopes support to high erodibility. The material is removed from upper slopes and deposited at the foothills. Large boulders are released and accumulated at the base of the hills. The unit appears to have maximum proportion of waste land, rocky barren and fallow land.

2.5.3 Gentle Slopes:

This unit comprises very less area of the study area. These slopes are observed in the western, southern part of the Khed Circle, western and eastern part of the Chakan Circle at Pimplegaon village, the confluence of Bhima and Bhama
River. The piedmont plain is formed by alluvium transported from the upslope region on the confluence of Bhima and Bhama River at Pimpalgaon. Such plains are favourable for the agriculture activities. The left bank of Indrayani River has also the plain area upto the confluence of Indrayani and Bhima River.

2.6 Drainage:

Drainage system is one of the important components of the physical environment which affects the agriculture directly and indirectly (Chauhan, 1987). It is a natural water source for the agriculture. Drainage, it’s nature and patterns play an important role in case of the agricultural land use. A deep soil on the banks of river supports the agriculture activity and land use type.

The study area drains by the Bhima River and its tributaries Bhama, Indrayani and Vel Rivers. Bhama on the northwestern side, Indrayani on the southern side and Vel on the northern side are the main tributaries of Bhima River in the Pune district. The main rivers and their tributaries are depicted in Fig. no. 2.5.

2.6.1 Bhima River and its Tributaries:

Bhima River rises at Bhimashankar at an elevation of 1015 m from the Western Ghat. Bhima River flows through Bhimashankar Range and Shingeshwar Range in meandering way towards east. The total length of this river is 87.9 kms. in Khed Tahsil. At the source of Bhima River, the area on both the banks is very hilly, undulating and has steep cross slopes. For that reason it flows 57.92 kms. through very narrow and rugged Bhimner Valley towards east with a general course to south-east. The river falls over rock of terraces from a height of about 914.4 m above the mean sea level. Bhima Valley opens out and plain area starts below village Bibi. The confluence of Bhima River and Bhama River is near the village Pimpalgaon at an altitude 560 m above mean sea level. After the confluence, Bhima flows generally slow. Along the banks of River Bhima and Bhama many natural levees, terraces and benches are formed. All the left bank tributaries of Bhima River are non-perennial and parallel to each other. It enters Shirur Tahsil after passing through Khed Tahsil. Bhima River flows through Chas, Pangri, Padali, Satkarsthal, Rakshewadi, Manjarewadi, Kharapudi Budruk,
Nimgaon, Dawadi, Pimpalgaon Tarfe Khed, Bahul and Siddhegavhan Villages. The area under cash crops mainly onion groundnut, vegetables is more in all the above villages. The area under sugarcane and vegetables is more in Pimpalgaon Tarfe Khed, Bahul and Siddhegavhan due to the availability of water. Donde, Vadgaon Tarfe Khed, Chandoli, Shiroli, Kharpudi Kurd, Kalus are located on the right bank of Bhima River. Therefore the area under cultivation is more in these villages.

Arla River is the right bank tributary of Bhima River, rises near village Tambadewadi in the range of Western Ghat. The total length of this river is 26.46 km. It flows parallel to Bhima River, flows in a meandering way from west to east direction in Wada Circle. The confluence of Arla and Bhima River is at Tulapur in Wada Circle.

Yenora Nadi is a tributary of Arla River rises at Shingeshwar Dongar at an altitude of 1293 m above mean sea level. Yenora Nadi flows north-ward from Singeshwar Dongar and then flows from west to east and then turns towards north-east. It has 10.76 km length. The confluence of Yenora and Arla Nadi is near Chikhalgaon at the altitude of 642 m above mean sea level.

Vel Nadi originates at Dhakale in the spur of the Sahyadri. It flows south-east nearly parallel with the Bhima. Vel River flows through Chichbaiwadi,
Chaudharwadi, Varude, Kanhoresar and Pur villages. The study region has only 13.91 km length of Vel River. It falls into the Bhima after a course of nearly 64.30 km at Talegaon Dhamdhere. Shelgaon, Pimpalgaon Tarfe Khed Koyali Tarfe Chakan, Bahul, Siddhegavhan villages are located in the lower course of Bhima River in the eastern part of the study area. These villages show more area under cash crops.

2.6.2 Bhama River:

Bhama River is the major perennial tributary of the Bhima River. It originates from Western Ghat at an elevation of 974.08 m above mean sea level near village Pardhyachi Wadi in Pait Circle. Bhama River flows between the Shingeshwar Range and the Tasubai southern mountainous boundary in a north-west to south-east direction till it confluenes River Bhama near village Pimpalgaon and Shelu. The length of the river Bhama upto its confluence with Bhima is 82 km. Bhama River has steep slope upto village Virham with a drop of 284 m in a length of 10.8 km. The river has an average bed slope of $1^0$ to $38^0$ in initial reach upto 10.8 km.

The shape of the Bhama catchment is fern-leaf type and river flows through mountainous and sub-mountainous regions. At the beginning Bhama valley is so narrow and it has a width of about 4.80 km and widens to about 8.60 km at the Waki. Therefore, the exposed hill slopes and vertical cliffs are observed at many places. The catchment has small base and mainly 3 to 4 tributary nallas, viz. from Pait, Deshmukhwadi, Parale, Anawale villages. All these tributaries join the main Bhama River at upstream of the Askhed village. Bahuli River is the tributary of Bhama, meets to Bhama River at Viraham village. Due to these natural sources of water and fertile soil, the area under crops is more in villages Pait, Koregaon Khurd, Chandus, Pimpri Khurd and Budruk and Kalus.

2.6.3 Indrayani River:

Indrayani River is the perennial tributary of Bhima River and it flows in meandering way on the southern border of Chakan Circle, having 54.85 km length and joins to Bhima- Bhama confluence at Shelgaon is known as Bhima. The area of Yelwadi, Sangurdi, Kanhewadi Tarfe Chakan, Khalubre, Nighoje, Moi,
Kuruli, Chimbali, Kelgaon, Alandi, Charholi, Dhanore, Solu, Pimpalgaon Tarfe Chakan, Golegoan and Marakal villages is totally alluvial.

The Kharif and Rabi crops are cultivated in these villages due to the availability of water resources and rich soil. The villages located along the right bank of Indrayani River and Chaskaman Irrigation sources mainly in the eastern part of the Chakan Circle have maximum area under sugarcane. This area has more density of drainage which influences on the agricultural land use and cropping pattern of study area.

2.7 Climate:

Most of the Cropping patterns depend on climatic factors such as temperature, rainfall, humidity, wind etc. Climate is the most fundamental factor in determining the physical environment, cropping pattern and agricultural land utilization. The proper and suitable climate helps to high production, yield. The study area has tropical monsoon climate. The year is generally divided into summer, winter and monsoon seasons.

2.7.1 Temperature:

Temperature is one of the elements of the climate and it plays important role in germination of the seeds. April and May are the hottest months in Khed Tahsil. The maximum temperature of these months is rises upto 36°C. The average maximum temperature is recorded in April and that is 38°C. The Western part of the Khed Tahsil has comparatively cool whereas the eastern part is hot and dry. December and January are the coolest months when the average monthly temperature is 14°C. The minimum average yearly temperature is recorded in the month of December that is 27°C.

2.7.2 Humidity:

Humidity is low during the March to May due to high temperature and evaporation losses from the atmosphere. The diurnal variations in humidity during this period are high, water vapor gets condensed due to falling night time temperatures and the day time temperatures are high.

In the month of summer the relative humidity ranges from a minimum of 20 percent to maximum of 67 percent during the day. During the monsoon period,
the relative humidity varies from 68 percent to 87 percent. The relative humidity during winter shows maximum diurnal variation varying from 37 percent to 88 percent.

2.7.3 Rainfall:

Rainfall is the single dominant weather parameter that affects plant growth, plant production, location of farming system and farmers selection of crops. Failures of rains or excessive of rainfall in a short period have brought repeated crop failures (Vyas, 1994). South-west monsoon from June to October is in rainy season. The heaviest rainfall occurs in the month of August and the lowest in October. The area receives about 85 percent of the total rainfall in rainy season. The general distribution of rainfall shows a remarkable spatial variation.

The north-western part of the Wada and Pait circle has high distribution of rainfall that is 200 cm to 550 cm. The average annual rainfall is 554 cm at the source of Bhima and Bhamna River that is at Bhimashankar in Wada Circle and Padyalchiwadi in Pait Circle. North-western part of Velhawale and Bhorgiri receive more than 400 cm rainfall. Wandre, Torne Khurd, Bhomale, Khurpud, Bhivegaon, Bhorgiri, Tokawade, Pabhe, Ahagaon, Abhu, Bhalawadi, Aadhe, Amboli, Virham, Waghu, Shendurli, Shrirgaon receive maximum rainfall (200 cm to 400 cm) as these villages are located in the north-western part study area.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Year</th>
<th>Rainfall mm</th>
<th>Sr. No.</th>
<th>Year</th>
<th>Rainfall mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>696</td>
<td>10</td>
<td>2003</td>
<td>386</td>
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<td>2002</td>
<td>454</td>
<td>Average Rainfall</td>
<td>656</td>
<td></td>
</tr>
</tbody>
</table>

(Source: Department of Agriculture, Pune)
The eastern part of the Wada circle the average rainfall is 107cm at Wada and the eastern part of the Pait Circle has only 102cm rainfall. The entire catchment area of Bhima and Bhama Rivers lie to the east side of Western Ghats and is located in a rain-shadow area. As a result, rainfall decreases from northwest to eastward. The average annual rainfall is 366 cm at Bhorgiri and it rapidly decreases to 102cm at Bibi Village. The eastern part of the Khed Circle and Chakan Circle has only 60 cm rainfall. Thus the rainfall decreases towards the eastern part of the study area. Table No. 2.1 shows the annual total rainfall of Khed Tahsil over the period 1994 to 2010. The average rainfall for the period is 656 mm. The highest rainfall recorded in 2006 and it was 1199 mm while the lowest was recorded in the year 2003 and it was 386 mm. The distribution of rainfall is shown in Graph no. 2.1.

2.7.4 Wind:

Generally winds in Khed Tahsil blow from east and west direction while the frequency of south and north winds are very less throughout the year. In the month of April and May winds are strong are dry. In the month of August winds are strong and wettest in the western part of the Khed Tahsil, therefore the distribution of rainfall is more. The eastern part has comparatively less distribution
of rainfall due to the less proportion of water vapour. During the period of easterly winds, cool breeze are blowing.

2.8 Soil:

Soil is the basic determinant of land use in any region. The formation of soil is influenced by the topography and climate. The agriculture and agricultural pattern is also based on the physical, chemical characteristics and distribution of soil. In order to establish the relationship between the characteristics of soil and land use, soils are classified into various types. The soils of the Khed Tahsil are mostly derived from Deccan trap, are more or less uniform and can be subdivided into light brown soils, black soils and laterite soils. Ratnparakh (1976) classified the soil of Khed Tashil into very shallow soil, shallow soil, medium soil and deep soil.

2.8.1 Shallow and Light Brown Soils:

Shallow and very shallow soils are mainly found on hilly terrain of the north-western part and the eastern off shoots of Bhimashankar Range, Shingeshwar Dongar, Tasubai Range, Bhamchandra Dongar etc. Brown soil is found in Pardhyachiwadi, Wandre, Waghu, Torne, Ambhu, Amboli, Bhilawadi, Virham, Borgiri, Dehne, Bhomale village, etc i.e. on the western part of Wada and Pait Circles. They are light brown in colour due to the heavy rainfall. These soils are characterized by brown in colour, loamy to clay loam in texture with granular to sub-granular, blocky in structure and shallow in depth and are alkaline in nature. The content of organic matter and nitrogen is so less, phosphate and potash level are low to moderate with less fertility. The rate of soil erosion is comparatively high in the northwestern part of the study area due to steep slope.

These soils are well drained, fairly moisture retentive and not suitable for raising bumper crops. It is most suitable for growing paddy and ragi crops. Such soils are used by using the manures and fertilizers for the agricultural purpose.

2.8.2 Medium Deep Black Soils:

Medium soils occur in the central part that is in the western part of Khed and Chakan Circle of the study area. These soils are clay loam to clayey in texture,
dark gray to black in colour, alkaline in reaction (pH 8 to 8.7) and deficient in nitrogen. The depth of this soil is ranging between 25 cm to 50 cm. This soil acquires loose particles and colour is medium black. It is suitable for wheat, jowar, sugarcane, onion and vegetables crops. It is observed along the bank of Bhama River and nearby area and the central part of the Khed Tahsil. Deep soils are generally observed in the eastern part particularly along the bank of River Bhima, Bhama and Indrayani, the villages near the confluence of the Bhima and Bhama River and in the eastern part of the Khed Tahsil.

**FIG. NO. 2.6 : KHED TAHSL - SOIL MAP**

These soils are clayey and fine textured with dark colour, sub-angular blocky to blocky, massive and compact in nature and alkaline in reaction. Such soils are rich in phosphorous and potash content. Their chief characteristics are their high fertility, highly argillaceous character, highly retentive of moisture, extremely compact, comparative richness in lime, high proportion of magnesium carbonate, ferrous oxide and aluminum oxide and rich in chemical properties. They contain sufficient quantities of potash and phosphoric acid. Both Kharip and Rabi crops are grown over it. Jowar and wheat are the chief crops. Different kinds of vegetables and fruits are also grown successfully. Therefore, these soils are more suitable for the agricultural purpose.
Laterite soils are found in the hilly area of Western Ghat and in the small patches of eastern offshoots of Western Ghat area due to high distribution of rainfall and humid climate. The pH value is 7.3 to 8.4. Such type of soil is found in the high altitude of western part of Velhavale, Tambatwadi, Wandra and Parhadwadi etc. This soil is suitable for the paddy cultivation.

2.9 Vegetation:

The cover of natural vegetation acts as rain holder and rain banker. The trees also act like millions of tiny damps and check the flow of water like a barrage (Khullar, 2002). Evergreen dense forests, deciduous forests and dry forests are distributed in the study. The western and north-western mountainous ranges have densely covered with forest while the density of the forest cover gradually decreases and plants and shrubs are found on the eastern part of the Khed Tahsil. As per the 2001 census, Khed Tahsil had 12.89 percent of area under the forest cover while the satellite data of 2011 shows only 8.09 percent area of forest.

**FIG. NO. 2.7: KHED TAHSIL - FOREST**

![Map of Khed Tahsil Forest](image)
2.9.1 Evergreen Forests:

Evergreen forests occur in adequate (over 200 cm) rainfall and consist of lofty dense and evergreen trees with numerous epiphytic ferns, mosses, orchids and aroids. These forests are found on the eastern slopes of the Western Ghats in Bhimashankar Sanctuary, Bhorgiri, Velhavali, Bhomale, Kharpad and Wandre villages. This tract contains valuable and medicinal trees such as Hirda, Behada, Jambhul, Chandan, Bel, Nilgiri, Moha, Kalalavi, Shatawari, Bamboo, Anjan, Arjun, Hiwar, Shikekai, Tendu, Nagphani, Katesavar, Tendu etc. There is also growth of valuable Bamboos in the Velhavali and Bhomale villages.

The another belt of evergreen dense forest stretches from Bhamchandra dongar to wander in the villages of Karanj-vihire, Waki Tarfe Wada, Shive, Wahagaon, Deshmukhwadi, Koliye, Gadad, Akhtuli, Torne Kh and Wandre. These forests contain reserved and protected forest areas with Anjan, Jamun, Teak, Hirda, Behada, Anjan, Arjun, Shatawari and various medicinal trees. The density of this forest is high due to the suitable physical factors and remote area.

2.9.2 Deciduous Forests or Monsoonal Forests:

Deciduous forests occur where the average rainfall varies between 100 cm to 200 cm. This type is generally found along central and northern part of the Khed Tahsil. The various types of soils such as red, laterite, black and clayey soil are distributed due to the variation in rainfall. Such forests are highly varied in its characteristics ranging from dense to open, deciduous and mixed and scrub land.

This zone starts from Wada and stretches towards the east for about 16.09 km and reaches Khed in the centre of the tahsil. Other belt begins from Deshmukhwadi to Bhamboli, Tambadewadi to Talawade. The common trees found in this forest are Sal, Ghaneri, Umbar, Sag, Neem, Awala, Palas, Murudsheng, Khair, Woodapple, Shivan, Bhaman, Datpadi, Dhayti, Chitrak, Tidhara nivdung, Mango, Neem and Eucalyptus etc.

2.9.3 Dry Forests:

Dry forests occur in the area having rainfall 50 to 100 cm. These are distributed in the eastern part of the tahsil and contain thorny bushes and cactus.
The vegetation becomes sparse and consists of acacia, ber, pipal and other scrubs and bushes. Dense cactus is distributed in Kuruli and Chimbali villages of Chakan Circle.

2.10 Population:

Man is a geographical factor and has greatly modified the natural landcape. Therefore, it is essential to deal with both, the physical as well as cultural landscape before any enquiry is made regarding the use of the land (Giri, 1976). The socio-economic profile consists of population growth and distribution, density of population, Sex ratio, distribution of Scheduled Caste (SC) and Scheduled Tribe (ST) population, literacy, occupational structure, irrigation, transportation and markets distributions.

Population of a region is considered as a resource. The relation between population and land use is reciprocal for instance the changes in farm, population pattern influence the utilization of the land and latter with changes in the agricultural controls to a great degree also determines the pattern of farm population (Singh, 1974). Census year 1981 to 2001 data was used to study the trend of the population growth, density, sex ratio, literacy, occupational structure etc.

2.10.1 Population Growth of Khed Tahsil:

Khed Tahsil’s rural and urban population growth from 1981 to 2001 is shown in table no. 2.2. The total increase in population during 1981 to 1991 was 59,141 persons with a rate of 26.36 percent and in the decade 1991 to 2001 the population increased by 42,145 persons with a rate of 14.87 percent. The population of Khed Tahsil is increased by 45.14 percent during the decade 1981 to 2001. As per 2001 census, Khed Tahsil is the 6th most populous Tahsil in Pune District.

Rural population was concentrated in the northwestern part of Khed Tahsil and it was increased by 1.24 times. The growth of urban population was increased by 14.12 percent mainly in the eastern part of Khed and Chakan Circle of Khed
### TABLE NO.2.2: KHED TAHSIL - POPULATION GROWTH
**(FROM 1981 TO 2001)**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Year</th>
<th>Rural Pop.</th>
<th>Urban Pop.</th>
<th>Total Pop.</th>
<th>Rural Pop. (%)</th>
<th>Urban Pop. (%)</th>
<th>Decadal Variation</th>
<th>Growth (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1981</td>
<td>2,16,840</td>
<td>7,523</td>
<td>2,24,363</td>
<td>96.65</td>
<td>3.35</td>
<td>------</td>
<td>----</td>
</tr>
<tr>
<td>2</td>
<td>1991</td>
<td>2,73,255</td>
<td>10,249</td>
<td>2,83,504</td>
<td>96.38</td>
<td>3.62</td>
<td>59,141</td>
<td>26.36</td>
</tr>
<tr>
<td>3</td>
<td>2001</td>
<td>2,68,768</td>
<td>56,881</td>
<td>3,25,649</td>
<td>82.53</td>
<td>17.47</td>
<td>42,145</td>
<td>14.87</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1981 to 2001</td>
<td>51,928</td>
<td>49,358</td>
<td>1,01,286</td>
<td>-14.12</td>
<td>+14.12</td>
<td>1,01,286</td>
<td>45.14</td>
<td></td>
</tr>
</tbody>
</table>

(Source: Population Census of Pune District 1981, 1991 and 2001 and computed by researcher)

### GRAPH NO. 2.2: KHED TAHSIL - RURAL AND URBAN POPULATION

Tahsil during the decades 1981 to 2001. The urban population was increased by 7.56 times during the two decades 1981 to 2001.

**Circle-wise Growth of Population:**

It is observed from table no. 2.3 that the highest growth was recorded in Chakan Circle during the span of twenty years. Khed Circle ranked second after Chakan Circle with 48.07 percent population growth rate followed by Pait Circle during 1981 to 2001 decades. The causes of high growth of population are urbanization, industrial development and more job opportunities in this circle. Though the lowest growth of population was of Wada Circle (9.96 percent), most
of the population particularly female is engaged in agricultural activities. Most of
the male population is migrated towards the urban area i.e. in Mumbai, Thane,
Chakan MIDC area etc.

**TABLE NO.2.3: CIRCLE-WISE POPULATION GROWTH**

*(FROM 1981 TO 2001)*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wada</td>
<td>5,393</td>
<td>-336</td>
<td>10.84</td>
<td>-0.61</td>
<td>9.96</td>
</tr>
<tr>
<td>2</td>
<td>Pait</td>
<td>9,840</td>
<td>3,859</td>
<td>21.30</td>
<td>6.89</td>
<td>29.65</td>
</tr>
<tr>
<td>3</td>
<td>Khed</td>
<td>15,989</td>
<td>15,232</td>
<td>24.62</td>
<td>18.82</td>
<td>48.07</td>
</tr>
<tr>
<td>4</td>
<td>Chakan</td>
<td>17,406</td>
<td>37,331</td>
<td>28.94</td>
<td>48.14</td>
<td>91.01</td>
</tr>
</tbody>
</table>

(Source: Pune District Census 1981, 1991 and 2001 and computed by Researcher)

**2.10.2 Population Density of Khed Tahsil:**

Population density is a simple concept of relating population size to the land area
with a view to assessing crudely the pressure of population upon the resources of
the area *(Chandana, 2000)*. The ever increasing population is creating continuous
pressure on the available resources. As per 2001 census the population of Khed
Tahsil was 3.25 lakh, spread over its area of 1424.25 sq. km and the highest
density was recorded in 2001 that was 230 persons per sq.km and the average
density was 193 persons per sq.km. During the two decades the density of
population is increased by 72 persons per sq.km.

**TABLE NO.2.4: KHED TAHSIL - POPULATION DENSITY AND SEX RATIO (FROM 1981 TO 2001)**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Circles</th>
<th>Density</th>
<th>Sex Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wada</td>
<td>127</td>
<td>143</td>
</tr>
<tr>
<td>2</td>
<td>Pait</td>
<td>119</td>
<td>143</td>
</tr>
<tr>
<td>3</td>
<td>Khed</td>
<td>212</td>
<td>257</td>
</tr>
<tr>
<td>4</td>
<td>Chakan</td>
<td>189</td>
<td>245</td>
</tr>
<tr>
<td></td>
<td>Khed Tahsil</td>
<td>157</td>
<td>192</td>
</tr>
</tbody>
</table>

(Source: Pune District Census Handbook and computed by Researcher)
Circle-wise Density of Population:

The density of population varies from circle to circle. Khed Circle had more than 201 persons per sq. km. density from 1981 to 2001. The lowest density was recorded in Wada Circle that was 119 persons per sq.km in 1981 and 143 persons per sq. km. in 2001. Chakan and Pait Circle had recorded continuous growth in population density during the period 1981 to 2001 but the highest growth of population density was observed in Chakan Circle that was 349 persons per sq. km. in 2001 census year. Thus the density of population distribution is increasing towards the east of the study area due to the availability of several favorable physical and socio-economic factors.

2.10.3 Sex Ratio of Khed Tahsil:

The proportion of females to males is an important issue for the development of the society. In study area, the female population is decreasing in comparison with the males very drastically. In 1981 the sex ratio of Khed Tahsil was 987 females per thousand males and in 2001, the sex ratio was 935 females per thousand males.
Circle-wise Sex Ratio:

Wada Circle had 1044 and 1009 females per thousand males in 1981 and 2001. High sex-ratio is observed in Wada Circle and followed by Pait Circle because of low literacy and the concentration of ST population that is of Thakar, Katkari and Hindu Mahadeo Koli communities.

**GRAPH NO. 2.3: CIRCLE-WISE ST POPULATION AND SEX RATIO**

Sex ratio is continuously decreasing in all the circles but the notable imbalance was recorded in Chakan circle that was 871 females per thousand males in census year 2001. This is because of the high literacy, urbanization and industrialization, transportation facilities, health, medical and educational facilities etc. Khed Circle shows the constant sex ratio in the decade 1991 to 2001.

2.10.4 SC and ST Population of Khed Tahsil:

The distribution of the SC population is mainly in the eastern part of the Khed Tahsil. The total SC population was only 2.03 percent in 1981 and it reached to 3.64 percent in 2001. The proportion of ST population was more than SC population. Khed Tahsil has three major tribal groups; they are Hindu Mahadev Koli, Thakar and Katkari. Khed Tahsil recorded 12.62 percent and 11.7 percent of ST population in 1981 and 2001 census year. The Table no. 2.5 revealed that the percentage of this population is decreasing with a low rate.
TABLE NO. 2.5: CIRCLE-WISE SC AND ST POPULATION
(From 1981 to 2001)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wada</td>
<td>1.38</td>
<td>2.39</td>
<td>1.67</td>
<td>33.58</td>
<td>34.23</td>
<td>35.95</td>
<td>34.28</td>
<td>44.36</td>
<td>56.98</td>
<td>34.28</td>
<td>44.36</td>
<td>56.98</td>
</tr>
<tr>
<td>2</td>
<td>Pait</td>
<td>1.56</td>
<td>3.12</td>
<td>2.08</td>
<td>9.79</td>
<td>5.53</td>
<td>12.09</td>
<td>31.87</td>
<td>41.56</td>
<td>54.41</td>
<td>31.87</td>
<td>41.56</td>
<td>54.41</td>
</tr>
<tr>
<td>3</td>
<td>Khed</td>
<td>1.86</td>
<td>3.35</td>
<td>3.09</td>
<td>5.71</td>
<td>6.28</td>
<td>6.01</td>
<td>40.13</td>
<td>51.82</td>
<td>61.97</td>
<td>40.13</td>
<td>51.82</td>
<td>61.97</td>
</tr>
<tr>
<td>4</td>
<td>Chakan</td>
<td>3.08</td>
<td>5.71</td>
<td>5.85</td>
<td>4.7</td>
<td>4.93</td>
<td>4.60</td>
<td>41.9</td>
<td>53.47</td>
<td>65.35</td>
<td>41.9</td>
<td>53.47</td>
<td>65.35</td>
</tr>
<tr>
<td></td>
<td>Khed Tahsil</td>
<td>2.03</td>
<td>3.8</td>
<td>3.64</td>
<td>12.62</td>
<td>11.66</td>
<td>11.66</td>
<td>37.63</td>
<td>48.7</td>
<td>60.93</td>
<td>37.63</td>
<td>48.7</td>
<td>60.93</td>
</tr>
</tbody>
</table>


Circle -wise SC and ST Population:

In Wada and Pait circle SC population is very less distributed and Chakan Circle stood first during the period 1981 to 2001. SC population is distributed in the eastern part of the Khed Tahsil that is in the villages of Chakan and Khed Circle.

In study area, twenty-seven villages are declared as ST villages and these villages are located in Wada Circle. Therefore Wada Circle had the highest ST population and it was 35.95 percent in 2001 and it is depicted in Graph no. 2.4 (b). The percentage of this population is in the north-western villages of Wada Circle. Pabhe village had 100 percent ST population while Dhuioli village had only 4.5 percent ST population. Dhamangaon Khurd, Dhamangaon Budruk, Bhivegaon, Naiphad, Goregaon had more than 90 per cent ST population and Eklahare, Kharapud, Moroshi had 80 to 90 percent ST population. Pait Circle stood second in ST population and village Torne Khurd had 100 percent ST population in 2001.

GRAPH NO. 2.4: CIRCLE-WISE SC AND ST POPULATION
(From 1981 to 2001)

GRAPH NO. 2.4(A)           GRAPH NO. 2.4(B)
2.10.5 Literacy:

The quality of population can be judged from the level of literacy. Literacy also indicates the level of agricultural development, use of agricultural implements, pesticides and fertilizers and high yielding varieties etc. Table no. 2.5 shows circle-wise literacy of Khed Tahsil. In the study area, the continuous growth of literacy is observed from 1981 to 2001. In 1981, Khed Tahsil had only 37.63 percent of literacy and it was increased with a high rate upto 61.24 percent in 2001. The positive growth in literacy was observed in the study area.

Circle Wise Literacy of Khed Tahsil:

The lowest literacy rate was observed in Pait Circle (31.87 percent in 1981 and 54.98 percent in 2001) and followed by Wada Circle (34.28 percent in 1981 and 56.98 percent in 2001). It is also observed that from 1981 to 2001, the rate of literacy is continuously increasing in all the circles and in Khed Tahsil also. In Wada Circle Katkari, Thakars are concentrated on the high level of Bhimashankar Range and they are away from the educational development.

**Graph No. 2.5: Circle Wise Literacy**

![Graph showing circle-wise literacy from 1981 to 2001](image)

In Wada Circles We do not see any influence of transportation development (Nashik_Pune Highway) on these tribes which are situated Tasubai and Bhimashankar Ranges. The circle Chakan shows high density and high literacy while Wada Circle shows less density and less literacy.
2.10.6 Occupational Structure of Khed Tahsil:

Agricultural land use is also generalized with considering the occupational structure of the study area. Occupation structure focuses on total workers, non-workers, main workers, farm workers or agricultural workers and non-agricultural workers. It determines the land utilization, economic development, causes, changes in land use etc.

Khed Tahsil’s Circle-wise occupational structure is depicted in table no. 2.9. This table shows slight increase in the working population during the two decades 1981 to 2001 by 3.92 percent. Out of the total workers, main workers accounted 86.71 percent in 1981 and 90.9 percent in 1991. But during the decade 1991 to 2001, the percentage of main workers was decreased by 5.2 percent.

Farm workers comprise the cultivators and agricultural labourers. The percentage of farm workers was 72.35 percent in 1981 and there was slight increase in 1991 by only 0.58 per cent. But in the decade 1991 to 2001, the percentage decreased from 72.93 per cent to 63.41 percent (by 8.94 percent). It is due to uncertainty of agriculture, the more job opportunities in many small scale automobile industries of Chakan MIDC and the other sources of income to the farmers. The percentage of agricultural labourers was less than the other workers. There is positive growth in the first decade and negative growth is in the next decade due to the establishment of many small scale industries in the study area particularly in the Chakan MIDC area.

Circle-wise Occupational Structure:

The percentage of farm workers has been calculated by the addition of the percentage of cultivators and agriculture labourers for the year 1981 to 2001. The percentage of farm workers was continuously decreasing during the two decades. It is observed that 70 percent to 80 percent of farm workers are concentrated in Pait Circle followed by Wada Circle. It indicates the dominance of agricultural activity and the high proportion of agricultural land use.

Khed and Chakan Circle the agricultural population was ranging between 50 to 70 percent. The notable decrease is observed in Chakan and Wada Circle.
Among the circles, Chakan Circle is most industrial and urbanized circle and well connected by NH 50, SH 55 and Major District Road (20) and just 35 km from Pune, so the agricultural workers are less in this circle.

**TABLE NO. 2.6: CIRCLE-WISE OCCUPATIONAL STRUCTURE**

**(FROM 1981 TO 2001)**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Occupational Structure</th>
<th>Year</th>
<th>Khed Tahsil</th>
<th>Wada</th>
<th>Pait</th>
<th>Khed Chakan</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total Workers</td>
<td>1981</td>
<td>47.96</td>
<td>48.12</td>
<td>51.69</td>
<td>46.45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1991</td>
<td>50.62</td>
<td>51.00</td>
<td>52.84</td>
<td>49.26</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2001</td>
<td>51.88</td>
<td>52.96</td>
<td>53.01</td>
<td>52.20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1981 - 2001</td>
<td>3.92</td>
<td>4.84</td>
<td>1.32</td>
<td>5.75</td>
</tr>
<tr>
<td>2</td>
<td>Main Workers</td>
<td>1981</td>
<td>86.71</td>
<td>88.41</td>
<td>85.65</td>
<td>83.54</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1991</td>
<td>90.90</td>
<td>85.35</td>
<td>88.03</td>
<td>94.34</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2001</td>
<td>84.83</td>
<td>77.47</td>
<td>86.12</td>
<td>89.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1981 - 2001</td>
<td>-1.88</td>
<td>-10.94</td>
<td>0.47</td>
<td>5.96</td>
</tr>
<tr>
<td>3</td>
<td>Cultivators</td>
<td>1981</td>
<td>61.14</td>
<td>69.51</td>
<td>68.39</td>
<td>56.62</td>
</tr>
<tr>
<td></td>
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<td>1991</td>
<td>58.19</td>
<td>63.88</td>
<td>64.71</td>
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</tr>
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<td></td>
<td></td>
<td>2001</td>
<td>53.86</td>
<td>56.37</td>
<td>64.11</td>
<td>55.36</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1991</td>
<td>14.74</td>
<td>10.95</td>
<td>14.01</td>
<td>13.00</td>
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<td>1981 - 2001</td>
<td>-1.66</td>
<td>-0.84</td>
<td>1.05</td>
<td>-0.03</td>
</tr>
<tr>
<td>5</td>
<td>Farm Workers</td>
<td>1981</td>
<td>72.35</td>
<td>78.67</td>
<td>76.86</td>
<td>66.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1991</td>
<td>73.93</td>
<td>74.83</td>
<td>78.72</td>
<td>70.97</td>
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<td></td>
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<td>2001</td>
<td>63.41</td>
<td>64.69</td>
<td>73.63</td>
<td>65.21</td>
</tr>
<tr>
<td>6</td>
<td>Other Labourers</td>
<td>1981</td>
<td>14.35</td>
<td>9.75</td>
<td>8.79</td>
<td>17.04</td>
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<td></td>
<td>1991</td>
<td>17.97</td>
<td>10.52</td>
<td>9.31</td>
<td>23.37</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1981 - 2001</td>
<td>7.07</td>
<td>-3.03</td>
<td>3.40</td>
<td>7.25</td>
</tr>
<tr>
<td>7</td>
<td>Marginal Workers</td>
<td>1981</td>
<td>13.29</td>
<td>11.59</td>
<td>14.35</td>
<td>16.45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1991</td>
<td>9.1</td>
<td>14.65</td>
<td>11.97</td>
<td>5.66</td>
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<td>1981 - 2001</td>
<td>1.88</td>
<td>10.94</td>
<td>-0.47</td>
<td>-5.95</td>
</tr>
</tbody>
</table>

2.11 Irrigation:

Irrigation is one of the technological factors which helps to cultivate double cropping, enables to apply barren land for cultivation and increases food production. In study region, the agriculture depends on the uncertain, erratic and seasonal monsoon rainfall for its crop growth. Therefore, it is essential to have an artificial regular and timely supply of water for the growth of crops.

2.11.1 Major Irrigation Project:

The study area has various types of surface irrigation sources namely river irrigation, lift irrigation, well irrigation, Kolhapur types weirs, canals, major and medium irrigation projects etc. Kolhapur type weirs are on Bhima, Bhama, Indrayani and Vel Rivers. The Chaskaman Irrigation Project, Bhamakshetra Irrigation Projects and Arla-Kalmodi Irrigation Projects are the multi-purpose river valley irrigation projects and the sources of surface irrigation. These projects serve the purpose of irrigation, water power generation, supply of water for agriculture and fish culture etc.

Chaskaman Major Irrigation Project:

Chaskaman Irrigation Project is on Bhima River and is located near the village Bibi. This is rolled fill type earthen dam with masonry gated spillway on left flank. The catchment area up to the dam site near village Bibi is 305.56 sq. km. The main purpose of this project is to provide water for agriculture and to generate electricity. The entire command area lies in Khed and Shirur tahsil of Pune district. The total length of left bank canal is 60 km in Khed Tahsil and Gross Cultivated Area (GCA) is 10245 ha while Cultivable Command Area (CCA) is 7890 ha and
Irrigable Cultivated Area (ICA) is 6313 ha. The actual irrigated area is 10245 ha of Khed Tahsil. As per data procured for year 2010, Chas, Pangari, Padali, Rajgurunagar, Kharpudi Budruk, Nimgaon, Davadi and Chinchoshi villages have been irrigated by left bank canal.

The total length of Right Bank Canal in Khed tahsil is 18 km and Waki Kalus Branch. The GCA is 3200 ha and cultivable command area is 2464 ha and ICA is 1970 ha. Donde, Vadagaon Tarfe Khed, Chandoli and Kharapudi Khurd villages have been right bank canal in Khed tahsil. In this project, 1800 ha area of water is used for fish culture by Shambhu Fishery co-operative Institute, Bibi Colony. Due to this irrigation project, the existing cropping pattern is changed due to this irrigation project. Farmers are interested in cultivating the cash crops instead of traditional crops.

**FIG. NO. 2.9: KHED TAHSL - IRRIGATION**

**Bhama–Askhed Project:**

This project is on Bhama River near the village Askhed and Waki-Karanjvihire that is why it is known as Bhama-Akhed Project. It is earthen dam storage across River Bhama, near the village Waki (Karanjvihire) on its right flank and Gawarwadi on its left flank Tahsil Khed, District Pune. The catchment area upto dam site is 198.08 sq kms.
Though this project is located in Khed Tahsil, the entire command area lies in Khed, Haveli and Daund Tahsils of Pune district. The total length of left bank canal is 14 km in Khed Tahsil and GCA is 2330 ha while CCA is 1817 ha and ICA is 1255 ha. This project has Left Bank Canal of 14 km and Right Bank Canals (Branch 1 or Main canal) of 61 km in Khed Tahsil. The GCA is 13449 ha and CCA is 9740 and ICA is 7833. The total length of Left Bank Canal is 14 km and GCA is 2330 ha while CCA is 1817 ha and ICA is 1255 ha.

The proposed total length of Bhama Askhed Right Bank canal is 30 km but only 18 km of canal construction is completed. 147.14 ha of Pait circle’s area and 110.92 ha of Chakan Circle’s area are acquired for the construction of this canal. The total ICA of this project is 1895.13 ha in which 612.49 ha of Pait Circle and 1282.44 ha of Chakan Circle. Karnajvihire, Askhed, Shelu, Koregaon Khurd villages of Pait Circle and Ambethan, Gonawadi, Rohokal, Chakan, Kharabwadi, Nanekarwadi, Waki Khurd villages of Chakan Circle’s have been irrigated by this canal.

Arla – Kalmodi Irrigation Project:

It is a minor project on the Arla River, the tributary of Bhima River near the village Kalmodi. The catchment area upto dam site is 40.611 sq km and it lies in high rainfall zone of Western Ghat. This is the masonry dam with 34.33 mt height. The total GCA of this project is 2255 ha in which the CCA is 1805 ha. The ICA is 1625 ha. The area benefited from this project is 5065 ha. All the irrigation projects support to increase the agricultural land of the study area and it is also helpful to cultivate the cash crops in this area.

2.11.2 Wells Irrigation:

Irrigation by wells is still prevalent and is the second important traditional means of irrigation. At present in study area masonry and earthen well irrigation is nearly 38.44 percent of the total land under well irrigation. Wells help in the early growing of mainly market garden which requires irrigation weekly or twice or thrice a week. Water pumping sets (3010) have a further added advantage for such irrigational requirements.
The area irrigated by wells was 75.6 percent of the total irrigated area in 1991-92. In 1991-92, out of total net irrigated area 24.39 percent of area was irrigated by surface irrigation. High proportion of surface irrigated area is observed in 2009-10 that is 61.56 percent due to the canal system of Bhama-Askhed and Chaskaman canal system. The surface irrigated area is continuously increasing in the study area. Out of the total net irrigated area, well irrigated area was highest in 1991-92 that was 75.6 percent but this percentage area is decreasing by 37.16 percent till 2009-10.

**TABLE NO. 2.7: KHED TAHsil - MEANS OF IRRIGATION**  
*(FROM 1991-92 TO 2009-10)*

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Year</th>
<th>Proportion of Irrigated area to Total Net Irrigated Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Surface Irrigated</td>
</tr>
<tr>
<td>1</td>
<td>1991-92</td>
<td>24.39</td>
</tr>
<tr>
<td>2</td>
<td>2000-01</td>
<td>43.32</td>
</tr>
<tr>
<td>3</td>
<td>2009-10</td>
<td>61.56</td>
</tr>
<tr>
<td>1991-92 to 2009-10</td>
<td>37.17</td>
<td>-37.16</td>
</tr>
</tbody>
</table>

(Source: Socio economic Review and District Statistical Abstract of Pune district and compiled by researcher, 2012)

2.11.3 Other Means of Irrigation:

The construction of Kolhapur type’s bandhare has been constructed on Bhima, Bhama Vel and Indrayani River from 1981 to 1988 with main purpose to store the water for the ground water recharging and to increase the water table level of wells in the study area. Bhima River had 10 kolhapur types of bunds in the villages of Bhivegaon, Bhomale, Donde, Rajgurunagar, Kharpadi, Watekarwadi, Nimgaon, Tambewasti, Shel Pimplegaon, Koyali and Siddhegavhan. The total ICA is 3383 ha of the above villages.

Total 9 bunds were constructed on Bhama River and these were in the villages of Amboli, Koregaon, Bordara, Pimpri, Waki, Kalus, Bhone, Shelgaon, Shelu and the total ICA is 3383 ha of the above villages. Total 4 kolhpaur types of bunds are on the river Indrayani and these are in the villages of Nighoje, Chimbli, Charholi and Dhanore. Varude, Pur and Kanhersar village has the kolhpur types of bunds on the river Vel.
Tank irrigation is mainly used in mountainous area like Wandre, Torne, Waghu etc. Tanks are located in hilly areas and help the farmers to start their cultivation earlier. As results, the Net Sown Area (NSA) and the Total Gross Cropped Area (TGCA) is increased in study area. During winter season the adequate and regular supply can be provided by these sources of irrigation, as results the TGCA and NSA is increased slightly but the area under rabi crops is increased during the study period.

2.12 Transportation Network:

The road ways play a significant role in collecting and distributing agro products. Road transport network has helped urbanization extend further, causing the dispersal of town, the spread of suburbs and the transformation of villages into dormitory settlements (K, Siddhartha, 2000). The study area has only road transportation facilities. Five types of roadways namely National Highway (NH 50), State Highways (SH 54, 55), Major District Roads (MDR), Other District Roadways (ODR) and Village Roadways (VR) are connecting in study area. Fig. 2.10 shows the distribution of road ways in the study area.

Khed Tahsil has only one Pune Nashik Road NH 50 runs south- north direction in Khed tahsil having total length of 192 km. and connects Chakan and Rajgurunagar urban areas. The total length of this highway is 28.71 kms. in the study area. Chakan and Rajgurunagar are situated on NH 50. As results, the villages lie along these roads is easily connected to Chakan and Pune markets. Two SH 54 and 55 connect weekly markets and having length of 46.18 km in Khed Tahsil.

MDR 13 and 20 connect important places and market centres having length of 43.36 km in Khed Tahsil. The MDR support to the agricultural production with market centres to the distribution of produce. The total length of MDR and ODR are 43.36 km and 47.88 km respectively. Alandi town is connected with the MDR. The village road ways are linked to MDR and ODR. Therefore, door to door services are available with the availability of road transportation facilities.

In the western part of the Wada and Pait Circles have comparatively less network of road transportation facilities due to the undulating rugged topography.
The network of transportation is well developed in the central and eastern part of the study area NH 50 of 28.71 km length is passing through Chakan Circle. Chakan is well connected by NH-50, SH-55 and MDR-20. Chakan is 180 km from Mumbai & just 35 km from Pune & is well connected by Road, Rail & Air. SH-55, MDR-48, ODR-36 are connected at Pimplagaon Tarf Khed. Alandi (MC) is well connected to SH-58, MDR-48 and ODR-35. Mendankarwadi, Nanekarwadi and Kharabwadi villages are located near and around the Chakan and therefore these villages have high rate of industrialization and urbanization.

Network of road transportation is well developed at Rajgurunagar or Khed (administrative centre of Khed Tahsil) Census Town (CT) Chakan, Municipal Corporation (MC) Alandi and Pimpalgaon Tarfe Khed. Therefore all these three urban centres are well benefited by rural amenities as well as urban amenities.

### 2.13 Market Centers:

There are thirteen weekly market centres in the study area. Bahul, Amboli, Vetale (Sunday), Kiwale, Kurkundi (Monday), Wafegaon, Davadi, Kude Budruk, Markal, Chas (Tuesday), Dehane, Kadus (Wednesday), Pait, Kanhersar (Thursday), Rajgurunagar (Friday), Chakan and Wada (Saturday) are the weekly markets in Khed Tahsil. All the other weekly markets are located on the main road network.
MDR which are shown in the Fig, no. 2.10. The size of market, it’s location encourage transport and handling innovations together with economic scale. Chakan and Rajguruujagar markets are located on NH 50 and have found accessible throughout the year. Chakan has big onion market to sell their agro-commodities and also for the industrial products. Alandi, Chakan, Rajgurunagar and Shel-Pimplegaon are daily markets. Due to the easy accessible daily and weekly markets, even small size holders are also interested in cultivation of cash crops. It leads to increase the area under crops area.

2.14 Land Holdings:

The size of agricultural holding depends on the geographical and climate conditions, partly upon the laws and social institutions, partly upon the methods and techniques of cultivation (Mamoria, C. B., 1995). Table no. 2.8 represents the distribution of land holdings and the percentage of farmers by size groups. In study area, there are five groups of land holdings and out of the total land holdings, only 3.96 percent area is recorded by large holdings whereas the percentage of number of farmers are less than 1.0 percent and it is particularly distributed in the eastern part of the study area.

### Table No. 2.8: Khed Tahsil - Land Holdings (Year 2009-10)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Size Group in Ha Area in (Ha)</th>
<th>Area in (%)</th>
<th>Percentage of Area</th>
<th>No. of Farmers</th>
<th>Percentage of farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Marginal Holdings (0.01 to 1.00 )</td>
<td>9661</td>
<td>11.89</td>
<td>19712</td>
<td>42.23</td>
</tr>
<tr>
<td>2</td>
<td>Small Holdings (1.01 to 2.00 )</td>
<td>23693</td>
<td>29.16</td>
<td>12926</td>
<td>27.69</td>
</tr>
<tr>
<td>3</td>
<td>Semi-Medium Holdings 2.01 to 4.00</td>
<td>28638</td>
<td>35.25</td>
<td>10841</td>
<td>23.22</td>
</tr>
<tr>
<td>4</td>
<td>Medium Holdings 4.01 to 10.00</td>
<td>16033</td>
<td>19.74</td>
<td>2936</td>
<td>6.29</td>
</tr>
<tr>
<td>5</td>
<td>Large Holdings More than 10.01</td>
<td>3216</td>
<td>3.96</td>
<td>267</td>
<td>0.57</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>81241</strong></td>
<td><strong>100</strong></td>
<td><strong>46682</strong></td>
<td><strong>100</strong></td>
<td></td>
</tr>
</tbody>
</table>

(Source: Khed Tahsil Agriculture Office, Year 2009-10)

Maximum percentage of farmers has 0.01 to 1.0 ha land holdings capacity. 42.23 percent farmers occupy marginal holdings and the actual area is 11.89
percent. In west and north-west hilly part of the study area, the concentration of these marginal holdings is more due to the fragmentation of the land. Semi-medium and small holdings occupy maximum area that is 64.41 percent in which the proportion of semi-medium holdings is 35.25 percent and the percentage of farmers is highest in case of marginal holdings. The distribution of these land holdings is more in the central part of the study area. Size and location of farm also determine the selection of crop, use of agricultural implements, development of agriculture etc. the traditional type of agriculture is concentrates in the western hilly part while the developed agriculture is observed in the eastern part of the study area.

2.15 Summary:

Khed Tahsil is one of the tahsils of Pune District. It occupies north-western part of Pune District of Maharashtra State. It is located between 18° 30’ N to 18° 57’ N latitude and 73° 30’ E to 74° 15’ E longitudes, comprising an area of 1414.25 sq. km. It is divided into four agricultural circles; these are Wada, Pait, Khed and Chakan.

Physical and socio-economic profile of the study area is discussed in detail. Geographical location, geology, physiography, relief, slope, climate, drainage, soil, vegetation are the physical factors. Geologically the entire study area is underlined by basalt rock and horizontally bedded lava flows commonly referred as “Deccan Trap”. The lava flows generally consist of “Pahoehoe” and “aa” type. Both “pahoehoe” and “aa” types are found in the Bhima and Bhamo basin. On the basis of altitude Khed tahsil is divided into 3 physical divisions namely, Western hilly region, plateau region and Bhima – Bhamo flood plain.

The study area drains by the Bhima River and its tributaries Bhamo, Indrayani and Vel rivers. Bhamo on the north-western side, Indrayani on the southern side and Vel on the northern side are the main tributaries of Bhima River in Pune district. The study area has tropical monsoon climate. Shallow soils, medium soils, Deep soils, light brown soils, black soils and laterite soils are major soils found in the study area.
Population growth, density, sex ratio, literacy, occupational structure, socio-economic conditions, availability of transportation and communication, irrigation facilities are the socio-economic and technological factors of Khed Tahsil are discussed in detail. As per 2001 census, Khed Tahsil is the 6th most populous Tahsil in Pune District. The total population was 3.25 lakh, spread over its area of 1414.25 sq. km. In 2001 the sex ratio for the Khed Tahsil was 930 females per thousand males. Urban population was 17.47 percent in 2001 whereas literacy was 61.24 per cent in 2001. Khed Tahsil had 51.52 percent working population to total population in 2001. The Chaskaman, Arla-Kalmodi and Bhamashasked are the irrigation projects in Khed Tahsil. Besides this, well irrigation, Kolhapur Types Bandhare, tank irrigation are also practiced here. The network of road transportation such as NH 50, SH 54 and 55, MDR 13 and 20, ODR and VR is well developed in the eastern part of Khed Tahsil. Weekly markets and daily markets are well connected through the road ways. Such socio-economic conditions help to know the general land use and agricultural land use changes in the study area.

2.16 References:
