

## SUMMARY AND CONCLUSION

This dissertation on **“RESOURCE APPRAISAL FOR INTEGRATED RURAL DEVELOPMENT OF SALEKASA TALUKA, GONDIA DISTRICT, MAHARASHTRA, USING REMOTE SENSING AND GIS”** was initiated to create a development plan for rural development keeping in the mind the resource base of the taluka. Both bio-physical and socio-economic scenario of the taluka has been taken into consideration. While data on socio-economic parameters points out the people, for whom the planning is required and their status, it also suggests the infrastructure and other limitations of any developmental plan. The bio physical attributes of any area define the problems and potentials of biological productivity of the region in terms of agriculture operation, growth of plant etc.

The area selected for this study is the Salekasa taluka, which is one of the eight talukas of Gondia district. The area is dominated by tribal population and most of the land is covered with forest. Salekasa is regarded as a naxal affected taluka of Gondia district. Agriculture is still the major means of sustenance in this taluka. It is mostly characterized by low productivity and low income mainly due to poor adoption of technologies, low access to credit and extension. Paddy is the main agricultural product. The district has poor indices in various areas of development including, amongst others, infrastructure, agriculture, food availability, nutritional health, land sanitation, and last but not the least economical backwardness of the habitation. It can safely be categorized as an underdeveloped region.

The total Geographical area of Salekasa taluka is 42277.98 ha. and lies between 21°09' and 21°26' north latitudes and 80°22' to 80°41' east longitudes. Salekasa taluka is situated on north-eastern side of Gondia district and share the taluka boundary of Aamgaon and Deori and the state border of Chhattisgarh. There are total 84 villages out of which 78 villages are inhabited and 6 villages are uninhabited in the taluka.

The major aim and objective of the present study is the (a) evaluation of physical and socioeconomic resources for realization of the problems and potentials of these resources and matching them with the needs and aspirations of the people living in the taluka, (b) to

delineate the Land Management Units for land use planning to ensure optimum utilization of the natural resources of the region, and (c) the ultimate objective of this study is to present a development plan for improving livelihood of the people of the area.

The modern techniques of Remote Sensing (RS) and Geographical Information System (GIS) have been utilized for recourse mapping and characterization in this dissertation. Satellite imageries of two different periods (2000 and 2013) are used to prepare land use/land cover (LULC) change maps. Land use land cover (LULC) attribute data for 40 years (1981-1991-2001-2011) was collected from various sources and integrated with village boundary on GIS platform to prepare LULC change maps. Demographic data for 2001-2011 is also used in this research. To attain relevant and update socio-economic information and to understand better interaction between people and available resources, field survey for 7 window villages having different characteristics is also conducted to analyze the agriculture status of this taluka. Several techniques are used for productivity analysis, Crop diversification, crop combination and cropping pattern. Land Management Units (LMU) is prepared for better land use planning.

Any attempt at Resource Evaluation for Development Planning requires data on various aspects both bio-physical and socio-economic and their integration. In this study the bio-physical resources are studied in which land, soil slope, depth, texture, soil erosion, water availability, irrigation, climate, flora and fauna were included. The socio-economic constraints of the taluka are studied and all the parameters have been highlighted with location specific details, especially maps, to appreciate the spatial dimension, socio-economic parameter like population, growth of population, literacy, tribal population, educational facility, medical facility, market, road network, electricity and irrigation facilities have been analyzed at the village level. Block level development planning as attempted in this study can be achieved by regional analysis through village level data sets. It is however felt necessary to obtain first hand information from the people inhabiting in area for which 07 sample villages were selected on a representative basis and detailed interview is conducted of all people living in the villages.

Soil is the most important component of the land characteristics since it represents the ultimate results of climatic, geological and geo-morphological activities that affect the mantle of the earth over a period of time. In the taluka *Fine Loamy Vertic Haplustept*, *Fine-Loamy Inseptic Haplustalf* and *Fine-Loamy Aeric Haplaquept* soil covered almost 85 per cent area of the taluka.

The slope of the land is considered as one of the most important land quality for land use pattern. The landforms of the Salekasa taluka are characterized by slopes which range from very gently sloping to steeply sloping. Very Gently Sloping area (1-2% slope angle) covered 55.18 per cent area in the western part of the taluka which really holds promise for cultivation.

Soil depth determines the potential rooting depth of plants to be grown and any restriction within the soil that may hinder rooting depth. In the taluka very deep soil covered 24.91 per cent area which is very good for agriculture while 45.21 per cent covered by moderate deep soil and 26.70% area covered by deep soil and the shallow soil covered only 0.14 per cent of the taluka.

Soil Texture is a very important component of land as it decides the aeration and water retention capacity of the agriculture crops. Soil texture is divided into 7 classes, but here two main soil textures are observed as Clayey Soil and Gravelly Clay Loam soil which covered 72.16 per cent of the taluka.

Salekasa taluka is influenced by water erosion. . The steeper slopes of the region make it highly vulnerable to erosion and this aspect needs special care for optimum use of land resources. The erosion problem of Salekasa taluka is observed in nearly 45 percent in the range of Moderate to Severe erosion.

Surface water bodies play an important role in the agriculture of the taluka in the form of river, lakes and ponds. In case of number of lakes and ponds they were 138 and 187 in 2005 and 2013 respectively. The irrigation system of the Salekasa also included canal irrigation, hand pump, electric pump and tank irrigation. Climatic condition of the taluka and the flora and fauna are also studied and discussed.

Population plays an important role in the development of any region. The population of this taluka shows increase during the decades 2001 to 2011 it was only 10.01 per cent. Village Amgaon Khurd is showing the highest density in 2011 (1435.64 per sq.km.) and village Dandari shows the lowest density (18.51). The sex ratio is in the favor of females.

The taluka has an average literacy around 73.24 per cent. In 2001 and 2011 literacy is increased by 10.30 per cent of total population and male literacy increased by 6.85 per cent and the female literacy increased by 13.59 per cent. The percentage of the workers has increased by 7.69 per cent and the numbers of agriculture labour and cultivators has increased by 3.4 per cent from 2001 to 2011.

In transportation facility the development of Salekasa taluka appears to be very poor. There is lack of educational facilities in the taluka too. In 2001, in 13 villages and in 2011, 8 villages, there was no educational facility. Provision of medical facilities shows no progress in last two decades. Only 1 village has Gramin Hospital and 17 villages have Primary Health Center (PHC). In agricultural development provision of marketing facilities is also important. In the taluka there is only 1 main market at taluka place and 22 weekly markets.

Since it was felt necessary to obtain first hand information from the people inhabiting in area, 07 sample villages are selected on a representative basis and detailed interview of all people living in the villages has been conducted. These villages are Dhanoli, Nimba, Ghonsi, Bakalsara, Jambhali, Serpar, and Halbitola. These window villages are selected from different location in the taluka and these villages also represent major Land Management Units (LMU). Dhanoli and Ghonsi Villages which are situated in the western side of the taluka represents Land Management Unit – II. Bakalsara, Jambhali and Serpar Villages are situated in the central and the southern part of taluka represents Land management unit – VI.

Land holdings are very small near about 83 per cent farmers are Marginal (0-1 ha), 12.31 per cent, Small (1-2 ha), 4.19 per cent large (2-5 ha) and only 0.18 per cent very large (above 10 ha) farmers in the window area which is representative of the taluka.

Out of the total farmers interviewed, 41.03 per cent of the farmers still use organic fertilizers like *Shenkhat*, Swine *khat* or compost fertilizers. Presently more than 41.66 use

chemical fertilizers. This percentage is more, because government offers loan partly in cash & partly in kind & thus offers fertilizers to the farmers. Nearly 38.09 of the farmers use the chemical pesticides. But in respect of insecticides more than half of the farmers use traditional methods. More than 80 per cent of the farmers use the traditional implements. They mostly do it because of their economic constraints.

Productivity analysis is calculated for Paddy (*Oryza Sativa L.*), Wheat (*Triticum aestivum L.*), Lakhori, linseed and Gram in these 7 villages by Enyedi's Method. The result shows that paddy is cultivated all over the taluka. The productivity index of rice reaches to 184 in some parts of the taluka. Wheat is not cultivated everywhere in the taluka and have very low productivity index. Same condition was observed for Lakhori, linseed and Gram.

Total population and density of these villages are calculated. Dense population is found mostly in the western part of the taluka because this is a plain region having very gently sloping and have a good quality for agriculture with transportation and other infrastructure facilities.

SC population is present in the western border of the taluka in Ghonsi and Nimba village 5.55 per cent and 10.83 per cent respectively, while ST population is presents in the village nearer forest area in Bakalsara village (80.67% ) and Halbitola (73.37%).

In these seven sample villages 45.66 per cent population is working population. The highest percent of working population in the Nimba village (63.36 %) of the total population located in the middle portion of the taluka. The total percent of cultivators is 49.30 and the labourer is 46.70.

Electricity supply is a very special aspect but in this survey of window villages 39.87 per cent houses don't have electric supply till now. This is one of the factors which affecting the development of this area and the people of this area as well as the less productivity of this region. Only 39.33 per cent households have the BPL cards. In these seven villages only 453 houses have BPL cards out of 1106 houses.

## **LAND USE / LAND COVER AND LAND MANAGEMENT DOMAINS**

Important aspect of this dissertation is change detection of land use/land cover, land management unit delineations and land use plan of the taluka. The land cover change map of Salekasa taluka with different approaches bring out the changes that have taken place particularly in the built-up land and forest area subsequently predict likely changes that might take place in the same over a given period. The objectives were to determine the trend, nature, rate, location and magnitude of seasonal land use land cover change with forecast of future pattern, to evaluate the socio-economic implications of these changes.

For the land use/land cover change analysis two types of data are used, the first is satellite data and the second is census data. With help of two satellite images of different time period (2005 and 2013) having difference of 8 year Land use/Land cover has been categorized into 7 different classes based on supervised classification of satellite image dense forest, degraded forest, water bodies, and built up area, single crop, double crop, and scrub land.

In this classification the taluka is dominated by two major units, agriculture area and forest area. The forest area is found in the eastern part of taluka having high elevation of 400 m to 600 m with steeply slope. And the agriculture area is present in the western part of the taluka which is having the elevation 300-320 m with its very gently slope. Near about 44.28 per cent area is covered by the forest and 45.90 per cent is covered by agriculture land. The forest area has increased by 9.67 per cent and the agriculture area decreased by 9.85 per cent from 2005 to 2013.

Problems and potentials of land use in the taluka has also been described in chapter IV which includes interpretative maps like agro-potentials lands and the problems of soils to identify the physical potentials and problems of land use in Salekasa taluka. The map on the agro-potential lands in the taluka manifests that nearly 51.62 per cent of the land are favorable for cultivation under various levels of management practices depending on their soil characteristics. The map on the problem areas brings out the levels of soil and land erosion and separates the area under severe and severe to moderate erosion in the taluka. In

this dissertation an attempt has also been made to highlight the socio-economic constraints in optimization of land use in the taluka.

Optimum land use in any given area is a function of the physical land characteristics including land quality, the absence or presence of institutional support mechanism and the attitude of the user of land if farmer does not have proper incentives, he may remain contented with the subsistence form of agriculture that has been practiced for so long (Chaturvedi, 1998)

The best way to appreciate the land use is by understanding the land where the use is practiced. Thus analysis and evaluation of land use vis-à-vis the land qualities could help in ascertaining the problem areas for sustainability. For proper land use planning the evaluation of land use in relation to land capability analysis has been carried out. In this analysis only 20.60 per cent of the agriculture area comes under the very good quality of soil and more than 50 per cent area of agriculture comes under class IV which needs urgent attention. More than 40 % of the forest area belongs to class VII category. Some scrub land comes under the class II which covers 10.33 per cent. This land is very good for agriculture.

## **LAND MANAGEMENT UNIT**

Digital mapping technique has been need for delineation of LMUs at various scale and have had differing levels of success. The approaches are based on continuous sensors to map crop yield and soil properties. The use of high resolution data in the definition of LMU's is very attractive as it may provide the ability to define LMU's with high resolution boundaries. The techniques adopted by National Bureau of Soil Survey and Land Use Planning, Nagpur has been utilized for mapping LMU in Salekasa taluka and six LMUs have been delineated. LMU I covered 3826.35 ha (9.03 %) and LMU II covered 2135.02 ha (5.04 %) of the taluka. LMU III covered 1791.32 ha (4.23%) of taluka. As earlier stated these areas are well irrigated and having a good quality of soil. In these parts of the taluka double and triple cropping systems are found. These areas cover 18.30 per cent of the taluka and 1.48 per cent of the district. LMU IV covered 3328.68 ha (7.86 %) and LMU V covered 9075.46 ha (21.43%) of the taluka. These units cover large portion which is 29.29 per cent of the taluka and 2.37 per cent of the district.

LMU VI covers the largest portion of the taluka (45.55 %) in this portion 72.99 per cent tribal population is found. This area is covered with hilly region.

## **LAND USE PLAN**

Salekasa taluka has 17464.77 ha (41.23%) area suitable for agriculture. The multiple criteria analysis reveals that 21.18 per cent of the taluka has the capacity for double cropping. Amongst these, 8.89 per cent area (LMU-I) of the taluka is agriculturally versatile land. The LMU II (12.29%) can also be used for double cropping but will require higher level of input as compare to LMU I. Salekasa taluka has 3.81% area under Rainfed-Single crop/animal Husbandry/Dairy (LMU-III) under moderate cropping land but limited in versatility. Rainfed-Single Crop/Animal Husbandry (LMU-IV) has 8.15 per cent area under moderate cropping land. Kharif Paddy/Animal Husbandry/NTFP (LMU-V) has 6.30 per cent area and it is little suitable for agriculture. Rainfed Paddy/ NTFP/ Animal Husbandry (LMU-VI) has 11.70 per cent area, which is marginally suitable for agriculture. In Salekasa taluka 38.49 per cent area is under dense forest, of which 4.21 per cent area has severely degraded forest which needs immediate attention. Afforestation and gap filling is the best way to conserve the soil and the forest. In Salekasa taluka 4.71 per cent area is under waste and scrub land. Silvi-pasture is one of the alternatives land-use system is available for improving the fodder resources of the taluka. In Salekasa taluka, Salekasa, Amgaon Kh., Bhajepar and Chand suraj village has area (1.11%) having good suitability for market and industrial development. Salekasa taluka has 0.17% area (under Hazra fall, Kachargad caves, Gadmata temple and Ardhnareshwar temple) having good scope in reference to tourist place.

## **DEVELOPMENT PLAN**

Agriculture continues to play an important role in rural areas, and in some regions it also contributes to economic growth. In the Salekasa taluka 45.90 per cent of the area is cultivated and mostly located in the western side of the taluka covering total 66 villages out of 84 villages. Considering the situation some variables were selected for measuring the level of development. Most villages in the taluka have above 75 per cent area under the kharif crop.

The taluka shows clear variations of productivity index. We can divide the area into eastern & western parts. In the western part the productivity is higher while in the southwestern part the productivity is below normal. The eastern part of the taluka has the medium productivity. The taluka has very low diversification of crops. In 22 villages the specialization of a single crop of paddy and in the category of Medium diversification there are 46 villages. In the category of diversification (Index under 40) there are 10 villages. Using crop combination method for 84 villages shows that Paddy is the dominant crop in the area & the natural environment is best suitable for this crop. Out of 84 villages in 71 villages monoculture is common.

A details survey of the income in the 7 villages have revealed that the total income obtained by agriculture amount to Rs 10115600 which is 37.76 per cent of the total income of the villagers in these 7 villages. As mentioned earlier there are 535 families/ households who own agriculture land and therefore the average agriculture income comes out to be Rs 18907 per year. As per information provided by the inhabitants, there is more money coming from working as agriculture labours (47.85%) in these villages. The income obtained from the service is 8.15 per cent and by the self employment is 0.74 per cent and income from other sources is 5.50 per cent. It is clear that 62.24 per cent income of people is coming from different work other than agriculture.

An Integrated Rural Plan deals mainly with the development of the rural area, determines the primary organization of land into agricultural, forest and built-up land. Further, the plan separates the zones for each category of land.

Six special Development Zones can be identified for Salekasa taluka. These are afforestation area, agriculture with conservation approach, intensive agro potential zone, agro processing center, growth center, conservation of agriculture and social forestry zone.

As per satellite data 2013 nearly 18.01 per cent area is under degradation and needs to be brought and afforestation since it is situated in reserve forest land. The development plan suggested the future land use system as follows. Total cultivated area is 45.90 per cent (19442.53 ha) of the taluka. Cultivated area having good quality for agriculture purpose is 45.05 per cent (19081.59 ha) of TGA. The taluka having 13023.56 ha area under agriculture

with conservation approach which is 30.75 per cent of the taluka. Intensive Agro-potential zone is 14.30 per cent (6058.03 ha) of the taluka and 31.74 per cent of total cultivated area. In the Taluka there are six villages which can be agro processing center covering 89.48 ha (0.21%) area of TGA. There are three villages in the Taluka which have a potential to evolve as growth centers of the taluka covering 114.55 ha (0.27%) area of TGA is Amgaon Kurd, Bhajepar, Chandsuraj.

## CONCLUSION

The present study is an attempt to analyze, evaluate and interpret the resources characteristics of Salekasa taluka in Gondia district for integrated rural development planning. One of the major conclusions observed is that the taluka suffers from poor resource base both in terms of bio-physical and socio-economic indicators.

There are several limitations associated with in terms of the soil quality such as, the limited span of water availability, uneven landforms, slope, erosion and drainage. All these have limitations for agriculture production coupled with poor knowledge of agriculture techniques, low investment and inputs, the productivity remains low, leading to vicious circle of poverty

As discussed earlier soil depth is a major limitation in this area as near  $\frac{3}{4}$  part of the taluka is under shallow to medium deep soils. Water is not a major problem as the taluka received almost 1200 mm rainfall and come under humid subtropical zone but the major precipitation is received between June-September and a water loving crop like wetland paddy and absence of good effective water conservation infrastructure leave not much water for rabi. Eventually the region is left with Paddy-Fallow system as the major cropping system in absence of water after the rain.

Studies done by National Bureau of Soil Survey and Land Use Planning for World Bank project titled "Efficient land use based Integrated farming system for rural livelihood security in Aurangabad, Dhule and Gondia district of Maharashtra" has brought out the limitation of banded paddy cultivated in terms of their workability for the rabi crop in the absence of mechanization. The poor tribal has no alternative but to rely on NTFP and other off-farm activities like labor for their survival.

The problem with the soil and land resources is that not much can be done to improve their properties. While fertilizers and nutrients can be helpful in increasing the productivity, the basic properties of soils cannot be changed. Thus an eroded soil has to be used within the limitations posed by them and that is why they are advised to be put under permanent cover that they may not further degrade. Preventive measures are crucial to ensure that the erosion problem is not further motivated. This requires soil and water conservation measures which

require awareness as well as financial inputs if the situations are very severe and physical structures are necessary. Salekasa taluka presents a classic example of this scenario.

The rural population shows a growth of 10.01 per cent in the span of 10 years. Population density in 2011 is 197.27 per cent per/sq.km. Gondia district have 10.13 per cent growth rate and population density 253 per/sq.km. in 2011 while Maharashtra state population growth rate was 15.99 per cent and the population density is 365 per/sq.km. It shows that Salekasa taluka have low growth rate and population density as compared to district and state. The caste composition is another characteristic of population, which is important in Indian context. In the year 2011, the SC population was 6.41 per cent mostly found in the southern and central part and ST population was 27.41 per cent from the total population mostly in the eastern part which is forest area while the Gondia district had 13.30 per cent SC population and 16.20 per cent of ST population. It shows that taluka has more tribal population than the district. 73.24 per cent of the total population is literate, 15.96 per cent population is cultivators and 12.17 per cent population is agricultural labor.

Tribal population of the region was always dependent on forest for their survival. It was only in the early part of 20<sup>th</sup> century they started cultivating around the waterbodies. Gradually they set up villages at the fringe of the forest and started cultivating maize and some food for their survival (Chaturvedi, 2015).

In comparison to the traditional cultivators of the alluvial region these farmers had very little experience/knowledge of agriculture practices and thus developed/evolved their own primary techniques. Thus poor soil cultivated by poor people with poor technical knowledge of agriculture is a trend that has continued till date.

Though soil and water conservation catchment area development program known as '*Panlot Vikas Karyakram*' has been taken by government, it needs to be strengthened. There is a need to distribute the water equally and at proper turn among the farmers, particularly in the canal command areas. As has been pointed out earlier, the ground water has not been fully utilized even though the potential is very high in the taluka. Sincere efforts should be made to develop well and dug wells in the taluka though it should be done judiciously after investigating the aquifer position of the region.

The taluka is very poor in infrastructure facility though the official records mention primary school in all the villages, the problem of education gets compounded at the middle and secondary level. Only 18 villages have middle school and only 8 villages have collage facility.

There is only one gramin hospital and 17 primary health centers. The taluka is having only 1 main market and 22 villages have weekly market but there are 61 villages without market facilities and poor transportation facilities.

The Scheduled Castes and Scheduled Tribes despite the constitutional safeguards and government's venture are still far behind in socio-economic indicators. Although the findings of the study may not be an accurate reflection of the development that has taken place, yet it represents a scenario of the Scheduled Castes and Scheduled Tribes, which would call for a re-orientation and correction of the policies, dedicated towards their liberation. Awareness of schemes and development program is a necessary condition for its successes. Literate population is another major constraint of the taluka. Illiteracy among the population is a major impediment.

The dwindling natural resources including forest and shrinking water and fodder supply have jeopardized their agriculture and livestock productivity. The small and marginal farmers rearing livestock and raising more crops and low productivity of livestock do not earn adequate income for their livelihood on sustained basis.

Educational facilities are being provided for the tribal people but more needs to be done. There is a need for including agriculture as a course in their curriculum. Good, reliable transport and communication facilities should be provided in villages. They need to be connected to a regular supply of electricity. Irrigation facilities should be provided by government tube wells and introducing facilities of modern technology to the tribal's so that their socio-economic standard can be increased.

During the survey, the villagers were asked about the various schemes that are in progress or that are expected to come in near future for the development of village economy. The major grouse was the accessibility. There are various schemes of surfacing the roads, broadening the roads making Kachcha roads where there is no access today etc. Similarly

there are various schemes to improve the rural life. Several provisions like repairing of the tanks, starting grain purchasing centers, making the bore-wells *etc.* are in progress.

A large number of the farmers uses fertilizers including organic fertilizers but without knowing the requirement of the soil. Very few farmers in the taluka have tested their soil in the laboratory and blindly follow the other farmers or they admire the traditions.

Nearly 34.53 per cent of the land is irrigated. As per records there are 187 tanks but most of them are not in use because they are completely silted up. If these tanks are cleared the water from them will increase the irrigation capacity of the area.

There is a strong need for a change in cropping pattern. Paddy is a primary crop and it will remain in this dominating position because of environment conditions. There are possibilities to raise certain other crops along with paddy with some irrigation during the winter and summer season. This multiple cropping will help the farmers to improve their economic condition. As mentioned earlier the water storage capacity for use after the rains needs to be improved. There is a scope for raising oilseed, grams or some other crops if water is available.

The size of land holdings in an area gives a fair picture about economic status of farmers, the dominant style of agriculture operations and the efforts needed by extension work to be carried out in an area. If there are more small holdings, more people will have to be covered under the extension and advisory work of the government agencies. The area under different category of land holding sizes also brings out the intensity of land utilization.

For the advancement of the area proper efforts in proper direction are necessary. There are some rice mills in the taluka which can encourage hundreds of farmers to raise these crops and add to their income by starting some incentives. Therefore a necessary co-ordination between the development of primary activity of agriculture and secondary activity of industry is necessary.

In this the priority should be given to education but they must be made familiar with the new techniques of farming. Administration as well as the co-operative societies and other institutions can help the farmers in several ways.

One of the major weaknesses of the agricultural sector is to be found in the production, disposal, and preservation, processing and marketing of agricultural products. There is a need to undertake joint efforts to create favorable conditions in agricultural areas, including the reinforcement of road networks for the transportation of product from production areas where rural people work, as well as the processing and commercialization of such products. There is a need to drop policies which are less favorable to rural women, focusing on the appreciation of their role as producers of wealth and strengthening the network of public services in rural areas, including health, education, and welfare services, as well as establishing policies that combat the asymmetries that prevent rural people from being protected against the effects of climate change. The training of rural people is very important, especially with the adoption of modern agricultural techniques that are tailored to local conditions and that use natural resources in a sustainable manner, with a view in achieving economic development without degrading the environment. It requires the dissemination of the results of research carried out by experts - including those on agro-ecological techniques -with a view to increasing Rural Women's production levels.

Similarly the administration must provide sufficient infrastructural facilities to this area. It must be provided with good roads, reaching to the remote area of the Villages, marketing facilities, loan facilities as well as seeds, fertilizers, insecticides and pesticides supplying centers, *etc.* Administration has several plans for the development of the agriculture. It offers help in terms of money or kind. But all these benefits don't reach to the farmers completely and therefore they fail to achieve their goals. If more transparency is brought in the system, the farmers will be more beneficial and it will turn the complete agricultural scenario and will bring prosperity to the region.

A comparison has been made between data obtained from satellite imageries and from the census data (revenue records) held at the district headquarters. One of the major differences between the two is while the satellite images manifest land cover unit the census records displays land use statistics. The combination of the two brings out a better analysis of the changed scenario in this study.

It is observed from both dataset that the forest area has been increasing. According to revenue record the area under forest increased by 2.16 per cent while the satellite data shown an increase of 9.67 per cent out of which the decreased degraded forest is in the tune of 1 per cent. The difference between these two is because the revenue records manifest only the notified reserved forest area while the satellite data overlooks such boundaries and gives overall picture of the vegetative index in the region. It is therefore obvious in the forest has increased, even in the area of outside reserved zone. It can also be calculated that some degraded forest are improving through plantation and converting into dense forest.

It is also observed that culturable waste land is decreasing and giving way to cultivation. On comparison between observed cultivation in satellite imageries and reported net sown area in revenue records reveals that while net sown area has ranged from 36-40 per cent in total geographical area between 2001-2011, cultivated land is higher (55%) in 2005 and 46 per cent in 2013.

This has shown a decrease which is alarming that cultivation is taking place even in the areas which are not reported as net sown area in revenue records. This is in line with observations by Chaturvedi *et al.* (2014) wherein they have pointed out that agriculture has infringed into various forest lands of Central India, especially after introduction of the Forest Rights Act of 2006 which has recognized the rights of forest-dwelling Scheduled Tribes and other traditional forest dwellers over the forest areas inhabited by them and permitted cultivation of the poor quality lands of small holding sizes.

Planning and management of land resources are integral parts of any rural development program as well as many development programs with rural components. Land use does not consider agricultural uses only but also encompasses natural areas, forests, watercourses and urban areas among others. Land-use planning has often had negative implications because it was traditionally associated with procedures. The land users have been ordered how to use their land based on a scientific assessment of its capability or suitability.

As mentioned earlier, there are areas where the soil and slope conditions are favorable for agriculture but availability of water is the limiting factor even in these areas. Adoption of

appropriate conservation measures like water management techniques (sprinklers, drip irrigation, construction of check dams, desolation of tanks etc.) and soil erosion control measures (contour trenches, bunding *etc.*) would reasonably enhance the potential of water and land resources. Overlaying village layer on the optimal land use will further help farmers in identifying problems, limitations and potential of their fields and thus formulating an appropriate site specific action plan.

### **Land Management Unit**

Land use planning aims at improved use of land and management of resources. It not only influences the environmental processes such as soil and stream erosion, sediment and nutrient concentrations in streams, quality of surface and ground waters in a watershed, but also affects social and economic development in that region. Land use planning has as its basic purpose to ensure that each area of land will be used so as to provide maximum social benefits, especially including food production, without degradation of the land resource.

As discussed earlier taluka have poor resource base both in terms of bio-physical and socio-economic indicators. On the basis of soil, depth, erosion status, land use land cover, cropping pattern and socio-economic parameters land use plan were prepared in which VI land management units (LMUs) were created.

Agriculture, which was the most labor absorbing field for the villager is no more a profitable business. Introduction of various development programs by government and emergence of new industries in locality have given an alternative source of livelihood for the villagers. The rural non-farm sector can become a major source of livelihood for the poor households. It has become a primary source of income and employment for many of tribal households.

There is a slight scope for improving the irrigation status of the area. Canal irrigation is common but not used all over the taluka. There are several tanks due to geological formations of rocks. It has been observed that the water from many of these tanks is not used at all it is used only partially. Clearing of these tanks and water management can bring a lot more land under irrigation. Persistent and honest efforts are necessary.

There are several schemes of agricultural development. Many of the advantages and help don't reach to the farmers and that ultimately harms the region. If proper help in terms of money or kind reaches to the farmers, it will help them in raising the production. There is a wide scope for accepting agricultural innovations. If all the farmers adopt new and scientific techniques of cultivation the intensity as well as the productivity will definitely increase.

The need of the day is to commercialize agriculture wherever it is possible. The integrated programme for the development of the agriculture and industry is necessary. A sugar mill, an industry of Soya products, oil mill etc. can create demand of agricultural products, which will help in the diversification, and commercialization of crops. In certain area there is scope for the cultivation of second or third crop but it requires irrigation that can be provided easily.

There is a need for help from the administration, co-operative societies and other institutions. There is a need of educating the farmers in the use of new techniques of cultivation. Simultaneously they're in a need of providing marketing and transport facilities to the area.

The implementation of the NTFP is contributing significantly to the protection, expansion and conservation of the forest resources of the taluka and to the socio-economic development, especially in rural areas. The task of integrating conservation and development objectives is not an easy one. Integrating both objectives in a management plan on an equal basis is proving to be especially difficult. Forests should offer alternatives for small businesses in rural areas, and so help creating new jobs for the local workforce.

Fisheries are one of the major components of agricultural activities, playing a significant role in nutrition, employment, income generation and earnings. Fish production is a very profitable business and it yields benefit to both the owners and the nation in various ways. This motivational program can be launched through department of fisheries.

Land management units are homogeneous agro ecological domains with similar infrastructural attributes. These were found to be very useful for land use planning of the area which has been taken as a base for the development plan for the taluka

Land use plan has been prepared for the taluka on the basis of identified Land Management Unit (LMUs) which reflect the bio-physical and socio-economic resources of the area.

In Salekasa taluka 38.49 per cent area is under dense forest, of which 4.21 per cent area has severely degraded forest which needs immediate attention. Afforestation and gap filling is the best way to conserve the soil and the forest. In Salekasa taluka 4.71 per cent area is under waste and scrub land. Silvi-pasture is one of alternative land-use system available for improving the fodder resources of the taluka.

Salekasa taluka has 2.89 per cent area under waterbodies, out of this 1.59 per cent area having big ponds. These waterbodies can be used for irrigation as well as fish production also.

The land capability class map of Salekasa taluka brings out the generalized grouping of soils and land according to their productive potential. Only 9 per cent of the area is of very good quality with minimum limitation. Thus more than 91 per cent of the soils and land of the Taluka needs some kind of conservation measures for effective utilization for sustained production. More than 70 percent of the land needs urgent attention as they belong to Land Capability Class IV and above.

The central and eastern parts of the Taluka seem to be favorable for rice crop and it is here that rice is actually grown in the taluka covering 45.18 per cent area. This area is highly suitable for the rice and 2.96 per cent area is highly suitable for wheat.

In the taluka there are six villages which can be an agro processing center because these villages have industries based on agriculture production. In these villages have 2-7 agro industries like Rice mills and Poha mills and also have 1-4 other industries. There are three villages in the taluka which have a quality to evolve as growth centers of the taluka.

Social forestry Zone with patches under agriculture is near by the forest area. These villages have more than 50 per cent forest cover. There are 15 villages covered under this portion. In this portion there is a lack of other facilities like the market area and the transportation facility. This portion belongs to tribal zone with more than 60 per cent tribal population. The soil in this area is fine loamy Vertic Haplustept which is covers 33.50 per cent area of the taluka. Moderate to severe erosion occurs there. The soil is moderately deep 25-50 cm. In this part of the taluka the condition of agriculture is very poor.

As per the development plan prepared on the basis of resource appraisal almost 45 per cent of the area can be allocated to forestry and another 45 per cent for agriculture proposes. Among the forest area nearly 18 per cent needs immediate attention *i.e.* intensive afforestation. Among the cultivable area around 50 per cent can be utilized for intensive agriculture as it has potential of high productivity and investment would be required for infrastructure, efficient irrigation practices, skill development and extension services to achieve these goals. Agriculture shall continue to be practiced in 30 per cent of the remaining area because of population pressure but this area require urgent conservation approach for soil water conservation. The remaining nearly 10 per cent of the land will have to be used for social forestry, agro-forestry and highly conservative agriculture.

Observing the trend of land use land cover change in between 2005 and 2013 and keeping in mind the increase of population changing life style and habits of people. It can be safely predicted that area under non agriculture uses is bound to increase in the coming period. If sincere efforts to increase the agriculture productivity is not made, people will shift from agriculture to other occupation and /or migrate to urban areas for better job opportunities as agriculture is not a very profitable occupation in the present scenario.

The large area under degraded forest is already a matter of concern with district administration and efforts are already being made to improve the quality of forest it can be safely presumed that afforestation program will be taken off at a large scale and have also been suggested in the development plan.

Chaturevdi *et al.* (2014) mentioned that “Efficient use of NTFP to supplement income from agriculture needs to be further explored and strengthened” in Gondia district, and with 44% area under forests, this can play an important role in development.

Rural development implies both improved quality of life as well as greater social transformation (OCED, 2001). In order to develop rural areas, there is need to realize their potential. Rural areas are not to be seen as problems; they in fact present opportunities and potential to contribute positively to competitiveness, growth of micro business, markets and the increasing role of women entrepreneurs. Although, agriculture continues to play an important role in rural areas, there is need to strengthen rural economies through diversification of economic activities. Moreover, with the introduction of market based reforms, economic pressure on rural areas is expected to increase, adding a major burden on the rural community in doubling agricultural production, alleviation of poverty and realizing food security.

At the outset the hypothesis of this dissertation is summarized as

1. A scientifically sound, sustainable development plan has to be based on detailed information about the bio-physical and socio-economic resources of any region.
2. The modern techniques of Remote Sensing and Geographic Information System are very useful in accurate and timely interpretation of the datasets required for Integrated Development Plan of any region.

It can be safely concluded from the previous chapters that information on bio-physical as well as socio economic variables is crucial for understanding and optimally utilizing, the available resources to meet the aspirations of people through a scientifically sound a sustainable development plan. As mentioned earlier both bio-physical and socio-economic scenario of the taluka has been taken into consideration. While data on socio-economic parameters points out the people, for whom the planning is required and their status, it also suggests the infrastructure and other limitations of any developmental plan. The bio physical attributes of any area define the problems and potentials of biological productivity of the region in terms of agriculture operation, growth of plant etc. It can be

observed that detailed analysis of these assets and liabilities in the Salekasa taluka is needed to prepare a Land Use Plan and over all development plan of the taluka.

Earlier resource mapping and characterization was attempted by conventional methods like data tabulations, statistical analysis and conventional mapping techniques. Digital mapping techniques like Remote Sensing (RS), Geographical Information System (GIS) and Global Positioning System (GPS) has accelerated of the phase of these activities leading to quicker and precise resource management.

In this age of resource paucity and thrust on their optimum utilization it is essential that their distribution, classification and categorization is known as to scientists and planners. Inventory is the first step for any land use planning. As the resource consumption is getting, accelerated and complicated, quicker and effective tools of inventorisation are required Remote Sensing and GIS tools provide the solution to this program.

Most resources, especially natural resources do not conform to administrative boundaries. These require location specific mapping to appreciate their distribution and extent *e.g.* SOILS, FORESTS. Conventional mapping was both, unreliable and time consuming. Larger the area greater the time it took to map it.

**Remote Sensing Caters** to varied fields of agriculture, geology, hydrology, forestry and marine resources. It is

- High speed
- Cost-effective
- Consistency of interpretation
- Synoptic Coverage

### **Digital Remote Sensing**

- Multi-sensor, multi-temporal data handling capability,
- Discrimination of large number of unique spectral classes,
- Versatile image enhancement techniques,
- Accurate and faster map updating

The biggest advantage of digital remote sensing is its Inter-operability with multi-level geographical databases as can be observed by LULC studies conducted in Salekasa taluka and reported in chapter 4.

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