Land Use and Land Cover Mapping Using Digital Classification Technique in Dindori Tehsil of Nashik District, Maharashtra State, India Using Remote Sensing

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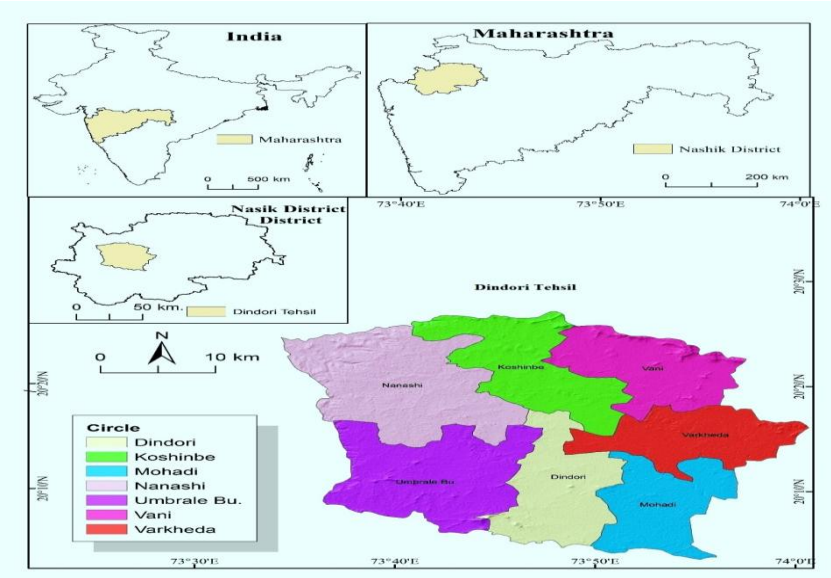
ABSTRACT
Land use land cover has been a rapidly change in the Nashik district because of rapidly increase the urbanisation. The natural interferences and remotely sensed satellite image have been used to detect the changes. The Dindori tehsil have use the LULCthis technique,the present study is the aimedto identify those change and model the future trend of Dindori Tahsil. Land use change in Dindori Tehsil has been studied by Remote Sensing GI method for the period 2001 to 2023 years.Dindori tehsil shows a positive increase in agricultural area during the period 2001 to 2023 in Nanashi circle 8.1 in Umarale circle 10.24 in Koshimbe circle 9.15 in Dindori tehsil 1.25 in Kasbevani circle 6.46 in Warkheda circle 1.26 and in Mohadi circle 4.24 Sq.km. Also, there is a negative increase in the non-agricultural area. Also there is a large increase in the settlement and there is a negative increase in the forest area. From this, in the future, planning will have to be done in 7 circles in relation to forest.The main objectives of the said research are to determine the actual land use and its classification in Dindori Tehsil.

Keywords: Landsat, TM, OLI,TIS, TM,ETM, digital

INTRODUCTION
Landuses is a form of the Earth surface creating physical, chemical, biological system and the process of changing take place with social economic transformation and behave with the respect to the space and time. The alternative nature of land use and land covers create natural and Scio-economic problems the monetary of these Complex system include the diagnosis and the properties of the changing land use and land cover in a holistic and local resources along with the urbanization, livestock, farming, tourism, industrialisation (Stamp 1931) . part of the change of nature and change of population structures industrial structure with by the regional planning. Recruitment of foods industrial raw materials and successful planning of agriculture growth organised urbanization regional development and their buy at actuated the process of development in the any Nations. As well as the regions the issues of the land use land cover it is environment all elements and the sustainable development of any Nation. The human is a factor on changing the land use and land. Remote Sensing is necessarily being use the land cover and land use research because provide the instantaneous synoptic and comprehensive picture of an area (Tan et.al.2007). The study of land use and land cover using the quantity and quality label techniques and methods this technique useful for the identification and calculations of land use land covers areas and change (Karwariya2011.
To support environmental policy urban planning and sustainable management of land water resources there is need for detect information on land use and applying a proper classification of satellite image or photography. The land use and land cover (LULC) change on the earth surface essential for accounting relationship and interactions between human and natural phenomena for enhancing management of

discussion making **(Lu. et.al 2004).** Remote sensing and regional and local scale has become the most useful tool in monetary natural and cultural landscape. land use and land cover changing has become a central components in current strategy for managing natural resources and monetary environmental change to mention the natural resources and understand the causes and concave of over explosion of soil and water resources the land use and land cover mapping and monetary as done by the any regions **(Harshika 2012).** GIS and Remote Sensing are important infrastructures for land use and land cover studies in modern times. Also, the use of this method is very important for studying or classifying natural resource management and environmental change (**Zubair, 2006)**.These centres are made up of land use and land improvement. Monitoring of current policy factors and natural resource wealth and environmental change is very important for natural management. For this purpose the use of satellite is considered very fundamental.Land is a natural resource asset and its change is naturally true. But humans have greatly altered land use under a variety of factors. Due to this change, humans do not have enough land for farming and other occupations. The main reason for this is the growing population due to the growing population putting a lot of stress on the natural resources. Therefore, it is very important to manage and plan these natural resources in the future. Remote sensing and GIS methods are beneficial. There are two main types of resource wealth one is natural resource wealth and the other is human resource wealth both the resources are dependent on each other. Socio-economic development of human beings depends on natural wealth and the quality and development of nature depends on human beings. Humans are developing their economy using natural resources**(ShejulM .E 2020).**Changes in land use are observed due to human economic activities. Growing population and increasing urbanization to accommodate the population are considered to be two important factors behind the declining area under agriculture (**P.HMhaske 2001**).
Therefore, with the help of Remote Sensing GIS of Dindori Tehsil, how much land use has changed in the last 30 years and different areas under the ground are going to be studied. The researcher mainly conducted a research using the following study method to classify the land use and land cover in Dindori tehsil of Nashik district.

Study Area
The absolute geographical location of the tehsil can be express as 20º 03’ 25” North latitude to 20º 27’ 06” North latitude and 73º 34’ 06” East longitude to 74º 00’ 06” East longitudes. TheKadvaRiver flows west toeast. Dindori tehsil is bounded by Peth tehsil towards the west, Surgana tehsil in north-west, Kalwan tehsil towards the north-east, Chandwad and Niphad tehsil towards the east and Nashik tehsil towards the south. Climatologically, it lies in the rain heavy rainfall zone of the Western Ghats and geomorphological, it is located in the Unanda in north and Kadava basin south, a part of upper Godavari basin.The total geographical area (TGA) of the tehsil is about 1342.19 square km. It is about 08.64 percentages of TGA of Nashik District. According to abstract of census handbook the tehsil comprises of 157 villages and one urban centre i.e. Dindori. According to census 2011 there are six circles namely Dindori, Mohadi, Umbrale, Vani, Varkheda, Koshinbe and Nanashi(Map. No 01)



Map 1: Location of Study area

Aims And Object

The main aims are to study the land use and land cover of Dindori Tehsil using Remote Sensing and GIS method. To achieve these Aims, the following objectives have been taken.

1. To study the land use and land cover of Dindori Tehsil with the help of digital classification technique.
2. To study the changing land use and land cover of Circle Wise in Dindori Tehsil at 2001, 2012 and 2023 years.

METHODOLOGY

The calculation and analysis of landuse in the study area have used the multi-spectral satellite data is used for supervised classification for prepare Land use map. The software ERDAS-9.2 and ARCGIS-9.3 is used data acquisition and processing. The data utilized is given in the following tables for the years 2001, 2012 and 2023. The uses remote sensing data Landsat thematic mapper 5 and 7 with the dated on October 2001, 2012 and 2023 and apply band no 2, 3 and 4.

1. Geometric corrections of IRS-1C LISS-III+PAN data using.
2. Selection of study area
3. Land use land cover classification using unsupervised classification
4. Land use \ Land Cover Classification by Normalized difference vegetation
5. The extraction of thematic layers
6. Comparison of overall accuracies of each method with respect to Performance Evaluation / Accuracy assessment.
7. Output generation

Contrast stretch enhancement algorithms are widely use:

Linear contrast stretch (CS) or Min-Max contrast stretch:

The linear stretch would be applied to each pixel in the image using the algorithm.

DN' **=** (DN-MIN) **/** (MAX-MIN) 255

Where,

DN'**=** digital number assigned to pixel in output image

DN**=** original digital number of pixel in input image

MIN = minimum value of input image, to be assigned a value of zero in the outputimage

MAX = maximum value of input image, to be assigned a value of 255 in the output image

Table 1. Data Source and Acquisition (Remote Sensing Data)

RS Data	Sensor	Spectral Composition (No. of Bands)	Spectral Resolution/ Precision Scale (m)
Landsat 5 LTM Oct. 2001	LISS-III+PAN	2,3,4	23.5 (all bands)
Landsat 5 LTM. Oct. 2012	LISS-III+PAN	2,3,4	23.5 (all bands)
Landsat 7 ETM. Oct. 2023	LISS-III+PAN	2,3,4	23.5 (all bands)

Different colors have been used for the explanation method for the elements that are in the land use and land cover through the satellite image. For that a detailed analysis is given in Table No. 02**.**

Table 2. Interpretation Key for Understanding Satellite Imagery Elements

Sr.no	Elements	Explanation method	Descriptions
01	Dense Forest	. It exhibits dark to Bright faint Green colour.	This is categorized as dense, sparse and scattered (low) plants utilization.
02	Sparse Forest		
03	Shrubs or Low Forest		
04	Agricultural Land	Yellow colour area under this category.	This is categorized land under crops, fallow plantation.
05	Barren Land	Gray colour area under this category.	It is uncovered land devoid of plantation.
06	Settlement	It is having regular pattern and appears in Red colour.	This category includes urban and rural settlements utilization.
07	Water Bodies	Water bodies include those dark to light Blue colour.	This category comprises area with surface water in from of ponds, drains and dam.

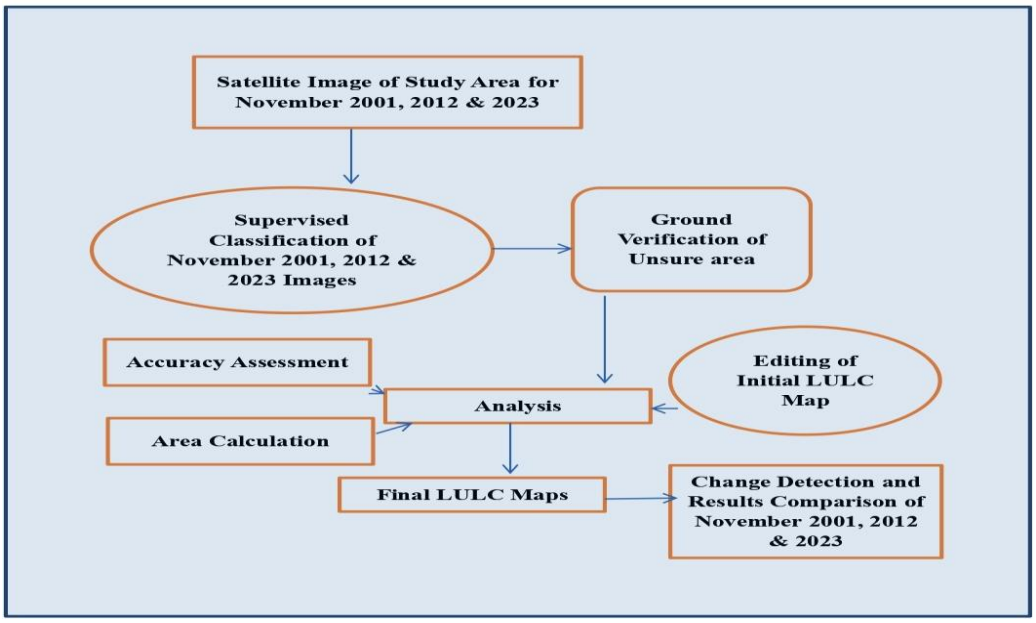


Chart 1. Methodology for Land Use & Land Cover Map

RESULT AND ANALYSES

By using Remote Sensing and GIS method, thematic mapper and enhanced thematic Mapper+ (TM/ETM+) images,Landsat 5 Operational Land Imager and Thermal Infrared Sensor (OLI/TIS) image, and used band no 2, 3, and 4. The actual area and land use change in Dindori Tehsil during the years 2001 2012 and 2023 has been studied.The general landuse classification in total agricultural land and sub class Net sown area, Cultivable waste land and permanent pastures and grazing land and non -agricultural it is Barren and cultivable land with the water bodies and settlements of urban and rural and lastly forest area in way dense, sparse and shrubs or low forest. Land us / cover pattern of a region gives information about the natural and socio-economic factors, human livelihood and development.All these things are mandatory to study, so the said topics are selected for actual use and classification of land in Dindori tehsil.

After the industrial revolution, population growth is observed mainly in developing countries, especially in developing countries. Due to this there is a big change in land use and its classification in such countries. The actual use of land by humans for various activities is seen mainly in developing countries on a larger scale or at a faster pace. Humans are using large amounts of land for various purposes with the help of their technology. It is from this point of view that how much land use changes in Dindori Tehsil can be said as follows.

Show in map no 1, 2 and 3 and Table No 3, Land use is a primary indicator of the extent and degree to which man has modified the land resources. It is application of human control in a systematic manner, indicating an intimate relationship between prevailing ecological conduction and man the study area classified forest, barren land, built upland, Water bodies, fallow land, and agriculture land. Land use change detection is a process of identification and analyzing the difference of an objective or a phenomenon through monitoring at different times .The total geographical area of study area is 1342.19 Sq. KMOut of the 876.23 Sq. KM in 2001 of area is under agriculture as well as in 2012 910.38 Sq. KM and in 2023 917.44 Sq. KM**.** The agricultural area under in various types that is net sown area was under in 2001, 389.8 Sq. KM, 2012 wise 469.1 Sq. KM and last according to 2023 499.12 Sq. KM area under agricultural activities. Cultivable waste area under in 2001, 382.93 Sq. KM and in 2012, 354.09 Sq. KMand lastly in 2023 area under 336.97 Sq. KM.thePermanent pastures and grazing landarea under in study area was in 2001 103.5 Sq.KM and according to 2012 area under this activities 87.19 Sq.Km and lastly 81.35 Sq.Km area under at 2023.The non -agricultural area in 2001 area about232.75 Sq.Km and according to 2012 non- agricultural area was 204.59 Sq.Km and last in 2023 area coverage was 195.27 Sq.Km. The class comprises areas of surface water either impounded in the form of lake and reservoirs or flowing streams, river, cannels etc. The water bodies covering area about that 48.88 Sq.Km in 2001 and in 2022 year 53.32 Sq.Km and according to 2023 water bodies about fewer than 55.87 Sq.Km. The settlements located in suitable land, available of waters and good transportation facilities have attraction of settlements. The rural area has good agricultural lands was attraction of settlements. In the study area under of settlements in 2001 about that 30.02 Sq.Km and in 2012 settlements area about 40.28 Sq.Km with the 46.11 Sq.Km area under settlements in 2023 but urban settlements covering area about 4.88

Sq.Kmin 2001 and 2012, 7.93 Sq.Km with the 8.59 Sq.Km Urban area in 2023. The rural Settlements area covered in 2001 about 25.14 Sq.Km and according to 2012 rural settlements under area was 32.35 Sq.Km and last in 202337.52 Sq.Km settlements area. The area under forest of the tehsil is total forest area was 154.31 Sq.Km in 2001 and in 2012forest area under by 133.62 Sq.Km as well as the in 2023 forest area under 127.5 Sq.Km area. The out of dense forest at same period 2001 area was 90.76 Sq.Km Dense Forest 7.31 Sq.Km and 61.29 Sq.Km in 2012 and 2023. Sparse Forest 42.02 Sq.Km in 2001 and 2012 period under sparse forest area was 38.23 Sq.Km with the 38.09 Sq.Kmareas under in 2023. In the year 2001, the area of shrub or less forest was 21.51 sq km, while in 2012 it was 23.8 km^2 and in 2023, the area was changed to 28.14 sq km. This means that this shrub or less forest area has undergone a positive change in these 30 years. In 2023, the area has increased by almost seven square kilometres compared to 2020.

Table 3. Total Land Use In 2001 TO 2023

	Years		
Land categories	2001	2012	2023
Total Agricultural Area	876.23	910.38	917.44
a. Net Area Sown	389.8	469.1	499.12
b. Cultivable waste land	382.93	354.09	336.97
c. Permanent pastures and grazing land	103.5	87.19	81.35
Non agricultural	232.75	204.59	195.27
Water bodies	48.88	53.32	55.87
Settlements Urban area	4.88	7.93	8.59
Settlements Rural area	25.14	32.35	37.52
Total Forest	154.31	133.62	127.5
a. dense forest	90.76	72.31	61.29
b. Sparse Forest	42.02	38.23	38.09
c. Shrubs or Low Forest	21.51	23.08	28.14
Total	1342.19	1342.19	1342.19

Sources: Landsat 5 Satellite Oct 2001 to 2023

A) General Land Use At Circle Wise (2001)

The agricultural land distribution and study of circle wise, study area covered there are seven circles namely Nanashi, Umarale, Koshimbe, Dindori, Kasbevani, Warkheda and Mohadi. The all circle wise agricultural land distribution was uneven because of effected on topography and rainfall distribution thus Umarale circle maximum agricultural land available because location of eastern side and non-hilly area with good water available and low agricultural area under in Mohadi circle because of hilly area. It is observed that high agricultural area in different circle but Net sown area maximum in Nanashi circle about area 80.82 Sq. km and lowest area Kasbevani circle about area was 31.01Sq.Km because this area very low water facilities. The Cultivable waste land maximum under of Kasbevani circle because of hilly area non irrigation area. The very low Cultivable waste land in Mohadi circle about that 41.22 Sq.km.

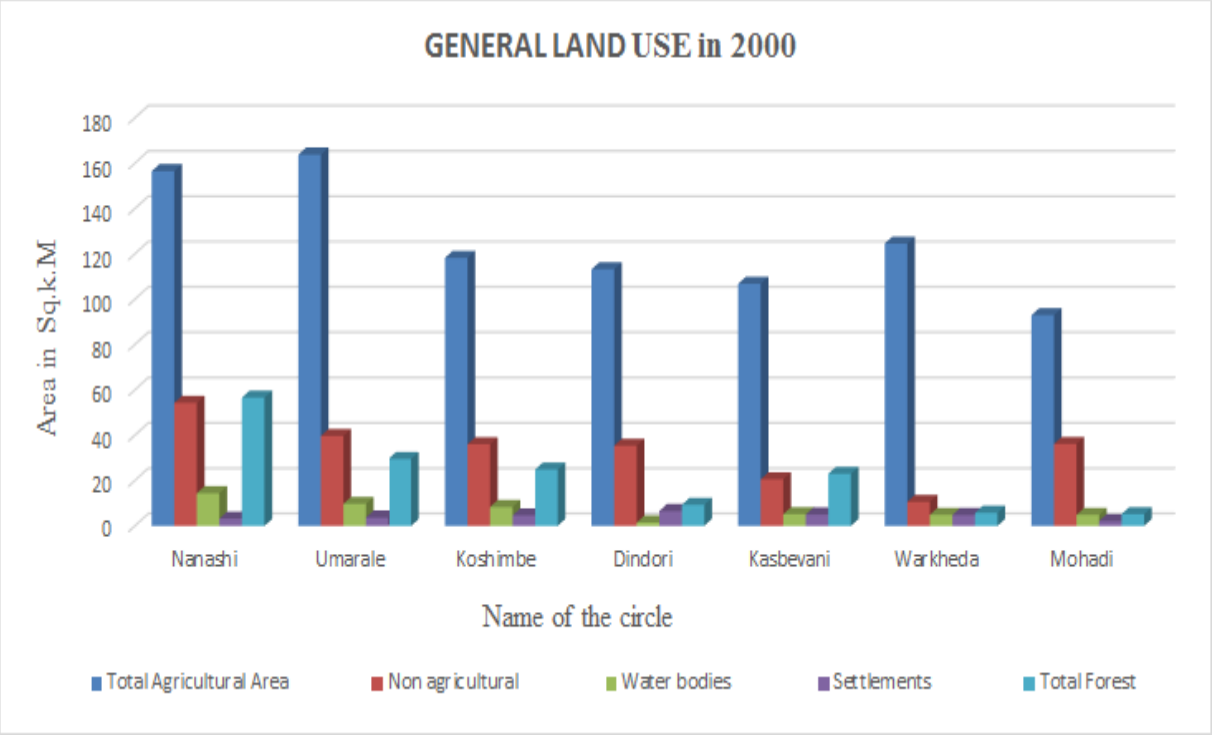
In 2001 the agricultural land it was observed in the eastern part of the eastern part where the physical conduction is suitable for the agriculture. The western, north and south part of this study area has very less distribution with small farm size due to the hilly area and mountainous soil. The non-agricultural area maximum of Nanashi circle because of this area location in western part and low agricultural development with the non-irrigation facilities. The low non -agricultural area under circle was Warkheda because of plan area area and location in Middle Eastern part. The maximum water bodies under area of Nanashi circle about that 14.41 Sq.Km because of this area position in west hilly area side thus good location in dam and various water storage. The eastern side very low water bodies are available and very low water bodies was available Dindori circle. The settlements good position was plain area and water availabilities with the transport network. In the study area there are two circle urban area settlements under area namely Dindori and Kasbevani and other area not available urban settlements. The out of Dindori and Kasbevani circles very fast rural settlements position around of agricultural filed area and western part. It is observed that very low forest are covered by Warkheda and Mohadi circle about 5.8 and 5.2 sq.km area and other good position of forest area in western apart circle was Nanashi 56.63 Sq.km area and second number of Umarale circle. The low forest area was distribution in eastern part and middle part of study area. The dense forest good position in Nanashi circle about 39.07 sq.Km second rank Umarale about that 16.24 Sq.km. It is observation that Nanashi and Umarale circle was good

environment conduction because of good position of forest area because of hilly area and good rainfall area (Map No 2).

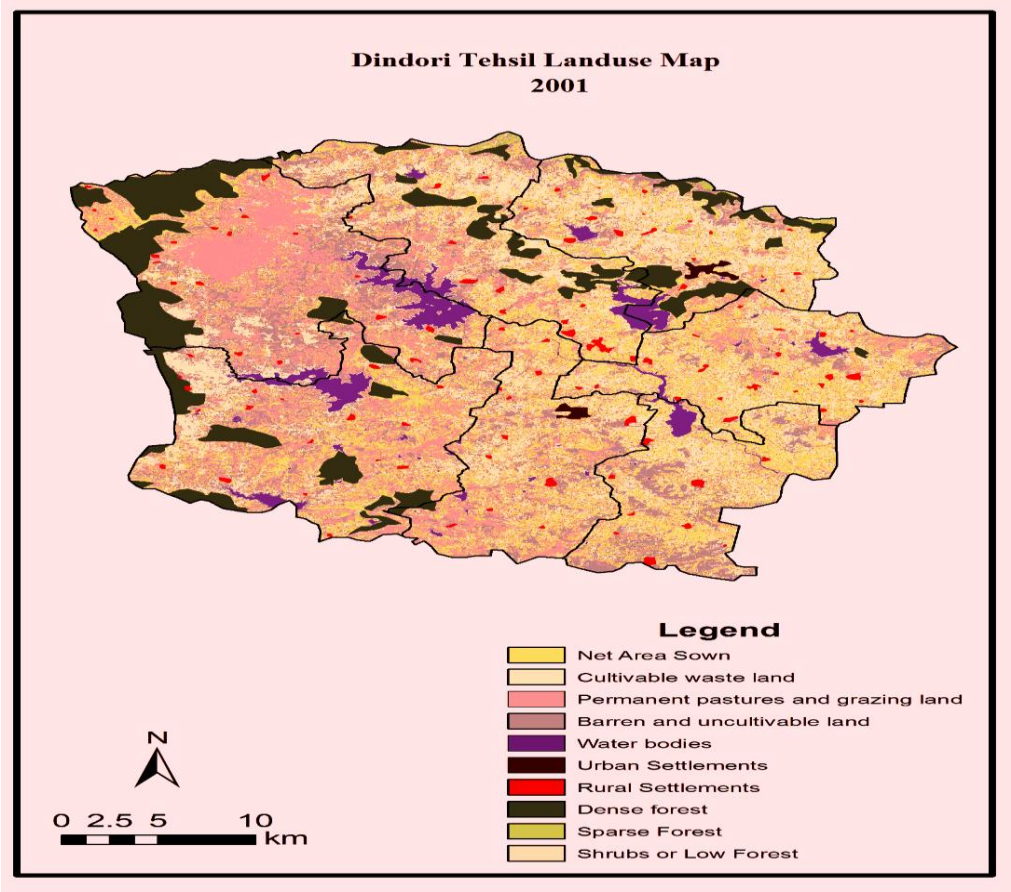
Table 4: General Land Use at Circle Wise in 2001 (Area Sq Km)

land use	Nanashi	Umarale	Koshimbe	Dindori	Kasbevani	Warkheda	Mohadi
Total Agricultural Area	156.55	163.84	118.24	113.23	106.83	124.56	92.98
a. Net Area Sown	80.82	70.68	46.08	43.46	31.01	68.7	49.05
b. Cultivable waste land	51.81	57.62	62.1	52.82	66.68	50.68	41.22
c. Permanent pastures and grazing land	23.92	35.54	10.06	16.95	9.14	5.18	2.71
Non agricultural	54.32	39.7	36.05	35.39	20.54	10.62	36.13
a.Barren and uncultivable land	54.32	39.7	36.05	35.39	20.54	10.62	36.13
Water bodies	14.41	9.7	8.33	1.5	5.21	4.86	4.87
Settlements Urban area	0	0	0	1.98	2.9	0	0
Settlements Rural area	3.21	3.7	4.65	4.59	2.1	4.78	2.11
Total Forest	56.63	29.53	24.89	9.25	23.01	5.8	5.2
a. dense forest	39.07	16.24	14.93	3.7	14.27	2.03	0.52
b. Sparse Forest	11.33	9.74	7.96	3.7	4.6	2.61	2.08
c. Shrubs or Low Forest	6.23	3.54	1.99	1.85	4.14	1.16	2.6
Total	285.12	246.47	192.16	165.94	160.59	150.62	141.29

Sources: Landsat 5 Satellite Oct 2001



Graph 1: General Land use at Circle Wise in 2001 (Area in sqkm)Use in 2001



Map 2: General land

B) General Land Use At Circle Wise (2012):

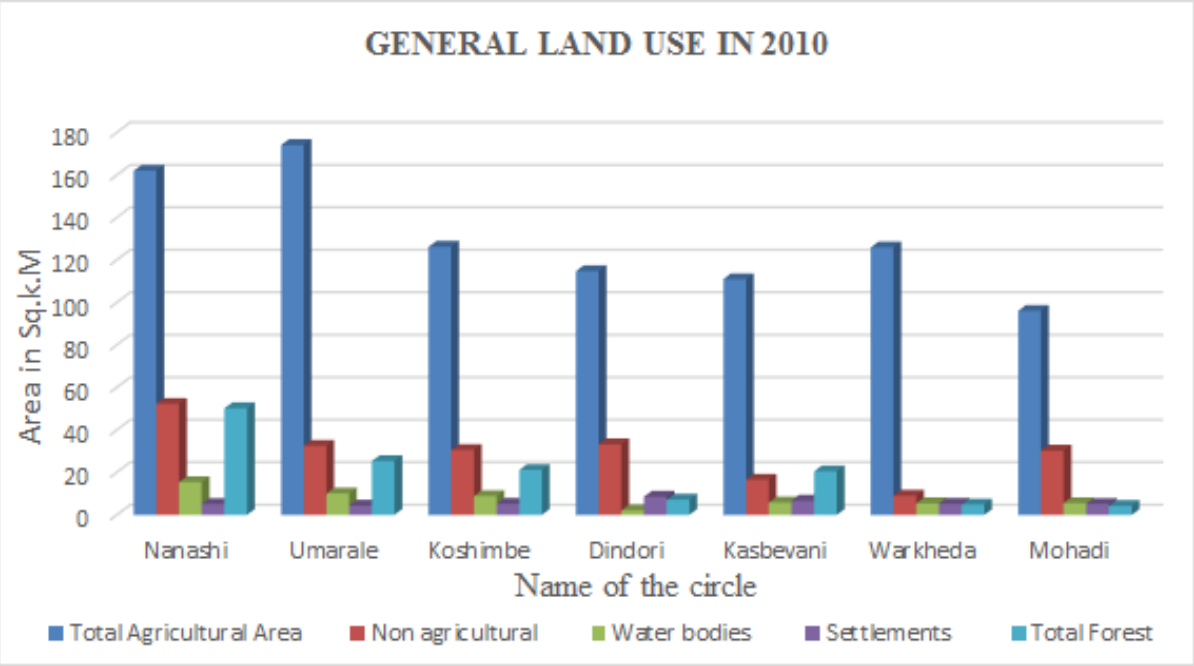
In 2012 the agricultural land it was observed in the eastern part of the eastern part where the physical conduction is suitable for the agriculture. The western, north and south part of this study area has very less distribution with small farm size due to the hilly area and mountainous soil. The agricultural land under maximum Umarale circle about that 174.15 Sq.Km second number was Nanashi circle about 162.06 Sq.km because of these circle position in eastern part with non-hilly area. Very low agriculture area under of Mohadi circle about 96.09 Sq.Kmareas because this circle located in western part with the hilly area topography and forest area. Net sown area means actual cropped area under various crops it is Umarale circle was very large area under actual crop about 98.25 Sq.Km and second Nanashi about 96.74 Sq.Km because of these circle was located on eastern part and Middle Eastern part. The Cultivable waste land maximum Warkheda circle about 48.52 Sq.Km second Nanashi circle about 47.2 Sq.Km area because of farmers maximum land waste land in one years it is cropping circular. Permanent pastures and grazing land maximum area because of dairy farming area and animal husbandries activities was greater occupied peoples those circles. The maximum Permanent pastures and grazing land cover in Umarale circle about 30.23 Sq.Km it means maximum peoples occupied animal husbandries activities. Mohadi very low permanent pastures and grazing land about that 1.89 it means this circle low animal husbandries activities and high commercial crops with the case crops area under agricultural.The non-agricultural area maximum of Nanashi circle about 52.32 Sq.Km because of this area location in western part and low agricultural development with the non-irrigation facilities. The low non -agricultural area under circle was Warkheda about 9.07 Sq.Km because of plan area area and location in Middle Eastern part. The maximum water bodies under area of Nanashi circle about that 15.41 Sq.Km because of this area position in west hilly area side thus good location in dam and various water storage. The eastern side very low water bodies are available and very low water bodies was available Dindori circle about 2.1 Sq.Km. The settlements good positions were plain area and water availabilities with the transport network. In the study area there are two circle urban area settlements under area namely Dindori, Kasbevani and new developed urban settlements Mohadi circles about 1.84 Sq.Km and other area or circles was not available urban settlements. The out of Dindori and Kasbevani circles very fast rural settlements position around

of agricultural filed area and western part with well agricultural position these all circles. Evergreen forest is distributed in this study area. Due to high temperature and rainfall distribution whereas the western part. But eastern part deciduous type forest is distributed due to less distribution of rainfall. It is observed that very low forest are covered by Warkheda and Mohadi circle about 4.89 Sq.km and 4.23 sq.km area and other good position of forest area in western apart circle was Nanashi 50.23 Sq.km area and second number of Umarale circle about . The low forest area was distribution in eastern part and middle part of study area. The dense forest good position in Nanashi circle about 30.14 Sq.Km second rank Umarale about 12.93 Sq.km.It is observation that Nanashi and Umarale circle was good environment conduction because of good position of forest area because of hilly area and good rainfall area (Map No 3 and Table No 5).

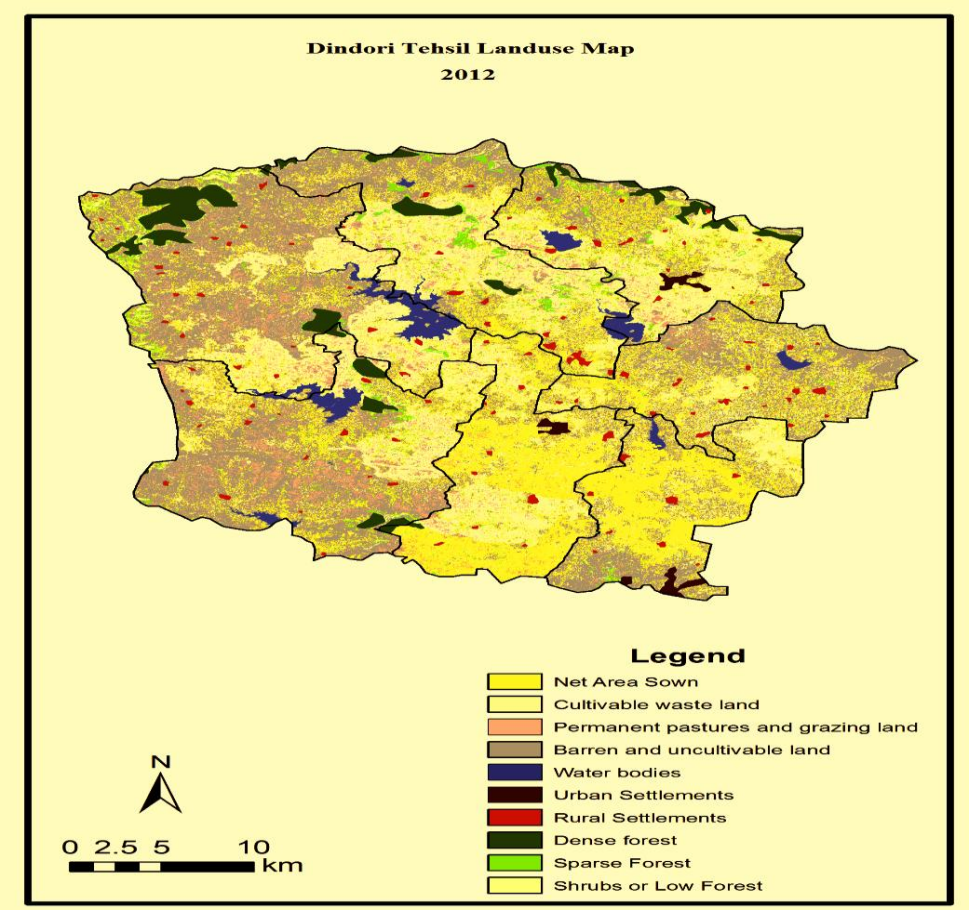
Table 5: General Land Use at Circle Wise in 2012 (Area in Sq Km)

land use	Nanashi	Umarale	Koshimbe	Dindori	Kasbevani	Warkheda	Mohadi
Total Agricultural Area	162.06	174.15	126.29	114.84	110.96	125.99	96.09
a. Net Area Sown	96.74	98.25	57.23	53.84	34.71	72.6	55.73
b. Cultivable waste land	47.2	45.67	59.5	46.54	68.19	48.52	38.47
c. Permanent pastures and grazing land	18.12	30.23	9.56	14.46	8.06	4.87	1.89
Non agricultural	52.32	32.5	30.59	33.26	16.56	9.07	30.29
a. Barren and uncultivable land	52.32	32.5	30.59	33.26	16.56	9.07	30.29
Water bodies	15.41	10.1	8.87	2.1	5.83	5.46	5.55
Settlements Urban area	0	0	0	2.59	3.5	0	1.84
Settlements Rural area	5.1	4.36	5.23	5.96	3.2	5.21	3.29
Total Forest	50.23	25.36	21.18	7.19	20.54	4.89	4.23
a. dense forest	30.14	12.93	11.65	2.88	12.73	1.56	0.42
b. Sparse Forest	12.56	8.37	6.78	2.52	4.11	2.2	1.69
c. Shrubs or Low Forest	7.53	4.06	2.75	1.8	3.7	1.12	2.12
Total	285.12	246.47	192.16	165.94	160.59	150.62	141.29

Sources: Landsat 5 Satellite Oct 2012



Graph 2: General land use at Circle Wise in 2012 (Area in sq km)



Map 3: General Land Use (2012)

C) General Land Use At Circle Wise (2023)

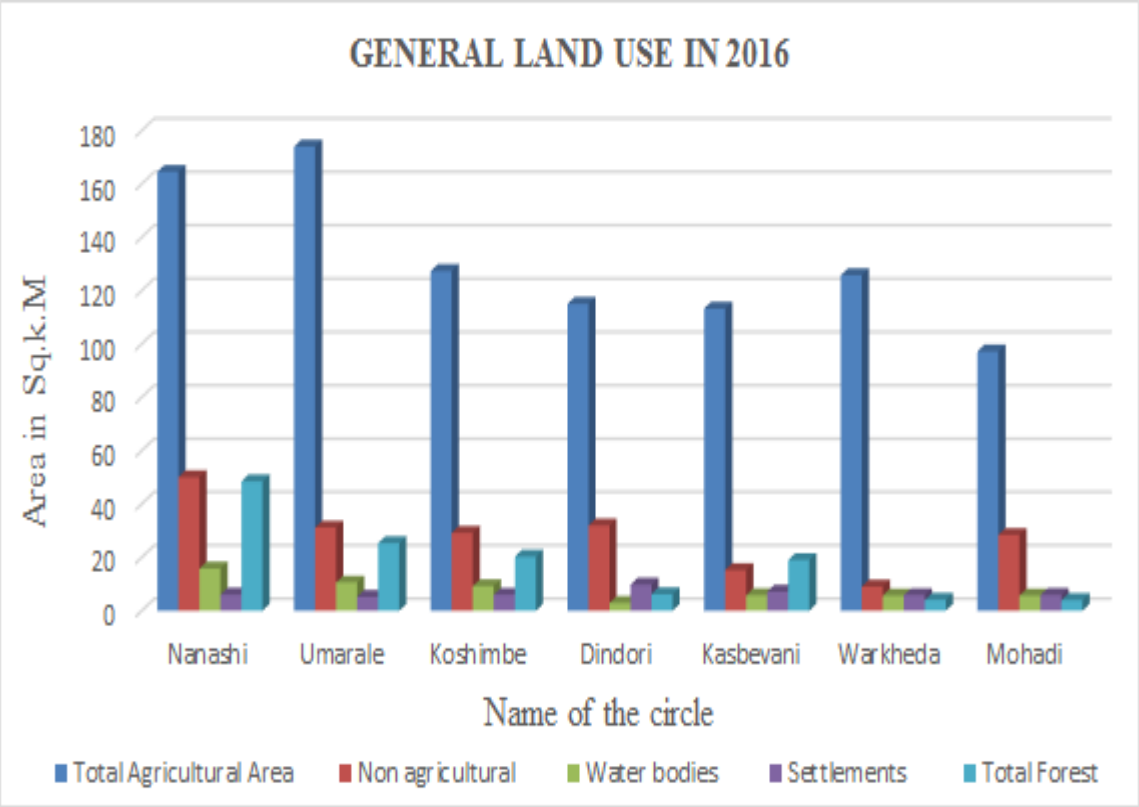
In 2023 the agricultural land it was observed in the eastern part of the eastern part where the physical conduction is suitable for the agriculture. The western, north and south part of this study area has very less distribution with small farm size due to the hilly area and mountainous soil. Umarale circle maximum agricultural area about 174.08 Sq.Km second position Nanashi circle about 164.56 Sq.Km. every poor position Mohadi circle about 97.22 Sq.Km because of this area position were western part therefore under hilly and forest area. The net area sown maximum under circle was Umarale about 102.55 Sq.Km and lowest net sown area Kasbevani circle area about 36.95 Sq.Km these circle west south part thus hilly area. Permanent pastures and grazing land area under Umarale circle about 29.33 Sq.Km theses circle under villages agricultural with animal husbandry occupation engaged peoples with helping the milk activities and industries. The very low position permanent pastures and grazing land were Mohadi circle about 1.5 Sq.Km. The non-agricultural area maximum of Nanashi circle about area 50.1 Sq.Km because of this area location in western part and low agricultural development with the non-irrigation facilities. The low non -agricultural area under circle was Warkheda about that 9.07 Sq.Km because of plan area and location in Middle Eastern part. The maximum water bodies under area of Nanashi circle about that 15.84Sq.Km because of this area position in west hilly area side thus good location in dam and water storage. The eastern side very low water bodies are available and very low water bodies was available Dindori circle about 2.9 Sq.Km. The settlements good position was plain area and water availabilities with the transport network. In the study area there are two circle urban area settlements under area namely Dindori and Kasbevani area about 2.9, 3.68 15.84 Sq.Km and new developed urban settlements Mohadi about 2.01 Sq.Km and other area not available urban settlements. The out of Dindori and Kasbevani circles very fast rural settlements position around of agricultural filed area and western part. It is observed that very low forest are covered by Warkheda and Mohadi circle about 4.1and 3.98 sq.km area and other good position of forest area in western apart circle was Nanashi 48.52Sq.km area and second number of Umarale circle area about 25.36 Sq.km. The low forest area was distribution in eastern part and middle part of study area. The dense forest good position in Nanashi circle about 24.26sq.Km second rank Umarale about that 11.41Sq.km. It is observation that Nanashi and Umarale circle was good

environment conduction because of good position of forest area because of hilly area and good rainfall area (Map No 4 and Table No 6).

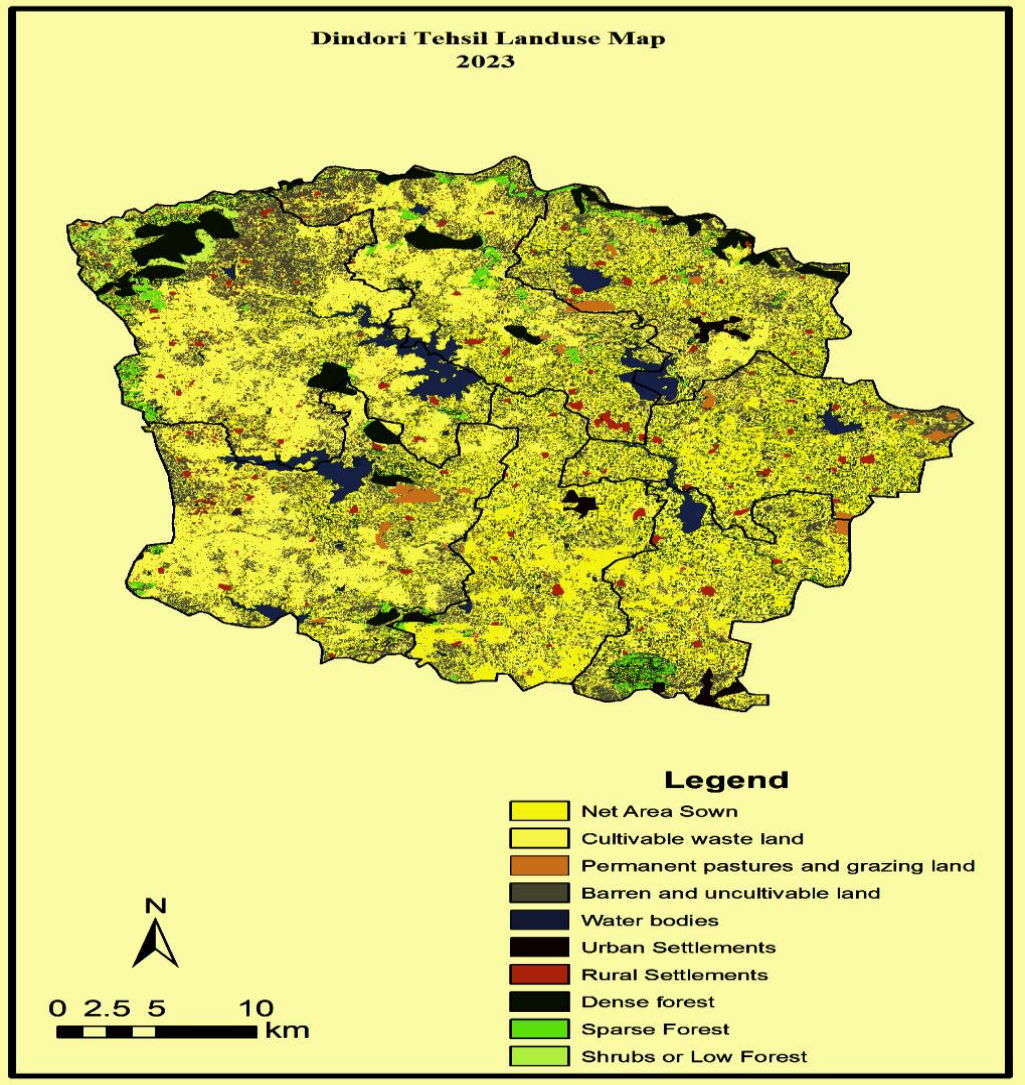
Table 6: General Land Use at Circle Wise in 2023 (Area in Sq Km)

land use	Nanashi	Umarale	Koshimbe	Dindori	Kasbevani	Warkheda	Mohadi
Total Agricultural Area	164.56	174.08	127.39	115.08	113.29	125.82	97.22
a. Net Area Sown	101.23	102.55	63.06	57.5	36.95	78.36	59.47
b. Cultivable waste land	45.6	42.2	56.25	44.53	68.89	43.25	36.25
c. Permanent pastures and grazing land	17.73	29.33	8.08	13.05	7.45	4.21	1.5
Non agricultural	50.1	31.2	29.23	31.96	15.26	9.07	28.45
a. Barren and uncultivable land	50.1	31.2	29.23	31.96	15.26	9.07	28.45
Water bodies	15.84	10.6	9.25	2.9	5.83	5.73	5.72
Settlements Urban area	0	0	0	2.9	3.68	0	2.01
Settlements Rural area	6.1	5.23	6.01	6.87	3.5	5.9	3.91
Total Forest	48.52	25.36	20.28	6.23	19.03	4.1	3.98
a. dense forest	24.26	11.41	11.15	2.37	10.47	1.23	0.4
b. Sparse Forest	12.13	8.88	6.49	2.31	4.76	1.93	1.59
c. Shrubs or Low Forest	12.13	5.07	2.64	1.56	3.81	0.94	1.99
Total	285.12	246.47	192.16	165.94	160.59	150.62	141.29

Sources: Landsat 5 Satellite Oct 2023



Graph 3: General Land Use at Circle Wise in 2023 (Area in sq KM)



Map 4: General Landuse 2023

D) Changing Landuse In 2001 TO 2023

Land Use/Land Cover (LULC) changes are affected by human intervention and natural phenomena such as agricultural demand and trade, population growth and consumption patterns, urbanization and economic development, science and technology, and other factors. Land use change is a chief subject of universal environment change. Land use is the change in the determination of the land which is not fundamentally only the change in land cover but also changes in concentration and organization. The arrangement of land use is not even but it changes from place to place and period to period. The changes in land use are studied by conformist as well as the modern methods. It is beneficial to make joined plans for optimum application of natural resources their planning for development of the region. Agricultural and non-agricultural are the two major types of rural land use. Agricultural land use means the amount of area used to cultivate different crops during the year. It is a spread activity which contains horticulture, grazing and forestry, but changes over space and time. It helps not only a primarily economic purpose of acquiring fright materials of human wants but also to achieve regional, national and social functions. It is besides used for amusing purposes. The essential purpose of agricultural land use is the cultivation of plants or agricultural crops. Agricultural land use study has developed different importance in the present day by many scholars and researchers. Therefore, it has been attempted to know the agricultural land use changes in agricultural circles of DindoriTehsil during 2012 and 2023. Agriculture is the oldest and most important economic activity of India. It is not only the most important activity but also the foundation of food to the people. It is the representative of economic development and useful employment in rural area. DindoriTehsil is not a freedom to this observation. Agriculture in Dindori Tahsil is almost traditional type same part. As per 2011 census, 41.76 percentages population of DindoriTehsil was involved in agricultural activity. It is influenced by the physical and socio-economic

factors such as heaving topography in the north-western part and western part the plain region in the south-eastern part and eastern, brown or reddish soil to medium or deep black soil, transportation, expansion of industrialization and urbanization, availability of irrigation, growth of population etc. As a result, agricultural land use in DindoriTehsil has been changing nowadays Table no 7 and Graph no 4 . It is observed that settlement this category of landuse comprised of areas of the land covered by structures. Built up areas (which include residential, commercial, industrial, institutional and transportation lands etc.), villages, strip developments along highways, transportation, power and communication facilities and areas such as those occupied by mills, shopping centres and complexes are included in this category. Areas of sparse residential landuse, such as farmsteads will be included in this category. Rural residential and recreational subdivisions are also included in this category. For the present study the settlement land includes mud and metal roads, footpaths, religious places and parks. According to the Indian LULC classification system, the barren land includes all barren and uncultivable land like mountainous, deserts etc. Barren or sparsely vegetation areas most often representatives of bare earth or soil. These lands are the rock exposures and devoid of soil cover and vegetation and not suitable for cultivation.This category of landuse comprises all such lands which are practically unproductive and unfit for cultivation. These lands are rugged or rocky, stony, gravelly, kankarized, surface sandy waste or saline tracts which cannot be brought under cultivation. These are not even suitable for pastures. Water body means an area that, during a year with normal patterns of precipitation, has standing water for sufficient duration to establish an ordinary high water mark and a depth of more than two meters. Water on the surface of the earth is an open body of water, such as a river, stream or lake. Surface water means perennial and seasonal streams, lakes, ponds, marshes, water courses and other bodies of water, natural or artificial. The water in most rivers and dam's is called freshwater because it is low in salts.

India is dominated by agricultural activities and the main land use of the country is agricultural landuse. These landuse is divided into two categories firstly the irrigated land and secondly irrigated land. With increasing population of the country, the demand and requirement for food is also increasing. As a result, more lands are being converted to agricultural lands. The development of the irrigation system by controlling structures, dams or reservoirs have also contributed to the rise in the area of agricultural land. Irrigated area is assumed to be irrigated for cultivation through such sources as canals (Government and Private), tanks, tube-wells, other wells and other sources. It is divided into net irrigated (area irrigated through any sources) and gross irrigated area (total area of crops).

Forest is very important and environmentally significant in LULC of the study area. Forest cover is the most crucial element for protecting the environment because of its role in providing long term ecological balance including conservation of our life supporting system. A few decades back the hills were full of natural vegetation and fauna but now the conditions have markedly changed and that too for the worse.

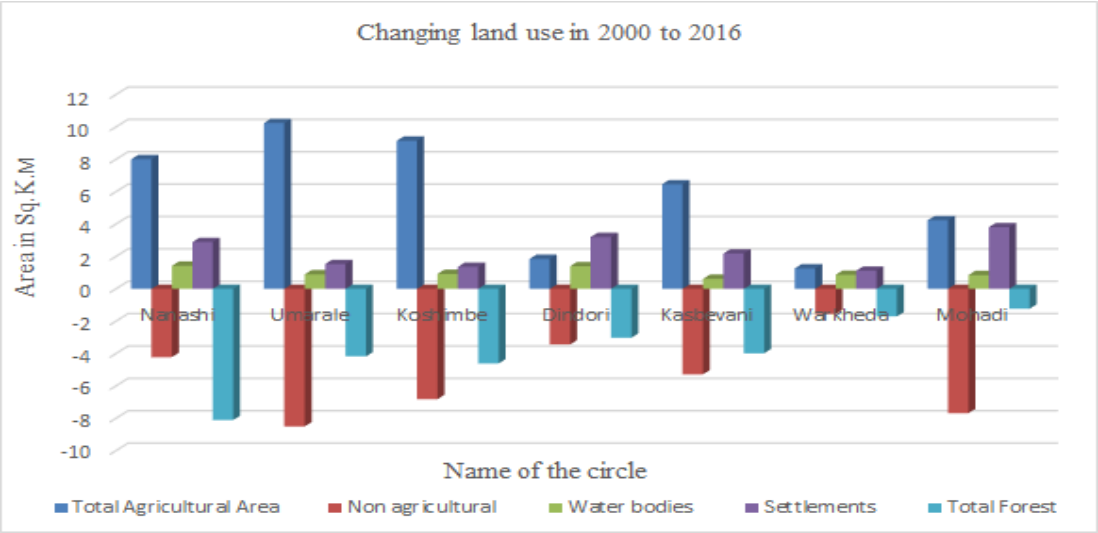
In the study area LULC pattern is changing. This is mainly due to increasing human population. During the past two decades, lots of barren land is converted to settlement, forest and agriculture land purpose. Especially sparse forest land is reducing day by day in the Tehsil. The undulating topography of the area adding more burden on the negative aspects of the Tehsil. A thorough study of LULC pattern and its change over time is very important and much needed for the study area. The soil nutrient status of the western part of the Tehsil area is poor for traditional crops but still the local farmers continue to cultivate the much water demanding crops like rice etc (Table 7 and Graph.no.4). Changes in LULC pattern affect ecosystems, biodiversity, agricultural productivity and other goods and services. Changes in LULCare important drivers of water, soil and air pollution. Other environmental impacts of LULCchange include the destruction of stratospheric ozone by nitrous oxide release from agricultural land and altered regional and local hydrology (dam construction, wetland drainage, irrigation projects, increased impervious surfaces in urban areas).

LULCpattern during 2001 to 2023 shows Table 07. In these sixteen years, the forested area in the study area is decreased by each circle e.gNanashicircle negative changes area about -8.11 Sq.km, Umarale - 4.17 Sq.km,Koshimbe -4.61 Sq.km,Dindori -3.02 Sq.km,Kasbevani -3. Sq.km,Warkheda -1.7 Sq.km and Mohadicircle -1.22 Sq.km. because of increasing settlements area, agricultural area, increasing roads and increased water bodies dams, small tanks etc. Nonagricultural area each circle negative changes because of increasing irrigation faculties increasing water bodied thus irrigated area increasing in the study area. The settlements area each circles was positive changes because of increasing a population in each circle of stud area.

Table 7. Changing landuse at Circle wise of Dindori Thasil (2001 to 2023)

Land use and land cover	Years and Change	Circle of DindoriTehsil						
		Nanashi	Umarale	Koshimbe	Dindori	Kasbevani	Warkheda	Mohadi
Agricultural Area	2001	156.55	163.84	118.24	113.23	106.83	124.56	92.98
	2023	164.56	174.08	127.39	115.08	113.29	125.82	97.22
	Changes	8.01	10.24	9.15	1.85	6.46	1.26	4.24
Non agricultural	2001	54.32	39.7	36.05	35.39	20.54	10.62	36.13
	2023	50.1	31.2	29.23	31.96	15.26	9.07	28.45
	Changes	-4.22	-8.5	-6.82	-3.43	-5.28	-1.55	-7.68
Water bodies	2001	14.41	9.7	8.33	1.5	5.21	4.86	4.87
	2023	15.84	10.6	9.25	2.9	5.83	5.73	5.72
	Changes	1.43	0.9	0.92	1.4	0.62	0.87	0.85
Settlements	2001	3.21	3.7	4.65	6.57	5	4.78	2.11
	2023	6.1	5.23	6.01	9.77	7.18	5.9	5.92
	Changes	2.89	1.53	1.36	3.2	2.18	1.12	3.81
Total Forest	2001	56.63	29.53	24.89	9.25	23.01	5.8	5.2
	20016	48.52	25.36	20.28	6.23	19.03	4.1	3.98
	Changes	-8.11	-4.17	-4.61	-3.02	-3.98	-1.7	-1.22

Sources: Landsat 5 Satellite Oct 2001to 2023



Graph 4: Changing landuse at in 2001 to 2023

Conflict of Interest
There is no conflict of interest.

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CONCLUSION
proper monitoring and prediction of land use land cone place significance roll in sustainable management of natural and manmade resources at the regional and local level that Dindori Tehsil is a classify by the sum of circulars has been monetary by land use land cover for sustainability study in proper way and use of Remote sensing and GIS provided platform.

In Dindori Tehsil, between ***2001*** and ***2023***, actual use of land and natural use of land have been studied under which factors have changed. From this it is clear that in Dindori tehsil the area under agriculture is increasing and the area under vegetation is decreasing. Urbanization is increasing in Dindori Tehsil, but the fallow area is decreasing. It is clear that the fallow area is being used for agriculture, under vegetation and for building houses, factories, roads. It is clear from this that although humans are a resource the use of natural resources is seen as humans grow through various technologies.It is clear from this that in the next few years' agriculture and the land under agriculture will have to be planned here in proper proportion. Also, by paying attention to the felling of trees, we have to pay attention or plan for how it will be reduced.

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