Quest Journals
Journal of Research in Humanities and Social Science
Volume 11 ~ Issue 1 (2023) pp: 195-207
ISSN(Online):2321-9467
www.questjournals.org

Research Paper

Temporal and Spatial Change of Forest Cover in Hazaribag District, Jharkhand

Pant Prakash Mehta
Assistant Professor,
St. Columba's College, Hazaribag,
Vinoba Bhave University, Hazaribag, Jharkhand.

Abstract
(*Forest cover is the area covered with minimum land area of half hectare, canopy cover more than ten percent ad minimum tree height of five meter. Hazaribag district is one of the districts of Jharkhand state where forest area is always high. Due to human activities, there are pressure on forest cover and changed in last several years. To detect change the forest cover in Hazaribag district satellite imageries of LANSAT data of three different years 1988, 2000 and 2015 are used. These data are processed and land use land cover maps of these three years are prepared. Based on these land use land cover different land use analysed. Total forest area in the district goes down from 2307 sq. km in year 1988 to 1872.3 sq. km in year 2015.****)***
Key Words: Electromagnetic Spectrum, Wavelength, LANDSAT, Geometric Correction , Radiometric Correction, Land Use Land Cover, Forest Cover

R*eceived 01 Jan., 2023;* ***R****evised 09 Jan., 2023;* ***A****ccepted 11 Jan., 2023 © The author(s) 2023.*
P*ublished with open access at* ***www.questjournals.org***

I. Introduction:

In different countries the definition of forest is different. As per the Global Forest Resource Assignment 2005 of FAO used, parameters of minimum land area of half Hectare, canopy cover more than ten percent and minimum tree height of five meter for the definition of forest cover. According to FSI, more than one Hectare of land and tree canopy cover is more than ten percent for the definition of forest. All the time the importance of forest remains its place. Forest provides nutrition to the soil. It protects soil erosion through its roots. It also provides shelter to the wild animals. Forest also increases the water table of the area through slow down the runoff and increases the infiltration times of surface water. Forest provides fodder. It provides several minor produces. These forest products are the source of livelihood to indigenous people. Hazaribagh district is one of the districts of Jharkhand state where the forest area is always high to its total geographical area.Due to several human activities in the past few decades the pressure on forest increases.Trees are cut down recklessly to fulfil the different needs of people.To detect the change inforest cover in the Hazaribag district the present study used the satellite data at an interval of 12 to 15 years such as 1988, 2002,2015.Forest cover of the district undergoes a change in different areas and in different years due to agriculture, construction of roads,railways,mining, industry etc.

Objective: The main objective of this study is to highlight the changes in land use land cover in general and forest cover in particular.

Study Area: Hazaribag District is one of the oldest districts of Indian state Jharkhand. It is established in 1834. The district of Hazaribag is part of north-eastern portion of the Chhotanagpur Plateau lies between $23^0$38'43" to $24^0$31'44" North latitude and $85^0$1'9" to $85^0$55"22" East longitude. The total geographical area of present district is 4313 sq. km.Hazaribag, that literally means a "thousand bags". The district can be divided into three physiographic divisions namely the Central plateau, the Lower Plateau and the Damodar valley. The district is drained by two major rivers, the Damodar and the Barakar with a few tributaries like Naikari, Bhera, Kusum, Bokaro, Keso, Harhi, Barosat, Chandwara, Kolhuteri, Karkara, Kewta, Konar, Siwane etc.

II. Concept and Methodology:

1 Remote Sensing

Remote Sensing is a modern technique of acquiring data. In this technique, data or information is obtained by a device without physical contact of the object. In Remote Sensing, electromagnetic energy is used for detecting the object's characteristics. In this method different range of electromagnetic energy is sensed through sensors. On the earth every object emits electromagnetic energy. Sun's electromagnetic energy, which is scattered, reflected or emitted by objects are measured through different sensors.

2 Electromagnetic Spectrum: A band of energy which wavelength ranges from nano meter to meter. It travels at the speed of light. Different object reflects different amount of energy on the earth. These energies in various wavelengths of electromagnetic spectrum.The range of EM spectrum from Radio wave region to Gamaray region.The wavelength of Radio wave is long and wavelength of Gama ray is short. The visible region is very small range of wavelength 0.4 μm to 0.7 μm in EM spectrum. Energy is function of wavelengths which is used in acquiring data in Remote sensing. Maximum energy reflected by the objects at day time which is 0.5 μm wavelength. This wavelength of energy corresponds to green band of visible region also called energy peak. During day and night, the earth surface radiate energy with maximum energy 9.7 μm. This wavelength corresponds to thermal band of IR region. The Ultra violet, X-ray and Gama-ray region energy absorbed by the atmosphere. Remote Sensing does not use these energies due to absorption of earth's atmosphere. Remote sensing data obtained through heigh transmission wavelength region called windows. The recorded energy helps in detection of objects. Spectral signatures, characteristic of wavelengths of objects of earth surface used in their measurement and identification.

Table: 1 Spectrum of Waves

Region	Wavelength
Gama ray	<0.03nm
X-ray	0.03-3.00nm
Ultraviolet	0.03-0.40μm
Visible	0.40-0.70μm
Infrared	0.70-100.00μm
Reflected IR band	0.70-3.00μm
Thermal IR band	3.00-14.00μm
Microwave	0.10-30.00cm
Radar	0.10-30.00cm
Radio wave	>30.00cm

3 Scanning System:

Remotely placed platform used scanning system for the recording of EM radiation. In a scanning system a sensor is used. To produce an image scanning system sweeps across the terrain with narrow field of view. Numerical data which is converted signals, received by sensors of reflected or radiated electromagnetic energy from the terrain. In remote sensing satellite a separate band of EM energy is used for recording of each array. Spectrometer disperse the incoming energy from different array of sensors into spectrum. Specific wavelength band of energy is recorded by sensors or detectors. After suitable manipulation of received information by sensors transported back to receiving station on ground. These received data are reconstructed into digital images. The digital image consists of picture elements. These images are arranged in rows and columns. Pixels or digital image position is determined on a X-Y co-ordinate system. Every pixel has a numeric value called DN (digital number). Each pixel has certain intensity of electromagnetic energy. Radiometric resolution of satellite's sensor system controls the range of DN in an image data. After processing of digital images, master image of study area is produced. To detect, classify and identify of various phenomena on the surface of earth the processing of digital data or digital imagery is done.

With combination of traditional techniques and remote sensing technique, management of natural resource become efficient, speedy and cost-effective. Remote sensing technique has the capacity of repetitive, multi spectral and synoptic coverage. Data base generation on land use, forest, soil, terrain characteristics and other phenomenon on earth become possible through Remote sensing data. The monitoring of these phenomenon in near real time become possible by Remote Sensing data.

Data source:
The following data are used in the present studies:
(a) Primary Data:
RemoteSensing satellite data obtained from thehttp//www.earthexplorer.usgs.gov such as LANDSAT-5 TM (6th December 1988), LANDSAT-7 ETM+ (2nd January 2000) andLANDSAT-8 OLI/TIR(3rd January 2015) used in the present study. The satellite images of path 145 androw 39 path 140 and row 43 and path 140 row 44 is taken.
(b) Secondary data:
Secondary data are important information in Remote Sensing. These data improve the interpretation accuracy and reliability of remotely sensed data.These data also help in verification of interpreted details, information that cannot be obtained directly from the remotely sensed data.For Hazaribagh district Survey of India toposheet number 72 H/3, 72 H/4, 72 H/6, 72 H/7, 72 H/8, 72 H/11, 72H/12, 72 H/15, 72 H/16, 73 E/1, 73 E/2, 73 E/5, 73 E/6, 73 E/9 and 73 E/13 of scale 1:50000 is the base layer of the satellite image are used in the present study.
LANDSAT-7 is equipped with ETM+ (Enhanced Thematic Mapper Plus) which provides ground survey in four modes of VNIR(Visible and NearInfrared), SWIR (Shortwave Infrared), PAN (Panchromatic) and TIR (Thermal Infrared- Thermal Infrared Range) scene size is 170 Km x 185 Km.
LANDSAT-8 satellite consists of two instruments the Thermal Infrared Sensor TRS and the OperationalLand Imager OLI. These two sensors provide seasonal coverage of land mass at a sportier resolution of 30 meter. OLI is a push broom sensor with four mirror telescopes.The LANDSAT- 8 scene size is 185kilometer cross track by 180 km along track.

Table: 2Characteristics of Satellite/Sensor used in the Research

Platform	Sensor	Spectral band	Resolution (in m)	Path	Row	Temporal Resolution	Source
LANDSAT-5	TM	Blue-0.45-0.52µm Green-0.52-0.60µm Red-0.63-0.69 µm NIR- 0.77-0.90 µm	30	145	39	16 Days	USGS
LANDSAT-7	ETM+		30	140	43	16 Days	USGS
LANDSAT-8	OLI		30	140	44	16 Days	USGS

Data processing:
Processing of data in the present study are shown in figure 5.1 the methodology
The methodology involved in the processing of data and was the following steps:
a) Geometric Correction
b) Radiometric Correction
c) Image Enhancement
d) Study Area Extraction Visual Interpretation
e) Overlay of Vector Database
f) Ground Truthing
g) Final Land Use Land Cover/ Map Preparation

a) Geometric Correction:
Errors is a digital imagery or systematic errors and non-systematic errors. Systematic errors occur due to the earth's curvature and rotation of the earth.Non- systematic errors occur due to the intermittent sensor malfunctions.At satellite receiving station systematic errors are corrected.In pre-processing stage random or non-systematic errors are corrected.Even after systematic error correction some residualerrors remain in respect of altitude attributes.Using ground control points there should be tunning for correcting the image geometrically. In the present study the whole images were geo-rectified by 72 uniformly distributed GCP.

Due to geometric distortion in raw digital images, they cannot be used. Cartographic projection of earth’s spheroidal surface into flat representation which is internationally accepted is called map. Two important features of a map are scale and projection. Scale is the representative fraction of distance between to geographic points on the map to the distance between two points on the ground. A map projection is the representation of earth’s parallels and meridians as a net or graticules on a plane sheet. Projected co-ordinate system of digital image from generic co-ordinate system is necessary for better analysis. In this study geo-refrencing is done with the help of Survey of India toposheet with scale 1:50000 of Hazaribagh district of series 72H/3-series and 73E/1 series.Information from various sources can be compared and integrated on GIS platform.

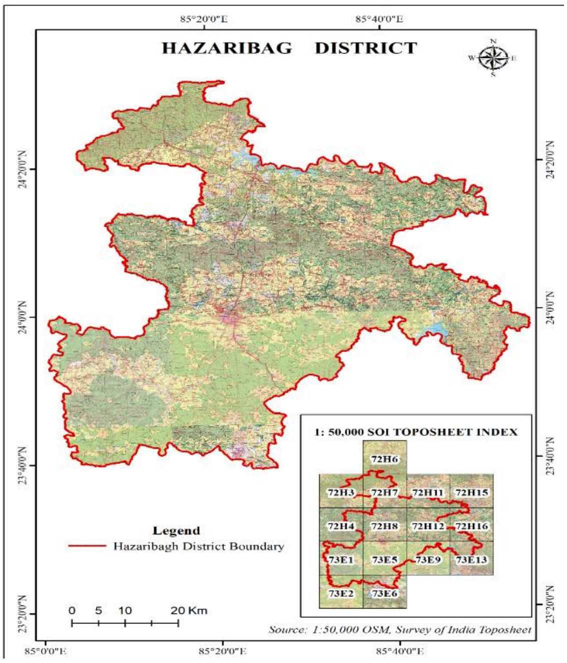


Fig: 1

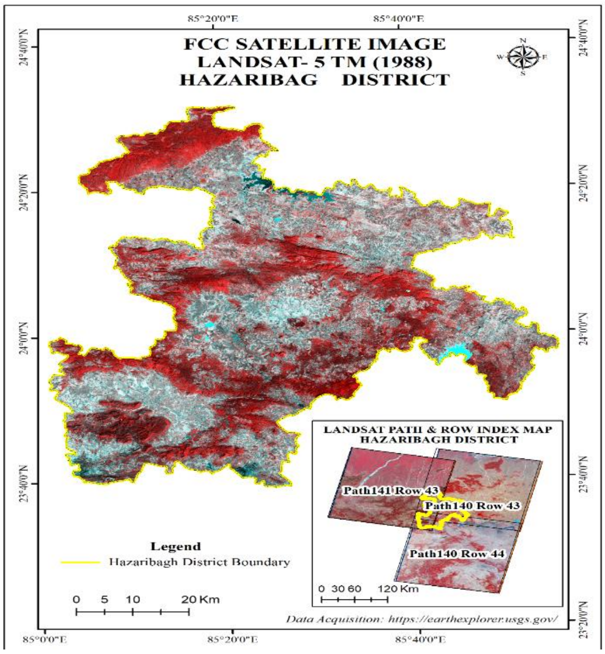


Fig: 2

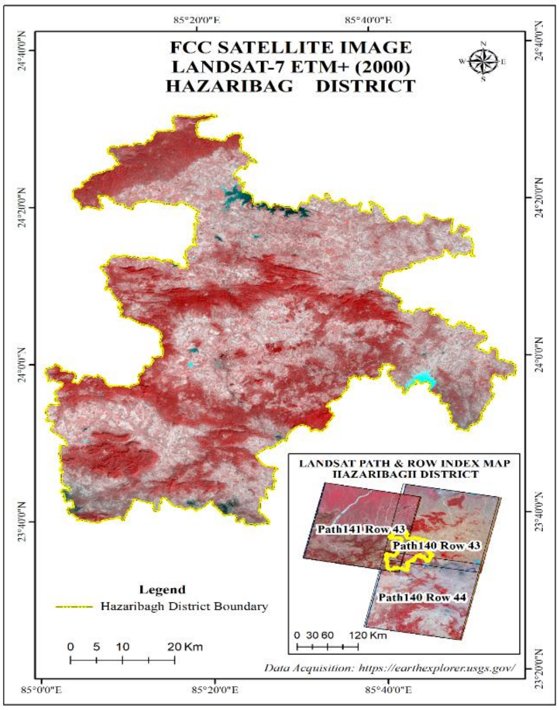


Fig: 3

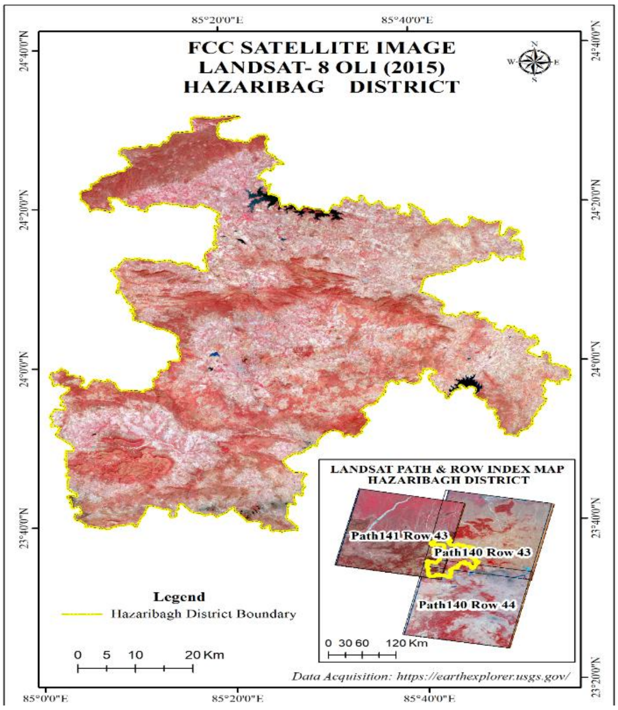


Fig: 4

Earth is an irregular sphere slightly flattened at the poles and bulging on the equator. Map is a flat surface. To convert the spherical shapes of the earth into a flat surface we need protection. The method by which the network of parallels and meridians called grids is transferred or projected from the spherical surface to the plane of a paper known as map projection. Projections are based upon cones, cylinders, and planes. The choice of map projection depends upon the purpose of for which the map is drawn.

In the present study image is projected to UTM (Universal Transverse Mercator), zone 45 and datum WGS 84.

b) Radiometric Correction:

The radiometric correction is applied for the elimination of radiometric distortion or errors. Electromagnetic energy which is reflected or emitted by the objects does not coincide with the observed energy from a short distance by sensors, radiometric distortion occurred. Due to Sun's elevation and azimuth, atmospheric condition etc. which affect the observed energy, this error occurs.

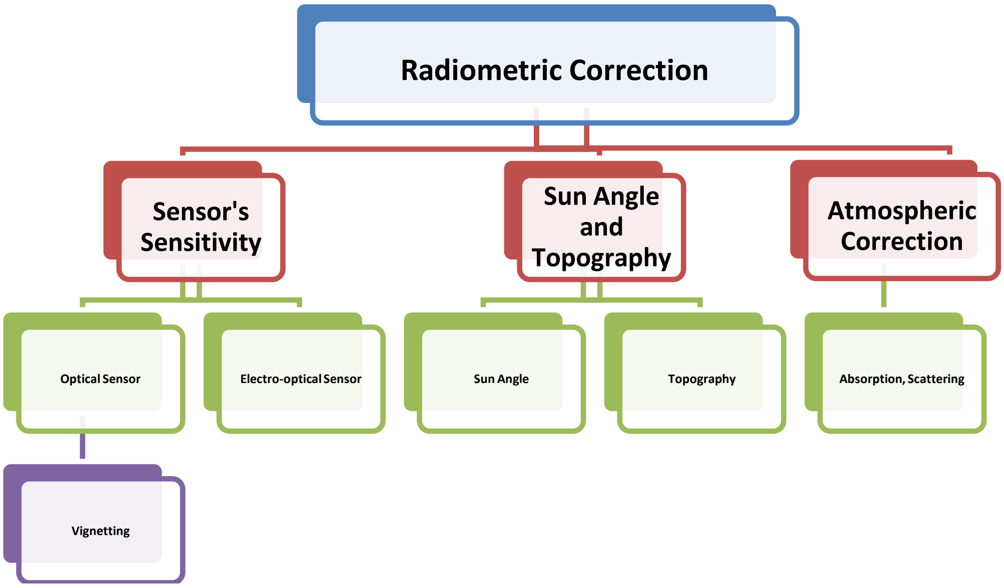


Fig: 5

For obtaining the real reflectance, irradiation it is necessary to correct these radiometric distortions. When optical sensors are used in compare to central area, the fringe area in the corners will be darker. This is called vignetting. On the ground surface as a result of diffuse reflected solar radiation, the lighter area in an image. It is called sunspot. The fringe area in the corners will be darker as compared with the central area whenoptical sensors is used.This is called vignetting.Diffuse reflected solar radiation onto the ground surface results the lighter area in an image.It is called sunspot.By Fourier analysis to explore the low frequency component estimating a shading curve used in correcting the combined effects of sunspot and vignetting.The effect of shading due to topographic relief is corrected by angle between the solar radiation direction and the normal vector to the ground surface.Due to absorption and scattering of solar radiation occur atmospheric errors.These reflected or emitted radiation form an object and path radiation need to be corrected.

c) Image Enhancement:

For better interpretability of raw data, it is necessary to enhance the image.Point or local operation techniques are used for digital image enhancement.The value of each pixel in the image data modified by the point operation.Brightness value of neighbouring pixels are modified by the local operation.Using the ERDAS image software for contrast manipulation on local operation is applied.False ColourComposite (FCC) image of Hazaribagh district is shown in Plate no. 5.2, 5.3 and 5.4 of 1988,2000 and 2015 respectively.

d) Study Area Extraction/Visual Interpretation:

Based on interpretation keys the image data were analyzed. Tone/colour, shape,size, texture, pattern, location association and shadows are the fundamental image elements which forms the interpretation keys.Image elements and other geo-technical elements like landform, relief, drainage pattern and physiography are selected or identify for each land-use landcover class.Through field survey, taking selective transversus in order to collect the ground information for the interpretation of image.This information helps in the classification on the basis of the variability of land-use land-cover condition and terrain characteristics and accessibility 204 point are selected for ground truthing.

e) Image Classification:

For image classification the images were resampled using nearest neighbour algorithm method with first order of polynomial transformation. After evaluating the statistical parameters of the training sets, reliability test of training sets, was conducted by measuring the statistical spectrum between the classes. The accuracy of the classification was finally assessed with reference to ground truth data. Land-use class in the

Hazaribag district was determined using ERDAS14 software. The classified image of Hazaribag district for the year 1988, 2002 and 2015 as shown in plate 5.5, 5.6 and 5.7 respectively.

f) Overlay of Vector Database: District boundary of Hazaribag is superimposed on the image vector layer in the Arc GIS 10.4 database and superimposed on the classified image.

g) Ground Truthing: Validation of the interpreted results from the study area through ground truth survey. Sample points were collected on different heterogeneous and homogeneous landscape of the study area.Cross checking of data with the field verification data using GPS Etrex30.

h) Final Land Use Land Cover Map Preparation:

Final land-use land-cover map of Hazaribag district of 1988, 2000 and 2015 were prepared in Arc GIS 10.4 and ERDAS-14 software. These maps are shown in plate number 5.5, 5.6 and 5.7 of year 1988, 2000 and 2015 respectively.

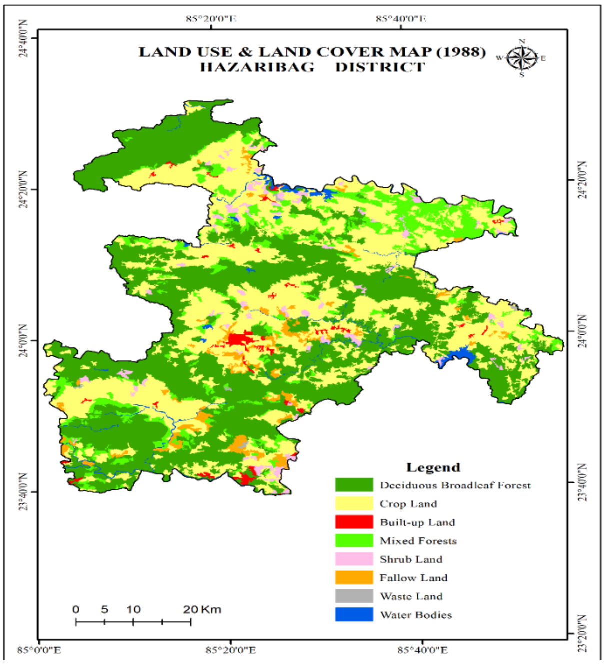


Fig: 6

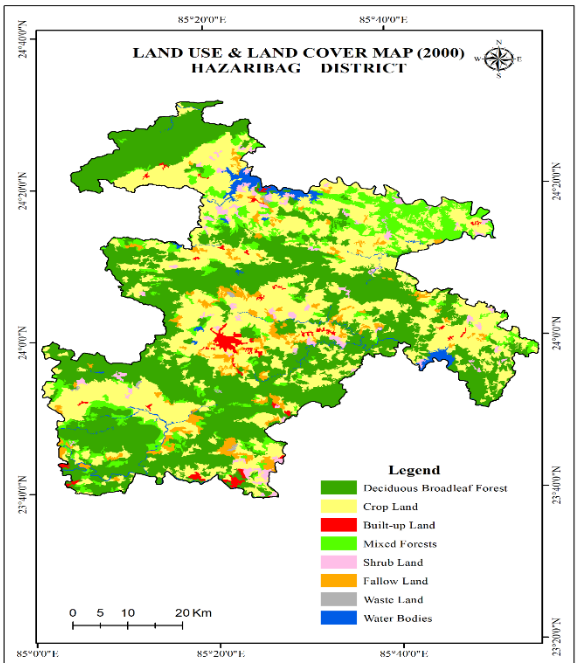


Fig: 7

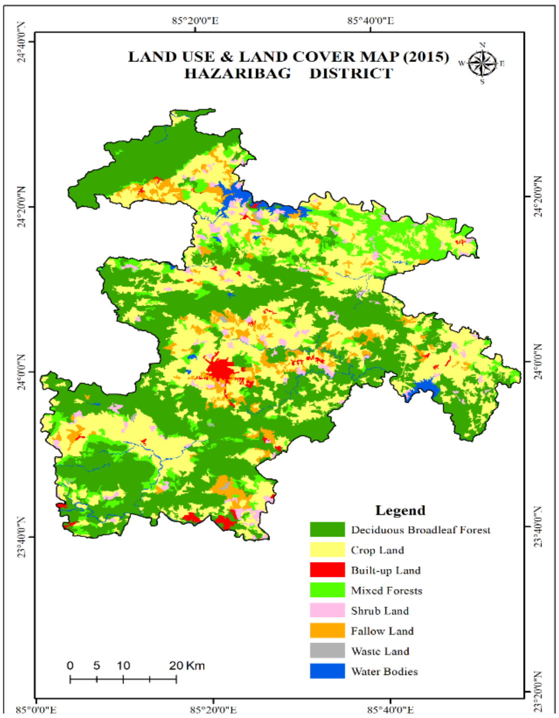


Fig: 8

Land Use Land Cover:

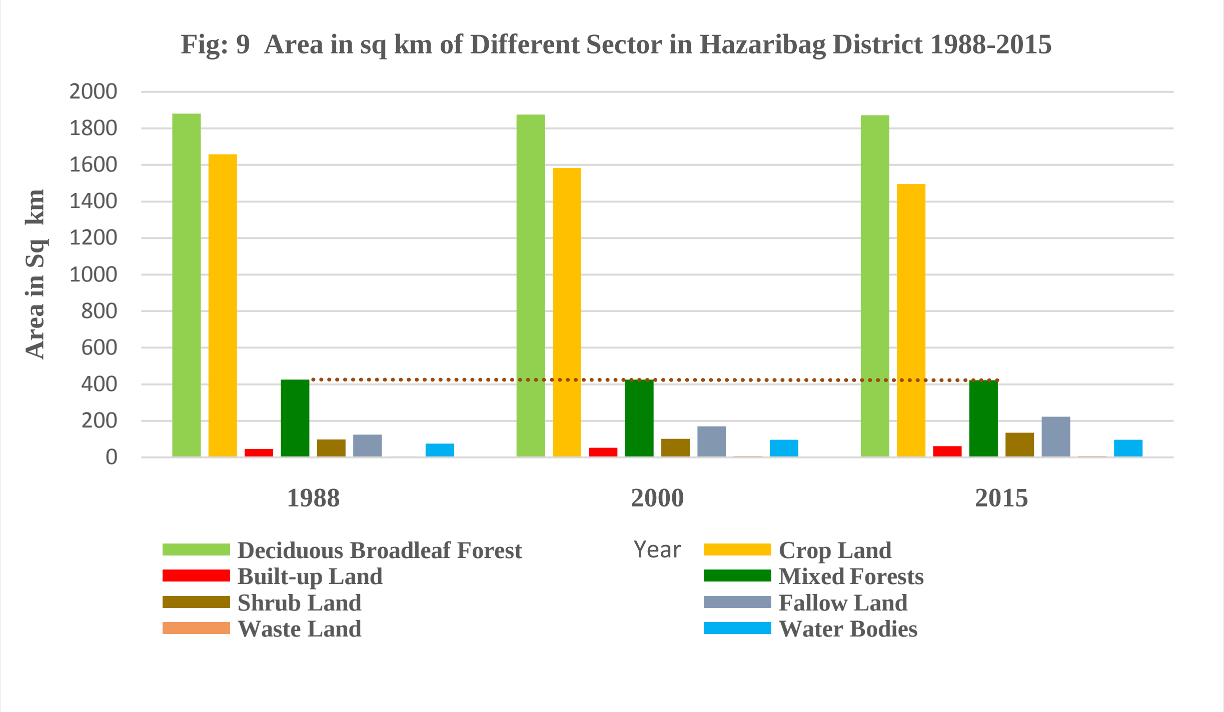
One of the most important natural resources is land on which all human activities are based. It is necessary about the different type of lands and its spatial distribution in the form of map. Quantification of spatial distribution of land is important for the geospatial planning and management of its optimal use.Forest cover in vegetation cover pattern has gained importance due to all-round environmental concern of any area.Spatial distribution areal extent, location rate and pattern of change of each category in land-use land-cover is important assessing the impact of forest cover in the district.

Various spectral and spatial resolution in remote sensing data provides comprehensive and accurate information for mapping of land-use land-cover pattern.Dynamics of changing patterns and trends over different time periods can be assessed through the land-use land-cover data.

Land Use Land Cover Classification:

Available information on land-use land-cover grouped under a framework to facilitate the creation of a land-use land-cover (LULC) database. The changing land-use land-cover pattern it is necessary to develop a standardized classification system. Nomenclature and definition of different categories incorporate the information acquired from the satellite data and available sources. The present study classifies into the different categories of land-use land-cover as follows:

(a)Deciduous broad leaf forestCrop land (b)Built up land (c)Mixed forests(d)Shrub land
(e)Fallow land(f)Waste land(g)Water bodies



Source: Quantification of satellite data (Landsat) 1988,2000,2015

Data Analysis and Change Detection:

Data acquired from LANDSAT of year 1988, 2000 and 2015 of Hazaribag district were processed by ERDAS 14 software for interpretation of various LULC in the present study. The area of different land-use land-cover of Hazaribag district is quantified by ERDAS Imagine software and shown in the table and distribution of different land-use classes are shown in figures.

Built-up Land:

All Constructions by human on the land surface comes under built-up land. This category has been divided in industrial, settlement, urban and rural classes based on availability of infrastructure. Total built up area in Hazaribagh district is shown in Table of different years.

Depiction of Built-up Land through enlarge picture of LULC

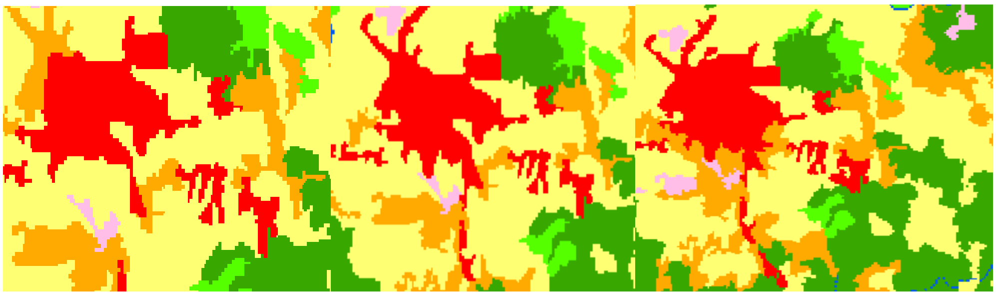
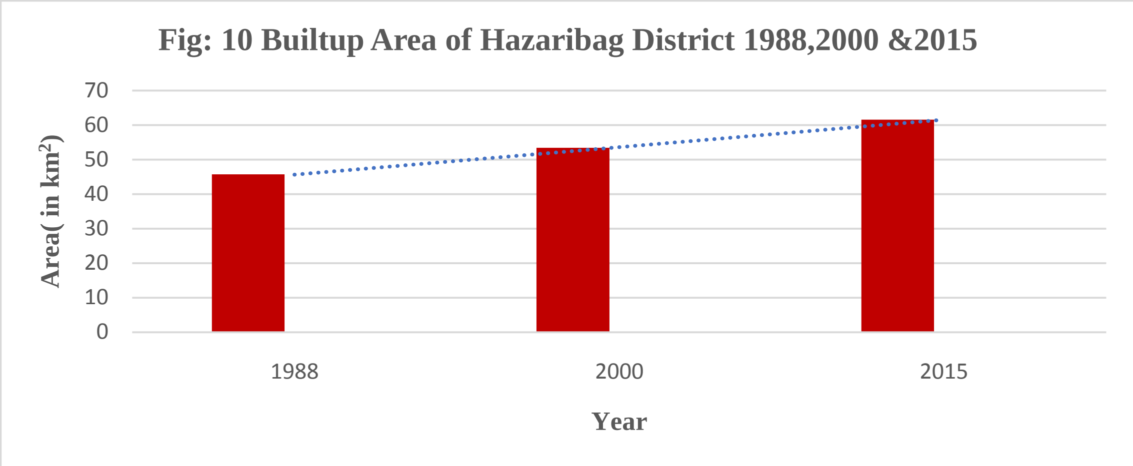


Fig: 5.5(a) 1988 **Fig: 5.5(b) 2000** **Fig: 5.5(c) 2015**

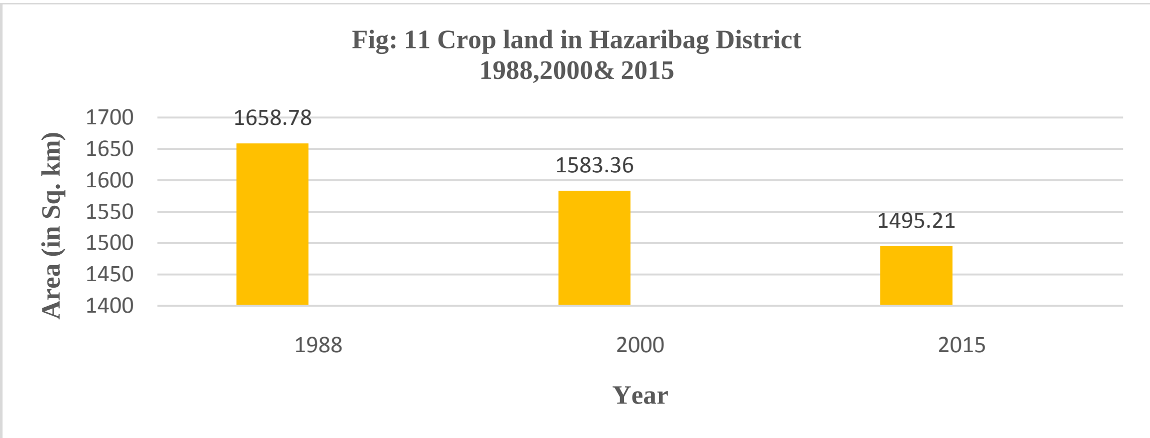
Illustration of Fig:(a), Fig:(b) and Fig (c) shows built-up land between 23°58'17" N -24°1'38" N and 85°19'38" E-85°22'55" E of year 1988,2000 and 2015 respectively. In picture it is clear that there is change in built-up area during 1988 to 2015.



Source: Quantification of satellite data (Landsat) 1988,2000,2015

It was 45.72 km^2 in 1988 increased by 7.66 square kilo-meter and became 53.3 8 square kilo-meter during 2000.Total 8.2 to km^2 increase from 53.38 km^2 to 61.60 km^2 during 2000 to 2015.An increase of 34.73 percent area of built-up area during 1988 to 2015.This increase of built-up area due to increase in population and consequently in the settlement. Development process may also one of the reasons for increase in the built-up area in the district. Several industrial establishment and construction of roads also play an important role in the increase of built-up area.

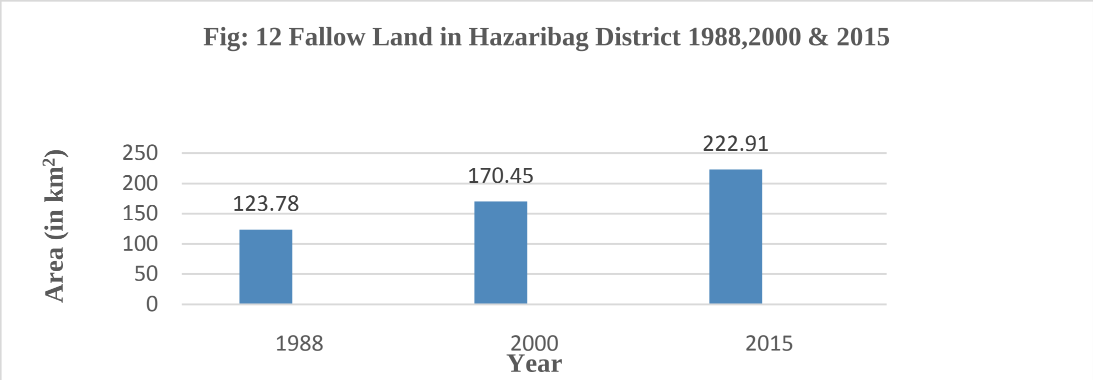
Crop Land:
Land under crop cultivation comes under this category. Farming and production of food, fibre and other commercial and horticulture fall in this category.



Source: Quantification of satellite data (Landsat) 1988,2000,2015

Crops are grown in different seasons like kharif, rabi and zaid. Kharif crops are sown in the month of June or July and harvested in the month of October and November. While the rabi crops are sown in the month of November December and harvested in the month of March or April. Zaid crops are grown in the summer season. Agricultural lands or Crop lands are those lands where standing crops on the date of satellite imagery or land is used for agriculture purposes. Agriculture is the main source of livelihood in the district of Hazaribag. Data from satellite images and analysis of these data reveals that cropland covers 1658.78 km^2 or 38.46% of the total geographical area of the district during 1988.Area under this category is falls 36.71% in the year 2000 and 34.67percent of geographical area in the year 2015. The reasons for decreasing of crop land is mainly due to increase in the area of the fallow land in the district.

Fallow land:
Fallow lands are those agricultural land which is left for one agricultural season or more. This includes current fallow land and permanent fallow land. Due to lack of irrigation or other financial reason farmers cannot sow their crops in the agricultural field the land becomes fallow land.

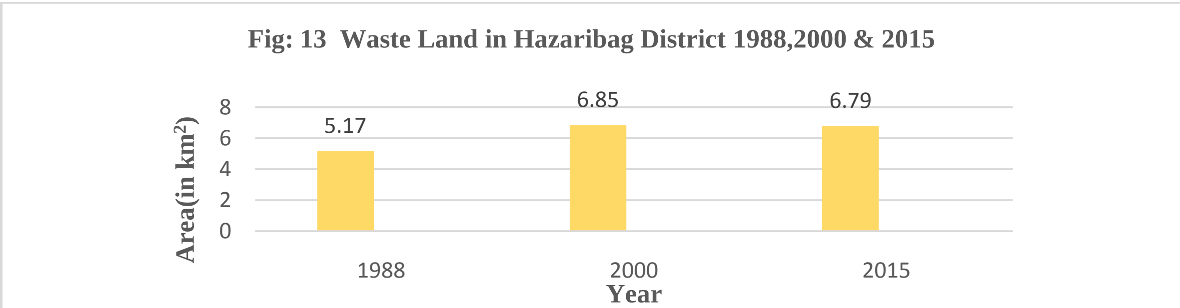


Source: Quantification of satellite data (Landsat) 1988,2000,2015

In Hazaribagh district the area of the land is increased during 1998 to 2015.In 1988 total 123.78 square kilo-meter area or 2.85 % of the total geographical area of the district increased to 170.45 square kilo-meter or 3.95 % of total geographical area in the year 2000.It further increased in the year 2015 and becomes 222.91 square kilo-meter or 5.17 % of the total geographical area. The trend shows that people are not interested in doing agriculture. There may be several reasons for coming out from the agricultural activities among the rural people.

Waste land:

Unutilized or underutilize land due to degradation of quality of soil called wasteland. The deterioration of soil due to natural causes such as soil erosion or lack of appropriate water and soil management. Land degradation may occur due to several reasons. Deforestation is one of the reasons. Forest trees are cut by human will increase the rate of soil erosion. The roots of plants and trees hold the soil and trees and plants slow down the velocity of surface runoff. These trees and plants protect the soil from erosion. Trees also slow the velocity of wind which is responsible the surface soil erosion. In Hazaribag district over the period of years several forest trees are cut. Mining activities also increased the land degradation. Dumping of overload due to quarry and mining of minerals and coal degrade the land. In Hazaribag district both open cast mining and underground mining of coal are in operation. In this district North Karanpura coalfield is an important site of coal mining. Dumping of industrial and domestic waste also aggravate the problem of land degradation.

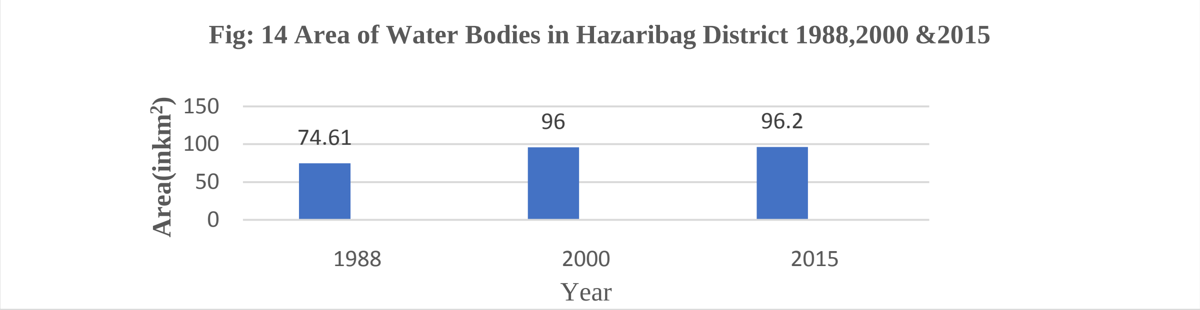


Source: Quantification of satellite data (Landsat) 1988,2000,2015

In the year 1988 5.17 km^2 area was wasteland in the district. It becomes 6.85 km^2 in 2000 and 6.79 km^2 in 2015.

Water Bodies:

Water bodies are the reservoir of surface water both natural and manmade including rivers and ponds. Natural lakes, big dams and ponds come under this category. In Hazaribagh district several dams are constructed for hydropower plants and industrial water uses. Ponds are constructed in rural areas for irrigation. Some canals are also constructed in the district for irrigation of farming land. In the year 1988 total area under water bodies in the district was 74.61 square kilo-meter.The area of water bodies increased to 96.0 km^2 in the year 2000.This area becomes 96.2 km^2 in a year 2015.



Source: Quantification of satellite data (Landsat) 1988,2000,2015

Depiction of Water Body through enlarge picture of LULC

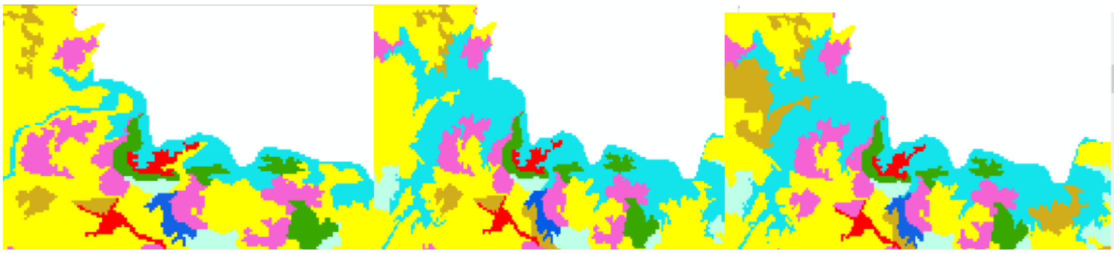


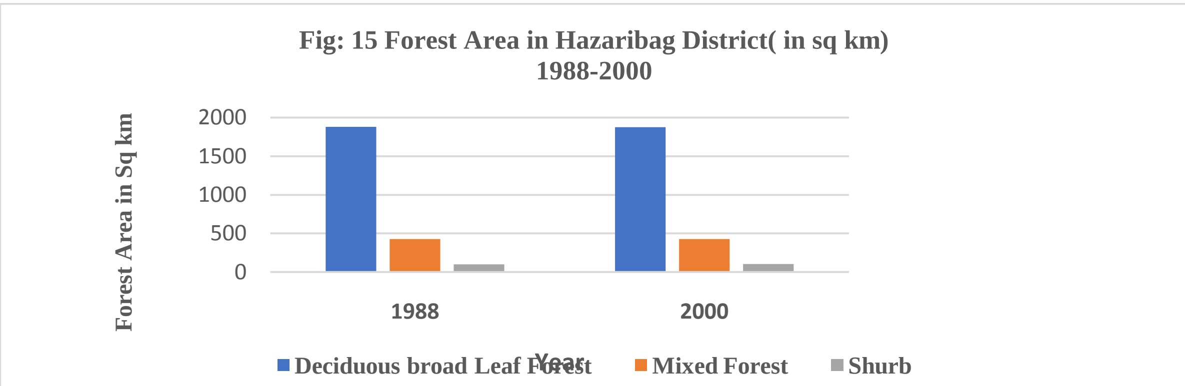
Fig:(d) 1988Fig: (e) 2000Fig: (f) 2015

Illustration of Fig: (d), Fig: (e) and Fig (f) shows forest area between 24°18'52" -24°22'33" N and 85°22'35"-85°31'53" E of year 1988,2000 and 2015 respectively. In picture it is clear that there is change in water body during 1988 to 2015.

Forest Cover and Shrub Land:

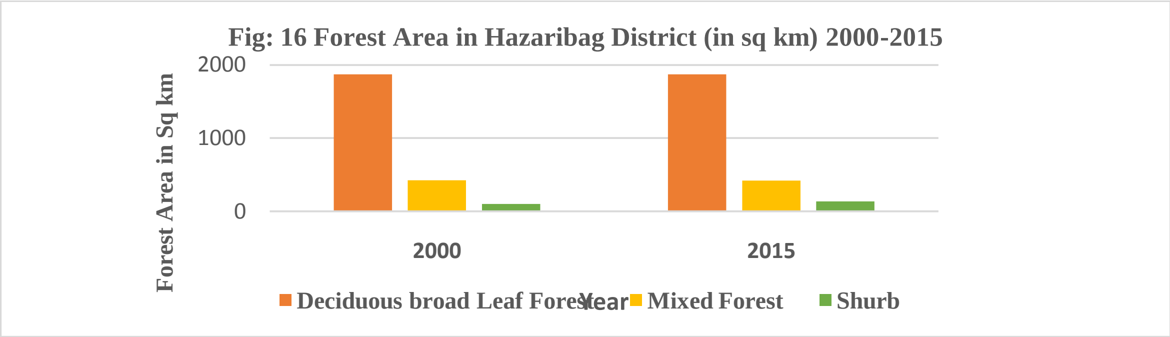
In satellite image forest cover is shown with vegetation cover is an association of trees and other vegetation which is capable of producing timber and other forest produce. It can be also the percentage of soil which is covered by green vegetation. In the present study forest cover includes deciduous broadleaf forest and mixed forest, the sub type of dense forest with crown density more than 40 percent, open or moderate dense forest with crown density 10 percent to 40 percent. The shrubs are those vegetations which crown density is less than 10 percent. In the analysis, vegetation cover shown in terms of total land use cover. Social forestry and plantation by the industries are also covered in the vegetation cover. The statistics of forest cover and shrub land in different years are shown in the following graph:

Analysis of data reveals that the forest cover in Hazaribag district was 2307 km^{2}in the year 1988 in which deciduous broadleaf forest was 1881.33 km^2 and mixed forest was 426.12 km^2. The shrub land covers an area of 97.49 km^2 in this year. Slight decrease of forest land from 1988 to year 2000. It goes down to 2300.59 km^2 in 2000 under which deciduous broadleaf forest decreased to 1875.27 km^2 and mixed forest 426.12 km^2. There is an increase in the area of shrub land it rises to 102.38 km2. The forest area further declined to 2294.67 km^2 in the year 2015. The area of shrub land increased to 135.63 km^2 in the year 2015.



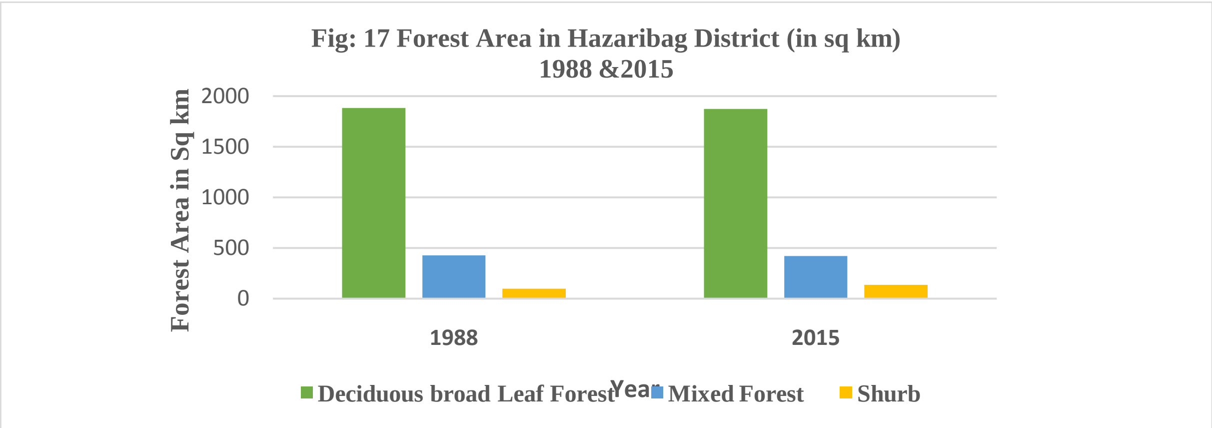
Source: Quantification of satellite data (Landsat) 1988,2000.

After examination of above figure 15, it tells that deciduous broadleaf forest cover an area of 1881.33 km^2 in the year 1988 decreased about 0.14 percent and come down to 1875.27 km^2 in the year 2000. The mixed forest covered an area of 426.12 km^2 decreased 0.02 percent and declined to 425.32 km^2. The coverage of shrub land was 97.49 km^2 in the year 1988 increased of 0.10 percent and become the area of 102.38 km^2.



Source: Quantification of satellite data (Landsat) 2000,2015.

Investigation of Fig: 16, it reveals that deciduous forest area in Hzaribag district decreased from 1875.27 km^2 in the year 2000 to 1872.43 km^2 in the year 2015. This is the decrease of 0.07 percent of total geographical area of the Hazaribag district. In the coverage of mixed forest there is also there is also decrease of more than 3 square kilo meters from 425.32 km^2 in 2000 to 422.24 km^2 in the year 2015. There is an increase of 33.25 km^2 area of shrub land from 102.38 km^2 in the year 2000 to 135.63 km^2 in the year 2015.



Source: Quantification of satellite data (Landsat) 1988,2015

Analysis of fig:17 disclose that about 9 km^2 area decreased in the deciduous broadleaf forest from 1988 to year 2015. In the coverage of mixed forest also decreased of 3.88 km^2 area from 1988 to year 2015. Total of 12.88 km^2 area decrease of forest cover from 1988 to 2015. The coverage of shrub land increased to 38.14 km^2 area from 1988 to year 2015.

Depiction of Forest cover through enlarge picture of LULC

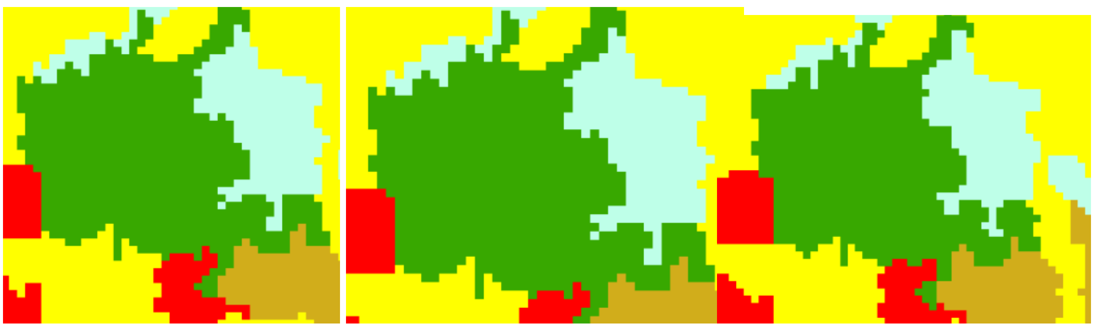


Fig: 5.10(a) 1988 **Fig: 5.10(b) 2000** **Fig:5.10(c) 2015**

Illustration of Fig: (g), Fig: (h) and Fig (i) shows forest area between 23°59'46" N -24°1'56" N and 85°25'28" E-85°23'4" E of year 1988,2000 and 2015 respectively. This is the area of Kanhari, Protected Forest. In picture it is clear that there is change in forest area during 1988 to 2015.

Depiction of Shrub Land through enlarge picture of LULC

Fig:(j) 1988 **Fig:(k) 2000** **Fig:(l)2015**

Illustration of Fig: (j), Fig:(k) and Fig (l) shows forest area between 23°39'12" N -23°40'29" N and 85°23'5" E-85°26'43" E of year 1988,2000 and 2015 respectively. In picture it is clear that there is change in shrub land during 1988 to 2015.

The land use land cover of Hazaribag district changes during the year 1988,2000, and 2015. Increase in built-up land is due to several infrastructural development in mining, industry and roads and railways. This is also due to increase in settlement area in the district. Change in coverage of water bodies due to construction of different artificial reservoirs. The change of forest cover is mainly due to cutting of trees in the district.

III. Conclusion:

Inlast twenty-five years, the land use land cover has changed. Most changes taken place in built-up areain Hazaribag district . Due to increasing population and other development in infrastructure the built-up area in Hazaribag district is more visible. During this period forest cover has also changed though these changes is not much but the quality of forest is detoriated. The area in crop land is also decreased this is due to either people are interested in other activities or low income from agriculture. The area of fallow land and waste land also increased.

References:

[1]. Jharkhand Space Application Center, (2014). Annual Report 2012-13, Ranchi.
[2]. Jharkhand Space Application Center, (2017). Annual Report 2015-16, Ranchi.
[3]. Jharkhand Space Application Center, (2019). Annual Report 2017-18, Ranchi.
[4]. Laxmi, G. (2015). Long term deforestation assessment in Jharkhand state India: A grid based geospatial approach, Biological Forum, Vol 9(1). pp.183-188
[5]. Pakiam, S.M. (2015). Deforestation causes and consequences, Valley International Journal. Vol. 2 Issue 03, pp. 1193-1200
[6]. Reddy, C.S. Dutta, K. and Jha, C.S. (2013). Analyzing the gross and net deforestation rates in India, Current Science, Vol. 105 No. 11 pp.1492-1500
[7]. https://earthexporer.usgs.gov