International Journal of Advance Research in Science and Engineering
Volume No.07, Special Issue No.07, April 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

LAND USE LAND COVER, CHANGE DETECTION OF FOREST IN KARWAR TALUK USING GEO-SPATIAL TECHNIQUES

Dr. A.G Koppad[1] , Malini P.J[2]

Professor and University Head (NRM) COF SIRSI, UAS DHARWAD
Research Associate, NISAR Project (NRM) COF SIRSI, UAS DHARWAD

ABSTRACT

The study was conducted of Karwar Taluk of Uttara Kannada District. The area lies between 14.820°North Latitude and 74.135°East Longitude with total area of 73535 hectare. The land use land cover classes as per LISS-3 data indicated that there are five classes among them dense forest covers about 75% of the total area. The NDVI map for the year of 2012 -2018 was prepared and results indicated that there are six classes and NDVI varies from -1 to 0.652 in 2012 and -0.115 to 0.991 in 2018. The change detection for the period of 6 years was about 800ha, 930ha, 977ha sparse, moderate dense and dense forest was reduced respectively whereas 2082ha, 630ha of agriculture and settlement was increased respectively. The land surface temperature of different land use system indicated that the forest has shown maximum temperature as lowest as compared to settlement. so the study concluded that forest play very important role in temperature reduction thus helps in reducing the global warming. The mapping of LULC, LST and NDVI was done using ERDAS Imagine and ArcGIS Software's.

Key Words: LULC, Forest, Land surface Temperature, NDVI and change detection

I INTRODUCTION

Remote sensing is a new technology that can gather information on a target without coming in direct contact, and usually refers to the acquisition and processing of information on the earth's surface. Satellite data of the study site is utilized for deriving LST. Land use pattern changes using remotely sensed data in a time domain manner is for comparison of sequential changes in LST of and. Visual interpretation is one of the successful methods of delineating spatial features of the Earth by a geospatial expert. Because of increase in the green house gases, it tends to increase in the LST for that area. As its value changes the local climate of the area also changes hence many researchers had calculated LST using the various Techniques.

II STUDY AREA

The study was conducted in Karwar Taluka of Uttara Kannada District, Karnataka, India. This region lies between 14.820°North Latitude and 74.135°East Longitude. It is situated between Sahyadri ever green Forest in East, Blue Arabian Sea to the West, towards South ends with harbor and North the beautiful Kali River. It has population About

1.5 Lakhs according to 2001 census. Karwar lies on coastal strip known as the Monsoon Coast. It has hot summers from March to May where the Temperature may reach 37°C. The Arabian Sea is warm throughout the year. Winters from December to February are very mild (24°C and 32°C). The windy Monsoon period from June to September has an Average rainfall of over 400 cm

III OBJECTIVES

The objectives of the present study are as follows

1. Land use Land cover classification using IRS-P6 LISS-3 data.
2. To study the variations of Land surface temperature for Karwar taluk of Uttara Kannada District.
3. Analysis of NDVI for the study area with respect to forest using remote sensing satellite data (Landsat-8 and Landsat-7 ETM+) in comparison with LISS3 data.

IV MATERIALS AND METHODS

Landsat-7 ETM+ and Landsat-8 is the latest among the Landsat series of NRSA. The data of Landsat 8 is available in Earth Explorer website at free of cost. In this study, Landsat-8 OLI Images of pertaining to the study area was used to calculate NDVI and the estimation of LST. Mono – window algorithm method has employed to find out LST in the study area. Vegetation proportion calculation, emissivity calculation, LST calculation etc were executed in ArcGIS9.3 software platform. The image was processed using ERDAS Imagine and classify the Land use Land cover thematic map with ground truth data collected from GPS for LISS3 data supervised classification. The methodology followed is shown in fig.1.

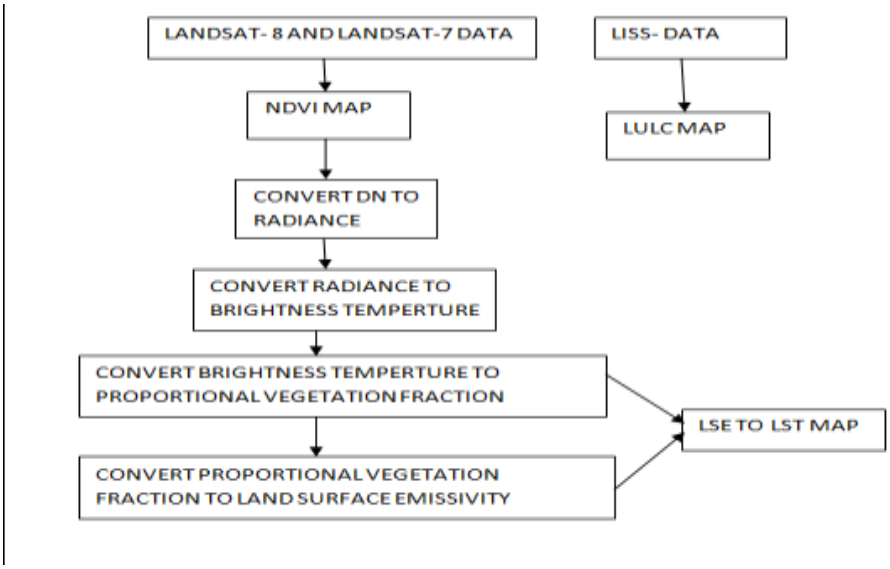

FIG.1 Flow Chart of LST Map

4.1. Image Acquisition and Pre-processing

The images were already rectified toWGS-1984-UTM-Zone_43N. The next step involved is the conversion of DN (Digital Number) to spectral radiance given in the metadata file and the Thermal band to at-Satellite Brightness Temperature. The file with extension .MTL provided in the Landsat-8 and Landsat-7 image set contains the thermal constants.

4.2. Land surface temperature analysis

The Landsat-8 OLI sensors acquire temperature data and store this information as a digital number (DN) with a range between 0 and 255. The detail step by step procedure for Land Surface Temperature (LST) calculation is given below

LST= BT/1+W*(BT/p)*In (e))

Where:

BT= At satellite temperature W=Wavelength of emitted radiance (11.5μm) p = h*C/S (1.438*10^ -2mk)

h = Planck's constant (6.626*10 ^ -34JS)

s = Boltzmann Constant (1.38*10 ^ -23J/K) C = Velocity of light (2.998 *10 ^ 8 m/s) p = 14380

1. The first step is convert digital number to radiance using the given below formula

Lλ is the Spectral Radiance at the sensor's aperture (watts/(m^2*ster* μm))

$$\mathbf{L\lambda = M_L Q_{cal} + A_L}$$

Where:

Lλ = TOA spectral radiance (watts/ (m^2*ster* μm))

M_L = Band Specific multiplicative rescaling factor from the Meta

(RADIANCE _MULT_BAND_X, Where X is the band number 10 or 11)

A_L = Band specific additive rescaling factor from the metadata

(RADIANCE _ADD_BAND_X, Where X is the band number)

Qcal = Quantized and calibrated standard product pixel values (DN)

2. The Second step is Convert Band radiance (which is derived from equation 2) to brightness temperature using the thermal constant given in Meta data file. The conversion formula is given below

$$\mathbf{T = K_2/In (K_1/ L\lambda+1) – 272.15}$$

Where,

T= At – Satellite brightness temperature in Kelvin (K)

Lλ = TOA spectral radiance (watts/(m^2*ster* μm))

K_1 = Band_Specific thermal conversion from the metadata (K_1 – Constant_Band_X, where X is the band number)

K_2 = Band_Specific thermal conversion from the metadata (K_2 – Constant_Band_X, where X is the band number)

272.15 = Convert Kelvin to ^{o} Celsius.

3. The third step is deriving Land Surface Emissivity (LSE).

e = 0.004Pv+0.986

Where, e = Emissivity

PV = Proportion of vegetation which is calculated using NDVI value

NDVI = Normalized Difference Vegetation Index

NDVI can be calculated in ArcGIS by applying the given formula

Float (Band5–Band4)/Float (Band5-Band4)

Float (Band4–Band3)/Float (Band4- Band3)

Where,

Band5 = Infrared Band, Band4=Red band

Band4 = Infrared Band, Band3=Red band

PV = (NDVI-NDVImin/NDVImax + NDVImin)^{2}

Now we can get *PROPVEG* as an output of Proportion of vegetation. Now we can calculate LSE by applying PV value in equation 3

That is e= **0.004 * *PROPVEG+0.986***

Now we can get LSE of the study area which shows in map.3

The final step is calculating land surface temperature using equation 1. The output such as *BANDSATTEMP* substitute for *'BT'* that is brightness temperature in ^{0}c, and *LSE* value replaced in *'e'* that is emissivity.

LST= BT/1+W*(BT/p)*Ln (e) --------- (Rajeshwari and Mani 2014),

Finally we can get the actual land surface temperature of band10 (LST) and Band 6 of the study area given the statistics of study area of LST. Sun elevation represent the time is probably the morning.

V RESULTS AND DISCUSSION

The Land use Land cover Map of Karwar Taluka of Uttara Kannada prepared using LISS-3 data is shown in Figure 2. The NDVI map showing the Land use and Land cover classes is shown in Fig3,5 and Table1. The Temperature according to Land use and Land cover classes is shown in Fig4 and Table2, The area as per Land use and Land cover classes is shown in Table3. The change detection of vegetation over the year 2012- 2018 with Landsat data is shown in fig 5 and 6 respectively.

The results indicated that the land use land cover classes in Karwar district shown that about 78.18% area is covered with Dense Forest, and 13.83 % area is covered with Agriculture and 1.67% of area is open Land and remaining area is occupied by settlement, coastal and water bodies (Fig2).

NDVI Map for the year 2012 and 2018 was indicated that the NDVI value ranged from -1 to 0.652 in 2012 and -0.115 to 0.991 in 2018 of Karwar District. There is a change in land use land cover over a period of 6 years. The change in land use and land cover was positive change in agriculture and settlement and there is a reduction in forest areas (Table 3 and Fig.7).

The LST Map shown that the temperature ranging from 22.345 to 38.790 in 2012 and 24.941 to 43.876 in 2018 of Karwar District. Among the different Land use classes the maximum temperature recorded with settlement was highest (38.79°C) (Zhi-qiang and Qi-gang Zhou, 2011), and the maximum temperature was less with dense forest (26.412°C) (Suresh.*et al.*, 2015; Fuqin,*et. al*.,2004). The similar trend was also noticed during the year 2018(Table 2).

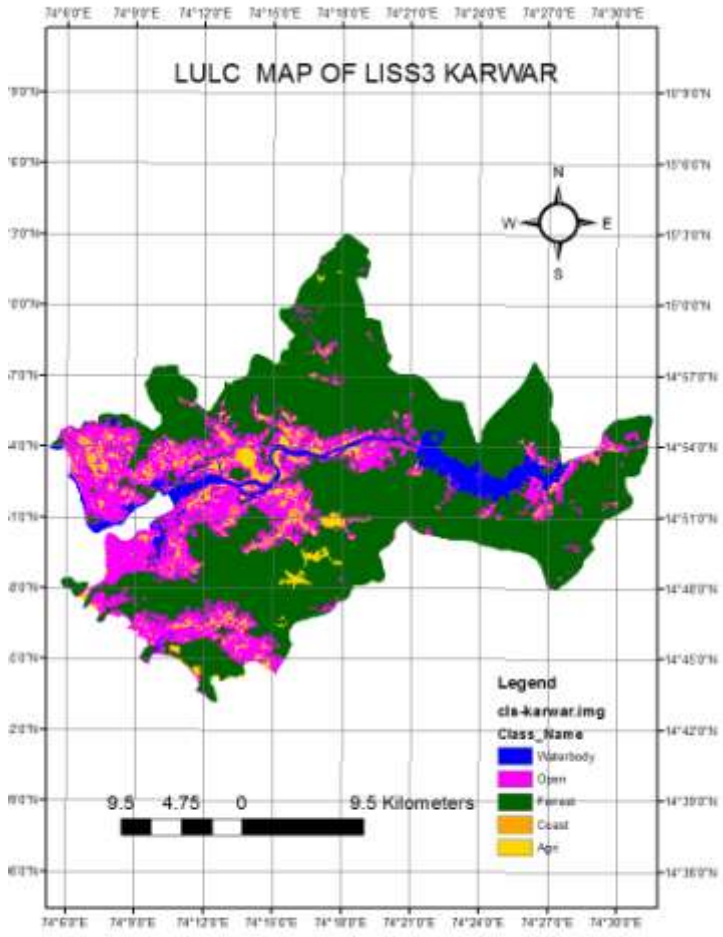

Fig. 2 LULC OF KARWAR TALUK

International Journal of Advance Research in Science and Engineering
Volume No.07, Special Issue No.07, April 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

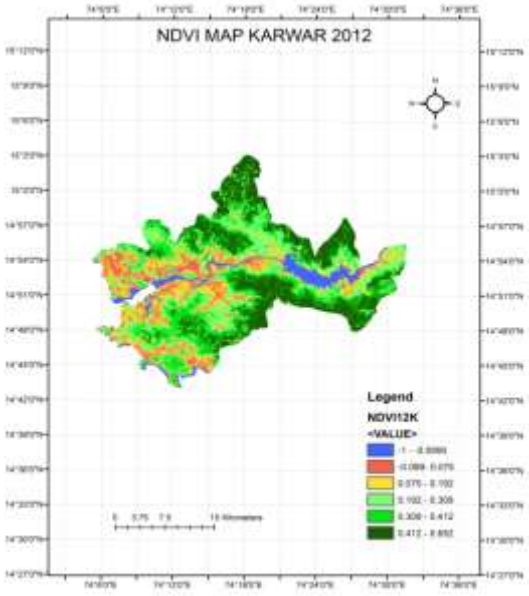

Fig. 3 NDVI MAP OF KARWAR 2012

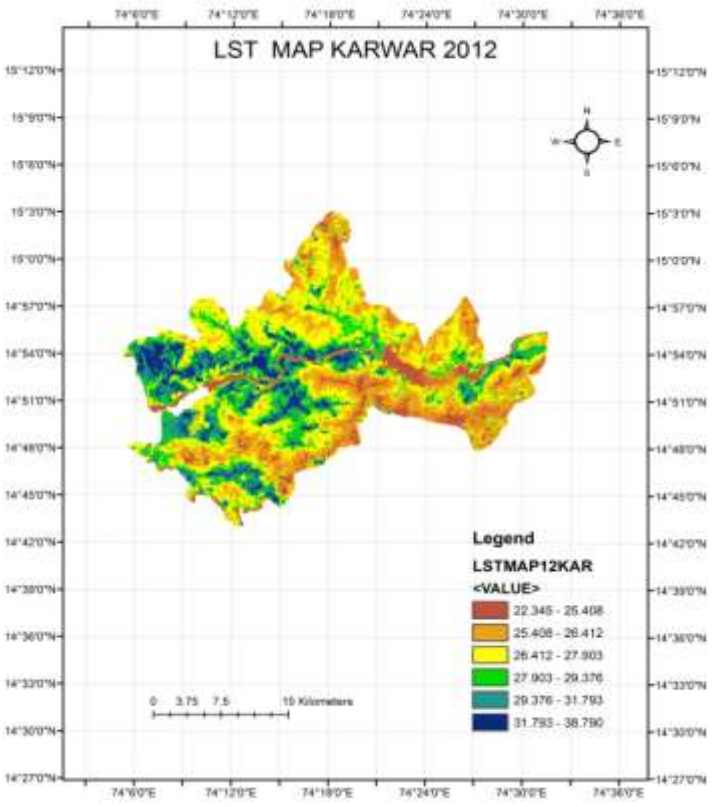

Fig. 4 LST MAP OF KARWAR 2012

International Journal of Advance Research in Science and Engineering
Volume No.07, Special Issue No.07, April 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

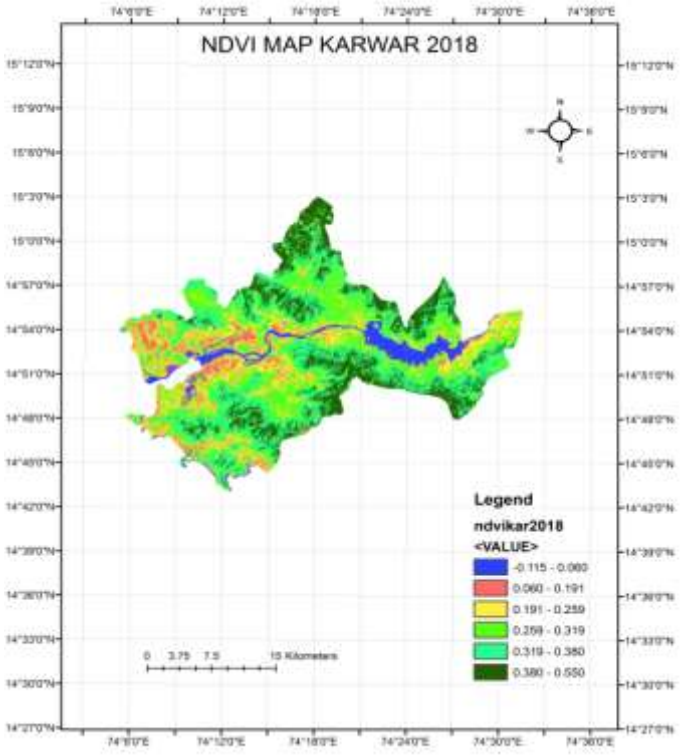

Fig. 5 NDVI MAP OF KARWAR 2018

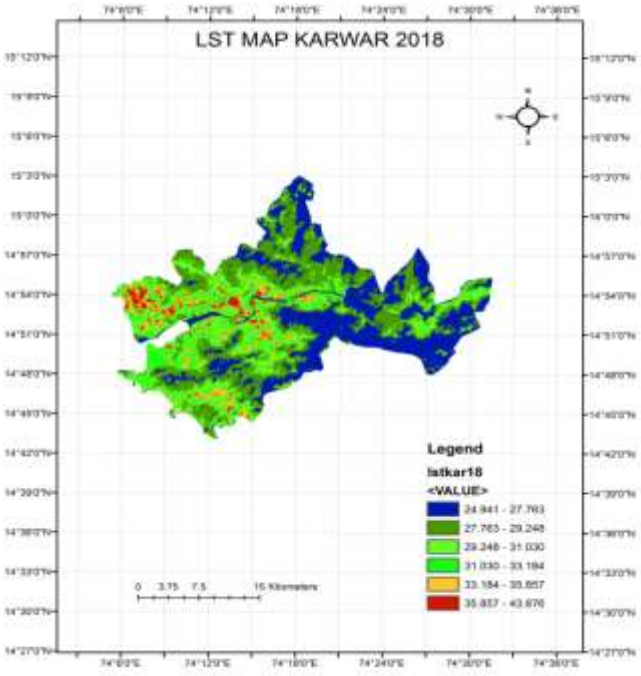

Fig. 6 LST MAP OF KARWAR 2018

TABLE1: NDVI VALUE AS PER LULC CLASSES IN KARWAR

FEATURE CLASSES	NDVI	
	2012	**2018**
Water Bodies	0.099	0.060
Settlement	0.075	0.191
Agriculture	0.192	0.259
Sparse Forest	0.309	0.319
Moderate Dense Forest	0.412	0.380
Dense Forest	0.652	0.550

TABLE2: LAND SURFACE TEMPERATURE AS PER LULC CLASSES IN KARWAR

FEATURE CLASSES	2012		2018	
	Minimum Temperature	**Maximum Temperature**	**Minimum Temperature**	**Maximum Temperature**
Water Bodies	22.345	25.408	24.941	27.763
Settlement	31.793	38.790	35.857	43.876
Agriculture	29.376	31.793	33.184	35.857
Sparse Forest	29.903	29.376	31.030	33.184
Moderate Dense Forest	26.412	27.903	29.248	31.030
Dense Forest	25.408	26.412	27.763	29.248

TABLE3: CHANGE DETECTION OF LULC CLASSES FROM 2012-2018

FEATURE CLASSES	2012 Area in hectares	2018 Area in hectares	Change detection Area in hectares
Water Bodies	4169.43	4169.43	No change
Settlement	4674.46	5305.05	630.59
Agriculture	10345.46	12427.47	2082.01
Sparse Forest	20249.90	19449.09	-800.81
Moderate Dense Forest	19830.72	18900.36	-930,36
Dense Forest	14261.00	13284.0	-977.0
Total Area	73535.4 HA		

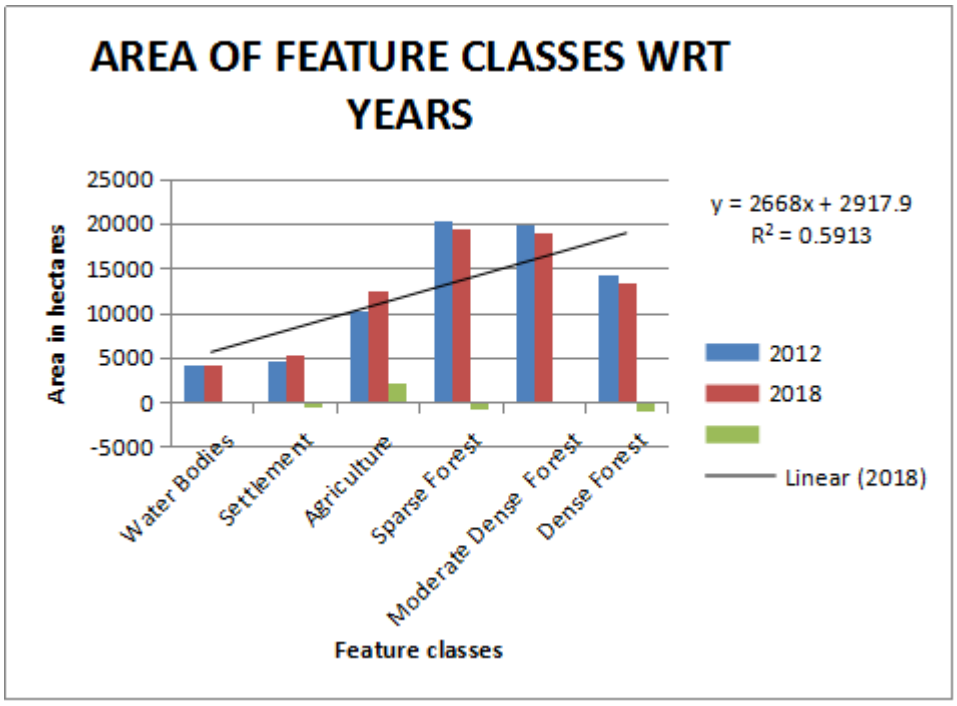

FIG.7: CHANGE DETECTION FOR THE YEAR 2012-18

VI CONCLUSIONS

Based on study it can be concluded that there is a anthropogenic fresher's on forest which is reducing year by year. And Forest play an important role in controlling the land surface temperature hence it helps in reducing global warming. Major portion of area in Karwar District is dense forest.

The attention is required to protect the dense forest. As it is changing towards the sparse forest due to anthropogenic freshers.

VII ACKNOWLEDGEMENTS

Authors are thankful to Department of science and technology New Delhi, for their financial Support to conduct the research at Karwar, uttarakannada District.

REFERENCES

[1] Fuqin Li, J.Thomas. Jackson, P .William. Kustas, Thomas J. Schmugge, Andrew N. French, Michael H. Cosh, Rajat Bindlish,"Deriving Land Surface Temperature from Landsat 5 and 7 during *SMEX02/SMACEX*, *Remote Sensing of Environment Elsevier 92*, 2004, 521-534.

[2] A. Rajeshwari and N.D Mani "Estimation of Land Surface Temperature of Dindigul District using Landsat 8 Data", *IJRET: International Journal of Research in Engineering and Technology*, 2014, 03, (5).

[3] S. Suresh, Ajay Suresh and K. Mani, Analysis of land surface temperature variation using thermal remote sensing spectral data of Landsat satellite in Devikulam Taluk, Kerala-India, *IJREAS*, 5(5), 2015, 145-154.

[4] L.V. Zhi-qiang , and Qi-gang Zhou , Utility of Landsat Image in the study of Land Cover and Land Surface Temperature Change , *Sciverse Science Direct-Procedia Environmental Sciences* , 2011, 1287-1292, Elsevier.