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Studies on Land Use and Land Cover and Their Indices and Its Impacts on Forest & Agriculture Sector in Mysore Taluk Using Space Technology

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Abstract:

A study was conducted by using remote sensing technology to assess water resources, soil moisture as well as vegetation indices at Mysore Taluka. The study area, which lies between latitude of 12.630° N and longitude of 76.607° E, encompasses an area of about 79,788 hectares. The land use and land cover (LULC) map was prepared from LANDSAT images in conjunction with ground truth. Attempt was also made to find out the effect of LULC and temperature on agriculture in relation to climatic parameters. For analyzing NDVI, NDWI, and NDMI map was used usingLANDSAT images. In contrary, NCEP reanalysis was carried using the data of relative humidity, soil moisture, solar radiation and water runoff. The findings of the study showed that the annual maximum temperature is increases from 2000 to 2016, while the annual minimum temperature and annual rainfall is decreases during that period. The NDVI analysis for 2000-2016 indicated that it is increases. In case of NCEP reanalysis, a decrease was observed in the annual average of relative humidity, soil moisture and water runoff for that period. The annual solar radiation also showed increases. It was found that the cropped area for cereals, millet's, pulses, oil seeds, cotton and sericulture was decreases at Mysore taluk. On the other hand, the cropped area for fruits, vegetables and sugarcane showed increases at Mysore Taluka. The C-MMACS,GCM Model, predicted an increase in rainfall and decrease in temperature at Mysore taluk for the year 2020 and 2030, respectively.

Key words: Land use and land cover, Normalized difference vegetation index, NCEP Reanalysis and MODISdata

I. INTRODUCTION

Forests provide a wide range of economic and social benefits, such as employment, forest products and protection of sites of cultural value (FAO, 2006). Forests provide a wide range of goods and services. Goods include timber, fuel-wood, as well as food products and fodder. With respect to services is concerned forests and trees playa importantrole in conservation of ecosystem, in maintaining quality of water, and in preventing or reducing the severity of floods, erosion, and drought.

Agriculture consists of hazardous emissions gases such as Green House Gases (GHG). There are several policies are introduced to reduce the risk of negative climate change impacts on agriculture and to reduce GHG emissions from the agriculture sector. Weather is an important factor in agricultural productivity, as well as both natural and soil properties. The effect of climate on agriculture is related to variability's in local climates rather than in global climate patterns. Mysore District is located in the Southern part of the state of Karnataka. The temperature in the district varies from 150C in winters and 350C in summers.

Water is most important source for plant or tree growth, the tree species adopt itself for the moisture and behaves as deciduous tree or evergreen tree. Most of the places where rainfall is low, less than 800 mm the some of the tree species would be of deciduous in nature if the same species is grown in such climatic situation where rainfall is more it behave like semi or

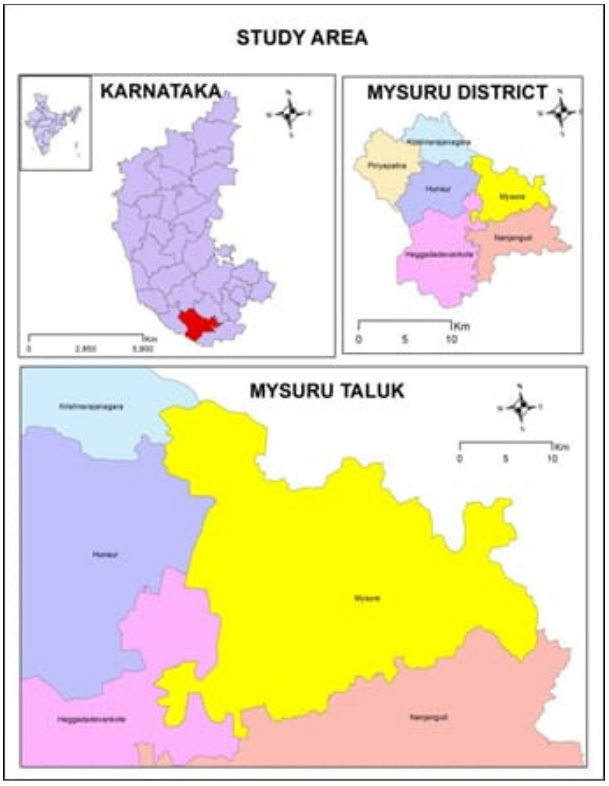
evergreen in nature. In Mysore Taluka the overall total population is about 1024410 in numbers and 1281768 in numbers similarly the total livestock population is about 158670 and 156759 in numbers according to 2001 and 2011census Agriculture is related to each other and aclimate change parameters influences the agricultural productivity. The effect of weather and climate on agriculture is related to variability in local weather and climates rather than global patterns. Weather and climate impacts agricultural sector in a following different ways such as

1. Precipitation drives the water availability and determines the sowing period of time.
2. Temperature influences crop growth and duration. It also influences milk production in animals and spawning in fish
3. Temperature and relative humidity influences pest and diseases attack on crops, livestock and poultry.
4. Photosynthesis productivity is influenced by solar radiation.
5. Extreme events like high rainfall, floods, heat waves, cold waves, cyclone, hail, frost etc cause the enormous losses of standing crops, livestock and fisheries.
6. Runoff shows that how much water is drained of from land to the streams.

II. MATERIALS AND METHOD.

Study area:

The study was conducted in Mysore taluk, one of the water resource dams called KRSdam. The map of Mysore taluka is given in fig. 1.



Objectives:

1. To assess the impact of water resources on productivity of forest and agriculture.
2. To study the LULC impact on Agriculture sector.
3. Analysis of agricultural scenario in Mysore taluk (using existing real time agriculture data).
4. Analysis of NDVI, NDMI and NDWI for the study area using Landsat-8 and Landsat-5 satellite data.
5. Mapping of watershed delineation for the study area using CARTOSAT DEM

III. RESULT AND DISCUSSION:

Based on the supervised classification the different LULC classes and their area details are shown the Table.1 and Fig.2&3 .The results indicated that the forest covers an area of about (%)forest and followed by Agriculture (%)and other classes are shown in the Table.1.

Table.1. Land use and Land cover different classification area details in Ha

Land cover features	Area in Ha 2000	Area in Ha 2016	Change detection
Water bodies	1756.8	1187.37	-569.43
Settlement	18568.8	26540.7	797.19
Agriculture	21992.0	23321.3	1329.3
open land	16246.2	12285.1	-3961.1
Forest	22529.4	17420.2	-5109.2
Total	**81093.2**	**81093.2**	**100**

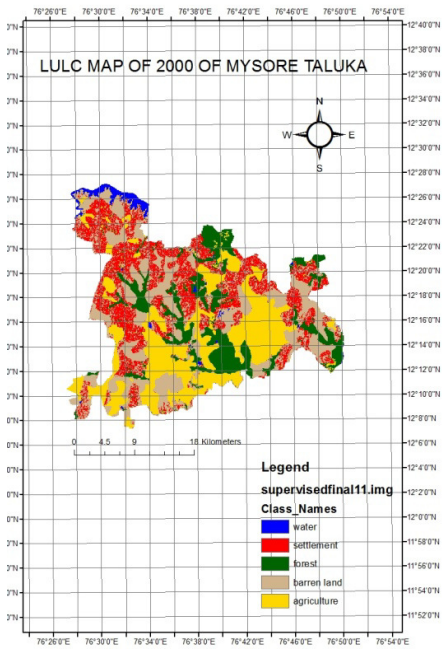


Fig.2 Land use and Land cover map of Mysore Taluka 2000

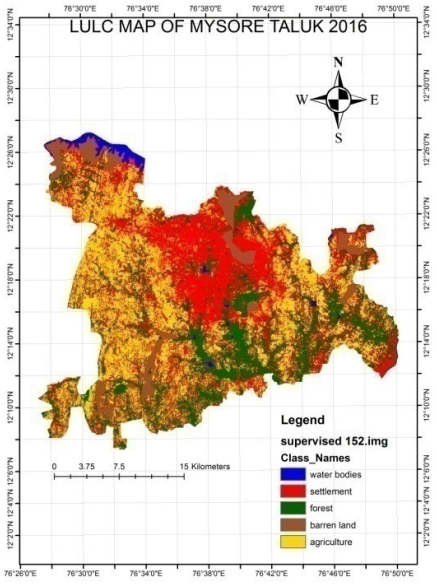


Fig.3 Land use and Land cover map of Mysore Taluka 2016

The NDWI map is shown in **Fig.4 and 5**. The results indicated that water content present in various land features as indicated by the NDWI which is varies from -0.532 to 0.426 in 2000 and -0.481 to 0.133 in 2016 because there is large variation in the water index due to the presence of moisture in the surface features .

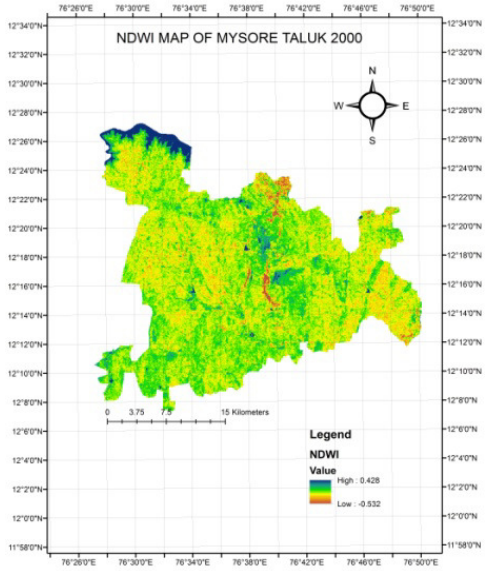


Fig.4 Normalised difference water Index map of Mysore Taluka 2000

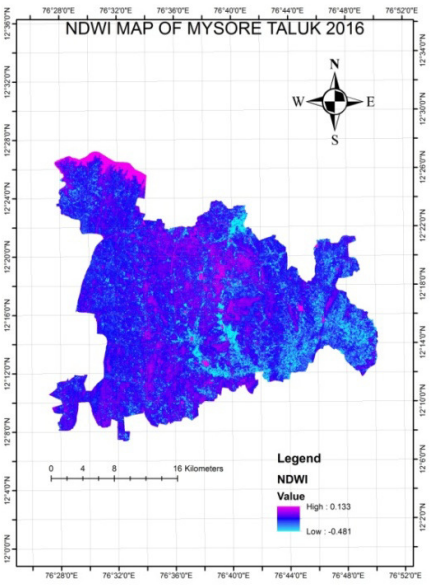


Fig.5 Normalised difference water Index map of Mysore Taluka 2016

The NDVI map is shown in **Fig.6 and 7** indicating the higher vegetation density with higher NDVI value is ranges from -0.342 to 0.589 for 2000 image and the NDVI valueranges from -0.077 to 0.535 in 2016 image due to increase in the urbanisation and other anthropogenic activities the forest area is degrading so the NDVI values are varies. When compared to the MODIS Data sets, the NDVI values ranges 0.446 to 0.443 in 2000 to 2016.

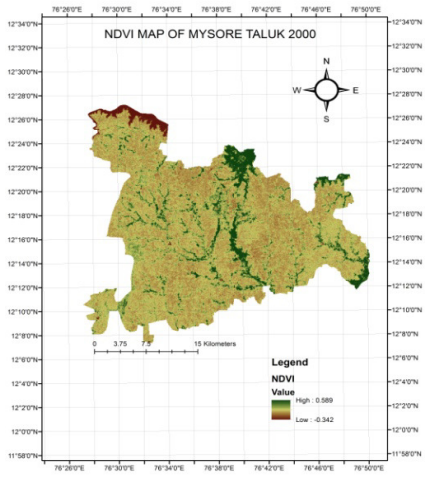


Fig.6 Normalised difference vegetation Index map of Mysore Taluka 2000

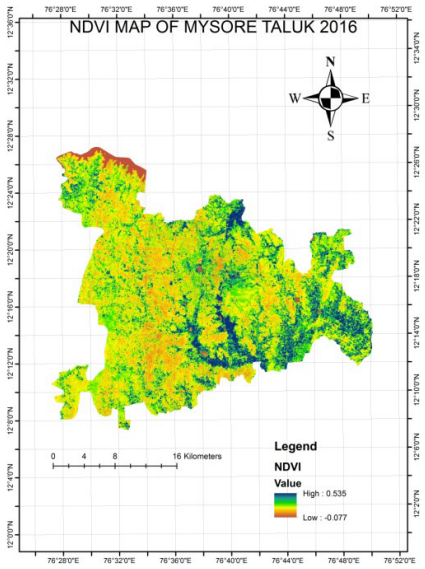


Fig.7 Normalised difference vegetation Index map of Mysore Taluka 2016

The NDMI map is shown in **Fig.8 and 9** indicating the higher vegetation density with higher NDMI value is ranges from -0.589 to 0.343 for 2000 image and the NDMI valueranges from -0.536 to 0.077 in 2016. When compared to the NCEP Reanalysis data sets the % soil moisture is differ from 0.21 in 2000 and 0.19 in 2016.However due to high temperature and loss of rainfall there is the loss of the surface moisture.

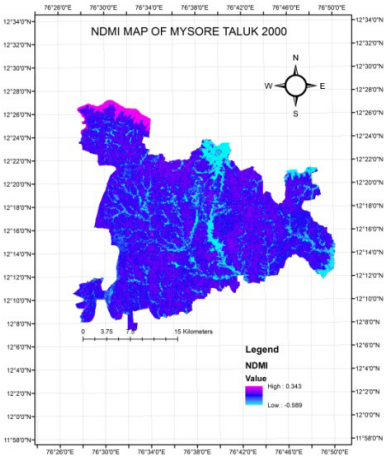


Fig.8 Normalised difference Moisture Index map of Mysore Taluka 2000

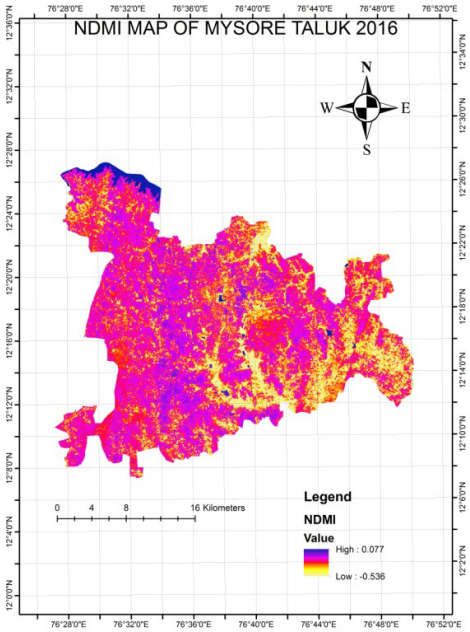


Fig.9 Normalised difference Moisture Index map of Mysore Taluka 2016

The watershed delineation and drainage map is shown in **Fig.10 and 11.**

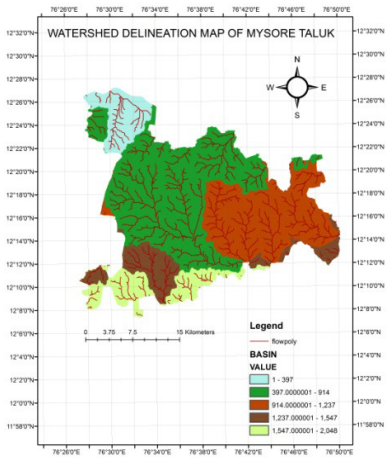


Fig.10 Watershed elevation map with drainage lines ofMysore Taluka

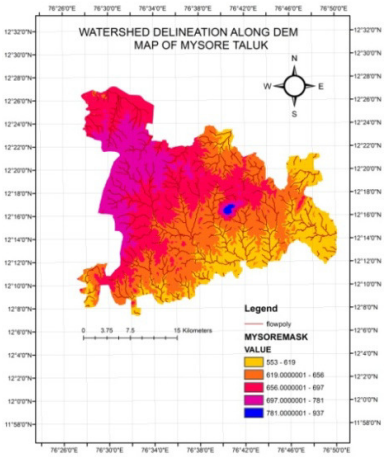


Fig.11 Watershed delineation along withDEM map of MysoreTaluka

Table.2. Statistics of annual weather and climatic parameters using Grads software's.

Statistics of annual weather and climatic parameters	2000	2016
Rainfall(mm)	81.77	32.2
Minimum temperature (°c)	22	21
Maximum temperature (°c)	29	32.2
Modis NDVI	0.446	0.443
Relative humidity (%)	70.96	68.31
Soil moisture (%)	0.21	0.19
Upward Solar radiation (w/m^2)	47.79	51.29
Downward solar radiation (w/m^2)	259.42	265.54
Water runoff(kg/m^2)	0.144	0.01

Table.3. Total area under Agriculture according to Mysore district statistics department

Total area under Agriculture according to statistics department	Area in Ha 2000	Area in Ha 2016
Cereals and minor millets	22459	11419
Pulses	18437	10400
Oil seeds	6313	930
Fruit crops	3426	1406
Vegetable crops	2546	1885
Sugarcane	1467	1831
Cotton	8783	2105
Sericulture Mulberry	881	235
Sericulture Cocoon production(Tonnes)	370	135
Poultry	1050000	1195000

Climate model prediction:

There are two important parameters considered in the GCM model that is temperature and rainfall. Henceforth, for the future agricultural analysis, the GCM Climate Model predicted scenarios are used, followed in the present study also. The projected parameters of rainfall and temperature are considered to study the future impacts on agriculture, due to climate changes.

C-MMACS by using GCM model, GCM is capturing the climatologically rainfall mean over India. Apart from that the spatial distribution of monsoon rainfall is simulated by GCM and compared with IMD observation. The monsoon rainfall data of global scale to regional scale downscaling techniques by using Grads Software.

Monsoon rainfall from June to September,(mm/day), over India based on 1951-2003 data, (a) Observed data, (b) Simulated by GCM, (c) bias (mm/day) between observation and prediction and (d) percentage change for the period 2020-2030 with respect to 1951-2003 is shown in Fig. 5.5 (a). The rainfall for Mysore taluk with Latitude and Longitude details is shown Fig. 5.5(b)

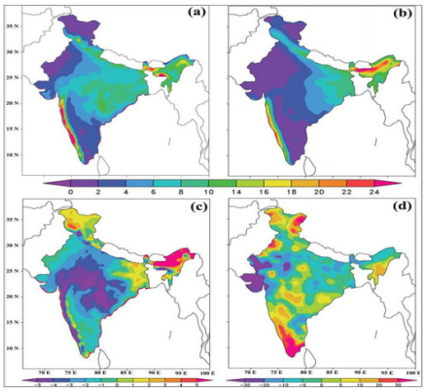
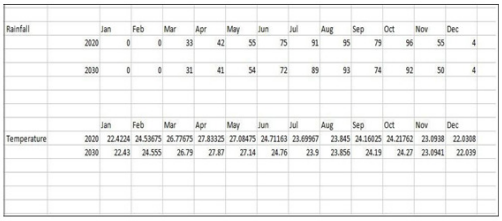


Fig.12The comparision of observation data in (a), simulated data (b), and biased data (c) and finally projected data for 2020 and 2030 (d)



Rainfall		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	2020	0	0	33	42	55	75	91	95	79	96	55	4
	2030	0	0	31	41	54	72	89	93	74	92	50	4

Temperature		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	2020	22.4224	24.53675	26.77675	27.83325	27.08475	24.71163	23.69967	23.845	24.16025	24.21762	23.0938	22.0308
	2030	22.43	24.555	26.79	27.87	27.14	24.76	23.9	23.856	24.19	24.27	23.0941	22.039

Fig.13The projected change in Rainfall and Temperature using C-MMAC GCM Model for the Mysore taluk

CONCLUSION

The study concluded that due to the anthropogenic activities the forest area are decreases and urban areas are increases. Due to change in the land use and land cover classification, the forest areas are decreases around 5109.2 ha and this is how the LULC impacts in the climate changes.

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