Influence of Land Use Land Cover Change on Regional Climate

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ABSTRACT *Present study focuses on the possible influences caused by land use/land cover (LULC) changes on regional climate. Our environment has experienced a continuous modification and changes due to human intervention. The ever increasing population, urbanization and industrialization have provided a greater pace to such modification. Their impact has also been felt on various spatial scales with a greater influence on local and regional levels. Temperature and precipitation being the essential components of climate are likely to get more affected due to environmental modification.*

***Key words*:** land cover change.

INTRODUCTION

Anthropogenic influence that can be easily marked on regional climate is through land use and land cover (LULC) change. Numerous studies are available documenting this impact through data interpretation or using various models (Chase et al. 2000, Kalnay and Cai 2003, Trenberth, 2004, Feddemaet al. 2005, Christy al. 2006, Nuñez et al. 2008). Therefore, it's undoubtedly that LULC has a significant impact on regional climate. However, its impact on global climate is not very obvious.The introduction of remote sensing and GIS in geographical studies has provided a greater assistance for such kind of analysis. Land use-land cover studies are multidisciplinary in nature and thus are being used in variety of studies ranging from wild life, conservation foundation to government, research and forestry department etc. In addition to these, they are also facilitating sustainable management of the land, land cover and land use information that can be utilized for planning purposes, monitoring and evaluation of development, industrial activity or reclamation etc. (Punia, et. al, 2010).However, in our country there appears to be a lack of comprehensive studies analyzing impact of land use land cover change on the surrounding climate.

Healthy environment to live has become an essential asset for the world which is influenced by variety of anthropogenic activities (Wenshi Lin, et. al., 2009). Natural resources, such as forest and water bodies; among other resources; are the worst affected features in the process of urbanization. The new infrastructure often develops over earlier existing forest land or water containing areas which are actually crucial to sustain biodiversity and are the important source of water recharge. In southern part of India there is a lack of perennial water resource and therefore most of the streams and ponds etc. are non- perennial in nature. They are totally dependent on rainfall which is highly unpredictable in our country. With this due to increase in urban population they are getting deteriorated day by day and many of them are diminishing. The growth in human population over the years has given negative impact on overall quality of

environment. Therefore, here an attempt has been made to analyze the impact of changes in land use land cover on local climate.

DATA BASE

Data for the study has been acquired from both primary and secondary sources. Primary data for ULLC has been collected from Survey of India Topographical sheet with a scale of 1:50000.For the region corresponding to the area of toposheet (row- 52, path- 143) satellite images (Landsat TM) have been downloaded for two different periods (2000 and 2010) from the website GLOVIS.Data regarding temperature and precipitation has been collected from the website http://indiawaterportal.org/met_data/for_the_period_of_30_years_(1981-_2000).For the period 2001 to 2010 temperature and precipitation data has been collected from the website Indiastats.com for the region.Data of LULC for different periods has been collected from Department of Economics & Statistics, Govt. of Tamil Nadu.

METHODOLOGY

With the help of ERDAS and ArcGIS techniques, supervised classification of the images has been done.Normals for temperature and precipitation have been calculated by averaging 30 year temperature and precipitation values.

Precipitation and temperature anomaly has been calculated for each of the stations.
(Anomaly = actual value- normal value)

Trend analysis has been done by using r^2 values. For graphical representation, simple line graphs and pie diagramhave been used.

AREA OF STUDY

Salem is an important district of Tamil Nadu which is the southernmost state of the Indian peninsula and one of the most developed states of our country. The maximum temperature is about 45°C in the summer and the minimum goes to about 10°C during the winter. Normal rainfall in the region is about 950mm.

Salem is an important industrial region of Tamil Nadu. The vegetation cover of the region, according to statistical records has remained quite poor. However, attempts have been made to increase the green cover of the city.Water is the most important resource for the livelihood of the human beings in every part of the world. However, Tamil Nadu is a water deficient state despite receiving approximately 950 mm of rainfall per year. Similar is the case with Salem.The district has a number of seasonal rivers and numerous big and small tanks which are the major source of water. As per the estimates, 60% of the ground water resources have also been utilized. So the management of available water resources on a sustainable basis becomes quite imperative. In this manner it becomes very important to analyze the availability of vegetation and water resources in the region for not only management purposes but also for its population.

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Location of Study Area

Fig. 1 Location ofSalem in Tamil Nadu, India.

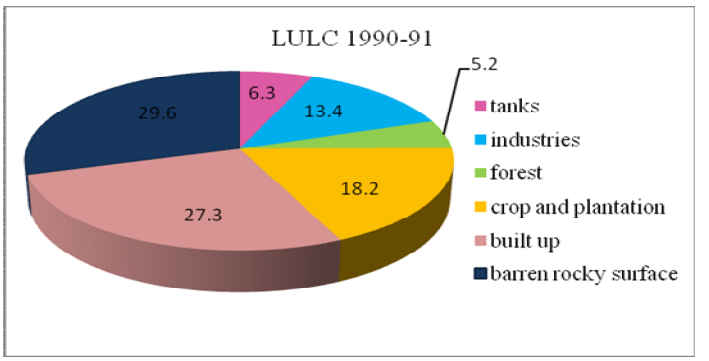
Source: google map.

The study area of Salem city is situated in Salem District of Tamilnadu, India. The town issurrounded by hills on all sides namely the Nagaramalai to the north, the Jarugumalai to the south, the Kanjamalai to the west, and the Godumalai to the east. It is divided by the river Thirumanimuthar in the main division. The fort area is the oldest part of the town. The study area covers the part of topographical sheet of Survey of India No.58 I/2 (1:50000,1972), 11° 45′to 11°30′ N and 78°0′ to 78° 15′ E. with an area of 91.34 sq.km. Mean elevation of the area is 278mt above Mean Sea Level. The soil types of the study area are red non- calcareous and red calcareous soils.

ANALYSIS

CHANGES IN LAND-USE AND LAND- COVER

Over the period of ten years there has been tremendous change in land use and land cover categories. These changes become more pronounce comparing the earlier land use land cover classification of the study area.



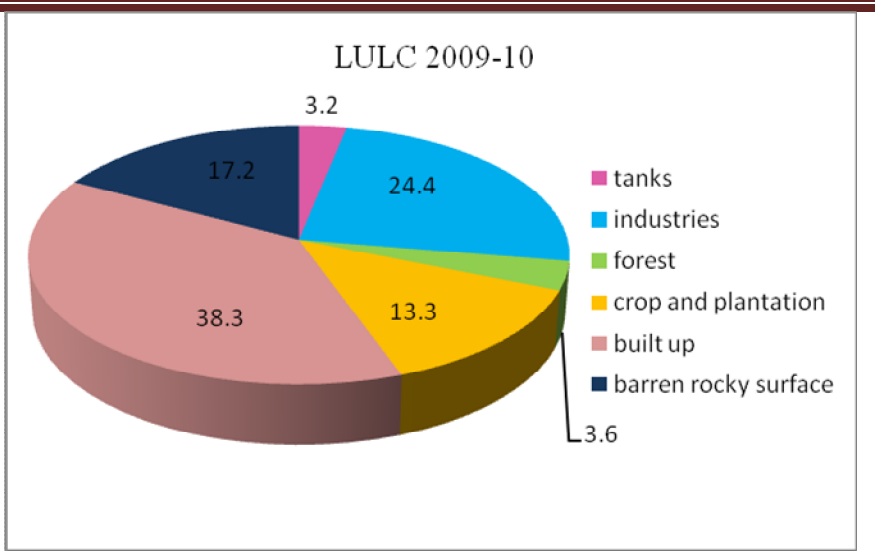


Fig 2. Changes in LULC between 1990-91 and 2009-2010

Source: Department of Economics & Statistics, Govt. of Tamil Nadu.

Table 1.Changes in Land Use Categories

Landuse Categories	1990	2010
Tanks	6.3	3.2
Industries	13.4	24.4
Forest	5.2	3.6
Crop and plantation	18.2	13.3
Built up	27.3	38.3
Barren rocky surface	29.6	17.2

By analyzing the chart and tableit has been observed that over the period of 1985-86 to 2000, the number of tanks that are very crucial source of water in the region has declined. However, there has been a slight increase in their proportion by proper management.There has occurred a very significant increase in the proportion area of industries.The area of forest, which was below than required amount even before, has continued to decline.The area of crop and plantation has also decreased but this decline is not much significant.The built up area has increased very significantly. And it appears that the barren land has been continuously replaced by settlements and industrial buildings.

TEMPERATURE

MAXIMUM TEMPERATURE

Over the period of thirty years maximum temperature has increased significantly.This increase in more pronounced 1993 onwards where it has mostly remained above normal, which can be attributed to change in land use and land cover classification as the concrete structures contribute to the rise in temperature.The decreasing vegetation cover and increasing built up

area keeps the city region warmer than its surrounding areas. Such phenomenon is known as Heat Island which is common to the urban locations.

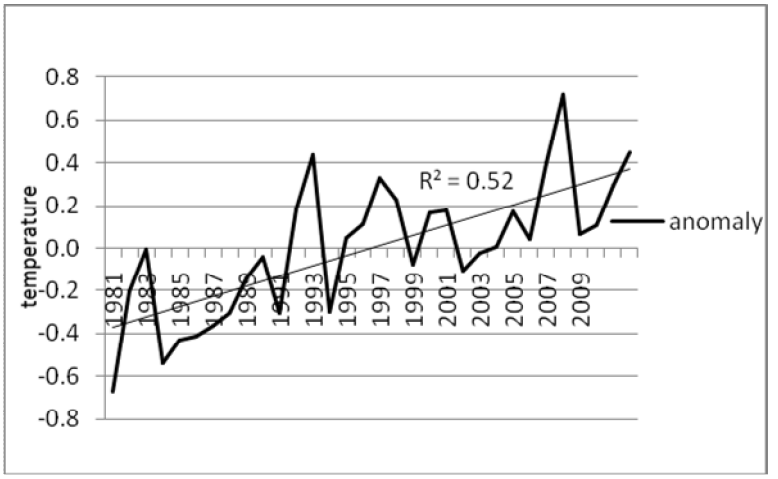


Fig 3.Variability in Maximum Temperature.

MINIMUM TEMPERATURE

Similar to maximum temperature, minimum temperature has also increased and 2001 onwards it has mostly remained above normal.The r squire value shows that the increase is quite significant.Most of the study shows that rise in minimum temperature is more as compared to maximum temperature, as the concrete structures generates heating impact and do not let the temperature in night to fall significantly.

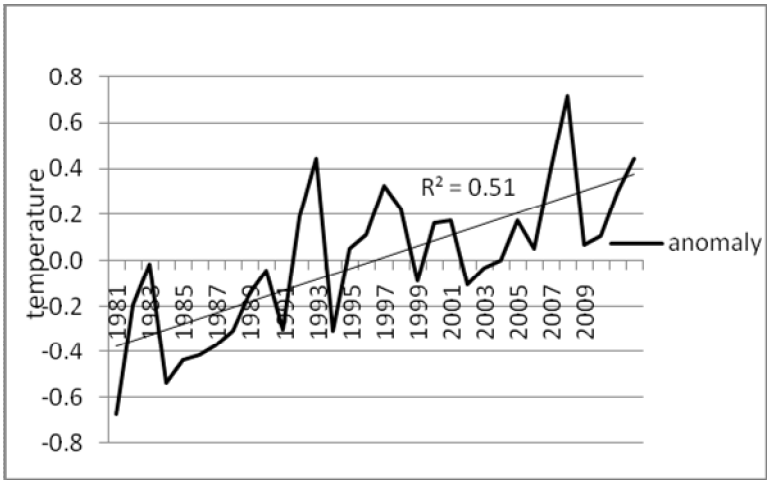


Fig 4.Variability in minimum temperature.

PRECIPITATION

Contrary to the findings in different literaturein Salem, precipitation has also increased with increasing temperature. However,the increase is lower than temperature.As the vegetation cover in the area has continued to decline, the outcomes can be negative in terms of amount of precipitation in future.

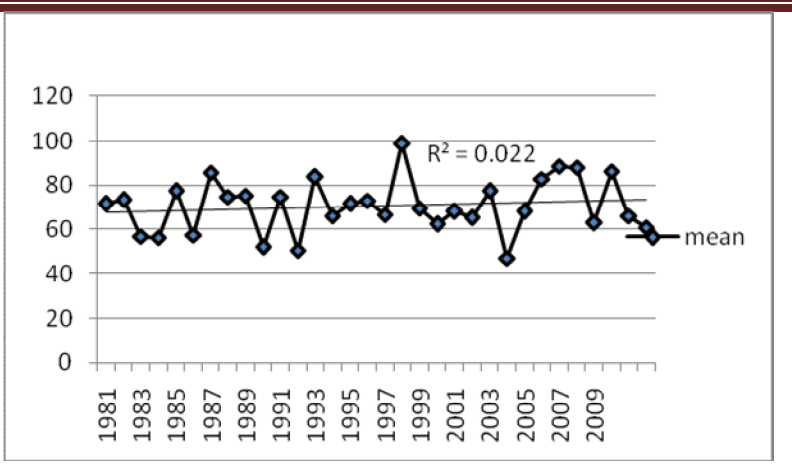


Fig 5. Variability in Precipitation

VARIABILITY IN MONTHLY PRECIPITATION

Variability in monthly precipitation has been studied for the decade 2001-11.The table 2 is showing higher consistency of rainfall for the months of January and February as the value of Sd is quite low while CV is quite high.

Table 2.SD and CV of Precipitation for different Months.

Months	SD	CV	Months	SD	CV
Jan	1.9	106.8	**July**	28.1	32.7
Feb	3.9	160.4	**Aug**	68.7	41.8
March	32.9	136.3	**Sept**	36.2	26.5
April	45.8	72.5	**Oct**	61.2	35.3
May	99.6	83.4	**Nov**	93.7	52.4
June	30.7	57.2	**Dec**	49.7	96.9

CONCLUSION

The study shows that there mayexist a significant relationship between change in LULC categories and variability in weather parameters, basically temperature and precipitation in the area of study. As we know that Salemis surrounded by hilly areas, it is usual that precipitation will be less. But still the influence of land use land cover on local climate cannot be denied. Rapid urbanization and industrialization in Salem city and its surrounding area has affected the local environment. The temperature, both maximum and minimum has continued to increase due to these changes. The precipitation has also increased over the period of analysis. But this precipitation is not very effective as most of its proportion drains out as overland flow which affects the ground recharge capacity. In this way, tanks play vary crucial role not only as a source of water and irrigation but also for ground water recharge. As it has come out in the study that their proportion area has increased slightly, is a good sign. Contrary to this, the status of forest is still poor and their area has continued to decline. Therefore, some measures should be adopted in order to maintain sustainable development in Salem.

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No one is so poor as an ignorant person.
~ Hebrew Proverb