

Name: Dipanwita Dutta

Department: Geography, Faculty of Natural Science

Supervisors Name: Prof. Atiqur Rahman, Jamia Millia Islamia

Dr. Saikat Kumar Paul, IIT-KGP (Co-supervisor)

Ph. D. topic: Monitoring and Modelling Urban Growth in Delhi and its Peri-Urban Areas using Multi Temporal Satellite Datasets

Abstract

The study deals with the spatio-temporal pattern of change in and around Delhi NCT and assessing the degree of change happened in the area through satellite based remote sensing technique. In order to assess the trend of urban green space and identify the spatio-temporal variation in trend, pixel wise trend was estimated. Here, long term SPOT VGT NDVI was used for estimating the green rate change. To identify the role of anthropogenic factor in changing scenario of green cover, the long term spatial pattern of rainfall was monitored and areas with anthropogenic and climate induced greening or degreening was estimated. Lastly, the fractional abundance of the impervious and vegetated surface, LST, built-up density, urban expansion and population density were compared through population growth, economic indicators like GSDP (gross state domestic product), per capita income, and growth in transportation sector as well as changing pattern of crop coverage correlation analysis. Finally, the interrelationship between urban impervious area and land surface temperature was assessed to monitor the impact of urban growth on micro-climate.

The spatio-temporal pattern of built-up area reveals that built-up area under NCT has been expanded towards its outskirts. Significant growth was observed in the built-up areas of different peri-urban centers like Gurgaon, Noida, Ghaziabad. Also, the classified map of 2014 reveals the emergence of numerous patches of built-up area in the peri-urban zone. This

prove the first hypothesis that there is significant change in the land use and land cover of Delhi NCT and its peri-urban areas due to urban growth during 1977 to 2014. The area under built-up class has undergone massive expansion by the conversion of surrounding agricultural, wasteland and vegetated lands. Built-up areas of peri-urban centres experienced large scale expansion mainly during the period, 2003-2014 through the conversion of agricultural and sparsely vegetated land.

The spatial pattern of correlation coefficient (r) between rainfall and NDVI shows a range between strong negative ($- 0.83$) to strong positive ($+ 0.91$) over the area. Strong negative correlation as found in Gautam Buddha Nagar district indicates inverse relationship between NDVI and rainfall which means, rainfall is not the sole controlling factor of vegetation in this area. The study reveals that negative NDVI trend in most of the areas resulted from anthropogenic effects i.e. conversion of agricultural and vegetated land into built-up surface.

The spatio-temporal pattern of impervious land was found coherent with the land surface temperature and NDVI. The correlation of impervious surface (r) with NDVI and LST were found 0.96 and 0.81 respectively. Strong positive correlations found between ISF-built-up density ($r = 0.94$), and ISF-population density ($r = 0.86$) certainly proves the potentiality of linear spectral unmixing technique for identifying and mapping urban growth. Therefore, the fifth hypothesis of the study proved that there is a strong relationship among growth of impervious surface, LST and vegetation cover. Thus, keeping in view the last hypothesis of the study, it can be safely said that with the increasing population be it natural or migration leads to urban growth which in turn leads to increase impervious surface and that have negative impact on micro-climate.