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## URBAN DEVELOPMENT AND ITS IMPACT ON THE VEGETATION OF LAHORE

### Doctoral Dissertation Abstract (2011)

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At present, out of the world's total population of 6.8 billion, one half (3.4 billion people) lives in urban centres or in cities. Therefore, present century is truly called the *Urban Century*. In comparison to the world scenario, Asia is having about 42 per cent of its total population living in defined urban territories. The situation in Pakistan is also alarming with more than 35 per cent of its population living in cities and towns. The urban population of Lahore is 82 per cent of its 8.4 million people as projected through recent estimates.

Lahore-the study area- is the capital of Punjab and in terms of population size it is the second largest city of Pakistan. It has a westerly location in the sub-continent and has an inland location in the Indus plain far away from the Arabian Sea. It situates on a widely-terraced alluvial plain to the left bank of river Ravi. The ground elevation ranges from 150 to 200 metre above mean sea level. Lahore extends from 31° 15' and 31° 43' North latitude and 74° 10' and 74° 39' East longitude and covers an area of 1,772 sq. Km.

Today, the urban development is

considered to be the potent and most widespread anthropogenic causes of the loss of arable land and decline in the vegetation cover. In Pakistan, as well as in Lahore, unprecedented population growth, coupled with unplanned developmental activities, have led to urbanization and urban development, which has engulfed vegetation cover from the open green lands of the city with serious implications on the environment. It necessitates sustainable management of the urban development, land use and urban population growth, taking the help of efficient monitoring tools. Hence, credible and complete information is the foremost necessity to quantify the assessment of the current situation and to predict future trends within the city of Lahore. Since the spatio-temporal distribution of vegetation and change is an important component of any urban setting while, greenery and vegetative cover is one of the important parameter of a city's environment hence, makes it an area of prime research. Increase in population and areal expansion of the city pose serious threats to the city environment, therefore, urban development from 1973-2009

as well as the changes and trends in vegetation cover at micro level in the Union Councils in Lahore was the major objective of this dissertation.

The raster data used in this study have been collected from; GLFC (USA), ancillary data and statistics published by the government organizations like Lahore Development Authority (LDA), City District Government of Lahore (CDGL), Punjab Horticulture Authority (PHA), Board of Revenue-Punjab, Botany Department of Punjab University Lahore, analog maps like topographical maps (1:50,000) published by SOP, the Lahore guide map(1994-95 published in 2000), Lahore land use maps i.e.; 1974, 1980-1987,2004 and projected land use maps of 2021 prepared by Lahore Development Authority(LDA), Master Plan for Lahore 2010-2025, demographic data from Census Organization of Pakistan and meteorological data from Pakistan Meteorological Department. In addition to this data, information was also collected from other sources like; reports published by the governmental and non-governmental organizations and primary data acquired through extensive field surveys. Finally essential components of both types of data were digitalized, wherever deemed necessary. The Union Council scale is taken as the basic analytical unit for evaluation of vegetation cover, built-up area, open area, population density, and land values (residential / commercial).

Since, vegetation of a city has an esthetic, economic, and hygienic values, therefore, without understanding the spatio-temporal context of this issue, it is not possible to find a viable solution to this problem. Thus, this study is an attempt to evaluate the loss of vegetation due to urban development in the City of Lahore with the help of satellite imageries (1973-2009). This has been achieved

by applying methods of spatial as well temporal analysis and the household survey. It provides a scientific and feasible solution for the urban planning and management of the problem of rapid vegetation loss by using the state-of-the-art modern tools and techniques like Remote Sensing and GIS. Spatio-temporal results as documented with satellite data further correlated with the perception survey of the experts and common people. Not only net physical change in vegetation has been monitored on satellite data but it was synchronized with public perception as well as that of experts in the disciplines related to the study of Urban Ecology.

Majority of people agreed that due to urban development, Lahore has lost its vegetative cover, be indigenous trees or spontaneous vegetation and a significant majority of the citizens of Lahore felt this change in green cover and has serious reservations about this environmental change. The study is first of its kind in Pakistan since it has tackled the largest time series (1973-2009) SRS data. The spatio-temporal analysis for vegetation vs. built up and open areas with the help of R.S and GIS has never been done before and with such intervals like 1973-1992(20 years), 1992-2001(10 years), 2001-2009(9 years) and 1973-2009 (37 years) as a whole. The study reveals that Lahore has recorded loss of vegetation in all of its constituent Union Councils (UCs) with varying magnitude. Though, the damage is catastrophic in many UCs but on the contrary the vegetation is well maintained in few UCs, for example, Model Town. Cartographic analysis reveals astonishing results which ultimately pinpoints the cluster of UCs devoid of vegetative cover particularly located in UCs of *Androon* Lahore. It must be pointed out that the change in vegetative cover viz; a viz; built-up area and open areas have never been measured before at

such a micro level administrative unit like, Union Council. In addition, the spatial distribution of NDVI (Normalized Distribution Vegetation Index) of Lahore has also been extracted from four satellite images of 1973, 1992, 2001 and 2009 which support findings of this research. It is evident that the NDVI or greenness is more in 1973 image as compared to other three. The images of 2009 depicts the least value of this measure, proving the fact that Lahore has actually lost its vegetation during the period under study, that is, 1973 to 2009. The vegetative cover from 1972-2009, therefore, shows a decreasing trend in all the UCs of Lahore. In general, NDVI in whole of the City and all its sub units / UCs has shown decreasing trends. Consequently, the remote sensing and the GIS techniques were found very efficient and effective for studying the urban development, growth patterns and consequent vegetation loss in the city. The outcome of this study is not only limited to an overall change in Lahore's vegetation but rather

the patterns of change and its linkages with the urbanization/urban development behaviour as well.

Precise, reliable, and meaningful results of this study leading to analyses and, consequent synthesis of the spatio-temporal profile of the urban vegetation cover of a metropolis, like Lahore, can help decision-makers and the urban planners to achieve their goals successfully. The outcome of this research shall play an important role in efficient urban planning, environmental protection, and making sustainable development policy. It shall, also, be helpful to identify the future growth corridors for the urban development in Lahore and shall suggest to the planners, the means to preserve vegetation in new areas when the future development operations are launched. Furthermore, studies like this may be helpful for other Third World Cities to adopt this strategy to monitor and control vegetative cover.