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A STUDY ON THE CHANGING URBAN ENVIRONMENT OF ADDIS ABABA CITY, ETHIOPIA, THROUGH REMOTE SENSING AND GIS

Doctoral Dissertation Abstract (2011)

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The present study is an attempt to understand the environmental changes that occurred due to spatial variations in land use/ land cover due to urbanization in Addis Ababa city, Ethiopia. The study examined the changing trends of climate and its implications in relation to urban activities. Further, an attempt has also been made to assess the agricultural patterns of the region as per the climatic conditions. Remote Sensing, Geographic Information Systems (GIS) and water balance techniques are the principal tools used in the present study. The thesis comprises six chapters.

The main objective of the study was to investigate the trends in urban sprawl and to infer land use/ land cover changes and environment impacts in Addis Ababa city.

Addis Ababa is the capital city of Ethiopia in East Africa and it is the only million plus city in the country which is undergoing the process of urban expansion, changes in natural landscape as a result of the twin processes namely urbanization and industrialization.

Addis Ababa is an elevated city (2440 m) in the world and is located in the central highlands of Ethiopia. Geographically, the city is located at 9° 03' N Latitude and 38° 43' E Longitude. According to Central Statistical Agency Report (1998) the city covers a total area of 540 Km² and divided into 10 Sub-Cities (Kifle-Ketemas) and 99 *kebelles* for the administration purpose. According to 2007 census the population of the city is 3 million.

The present study demonstrated the efficiency of remote sensing and GIS as a tools in the study of land use / land cover changes. Both visual and digital techniques were used to extract land use/ land cover characteristics and the temporal variations. Five land use / land cover categories were delineated using digital classification techniques. Interpretation of multi-date satellite images has revealed the temporal variations in terms of land use / land cover characteristics of the city. From the quantitative assessment of land use /land cover change analysis, it is clear that built-up area has increased from 25.2 km² in 1973 to 209.8 km²

by 2007 with an increase of eight times in 34 years. It is found that the city has expanded at an average rate of about five square kilometers per annum. In contrast, the extent of vegetation cover decreased by 72.2 per cent and water bodies by 25.4 per cent when compared to 1973.

The urban sprawl of Addis Ababa city was studied in terms of qualitative and quantitative parameters. Factors responsible for the expansion of the city include annexation of adjacent rural areas into the city and influx of population in search of employment.

The urban sprawl of Addis Ababa reveals that the city's expansion is not uniform in all the directions due to physiographic conditions. The city is expanding towards southern and eastern plains. However, the growth of the city is restricted towards hilly north and to some extent towards west. The study exhibits ribbon sprawl conditions as the expansion of the city is along the highways which are radiating outward from the city.

The analysis of temperature distribution during the period 1970-2008 shows the changing trends in the temperature. The temperature analysis indicated that the mean temperature at Addis Ababa city has increased by 2.4°C at the city centre and 1.9°C in the periphery. Analysis of day and night time

temperatures revealed the city centre is warmer than the periphery during day time and in contrast the periphery is warmer than the city during night time.

The analysis of annual rainfall of Addis Ababa indicted an increasing trend in rainfall. However, the increasing pattern is not uniform throughout the city. Annual, seasonal and decadal analyses of rainfall indicated that there was an increase in rainfall in the city centre and decrease in the peripheral regions.

Based on the Thornthwaite and Mather (1955) thermal regime classification, Addis Ababa comes under meso thermal (B'2) type of climate with enormous thermal potential without any seasonal variation. On the other hand, under moisture regime conditions, Addis Ababa is experiencing humid climate with little water deficiency conditions. This type of climate can support forest type of vegetation.

The study revealed that on average Addis Ababa has experienced 19 droughts in 39 years. The dominant drought type in Addis Ababa is 'large' followed by the 'moderate' type. The overall drought proneness of Addis Abba is 48.7 per cent.

The moisture adequacy analysis showed that the city and its environs are suitable for supporting crops and vegetable farming.