

CS-80

ANALYSIS OF URBANISATION AND ENVIRONMENT CHANGE IN COLOMBO,
SRI LANKA, USING REMOTE SENSING DATA.

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1.0 INTRODUCTION

Due to the tremendous impact that cities have on the natural environment, in recent times there has been an increasing interest in the relationship between cities and their natural environment. Rapid urbanisation that has taken place in many Asian Cities has resulted in the degradation of the natural environment within the city and its environs and it has become important to be able to estimate the change in the natural environment due to urbanisation.

The objective of this study is to estimate the change in the natural environment due to urbanisation using remote sensing data. A case study of the City of Colombo, in Sri Lanka is used.

With the major development projects commenced after 1977 and the establishment of the Industrial Processing Zones, north of the Colombo City, changes in the natural environment in the Colombo Metropolitan Region is expected.

2.0 REMOTE SENSING DATA APPLIED TO
ESTIMATE URBANISATION AND ENVIRONMENT
CHANGE.2.1 REMOTE SENSING DATA APPLIED TO
ESTIMATE CHANGES IN URBANISATION

Digital data from a Landsat TM scene acquired on the 12th of February 1993 was used in this study.

The index UI, was computed as shown below by using digital reflectance values of Landsat TM band 7 (B7) and band 4 (B4).

$$UI = \left(\frac{B7 - B4}{B7 + B4} + 1.0 \right) \times 100 \quad \text{---(1)}$$

The distribution of UI values, calculated as shown in equation (1), for Colombo City and its environs is seen in photograph No: 1.

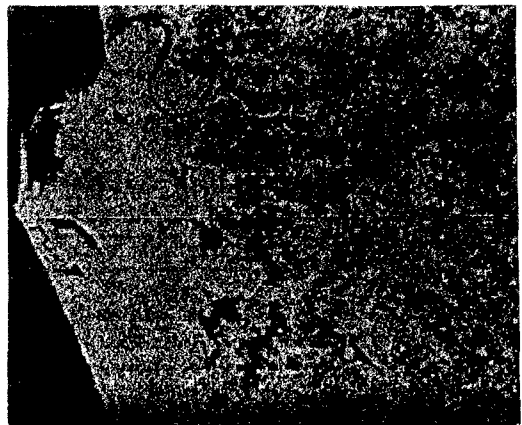


PHOTO: 1 DISTRIBUTION OF UI

From the above it could be seen that UI value is high in the old city area. This shows that UI is high where building density is high. Thus UI represents the density of the built-up area.

Data of building density was obtained from a 1:12672 (16 chains to one inch) map of Colombo City and Environs of 1970. This map was scanned in grey scale and Urban Density (UD) values were computed. UD represents the percentage of building cover within a raster grid cell of 650m x 650m. The average UI values in the corresponding raster grid cells were computed. Then using UD values from the areas in which building cover has not changed much during the past two decades, the relation between UI and UD was established as written below and is shown in Fig:1.

$$UI = (0.47 \times UD) + 49.2 \quad \text{---(2)}$$

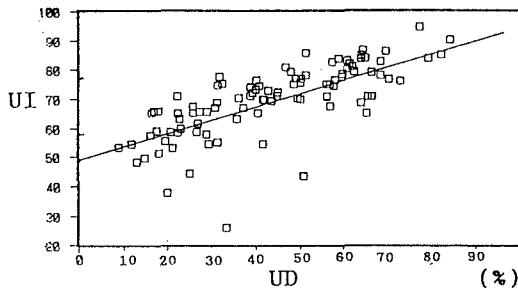


FIG:1 RELATION BETWEEN UI AND UD

2.2 REMOTE SENSING DATA APPLIED TO ESTIMATE CHANGES IN THE NATURAL ENVIRONMENT.

NVI was used to estimate the change in the natural environment. NVI was defined as shown below using Landsat TM band 4 (B4) and band 3 (B3).

$$NVI = \left(\frac{B4 - B3}{B4 + B3} + 1.0 \right) \times 100 \quad --(3)$$

The relation between UI and the corresponding NVI values was established as written in equation 4 below and is shown in Fig:2.

$$UI = (-0.94 \times NVI) + 178.3 \quad --(4)$$

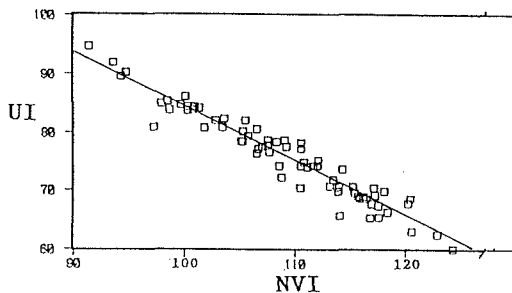


FIG:2 RELATION BETWEEN UI AND NVI.

3.0 ESTIMATING THE CHANGE IN URBANISATION AND THE NATURAL ENVIRONMENT DURING THE PAST TWO DECADES.

3.1 CHANGES IN URBANISATION.

The relation between UI and UD given in equation 2 and shown in Fig:1 was used to estimate the UI values of 1970. The corresponding UI values for 1993 was computed from Landsat TM data. The UI values of the two periods were

compared and the change was estimated. This change is shown in Fig:3.

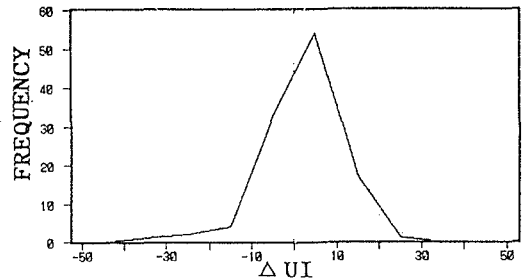


FIG:3 ΔUI

This shows that more than half of the UI increase is from 5 to 15 corresponding to an increase in Urban Density from 10% to 30%.

3.2 CHANGE IN THE NATURAL ENVIRONMENT.

The estimated UI values for 1970 were used in the relation between UI and NVI given in equation 4 and shown in Fig:2 to estimate NVI values for 1970. Then the change of both UI and NVI for each area represented by each cell in the raster grid is known. The vectors in Fig:4 below show this change for some of the areas.

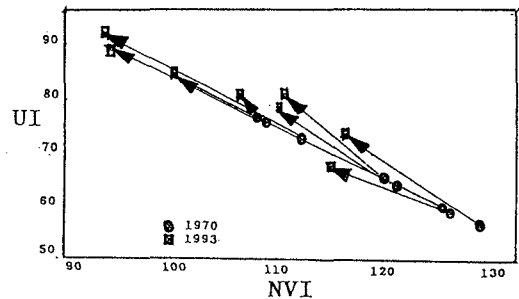


FIG: 4 NVI-UI

The decrease of vegetation in the developed areas could be recognised from this figure. The average NVI value decreased by 5%.

4.0 CONCLUSION

From this study it could be concluded that remote sensing data could be used to estimate changes in urbanisation and the change in the natural environment associated with it.