



# ANALYSIS OF URBAN GROWTH USING REMOTE SENSING AND GIS : A CASE STUDY OF KOLKATA-HOWRAH REGION

**Basudeb Bhatta**

Computer Aided Design Centre, Dept. of Comp. Sc. & Engg.  
Jadavpur University, Kolkata - 700 032, E-mail : basu\_bhatta@rediffmail.com

Urban spread is the expanding area of development for urban uses which can be mapped, measured and modeled using remote sensing and geographic information system (GIS) techniques. In this study three temporal satellite images of 15 years interval (1975, 1990 and 2005) have been analyzed to determine the urban extent and growth of Kolkata-Howrah in eight different pie-sectional directions within a circular region. It has been found that the urban growth during 1975-90 was 4.96% per year, which potentially decreased during 1990-2005 as 1.62% per year. However, the urban growth rate never found prototype in all directions. Though this finding shows declining built-up growth rate, but not necessarily it directs compact development in the city, rather, the study clearly indicate more dispersed urban growth with time. 'Weights of evidence' statistical method is employed to calculate the transition probabilities for each direction individually. Then Pearson's chi-square test is applied to calculate the 'degree of freedom' for urban growth in each individual direction and for each temporal instant. The analysis clearly shows that the degree of freedom is low (i.e., similarity in observed and expected values) for North, South, and East; whereas it is very high (i.e., dissimilarity in observed and expected values) for South-East, South-West, and North-East. The analysis also shows a freedom of 12.48 for the time span 1975-90, and 21.91 for 1990-2005. The overall degree of freedom was calculated as 34.40. This higher overall freedom indicates lack of equal weightage and lack of consistency in planning with the entire city in consideration. Higher degree of freedom for a particular zone (direction) is an indication of unstable development within the zone with the change of time. And higher degree of freedom for a temporal period can be considered as higher inter-zone variability in urban growth. This may be considered as an indication of urban sprawl. To check the hypothesis of sprawl considering degree of freedom, the Shannon's entropy method was applied to determine the urban sprawl for each temporal instant. This clearly shows that the city is becoming more dispersed with the declining rate of built-up growth. This finding supports the hypothesis derived from the analysis of freedom to detect the urban sprawl. Apart from the derived results, this study also shows the potentials of remote sensing and GIS techniques in spatio-temporal analysis and effectiveness of demonstrated neoclassical statistical models to study urban growth.