

## Analysis of Urban Growth Pattern in Tehran City by Landscape Ecology Approach

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### Extended abstract

#### Introduction

Developed world and developing countries are different in urbanization process and the proportion of people living in cities. But population growth rate is a global trend. Diagnosis and understanding the changing urban growth pattern is very critical and necessary. Results of different studies show that spatial temporal metrics are useful method for description, quantification and understanding of the spatial patterns of urban growth and association of the spatial patterns with population growth and socio-economic processes. On this basis, the main purpose of the current study is to determine the spatial-temporal growth of Tehran megapolis between 1973-2014, using Landsat images and spatial metrics.

#### Methodology

Urban growth maps were extracted for different time periods using landsat satellite images (TM, +ETM, OLI). To extract urban areas from the satellite images, we used object oriented classification and visual image interpretation method. Spatial-temporal analysis of urban growth patterns in Tehran megapolis was performed for 41 years (1973-2014) using spatial metrics. The metrics were selected on the basis of literature review (Dietza et al., 2005; Augilera, 2011; Jain et al., 2011; Herold et al., 2003; Herold et al., 2005; Seifolddini and Mansourian, 2014) and calculated using "Fragstats" software. The metrics describe four dimensions: absolute size, relative size, complexity of urban form and spatial distribution of patches.

#### Results and Discussion

Tehran urban land areas have constantly been increasing from 1973 to 2014. The growth was fast in 1973-1985. But it was faster in 1985-2000. This shows very rapid urban growth of urban

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land area in this time period. After 2000, urban growth curve shows less steep grade and gradually has turned into almost flat shape. It shows the stable urban growth rate. But population increase continues to grow. Urban population growth, despite relative saturation show vertical urban growth instead of horizontal growth.

Diagram showing the percentage of urban patches, for the years 1973-2014, is an ascending curve. The diagrams showing the mean patch size and largest urban patch for the years 1973-2014, is a U shaped curve. The diagrams showing the urban patch density, the number of urban patches and shape of the landscape for the years 1973-2014, are also U shaped curve.

### Conclusion

The spatial- temporal analysis of the metrics in Tehran megapole proved a number of the deductive generalizations. First, urban growth in Tehran can be divided in three time periods. The first period was 1970s. Urban physical expansion was rapid, but urban growth rate was consistent. Most important reasons for urban growth are industrial investment, concentration of political and economic activities in Tehran and also rural-urban migration. Second period, 1973-2000, represented very rapid urban growth in Tehran. The important reasons are Islamic Revolution, lack of implementation and supervision of the master plan. In the third period, 2000-2014, urban growth rate declined and then reached relatively stable condition. The reasons are socio-economic and environmental problems of Tehran city. Formulation and approval of the various plans were to control Tehran physical growth and transfer the growth to surrounding areas of Tehran.

The second point is that Tehran urban growth pattern shows the process of urban growth in three stages: 1. development of city core, 2. dispersion and 3. coalescence. Results of these spatial metric indicated this process. For example, numbers of patches show its increasing value until 2000 and then a stable trend. It is expected that with more infill development and attachment of individual patches to each other for more convergence and coalescence of patches. The value of AWMPFD shows that the forms of patches have been more irregular until 2000. Since 2000, with attachment of the patches, more regularity is observed.

The third point is the approval of tidal wave urban growth pattern for Tehran city. With the decrease of urban growth in one zone in a concentric pattern, the tidal wave pattern of urban growth was observed in the next zone. The high peak of urban growth moves like a wave to outer zones.

The urban growth pattern in different zones follows the same pattern happening for the whole city, i.e., formation of city core, dispersion and coalescence. The values extracted for the following metrics including number of patches, fractural dimension, mean size, contiguity and mean geometric distance to nearest neighbor shows that in each zone, the same pattern is happening in different time periods. For example, AWMPFD shows an increasing trend and increasing and then decreasing trend in all zones over time. This shows dispersion of individual patches, expansion of central core and then coalescence of patches over time.

Comparison of the results of this study with other studies (Li et al., 2006; Zhang et al., 2001; Yu et al., 2007; Yu et al., 2006; Yang et al., 2003; Xu et al., 2007; Luck et al., 2002; Ji et al., 2006; Aguilera 2011; Seifolddini and Mansourian, 2014) indicates that urban growth process in majority of cities follows the tidal wave pattern, but this process is also affected by social, topography, transportation network, socio-economic condition, and creates different pattern in different countries. For example, in case of Tehran city, existence of the mountains in the northern part of Tehran prevents growth in that area. Understanding the patterns and processes of urban growth can provide better understanding of urban growth. Quantifying urban growth by using spatial metrics can be used as an important instrument.

**Keywords:** landscape ecology, remote sensing, spatial metrics, Tehran Metropolitan, Urban growth.

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