Comparative study of structural changes of landscape based on urban development patterns in Tabriz metropolis, Urmia and Maragheh

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Introduction

City is considered as a dynamic phenomenon that is transforming and changing over time. The set of human elements and artificial factors are effective in creating this dynamism and transformation (Roshani et al., 2016: 32). In fact, urban landscapes are a combination of natural and human components. The expansion of cities has occurred with unprecedented growth throughout the world in the last few decades. The main concern of this rapid development is its profound impacts on urban ecosystems and biodiversity due to fragmentation.

This issue has increased interest among ecological researchers to examine the structure of urban landscapes and environmental outcomes and, consequently, the physical development of cities (Fan et al., 2017). Understanding the landscape pattern, changes and interactions between human activities and natural phenomena is essential for land management and decision- making (Kammer et al., 2015). It should be noted that traditional methods such as mapping to examine changes in land uses are time-consuming and costly and require special skills (Nazarnejad et al., 2018: 24). In this regard, the emergence of remote sensing techniques and GIS has enabled researchers, planners and city managers to have a comprehensive view of land and land use change over time at a lower cost (Aryana et al., 2010).

Data and Method

Nowadays, the concept of cities is unperceivable without considering growth in various forms. In fact, urban life and its physical and natural impacts are considered as one of the important topics in planning and macro management. In the present study, Landsat satellite images with a resolution of 30 meters, TM and OLI sensors were used for the years 1984, 2000, 2018 and 2019. After pre-processing and processing, the images were classified in eCognition software using the nearest neighbor algorithm. Object-oriented classification is the newest method of classification based on segmentation.

The images were classified into 6 categories (construction, gardens and green space, water, vegetation, barren and rangeland) to extract the land cover map and detect the changes in the images resulting from classification, and the generated maps entered Fragstats software to measure land use metrics. This software obtains metrics at three levels: spot, land class, and landscape (Marx, 1995: 23). One of the advantages of assessment by using landscape metrics is to help gain knowledge on the level of development or fragmentation of the study area in the shortest time possible with digital data that is comparable to replicate the study in future. Given the aim of this

study, a class of metrics was analyzed.
The NP metric has been increasing for all three cities, reflecting the fact that land uses have fragmented and lost their integrity over time in recent decades due to the growth of urbanization and the increase in construction. The LPI metric for the construction land use of Tabriz city had the lowest value for 1984 and has had an increasing trend in later periods, and the cities of Urmia and Maragheh, in addition to the construction land use show an increase in barren land use. The ED metric calculates spot margin density and uses it to measure the degree of connection of land uses. Due to an increase in construction, land uses of the three cities have reduced and they have faced degradation of rangeland over a 35-year period.
LSI metric: This indicator represents the standardized size of total length of edge or edge density. The land uses of construction, gardens and green space are showing increasing trend for Tabriz and Maragheh cities, and land uses of vegetation, gardens and green space and construction are showing an increasing trend for Urmia city. This disorder has been more severe between 2000 and 2019. It suggests that the shape of the landscape in cities has become more complex and geometrically irregular. Then, the patterns of urban development trends were analyzed using the Landscape Index. This index is defined according to buffer. In this index, if the newly grown spot belongs to the center and around it, it will be infilling type, if the development is from the margin of empty fields, it will be edge-expansion type, and if the expansion of the area is far from the main area and in empty parts, it will be outlying type.

Results and Discussion

Nowadays, changing lifestyles and meeting the vital needs of human beings in different regions requires basic information that satellite images make it possible for planners and managers by collecting information from land sources in a regular and systematic framework. Obtaining quantitative data and preparing maps that are a reflection of biological and human phenomena on the surface of the earth over time will solve one of the problems of urban human beings, namely environmental problems. Good urban management requires classification maps in addition to a proper understanding of the nature of components of the landscape. Gaining knowledge on the process of change in the city and directions of its development will play an effective role in managing the current situation.
Results obtained for three periods suggest that urban construction had the most changes in the landscape of Tabriz and Maragheh cities between 1984 and 2019, which has led to a reduction in rangeland. The metropolis of Urmia shows the change of agricultural lands and an increase in gardens, in addition to construction. Also, based on the landscape development index, it was found that Tabriz and Urmia develops mostly from suburbs and outskirts, indicating the construction of towns and marginalization development from the center to the outskirts. Expansion of commercial centers and reconstruction of old areas may be one of its reasons. In the Maragheh city, expansion is from the center, which includes the increase of the rural population or the integration of the villages and from distant area, which indicates development of gardens and other things. In general, several influential factors were considered in the present study. By obtaining quantitative data (according to a management principle, non-quantified data cannot be managed) and comparing them with classified maps using object-oriented classification technique, as one of the most accurate and up-to-date classifications, the ecology of cities was examined over a period of 35 years to provide basic information for planners and city managers for major cities that are increasingly growing.

Key Words: Comparative study, landscape expansion Index, Landsat , eCognition

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