

## **Investigating the Changing Process of Green Spaces during the Past Three Decades using Remote Evaluation (Case Study: Yazd)**

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### **Extended abstract**

#### **1. Introduction**

The role of green spaces in urban development is highly significant, to the extent that it is considered as an index of sustainable development. Through the perspective of urbanism, an urban green space is regarded as a part of cities' anatomy and morphology. In other words, green spaces along with the physical structure of the city indicate its overall body and appearance (Hosseinzadeh Dalir, 1992). The physical and natural impacts of these spaces in urban systems as well as their ecological, social, and economic efficiencies in the structure of societies are undeniable. As a part of cities' overall appearance, green spaces are considered as natural phenomena and a subject to which humans are constantly exposed. The ever-growing population has led to the extension of cities and excessive population density, intensifying the need to increase functional services, especially green spaces (Saeedinia, A. 2000).

#### **2. Methodology**

Having an urban green area of 774.5 acres, Yazd city has a population of 582682 people. This city consists of three regions in which many districts from regions 1 and 2 are a part of the primary and old core of

the city. During the past few decades, the city has witnessed a rather rapid growth toward industrialization. The study and investigation of vegetation require conducting extensive field operations and often involve a set of limitations including costs, time, facilities, and equipment; subsequently, the most suitable method would be remote evaluation and its useful techniques for assessing urban environments such as green spaces. Therefore, many researchers have employed data collected from remote evaluations in order to examine vegetation, making the technique a proper approach for conducting these types of studies (Huete, 2004). As a matter of fact, the use of remote evaluation indices is the new, prevalent view in the area of examining vegetation (Drysdale & Metternicht, 2003). To demonstrate the changes in Yazd city's green spaces, the information collected from TM and ETM sensors of landsat satellite bands in the years 1987, 1999, and 2015 were used; then, the NDVI index was calculated for the aforementioned years in all three regions of the city. Following the indication of NDVI index on images, the total area of green spaces in Yazd was calculated twice, whilst taking into account the gardens, and vice versa. In order to conduct an accurate analysis, five parks including The Great City Park, Qadir Park, Daneshjou Park, Haft-e-Tir Park, and

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Azadegan Park were selected as the field data for sampling, once by points (four corners and the center of the park) and once as a whole (park's area). In order to identify and separate the gardens, areas with such functions were found in each region using Yazd's zoning map as well as considering the 1987 image as the basis; then, garden zones in all three regions were identified and separated using Google Earth.

### 3. Results

The results of the study showed that regions 3 and 2 encompassed the smallest and largest green areas in 1987, respectively. Given such results, changes in green spaces of region 3 have been positive as the growth of green areas mostly included urban green spaces rather than gardens. Furthermore, the extents of urban green space area, changes in use, transformation of gardens into residential regions, and other urban uses were reduced by 271.71 acres during the past thirty years; meanwhile, 332124 people have been added to the population of Yazd during such time. The highest reduction in green spaces during these years is 205 acres which has occurred in region 2. According to the results, the green spaces in regions 1 and 2 have been decreasing during these years. Meanwhile, the development of such spaces in region 1 has been growing since 2005. There has been fewer changes in green spaces of region 2, in which gardens and

green environments are of considerable importance due to their old age. In region 3 however, green spaces have been growing with the highest increase of green environments per capita taking place in 2015.

### 4. Conclusion

Given their considerable importance, gardens should be unrestricted and a set of budgets and policies should be assigned for their maintenance and conservation; this way, gardens are revived and become more effective in the organization of urban landscape. The presence of correct planning and policies is necessary for the development and conservation of urban green spaces. In general, adherence to a set of principles such as improving the public's role through education, the society's use of urban green environments, their ecological efficiency, and refining legal policy making and financial frameworks could guarantee the success of urban green environment management mechanism. As a result, it is necessary to increase green areas in addition to a proper distribution and developmental planning in line with conserving gardens while increasing green space per capita, especially in regions 1 and 3.

**Keywords:** Satellite data, Remote evaluation, NDVI Index, Yazd City, Green spaces

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