



## Urban sprawl analysis of the city of Kerman via remote sensing

Mohimi, A<sup>a</sup>, Fadaei Qotbi, M<sup>b,1</sup>, Esmaily, A<sup>c</sup>, Ghazanfarpour, H<sup>d</sup>

<sup>a</sup> Ph.D. Candidate, Department of Urbanism, Faculty of Art, Architecture and Urbanism, Kerman Branch, Islamic Azad University, Kerman, Iran

<sup>b</sup> Assistant Professor, Department of Urbanism, Faculty of Art, Architecture and Urbanism, Kerman Branch, Islamic Azad University, Kerman, Iran.

<sup>c</sup> Assistant Professor of Surveying Engineering, Graduate University of Advanced Technology, Kerman, Iran.

<sup>d</sup> Associate Professor of Geography and Urban Planning, Shahid Bahonar University of Kerman, Kerman, Iran.

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### Extended Abstract

**Objective:** Over the past few decades, the increase of world's urban population has resulted in uncontrolled urban growth especially sprawl of major cities. Urban growth is a spatial and demographic process and refers to the increased importance of towns and cities. Accordingly, analysis of such phenomena and determining urban development and sprawl patterns should be taken into consideration as a necessity. As the capital of the province, city of Kerman is the most populated city in Kerman province. By the year 1340, land reform regulations began to affect urban and rural areas. Several people from rural areas started to move to the cities seeking for better quality of life and job opportunities and this trend continued after the Islamic Revolution only with more intensity. The outcome of this case of movement was clear: an uncontrolled and sprawled urban expansion which we tend to assess in this study. Concerning about rapid urban growth in populated cities as a matter of interest, several studies employed statistics for measuring urban sprawl using Remote Sensing Methods.

**Methods:** This article aims at measuring the level of urban sprawl of the city of Kerman using remote sensing data from period of 1352 to 1397. For this purpose, 10 remotely sensed images were selected with an acquisition date interval of 5 years. Pre-processing methods were applied to the Remote Sensing images via ENVI software by using "Radiometric correction" in order to achieve the "Radiance" and "Atmospheric correction" in order to achieve "Reflectance". Processing methods were applied to the Remote Sensing images via ENVI software by using "Principal Component Analysis (PCA)" method and "Normalized Difference Built-Up Index (NDBI)". Classification methods were applied to the RS images via ENVI software by using "K-Means" for Unsupervised Classification and "Support Vector Machine (SVM)" for Supervised Classification. Furthermore, Post Classification methods were applied to the Remote Sensing images via ENVI software by using "Confusion Matrix Using Ground Truth ROIs". The Kappa Coefficient for years above were calculated and then accepted for further stages. Afterwards, for different periods, built-up areas were extracted and assessed by these three indices: "Degree of freedom (DoF)", "Degree of sprawl (DoS)" and "Degree of goodness (DoG)". For better interpretation, the city was divided into 8 triangles with same area in line with 8 geographic directions.

**Results:** The findings show that during 1392 to 1397, city of Kerman had the most growth of built-up areas while during 1372 to 1377 this growth had the minimum extent. Moreover, during these 45 years, the most growth of built-up areas were accrued at the western zone of the city while northern zone had the minimum growth. During 1387 to 1392, city of Kerman had the most extent of DoF while during 1352 to 1355 DoF had the minimum extent. Moreover, during these 45 years, the most extent of DoF were accrued at the eastern zone of the city while northeastern zone had the minimum extent. During 1352 to 1355, city of

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<sup>1</sup> Corresponding author at: Islamic Azad University, Kerman Branch, P.C: 7635131167, Kerman, Iran. E-mail address: [m.f.qotbi@iauk.ac.ir](mailto:m.f.qotbi@iauk.ac.ir) (Fadaei Qotbi, M).

Kerman had the most extent of DoS while during 1372 to 1377 DoS had the minimum extent. Moreover, during these 45 years, the most extent of DoS were accrued at the northwestern zone of the city while south zone had the minimum extent. During 1352 to 1355, city of Kerman had the most extent of DoG while during 1387 to 1392 DoG had the minimum extent. Moreover, during these 45 years, the most extent of DoG were accrued at the northeastern zone of the city while eastern zone had the minimum extent. Nevertheless, as the matter of fact, during 1387 to 1392, the city of Kerman had the most sprawl expansion, while during 1352 to 1355, it had the minimum extent. Furthermore, during these 45 years, the most sprawl expansion were accrued at the eastern zone of the city while northeastern zone had the minimum sprawl expansion.

**Conclusion:** Broadly speaking, near half a century, the growth of the city of Kerman was mostly unplanned and intensity of urban sprawl in the city was explicit. At times, this growth of the city of Kerman had designated various growth-rate, nevertheless, all of these growth-rates were above the average. It seems, this uncontrolled immethodical unfit growth of the city of Kerman caused by poor municipality and urban management, lack of regulations in house planning, immethodical regional planning and development, improvement of transportation, and physical barriers around the city. This study has attempted to understand the urban sprawl of the city of Kerman, quantified by defining important metrics. The results of this research signify the importance of modeling the patterns of the urban growth and the assessment of measures of sprawl.

**Keywords:** Urban Sprawl, Urban Growth, Remote Sensing, City of Kerman.

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