Spatio-temporal analysis of sprawl in coastal areas of Caspian Sea

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Expanded Abstract

Introduction

There are long coastlines on the northern and southern regions of Iran. The length of the coastline in the northern strip is 890 km and in the south it is about 4900 km. Among the Iranian coastal areas, coastal zone of the Caspian Sea due to the boom in tourism activities, agriculture, fisheries, port activities, favorable conditions for natural resources such as forest and fertile soil, good rainfall and access to surface water is one of the most densely populated areas of Iran. In contrast, the Caspian Sea level fluctuations, improper utilization of resources, erosion, high seismicity, lack of proper wastewater treatment systems for domestic, industrial and agricultural activities, lack of suitable land for waste disposal due to high groundwater level, and privacy in coast faced this region with serious challenges. Of all the challenges, rapid changes in land use and land cover due to urban sprawl, faced coastal zone of the Caspian Sea with complex spatial crisis. The first step to overcome the current situation, identify the trends in land use and land cover in the coastal zone of the Caspian Sea. We are to provide the basis for understanding the past and present spatial changes and the possibility of adopting necessary measures to improve the future status of the region. The aim of this study is to analyze the spatio-temporal changes in population and land cover in the coastal zone of the Caspian Sea. The urban sprawl as a major factor in the formation of spatial crisis has been quantized and spatio-temporal characteristics of sprawl have also been detected.

Methodology

In order to analyze demographic trends in the Caspian Sea coastal region, we have used the results of the General Population and Housing Census of Iran. To represent a clear picture of demographic trends in the region in 55 years, the absolute changes in population, the annual growth rate of population, urban primacy index, rank-size rule and some spatial statistical techniques such as elliptic standard deviation were used. To study the spatio-temporal changes in land cover, we have also used satellite imagery in the coastal strip of the Caspian Sea. After pre-processing of data, using object-oriented classification and eCognition software, land cover maps

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in the periods 1985, 2000 and 2015 were prepared. Maps we have produced are consisted of four classes of land covers including built-up land, water bodies, vegetation and bare land. Google Earth software has also been used to verify the classification results.

Results and discussion

One of the most important factors driving spatio-temporal changes in land cover is population and relevant changes. Caspian Sea coastal population in the period from 1956 to 2011 has experienced significant changes. The annual growth rate of 23.2% with the approximately 15.2 million in 1956 has increased to more than 33.7 million people in 2011. With the increasing population in the coastal strip of the Caspian Sea, the region with the relative density of over 126 inhabitants per square kilometer has become one of the densest regions of Iran. In addition, over time, the distribution of population in the coastal zone of the Caspian Sea has been more diffused. Urban primacy index was significantly reduced at 55 years and the results of elliptical space-based standard deviation confirm the concentration of population in the wider zone compared with 1956. Following demographic trends and the increasing population in the coastal areas of the Caspian Sea, obvious changes have occurred in land cover and land use. Most of the changes belong to the land of cities and villages that has increased with annual growth rates of 2.3% from 1158 hectares in 1985 to more than 3162 hectares in 2015. An increase of about 2 thousand hectares of built up land have been occurred mainly by changes in vegetation covers from agricultural land, forests and pastures to urban lands. The main point in Spatio-Temporal urban land changes in the coastal strip of the Caspian Sea is pattern changes. The results of the analysis of growth patterns in urban lands using sprawl index showed that the growth pattern of urban land in the study area has been urban sprawl or dispersed growth. In this situation, sprawl index, or the ratio between the growth rates of urban land to the population growth rate in the period 1985 to 2015 in the coastal strip of the Caspian Sea is 4.7. This indicates the existence and dominance the sprawl phenomenon in the study area.

Conclusion

In general, the increasing population, followed by spatio-temporal changes in land cover in the coastal strip of the Caspian Sea, can lead to urban land expansion and sprawl and unplanned growth, the coastal zone the area is faced with the spatial crisis. As the situation is continued in the region, the coastal region will be faced with a spatial crisis and fragmentation of landscape.

Keywords: Land cover, Sprawl, Spatial Metrics, Coastal Regions, Caspian Sea

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