EXTENDED ABSTRACT

An Application of GIS Spatial Analysis and Decision Making Systems for Modelling and Predicating of Urban Water Consuming Pattern in Tabriz

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1. Introduction

Considering its key effect on the welfare and health of society, water plays a crucial role in the growth of communities and is one of the most important natural resources. In recent years, the problem of scarcity of water resources has been exacerbated by the growing population worldwide and increased competition for access to water resources, which leads to increased costs of water use. Therefore, the use of this vital resource requires proper management. The present study was entitled Predicting and Modeling the Urban Water Consumption Pattern in Tabriz to Investigate and Analyze the Urban Water Consumption Pattern Using Geographic Information System (GIS).

2. Methodology

The present research is applied in a descriptive-analytical, survey-based and purpose-based manner. The purpose of this study, in addition to determining the pattern of water consumption in the city of Tabriz in 1395, 1396 and 1397, is to predict possible changes in the pattern of water consumption in 1403. To achieve this goal, point pattern analysis methods were used to extract the consumption pattern in the mentioned years in ArcGIS software environment. The method used to identify the pattern of water consumption in the city using the location data of subscribers was the Point Density method, which was performed by subscribers using a column of information on water consumption. After the subscribers identified the water consumption raster layers, the layers were transferred to the TerrSet software environment to enter the Markov chain model for forecasting for 1403. Thus, first, using the Markov command, predictions and changes were made based on the existing layers with an interval of two years, ie the years 1395 and 1397. Then, by entering the CA-Markov automatic cell model, the forecast map for 1403 was obtained in 10 floors.

3. Results and discussion

The trend of water consumption in 1395, 1396 and 1397 was increasing and this was effective in forecasting water consumption in 1403. The highest amount of water consumption in 1403, according to the map predicted using the CA-Markov method is equal to 196,000 cubic meters, which is an increase of 146,407.63 cubic meters compared to 1397. The results showed that the relationship between latent patterns of water consumption and the location of subscribers in the city of Tabriz is evident. The location of the subscribers and the amount of

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water consumption by them and the type of water use by the subscribers indicated that consumption is at a high level in the northern and central areas of the city. Due to population density and the establishment of commercial centers, it was determined that consumption by commercial and home use. Areas are high. In addition, in some areas, the density of buildings with a high number of floors has led to an increase in water consumption, which indicates the high density of population in these areas.
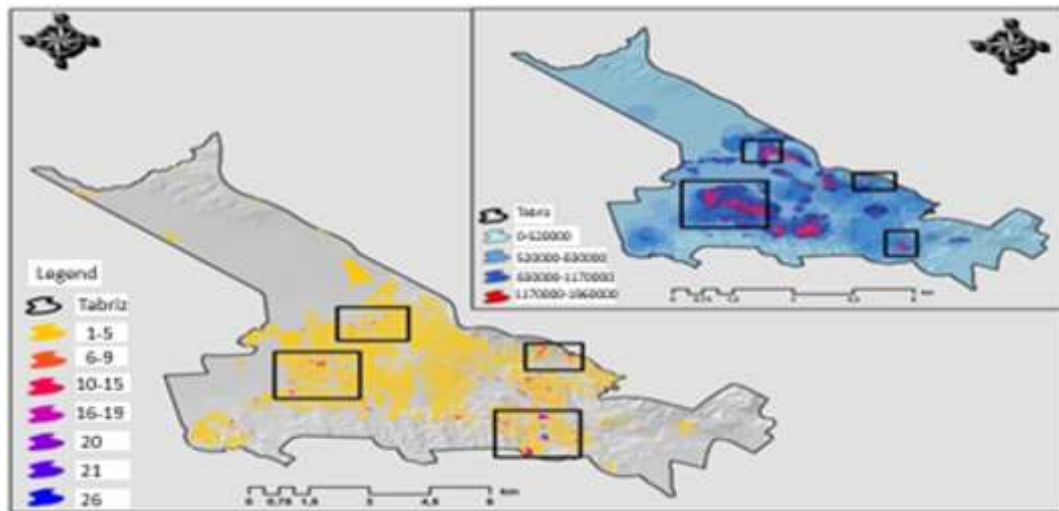
Fig. 1. Comparison of areas with high water consumption in the map predicted by the CA-Markov method with the map of the number of floors of buildings in the city of Tabriz

In relation to real-world modeling in the software environment, having spatial information is one of the main pillars. In the present study, with the subscribers' information and also their position as the main component of spatial analysis and modeling, the models of latent water consumption were modeled by the subscribers in Tabriz for the years 2016, 2017 and 2016. Spatial analysis such as detection of high consumption areas using point pattern analysis methods such as density analysis and interpolation of water consumption information by subscribers in specific geographical locations in ArcMap software environment and its combination with forecasting method The Markov chain showed good results in showing the trend of water consumption in 1403. Also, in examining the relationship between water consumption and different uses in the city of Tabriz, it was concluded that in areas where the density of residential use is high, water consumption is also high. In addition to examining the relationship between water consumption and land uses, it can be argued that population density is also high in residential areas. Therefore, water consumption also increases. In some areas, buildings with a high number of floors are also effective in increasing water consumption. The method used in the present study to spatially investigate and extract hidden patterns of water consumption, while not a complex and difficult method, provided acceptable and useful results. The use of simple spatial analyzes can only be used to achieve accurate and reliable results if they have the right data. The use of spatial analysis methods such as interpolation of information that has a spatial dimension and geographical coordinates, in addition to the distribution of points (eg water consumption subscribers) in the study area, can be accompanied by the analysis of their side information and the amount and Show its zoning pattern, criteria and information in the study area. This operation was performed in the present study and in addition to identifying areas with high consumption, the amount of consumption and the type of uses that have high consumption. Therefore, the use of spatial data analysis methods for similar research is recommended. In addition, the use of forecasting methods such as the Markov chain in the present study, the trend of water consumption in the future can also be predicted. Since water consumption can be a very important factor for environmental planners in maintaining water resources, maintaining the health of water resources, especially drinking water for domestic and commercial use, careful collection and maintenance of subscriber consumption data It is one of the suggestions that can be made for those in charge of water and wastewater management, because as mentioned, if the data and information is correct, it can allow simple spatial analysis to obtain Provide important results, what has been done in the present study.

4. Conclusions

The results revealed that the trend of water consumption in 1395, 1396, and 1397 has been increasing. The projection map of the water consumption pattern was also obtained for 1403, according to which the maximum amount of water consumption will reach 196,000 cubic meters. Comparison of the results of CA-Markov water projected map with population map, the number of floors of buildings, and type of use revealed that in residential areas the amount of urban water consumption is high. By providing the results of this research, urban managers and planners will be able to make better and more accurate decisions in water consumption management in urban areas.

5. References

Mackenzie Moore D, Arley N, Willie Schultz P, Kotler PH, "Social marketing to environmental protection", Translated by Kambiz Heydarzadeh, Ali Soltani, 2014, Tehran City Publication (In Persian).

Campbell HE, Johnson RM, Larson EH, "Prices, devices, people, or rules: The relative effectiveness of policy instruments in water conservation", Review of Policy Research, 2004, 21 (5), 637-662. doi.org/10.1111/j.1541-1338.2004.00099.x

Zhang R, Tang C, Ma S, Yuan H, Gao L, Fan W, "Using Markov chains to analyze changes in wetland trends in arid Yinchuan Plain, China", Mathematical and Computer Modelling, 2011, 54 (3-4), 924-930. doi.org/10.1016/j.mcm.2010.11.017