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Sustainable ecological development planning (case study: County of Tabriz)

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Keywords

Land use planning,
Sustainable ecological
development,
Factor Analysis,
Weighted Sum,
County of Tabriz.

Abstract

Land use planning and sustainable urban development in the modern areas emphasize essential to balance urbanization, environmental protection, and improving quality of life. Cities performance as sustainable and knowledge-based communities, contributing to social and economic development while protecting resources. For this reason, the purpose of this research is sustainable ecological development planning of Tabriz County. The current method in this research is based on weighted sum modeling. According to the results, it was determined that the sustainable ecological development of Tabriz County is more suitable in the western and eastern areas compared to other regions. Furthermore, according to weights of ecological factors, it was revealed that the LST factor has the most important impact on the development of Tabriz County, while the DEM and NDVI factors are ranked next.

Introduction

Land use planning and sustainable urban development in the modern areas emphasize essential to balance urbanization, environmental protection, and improving quality of life. Cities performance as sustainable and knowledge-based communities, contributing to social and economic development while protecting resources (Schewenius, 2020). However, illogical urban development leads to increased social and environmental costs and disturbs sustainable development processes, requiring a review of traditional planning paradigms and adopting a comprehensive ecological approach for sustainable urban development (Wang et al., 2020) that considers ecological principles and adopts a harmonious relationship between humans and the environment. Furthermore, cities take an important role in greenhouse gas emissions and climate change, and urban development can contribute to the urban heat island, which has negative impacts on public health (Kattel et al., 2015). Nevertheless, nowadays cities are striving to review their strategies for urban sustainable planning, carefully considering their local and original characteristics, by the main goal of improve quality of life through optimal and efficient application of available resources (wang et al., 2022). Iran, as a quickly urbanize developing country, is experiencing irregular and faster urban development. To control this trend and move towards sustainable development, it is suggested to apply land-use planning principles and detailed urban development plans.

Material and Method

The purpose of this study is to investigate ecological development in county of Tabriz by using LST, NDVI, and DEM factors. Data analysis was achieved by ArcGIS and SPSS environments. Factor analysis was used to extract the weights of factors in the SPSS environment (Oskouee Aras et al., 2024). Then, the layers were standardized in the ArcGIS environment by the Fuzzy membership method with linear function for standardization, and in conclusion, the final map was obtained by overlaying the weighted layers through the Weighted Sum technique.

Study Area

metropolis of Tabriz, the capital of East Azarbaijan province, is located at 38 degrees 88 minutes north latitude and 46 degrees 15 minutes east longitude. Tabriz is limited by the Sahand mountain from the south and Aun Ibn Ali mountain from the northwest. This city is one of the 10 metropolises of Iran and the largest metropolis in the northwest. Its population in 2015 is estimated to be 1,558,693.

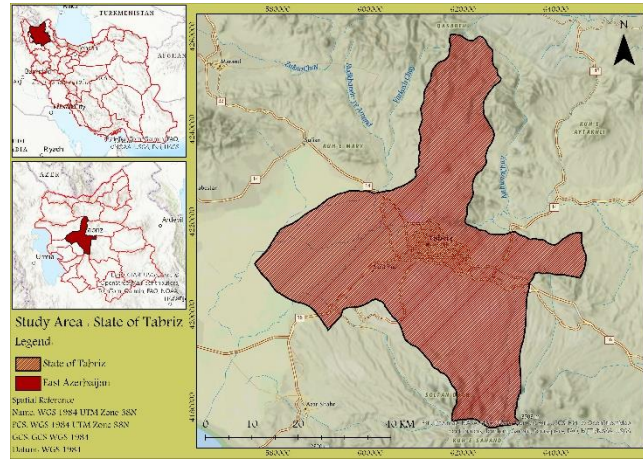


Figure 1. Study Area

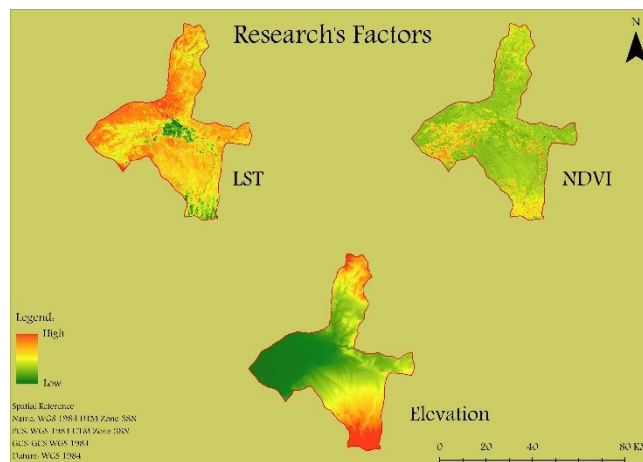


Figure 2. Research Factors

Results

The purpose of the current research is to evaluate the areas prone to Sustainable ecological development in Tabriz metropolis. For this purpose, factors NDVI, LST and DEM were prepared from Satellite images. Then factor analysis was used to extract the weights of the factors. Finally, in order to modeling the sustainable ecological development of area, the weighted sum function was used.

The results of KMO by 0.545 value (Table.1) show the significance of the suitability of the sample size. In this analysis, the minimum factor loading accepted for the items was determined to be 0.4, and the varimax rotation method was used to rotate the factors. according to result of factor analysis the weights of NDVI= 0.354, LST=0.661 and DEM= 0.487 was obtained.

Table 1. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.542
Bartlett's Test of Sphericity	Approx. Chi-Square	51.700
	df	3
	Sig.	.000

The Sustainable ecological development factors were prepared by satellite images, then the layers were overlaid. So, the value of factors was scaled based on fuzzy function. Finally, the weights obtained from factor analysis were used to weight each of the factors, and the final map for sustainable ecological development was obtained by overlaying the layers.

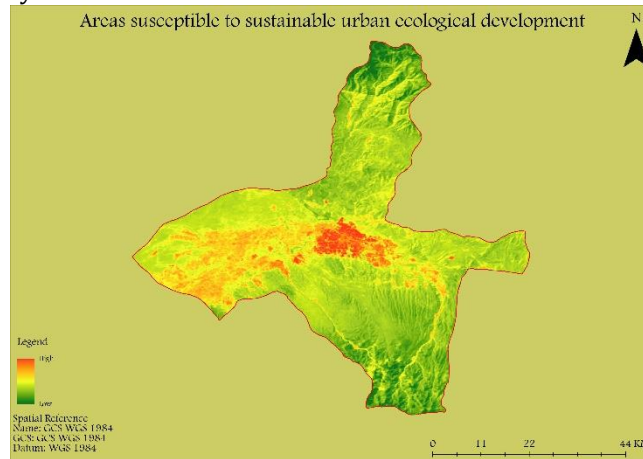


Figure 3. Urban Sustainable Ecological Development Areas Based on the weighted sum

The western areas and parts of the eastern of county of Tabriz are suitable for sustainable ecological development, that portrayed in red shades. These areas show favorable environments, including higher NDVI, lower LST, and suitable DEM, this makes these areas ideal for planning and future development.

Conversely, the southern and northern areas, represented by green, are less suitable for sustainable ecological development. These regions face challenges such as higher land surface temperatures, lower vegetation cover, or unsuitable elevation environments, which, in the absence of suitable planning, can create serious threats to sustainable urban development and the environment.

Conclusion

According to the importance of sustainable ecological development, in the current study, the ecological development planning of Tabriz County has been noted using factors such as NDVI, LST, and DEM. Based on this, the results obtained from this research are in line and consistent with the findings of other studies, such, Zhang et al. (2024) and Nie et al. (2022).

Results

The purpose of this research is the sustainable ecological development planning of Tabriz County via LST, NDVI, and Elevation factors. After analysis, it was determined that the ecological development of Tabriz is more suitable in the western and eastern areas compared to other regions. Furthermore, according to weights of ecological factors, it was revealed that the LST factor has the most important impact on the development of Tabriz County, while the DEM and NDVI factors are ranked next.

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