

Evaluating Ecological Capability of Urban Land-Use through Multiple-Criteria Decision-Making (MCDM) and GIS: A Case Study of Sahand

Ziba Beheshti¹

Ph.D. Candidate of Land Use Planning and Assessment, Islamic Azad University, Science and Research Branch, Tehran, Iran

Masoud Monavari

Assistant Professor of Environment and Energy, Islamic Azad University, Science and Research Branch, Tehran, Iran

Received: 17 October 2015

Accepted: 13 September 2016

Extended Abstract:

1. Introduction

Without taking the ecological differences and environmental capabilities of lands into account, using land can culminate in unpleasant consequences and destroy the environment. This will endanger natural resources and obstruct the environment's sustainable development as such. The region of Sahand (located in East Azerbaijan Province) boasting a diverse, suitable ecosystem for human life and a variety of natural attractions together with invaluable environmental sceneries is among the most important regions in East Azerbaijan province which is capable of population attraction. Hence, the growth of cities and rural settlements with their concomitant construction of infrastructures and facilities required by humans has resulted in insufficient evaluation regarding the ecological capability required for proper land use prior to the allocation of the swathes of this region for the land-use in question.

2. Methodology

In the present study, the systematic location finding concerning the physical development of the city of Sahand is the main objective. In MADMs, the intended criteria should be weighed first. Weighing process is crucial and decisive. In this sense, careful attention should be paid to the selection of weights so that the results are in line with expectations.

In the present research, weighing was done using Analytic Hierarchy Processes (AHP). In the first stage, Sahand, as the area under the study, and the influential physical-ecological factors in urban development location-finding, including physical (i.e., the surveys of geography, geology, soil, hydrology, hydrogeology, climatology, etc.) and biological (i.e., the evaluations of flora and fauna in the protected areas, etc.) features were determined. In the second stage, the standardization and the overlying of information layers were done using Arc GIS, and the directions of the city's development were identified. The third stage involved the analysis done using AHP and WLC in which the map of Sahand's ecological development capability was extracted and then categorized by comparing it with the model of urban development. At the moment, the city of Sahand spans an area of 2329 acres. In the research, basic and influencing variables affecting the development of a city were used. These variables include height from the sea level, slope, slope direction, distance from fault lines, lithology, the texture of the soil, the distance from roads, underground waters, surface waters, and the distance from power grid. These maps were then standardized using fuzzy model.

3. Results

The findings revealed that out of the overall studied surface area of Sahand identified as 1721 ecological units and spanned 45200

1. Corresponding author. E-mail: zibabeheshti64@gmail.com

acres, 3326 acres were placed in the first class potential and 4279 acres were in the second class potential regarding urban development. At the moment, the spatial distribution of population centers in the township is mainly located in the second class (average) land-uses, which can be attributed to important factors, such as moderate slope, a rather suitable texture of soil, the proper drainage systems, and favorable climate.

4. Conclusion

From an urban planning perspective, the final confines of area development are determined through the overlying of maps pertaining to proper ecological capability and those of proper slopes. In division maps, slopes are considered to be 0-8 percent, 8-12 percent, 12-15 percent, and 20-15 percent. It is suggested that slopes of 15-20 percent be used for green spaces. Moreover, in the newly suggested area, the creation of flanks with unsuitable width has been avoided, since they increase the infrastructure costs. In determining the new area for development, we have tried to make the most of topographical lines. The evaluation of the findings indicates that in addition to identifying the suitable locations for urban development in acceptable directions, the model designed with AHP also suggests other directions. However, WLC model yields directions for development based on both evidence of survey studies and the comparison of the findings with the existing reality. According to the directions of development identified in both AHP and WLC models, the best alternative was chosen based on ranking. The southern part of the city is surrounded by steep height, and currently some parts of these mountainsides with a considerable slope are occupied by people in the vicinity. Not only is this part of the city incapable of further development, but some of its population will also be displaced in case the improvement and renovation projects of the distressed areas are put into action. This area, due to its location, has some partial limitations, especially with regard to

the shape of the land. The western area has very limited potential for development and the creation of metropolitan applications and job centers along the former route from Sahand to Tabriz. Typological complexities have deprived this area of playing a crucial role in development and population attraction. The western area is predominantly occupied by heavy industries and does not have any potential for development or settlement or whatsoever due to its direction of prevailing winds. Similarly, in the south-western area the development seems impossible due to closeness of the city of Sahand to Tabriz and their facilitating integration. Given the finalized maps of AHP and WLC models, the lands located on the eastern area create the most essential and natural possibility for the development of Sahand due to having proper slope, facing the sun, and having suitable status in terms of the environmental factors. The studies conducted in this regard, including Sahand's master planning, acknowledge the fact that in recent years the city has faced major natural obstacles regarding its development, and has inevitably raided some parts of nature; this has resulted in instances such as the destruction of the renowned Osku gardens. Sahand's master planning with regard to the geographical and typological location of the city suburbs has proposed the eastern and north-eastern areas as the most suitable parts for the physical development of the city. By pursuing development in these parts, a sufficient area provided for the development and the density of urban spaces is highly avoided at the same time. Reviewing the studies revealed that in the southern section of Sahand, that is, from Sahand to Osku, lush gardens are located whose land use should be changed under no circumstances. Moreover, the relative adjacency of western part of Sahand to the heavy industries creates the opportunity for installing the non-polluting industries located along the Tabriz-Azarsharh route. An important point to bear in mind while using AHP and WLC is to choose weights correctly and use information layers effectively. This is of great importance,

because when the selected weights are not suitable for the process of decision making regardless of the number of the used

information layers, the findings will not be satisfactory.

Key words: Evaluating ecological capability, Urban development, GIS, MCDM

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How to cite this article:

Beheshti, Z., & Monavari, M. (2017). Evaluating ecological capability of urban land-use through multiple-criteria decision-making (MCDM) and GIS: A case study of Sahand. *Journal of Geography and Urban Space Development*, 4(1), 41-55.

URL <http://jgusd.um.ac.ir/index.php/gud/article/view/25904>

ISSN: 2538-3531