Geomorphology Planning Zonation for the Development of Residential Areas Based on the Fuzzy Model (A Case Study of North and East Yazd Province)

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Extended abstract

1. Introduction

Traditional style of life and geomorphologic unfamiliarity in coping with environment has made human communities to search for new places to dominate and utilize its potential for settlement. Thus, it can be said that such settlements were initially based on natural potential and in a close relation with it. Stuyding the natural environment of these settlements is important because their development depends on their natural condition. While the rapid development of cities is an undeniable fact, determining the proper places for cities expansion is critical. While most of cities are growing fast and have a physical development process, identifying suitable sites for development is essential. To control and guide the development of urban and rural areas to determine the optimal development, directions, locations, and appropriate protective measures are necessary. In order to control and direct city expansion, it is vital to define the appropriate orientation of the development, proper sites, and protection practices. The facing problem is that which places are suitable for settlement expansion according to their resistancy condition. Consequently, this paper aims to delineate sites with high potential of settlement development.

2. Theoretical Framework

Data were analyzed by Fuzzy Logic and geomorphologic planning techniques. In the Fuzzy set, zero means any member doesn't exist in the set and one means all the members exist in the set. The AND, OR, Product, Sum, and Gamma functions are used in modeling.

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3. Methodology

In order to provide the layers of the desired parameters, first of all, the desired images were geo-referenced using the same system (UTM: WGS 1984, Zone 40N) and layers with common pixel size of 30 m were produced. Information resources used in this study consisted of written documents and statistical data. (Visual documentation and interviews are shown in a flow chart. The data included topographic maps (1/50000, 1/250000), geology (1/250000, 1/100000), soil map (1/250000), land use (1/250000), and air lab (1/55000). Digital resources included digital elevation model (DEM) 30 meters and TM's satellite images. Also, much of the information related to the area such as lithology and faults, soil, land use, hypsometric, political subdivisions maps, towns and villages, a variety of maps, aerial photos and satellite images, and DEM were extracted. In an attempt to determine proper places for settlement expansion, several environmental parameters were selected including slope degree and aspect, altitude, geology, soil, land use, distance to fault, distance to river, distance to road, distance to nearby settlement, and geomorphology. A digitized layer was prepared for each parameter using GIS technique. Available maps, layers, and images were initially georeferenced by using the same georeference system that is UTM: WGS 1984, zone 40N. Produced layers have the same pixel size of 30 m2. Data were then analyzed by fuzzy logic and geomorphologic planning techniques.

4. Results and Discussion

Determined parameters were overlayed in fuzzy models with gamma=0.9 as the best criteria. Using natural fracture method, the generated map was then classified in five groups of totally inappropriate (0-0.184), inappropriate (0.184-0.332), average (0.332-0.498), proper (0.498-0.625), very suitable (0.625-0.986). The group named totally inappropriate with 72.79% has the maximum area. Following it, proper group with 9.92% has the second ranking of area. Inappropriate, proper, and average groups have 1.18, 7.25 and 8.85 percent area respectively. Comparing these points with the final map shows that the most settlement sites are located in the average group. However, the least numbers of settlement points are found in inappropriate group. However, these few sites were remained abandoned in recent decades due to the unfavorable environmental condition.

5. Conclusion and Suggestions

Results show that the assessment of factors affecting the forming and trend of groups has a main role in determining proper or inappropriate sites for human settlement. According to the final zoning map, south and south east of the study area are suitable for settlement expansion. Also, most settlement sites were located in the average group, while the least numbers of settlement sites were found in the inappropriate group. A typical example of such unfavorable environmental condition is Kheirabad village which was abandoned due to desertification problems. Results show that inappropriate sites were seen in mountains, playa, clay valley, badlands, and sand dunes units. These areas do not have an acceptable condition for development due to steep slopes, rugged topography, badlands, and

lithology. Proper areas for development match with alluvial fans and hillsides that have gentle slays, smooth topography, fertile soil, and so on.

Key Words: Geomorphology, Planning, Residential development, Fuzzy logic.

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