

Geodiversity Mapping of Mashhad Township Based on landform sensitivity variations

Extended Abstract: Geodiversity is a difference in the properties of rock, climatic conditions and landform susceptibility. Today, geological protection has been widely applied and mark as a new approach to protect geological heritage (Which is part of the natural heritage). In Iran not only the geological conservation methods have not been developed, the methods of evaluation and description of the geological heritage also has not been prepared. Thus, understanding the importance of these documents and preserve (what is called common heritage of humanity) is very essential. Conservation of nature and includes two varieties: Land variety and Biodiversity. In this regard, based on identifying the factors affecting terrestrial diversity, a map of land diversity of Mashhad city has been derived based on Landform's susceptibility. Therefore, based on the subjects described, land variety map of Mashhad province has been derived in present study to identify the factors affecting land diversity. In this regard, overlying and Vikor methods have been evaluated. Results show that the results of these methods are good agreement with each other.

Results showed that as sensitivity increased, the land diversity is increased respectively. As the highest amount of land diversity is found in the northern half of the city which is mainly located on the limestone and dolomite formations. Results obtained from Vikor model are more consistent with reality. Because based on in situ measurements the maximum land diversity is found in areas of Kardeh village and the elevation ranges from 1500 to 2000 meters.

Based on the objectives described, quantitative-analysis methodology has been used. Firstly, literature review was conducted based on the papers, books reports and etc and primary data were collected and intendent indexes were selected. Secondly, geological, geomorphology and topography map were outlined. Also Digital Elevation Model (DEM) was used for deriving land form energy map (used for Geodiversity). Finally, geomorphology, geology and energy maps were used for extracting fragmentations model and NDVI and Land use maps used for deriving landform preservation map. In order to achieve the desired objectives, Google Earth, Global Mapper, Arcgis and Vikor softwares used. As aforementioned, two different methods were used in present study (overlapping method and the Vikor decision matrix). In the first step, after selecting indicators, vector layers have been converted to raster. Then all raster layers have been rated and were reclassified and the land variety map derived by combining all layers. At the second step, using Vikor decision matrix method, the indexes were averaged based on aspect ratio, elevation and village polygons. After organize decision matrix and normalization of primary matrix, the ideal positive and negative values calculated and with use of these values. The profit and rate obtained finally with counting vikor index, geodiversity zoning made in 3 group (high, average, low) and based on vikor index rank geodiversity map extracted for high and villages category.

Results and discussion: Sensitivity layer created shows that about 33% of Mashhad province classified as high sensitivity and about 60 and 7% of the remaining areas classified as medium and low sensitivity areas respectively. Also the preserve layer illustrate that about 47% of study area is classified as high protection, and the remaining areas classified as medium and low protection (about 36 and 16 percent respectively). By combining the sensitivity and protective layers, land variety map extracted which the results show that about 86% of Mashhad province classified as low variety (including residential and agricultural areas). Also about 9 and 5% present of case study region classified as mid variety and low variety regions respectively (including the northern half of the study region which is located over limestone and karst thick layers). Variety map which was extracted using Vikor method shows that Kardeh rural area and areas located at an altitude between 1500- 2000 meters classified as the highest variety. This result is consistent with the results of the first methodology.

Overlapping method shows that as the sensitivity increased, land variety increased too. As the highest amount of land variety found in the northern half of the province which is located over limestone and dolomite constructions. The results of Vikor method show the good confirm with the reality, because in site measurements show that the highest amount of land variety located around the Kardeh rural and at an altitude between 1500- 2000 meters. Finally, the three land variety maps compared with each other. In each land variety maps, areas with high variety show a good agreement Also according to the results obtained from the Vikor model it can be concluded that in the karde village of Mashhad which has high

geodiversity. We can develop geotourism with appropriate planning and management. Moreover, the city of Mashhad annually welcoming millions of tourists and pilgrims that can even be increased in number by creating geotourism sites in areas with high-diversity, also with revenues from these items can play a determining role in sustainable development of area.

Geodiversity, Vikor Method, GeoHeritage, Landform Conservation, Landform Sensitivity