Linear programming model to develop geodiversity map using utility theory

Adel Sepehr

Natural Resources and Environment College, Ferdowsi University of Mashhad (FUM), Mashhad, Iran, (adelsepehr@aol.com, +98 915 508 5732)

In this article, the classification and mapping of geodiversity based on a quantitative methodology was accomplished using linear programming, the central idea of which being that geosites and geomorphosites as main indicators of geodiversity can be evaluated by utility theory. A linear programming method was applied for geodiversity mapping over Khorasan-razavi province located in eastern north of Iran. In this route, the main criteria for distinguishing geodiversity potential in the studied area were considered regarding rocks type (lithology), faults position (tectonic process), karst area (dynamic process), Aeolian landforms frequency and surface river forms. These parameters were investigated by thematic maps including geology, topography and geomorphology at scales 1:100'000, 1:50'000 and 1:250'000 separately, imagery data involving SPOT, ETM$^+$ (Landsat 7) and field operations directly. The geological thematic layer was simplified from the original map using a practical lithologic criterion based on a primary genetic rocks classification representing metamorphic, igneous and sedimentary rocks. The geomorphology map was provided using DEM at scale 30m extracted by ASTER data, geology and google earth images. The geology map shows tectonic status and geomorphology indicated dynamic processes and landform (karst, Aeolian and river). Then, according to the utility theory algorithms, we proposed a linear programming to classify geodiversity degree in the studied area based on geology/morphology parameters. The algorithm used in the methodology was consisted a linear function to be maximized geodiversity to certain constraints in the form of linear equations. The results of this research indicated three classes of geodiversity potential including low, medium and high status. The geodiversity potential shows satisfied conditions in the Karstic areas and Aeolian landscape. Also the utility theory used in the research has been decreased uncertainty of the evaluations.