Analysis of Geodiversity (Case study: Eshtehard County, Iran)

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Extended abstract

Introduction

In recent decades there has been an increasing interest in the earth natural events and this developed three concepts of geodiversity, geotourism and geoconservation. The concept of "Geodiversity" can be defined as the natural diversity of geological (rocks, minerals, fossils), geomorphological (land form, physical processes) and soil features. It covers the assemblages, relationships, properties, interpretations and systems.

There is as much geodiversity in the world as biodiversity. Geodiversity and biodiversity are the concepts evolved from the World Biodiversity Convention, in 1992, in Rio de Janeiro, Brazil (Rio-92). Serrano and Ruiz-Flaño (2007) and Serrano et al. (2009), through detailed geomorphological survey, applied the spatial distribution of geodiversity in Spain, based on the study with a wide range of mapped elements of geomorphology, geology, hydrology, soil, and active processes.

Zwoliński and Stachowiak (2012) carried out research on geodiversity in a protected area that also served as touristic attraction. The evaluation carried out based on some elements such as waterfalls, rock types, cavities, landforms, slopes, presence of lakes, altitude, watercourses on cliffs, soil, and geo-ecological structures. Instead of a variety of elements, the applied method was based on map algebra, as the elements were given different scores. It can be concluded that the mountains with steep cliffs are more geodiverse areas. Manosso & Nóbrega (2015) calculated and analyzed the distribution and the diversity of abiotic elements in landscape units. The sample units were compared according to geological, geomorphological, hydrographical, and pedological elements, as well as land use and habitation.

Haririan (1990) was the first to present a definition of geodiversity in Iran. In his view, the formation of geological diversity depends on the diversity of internal and external processes. Sepehr (2013) also expressed the natural hazards and geodiversity by paleo-geomorphological evidence. As the geodiversity has been affected by complexity of process and time, he has presented a geo-system analysis. Ba-tajrobe et al. (2016) offered the geodiversity map of

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Mashhad City based on the analysis of landforms sensitivity to erosion and weathering. The purpose of this work is to perform a quantitative evaluation of geodiversity in 3 units in Eshtehard County, the southern part of Alborz province, Iran.

Materials and methods

In this study, we have used some data including 1:50,000 scale topographic maps, 1: 100,000 scale geological maps, Googleearth satellite images, Digital Elevation Models (DEM), library resources and field observations. To check the type and distribution of geodiversity elements in the study area, the following five steps were performed using Geographic Information System (GIS):

- The border of the study area was determined using maps and satellite images.
- Geomorphological units were determined based on the three landscape units including plain, hills and mountains.
- Ground elements in the region, using satellite imagery, topographic maps, geological maps, soil maps, hydrographical maps and field observations were also identified.
- Required maps using GIS mapping and photographs of the field works are prepared and evaluated.
- Geodiversity index was calculated for each unit and comparative analysis was performed.

In order to evaluate geodiversity condition in study area, we have used geodiversity index (Serrano and Ruiz-Flaño, 2009) as follows.

$$GD = \frac{Eg.R}{Ln\,S}$$

where GD is Geodiversity index, Eg is Number of abiotic elements, R is Roughness of the relief, and Ln S is Log of the sampling area. Index (R) was calculated using the topographic relative position method in GIS and was placed in Formula 1. The final step is presentation of the concept of protection and maintenance conditions in the study area.

Results and discussion

The diversity of abiotic elements in Eshtehard is not only in terms of geological diversity but also in terms of soil, hydrological conditions and landform. Eshtehard playa is an evidence of environmental changes during the cold periods of Quaternary. According to previous studies, it has been an old lake bed during quaternary. Salt River, in this context, is ongoing and will eventually connect that to Hoz-e-Sultan Lake.

Rainbow-colored hills in north part of the Eshtehard are one of the most remarkable landscapes in the region. Within the colored hills, there are some features including a seasonal lake, salt cave and two different springs as geodiversity features in the hills. The marl hills and stone houses in the northwest part of Eshtehard are other perspectives of the unit G1.

The area in south part of the Eshtehard is surrounded with Halqe-dar and Tavreh mountains. The maximum height of the mountain is 2,000 meters above the sea level. The important differences in unit G3 rather than G2 and G1 are presence of several springs and variable volcanic stones.

The highest (R) is related to unit G1, 0.4745 GD. Most of the abiotic elements are in G3 unit (60 elements) and the least are located in G1 (30 elements). After calculating the parameters, we

realize that the greatest geodiversity index belong to G3 (4.716) in the South Eshtehard area; because of high level of diversity in hydrologic and lithological elements.

Finally, because of importance of abiotic phenomena in study area and high level of geodiversity, geoconservation activities are necessary for valuable land resources; for management of the geotourism capacity.

Keywords: Eshtehard, geoconservation, geodiversity, geotourism, landform.