



Geodiversity of the Umbria region (central Italy): a GIS-based quantitative index

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The measure of natural range related to geological bedrock, landforms and geomorphological processes is the necessary starting point to geodiversity evaluation.

Geodiversity plays a strategic role in landscape management. Whereas geotourism and geosites are identified as a driving power for the scientific and economic promotion of an area, the geodiversity knowledge is required for a complete and accurate research. For example, high values of this abiotic parameter identify and support the foundation of geoparks. According to this perspective, the geodiversity is the unifying factor for these areas of interest.

While a subjective and qualitative approach may be adequate for geosites definition, identification and cultural promotion, the geodiversity concept needs a different evaluation method. A quantitative procedure allows achieving an objective and repeatable process exportable in different geographic units. Geographical Information Systems and spatial analysis techniques are the base to quantitative evaluation involving topographic, geological and geomorphological data. Therefore, the assessment of a numerical index derived from the overlay of spatial parameters can be conveniently computed in GIS environment.

In this study, a geodiversity index is proposed where geological, geomorphological and landcover factors deriving mainly from maps and field survey; topographic ones are employed from DEM and remote sensed data. Each abiotic parameter is modelled in a grid format; focal functions do provide neighbourhood analysis and computing variety statistics. A particular extent is dedicated to topographic information and terrain roughness, that are strictly related to efficiency of geomorphological processes and generally corresponding to the abiotic components variability.

The study area is located in central Italy and is characterized by a well known natural heritage. Thirty-seven geosites are detected in the Umbria region, where seven regional and one natural parks are present. All the area shows a strong correlation between the geological setting and the relief energy associated to topography assessment. Three main outcrop complexes are present: a fluvial lacustrine, where the lowest slope values and plain area are widespread; a terrigenous one, with a medium slope value; and a calcareous complex corresponding to the mountain areas and the highest amplitude of relief. This partition matches different geomorphological processes and landforms, ensuring a widespread distribution of geodiversity.

The final map is a digital data that localizes areas with, respectively, null or minimum, medium, and high geodiversity values. The highest class overlaps to geosites areas, to high values of amplitude of relief and where the geomorphological processes are more effective and various. This confirms the method accuracy.

The results obtained represent an important advancement in geodiversity research and a significant instrument for economic development and conservation management.