

# GEOMORPHOLOGICAL HERITAGE ASSESSMENT IN NATURAL PROTECTED AREAS. APPLICATION IN THE PICOS DE EUROPA NATIONAL PARK

**Juan José González Trueba<sup>1</sup> & Enrique Serrano Cañadas<sup>2</sup>**

1. Depto. Geografía, Universidad de Cantabria

2. Depto. Geografía, Universidad de Valladolid

Geomorphosites are often important elements of Natural Protected Areas (NPAs) and may be valued both as structural and functional elements of the natural system and for their social values in relation to their location. Natural protected areas are designated as a result of a wide range of natural and cultural values that define a landscape, a natural environment, an ecosystem or a habitat. The conservation and study of the geomorphic values of NPAs may be approached from three viewpoints: as the infrastructure of habitats and ecosystems, as the landscape in general, and as an intrinsic value of the natural environment. Up to now the first view has been dominant and has resulted in a failure to consider geomorphic features as elements of value for conservation, investigation and management. In light of the second approach, geomorphosites have now been redefined in the framework of the cultural landscapes with which they are interrelated and which they affect. In this sense, the geomorphosites represent cultural, economic, tourist, educational and environmental resources involving a multiple assessment especially useful to NPAs. Moreover, with respect to regional or national inventories, NPAs have their own characteristics when it comes to defining geomorphosites because the interest is centred locally on their detailed territorial and cultural relationships. The protected areas in this way acquire heritage value.

The Picos de Europa was declared a National Park in 1918, the first in Spain, due to its historical, landscape and geomorphic values: limestone mountains and glacial landforms around the glacial lakes of Enol and La Ercina. In many respects it marked the starting point of the Spanish conservationist movement and has been a symbol for mountaineers since the first ascent of Naranjo de Bulnes in 1904, effectively heralded as the beginning of rock-climbing in Spain. The assessment of the ecosystems and species present in the Picos de Europa area formed the basis for its extension in 1995 to include the high mountain region of the three massifs of Picos de Europa. Landscape highlights are dominated by geomorphic elements over human or biotic ones, and although they are pre-eminent in the Picos de Europa National Park, they have not been introduced into either the management of the area or edu-

cational or promotional publications. They are, for instance, absent from recent nature guides describing natural landmarks and excursion itineraries.

The relief of the Picos de Europa derives from its original geological and morphostructural characteristics, but is also the result of fluvial and torrential erosion, Quaternary glaciers, karst processes and active periglacial morphodynamics in the high mountain areas. Upper Carboniferous limestone is predominant, while sandstones, shale and quartzite conglomerate are also present to the south. The relief is defined by hogbacks facing north and fronts towards the south, forming a succession of morphostructures striking from east to west. The lithological changes result in an important morphological contrast between the calcareous massif and its surrounding valleys. Glaciers covered the massif during the Last Glacial Maximum. The most relevant and common landforms are glacial and karst, which are mutually modified. The imprint of Pleistocene glaciers is still clear and widespread, but the glacial landforms are now reworked by karst, nival and periglacial processes. The high mountain landforms have been studied by several authors since the 19th century. This work is based on more than 35 scientific papers on the geomorphology of the Picos de Europa (morphostructural, karst, glacial and periglacial studies by Spanish, French, German and British researchers) and includes our research on Quaternary and Little Ice Age glaciers and on periglacial geomorphology.

The methodology applied to the Picos de Europa National Park is based on the geomorphological mapping of the NPAs, a basic tool for the inventory of all the landforms and processes present in the study area and their spatial relationships. The map allows the identification of individual or representative sites earmarked for assessment. Evaluation cultural

The aim of the methodology of analysis of geomorphosites in NPAs and at a local scale is the achievement of maximum objectivity in the analysis of geomorphic elements from a scientific point of view and the inclusion of added values and those of use and management subject to a greater social, historical, personal subjectivity. Nevertheless, it is necessary to develop a method that could be as objective as possible, which would allow comparative assessment. The distinction between singular and representative geomorphosites leads to a better understanding of the resource.

A three-layered evaluation has been established based on geomorphological mapping and on geomorphosite cards. Once an inventory of landforms, processes, and landform systems in the study area has been carried out, the geomorphosites are analysed, assessing for each the intrinsic value of each element or shape, alongside its added value and its use and management value. Those three categories of assessment are defined as follows:

1) *Scientific or intrinsic value* are based on geomorphic topics, allowing a more objective and thorough knowledge of the site. Landforms and landform systems are analysed and assessed by means of the enumeration of intervening elements in the morphogenetic system. A maximum of ten individual elements are used for each site to obtain a significant parameter between 0 and 10. The total value is 100, but is expressed between 0 and 10 for ease of comparison with the scale used for added and use values.

2) *Cultural or added value* are based on the consideration of cultural and environmental elements affecting and enriching the intrinsic values. The maximum value is 70, but will be expressed between 0 and 10, for ease of comparison with intrinsic and use values.

3) *Use and management value* are territorial components and the potential for use of geomorphosites are assessed. From a detailed knowledge of intrinsic and added values along with fieldwork (location, geomorphological mapping and images), the potential for use and management are evaluated. Three categories are used: high (2 points), potential for use while guaranteeing conservation; medium (1 point), potential for use with suitable management; low (0 points), impossibility of use without suitable management and possible serious deterioration. The cultural and use values are prone to a more subjective approximation and so are assessed separately. For intrinsic and added values a binary scoring system is used (present =1; absent =0), without subjective weighting of one over the other. For use and management, a semi-quantitative scale of values is established. The results of the assessment are threefold. An alphanumeric evaluation of the three elements allows the comparison of the importance of each attribute in the assessment and management of the geomorphosite. In this way, the manager can assess the intrinsic and added values, alongside those concerning use and management, for all the geomorphosites of the NPA, and bring out their spatial distribution. The points from 0 to 10 of the first two categories allow an immediate comparison of the dominant (natural or added) values, therefore providing the context in which the management of the different types of use and conservation apply.

In this work we carried out an inventory and assessment of twenty-two geomorphosites of the central massif of Picos de Europa in the Picos de Europa National Park, all of which were classified according to intrinsic value, added value and use and management value. Relationships among the three categories allow the differentiation of four main types of geomorphosites: (I) high intrinsic and added values with medium or low use value; (II) medium-high intrinsic, added and use values; (III) medium-low intrinsic and added value with high use value; and (IV) low intrinsic, added and use values. From a use and management potential point of view, we established three value groups: high, medium and low. These classifications and typologies take into account the geomorphological values of the Picos de Europa National Park, and to incorporate the geomorphological values in the management and conservation policies. In the National Park high levels of human pressure (tourism, hiking, 4x4) on sites of medium and high intrinsic value have been observed. The impacts of tourist activities on geomorphosites is concentrated around the itineraries and resorts. This contrasts with low levels of pressure on geomorphosites of high intrinsic value in poorly accessible areas. The poor accessibility of some of the geomorphosites of high value may assist in the task of conserving them, but the most accessible must be carefully managed if irreversible impacts are to be avoided.

The method adopted for the analysis and assessment of geomorphosites in NPAs allows the establishment of intrinsic, added and use values of each geomorphosite selected. It also describes how to make a comparative assessment of the geomorphosites of the National Park. The methodology proposed in this work would certainly facilitate the assessment of geomorphosites in NPAs, but could also represent a useful educational and management tool.

