



The environmental protection of landscapes in the high semiarid Mediterranean mountain of Sierra Nevada National Park (Spain): Historical evolution and future perspectives



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A B S T R A C T

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Sierra Nevada is a protected mountain in the Iberian Peninsula classified as a Biosphere Reserve (1986), Natural Park (1989) and National Park (1999). All these environmental protection programmes are a consequence of its unique landscape in the context of the mid-latitude semi-arid mountains, with enclaves of exceptional scientific and cultural value. Thanks to its high altitude, Sierra Nevada held the southernmost Quaternary glaciers in Europe, as well as it happened during the Little Ice Age. In turn, Sierra Nevada is also singular thanks to its vast cultural heritage, since very early societies settled on its slopes and valleys and accommodate their lifestyles and economy to the characteristics of this mountain environment. Currently, Sierra Nevada has become an important tourist centre and receives a large amount of visitors. This process of change has conditioned the implementation of a different economic model: it brings benefits to the populations but it involves changes in the landscape as well, sometimes questionable. From this perspective, a critical revision of the legislation is required balancing the sustainable economic development of the population and the preservation and safeguarding of the heritage values of the landscape. With this goal, we suggest creating and implementing the Sites of Geomorphological Interest.

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Introduction

Landscapes – the object of study *par excellence* of geography – have progressively acquired an important place in discussions concerning regional planning and management. And, increasingly, their heritage value is being recognised (Corneloup, Bourdeau, & Mao, 2004; Scazzosi, 2004), their worth being attested to both in terms of what might be considered their broader biophysical framework (or that provided by their natural environment) and in terms of the imprint man has left in this biophysical space throughout history. For, clearly, both values endow landscapes with their uniqueness.

There exist a wide variety of interpretations of the landscape concept. Thus, for example, article 3 of the Law on Natural

Heritage and Biodiversity interprets it on the basis of the European Landscape Convention (Florence, October 2000) and defines a landscape as: “any part of the territory, as perceived by the population, whose character is the result of the action and interaction of natural and/or human factors”. What is unmistakable is the increasing amount of interest being paid of late to the landscape not only by the scientific community but by society at large, especially during the last decades of the 20th century which was when attention was first drawn to the deterioration being suffered by land and marine ecosystems and to the progressive exhaustion of non renewable natural resources. Geography, as a discipline lying between the social and natural sciences and concerned with discovering and explaining the relations that are established between man and the environment, has always been concerned with the study of the landscape (Haggett, 2001). And today, based on this plurality, it continues to assume this challenge from a variety of perspectives and in full awareness of the need to open up channels of communication with those other disciplines for whom, given their identity, the landscape also constitutes their object of study.

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The objective of our study is the massif of Sierra Nevada, a protected high-mountain area in southern Iberian Peninsula. High-mountain environments are very sensitive areas promptly reacting to climate changes and human activity (EEA, 2010). The management and preservation of these environments requires a thorough understanding of the natural and historical processes that have taken place in these regions. The management of protected areas requires also an efficient complementation with research and monitoring activities (Leverington, Costa, Pavese, Lisle, & Hockings, 2010).

In this paper, we study the uniqueness of the mountain landscape in Sierra Nevada as well as the process of its scientific discovery, dating back to the 18th and 19th centuries. It also analyses the events of the 20th century that led to the tourist potential and the beauty of the landscapes of Sierra Nevada being recognised and appreciated.

This research also wants to underline the fact that, in areas with great ecological significance – as it is the case of Sierra Nevada – it is still possible to balance the preservation of the environment and the development of sustainable economic activities, provided that legislative framework is rigorous and adequate. With regard to the coexistence between landscape preservation and the implementation of economic activities, we have analysed the opportunity of promoting sustainable tourism activities and the maintenance and strengthening of traditional activities (agriculture, livestock) and some other more recent and contemporary though with long tradition in the area (commerce, handicraft industry, medicinal plants and mushroom harvesting).

We also propose the implementation of a new category for the management of the landscape in Sierra Nevada based on the geomorphological significance of many sites in the high lands of the massif.

Materials and methods

Standard procedures from the geographical discipline have been used in this research: review of relevant literature, consultation of cartographic and statistical sources, arduous field campaigns and data processing. Concerning data elaboration, we have analysed especially those sources that have enabled to reconstruct the process evolution by which Sierra Nevada landscape has become a touristic attraction thanks to its scientific and cultural values. Apart from own books (original works, copies of originals, facsimiles, etc.), many other documents from several libraries and documentary archives have been studied in this research, namely: Library of the Natural History Museum (Madrid), Andalusia Virtual Library and Miguel de Cervantes Virtual Library, Library of the Museum Casa de los Tíros (Granada), Archive of the Royal Chancery of Granada, Library of the University of Granada and Municipal Archives of Granada.

Demographic statistics were obtained from the Institute of Statistics and Cartography of Andalusia, while the National Park of Sierra Nevada provided the number of annual visitors to the Park. Cartography is based on the orthophoto of the project PNOA07-10 (2008, 2009), the topographical map of the Institute of Statistics and Cartography (scale 1:10,000) of Andalusia and the topographical map of the National Geographical Institute (scale 1:25,000). Image processing was conducted with the program ArcGIS 9.2 at scale 1:3000. The scale of the map presented in this paper is 1:8000.

Field work has allowed identifying *in situ* specific sites regarding their geodiversity and biodiversity as well as historical and architectural singularities rooted in these mountain villages. This task consisted of: (a) Preliminary photogrammetric mapping of the natural and cultural resources with the purpose of identifying potential sites for field validation, and (b) Field work campaign

Table 1

Summary of the characteristics of the natural and human values mentioned in the text with an example from Sierra Nevada for each of them.

Value	Characteristics	Example
Geological	Area characterized by a high diversity of structures and lithologies	Veleta unit
Geomorphological	Area characterized by a high diversity of reliefs and active and inactive geomorphological features	Veleta cirque
Biological	Area characterized by an abundant distribution of vegetation and/or presence of endemic species	San Juan valley
Edaphological	Existence of well-structured soils and/or patterned ground	Wetlands (<i>Borreguiles</i>)
Hydrological	Presence of lakes, streams and late-lying snow patches	Siete Lagunas
Palaeoenvironmental	Terrestrial and aquatic sedimentological records that may provide information about past environmental and climate conditions in the area	Solifluction lobes and lakes in Río Seco
Historical-cultural	Evidences of the historical presence and cultural impacts of the societies in the area reflecting their life forms and traditional activities	“Careos” system canals

following the previously tracked routes for validating *in situ* the observed elements.

Theoretical background

This paper aims to highlight the uniqueness and originality of Sierra Nevada within the Western Mediterranean focussing attention on the ecosystems and landscape management in some of the southernmost paraglacial environments in Europe that still contain relict ice and permafrost in degradation since the last cold phases of the Little Ice Age. Sierra Nevada is a massif heavily anthropized since Medieval times; the life forms, the type of settlements and the regional economy, with evident effects on land uses, have always marked the identity of the people living there, which is also result of the different cultures that settled in the massif and neighbouring areas over the last centuries. The interaction of the natural and cultural resources has been crucial in the long-lasting process by which the mountain range of Sierra Nevada has been designated as a Biosphere Reserve, Natural Park and National Park, which is reviewed in detail in this paper. This article pretends to highlight the heritage resources of Sierra Nevada landscape, where there converge natural-scientific elements – located mostly in the summits – and cultural factors – now located in mid-slope areas, where traces of secular human presence are widespread Table 1.

The objectives should be framed within the philosophy – endorsed in laws and international conventions – of contemplating the natural areas as ecological reserves owing to the resources they contain (Panizza, 2001; Reynard, 2004). Mountains have been

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