

Monitoring Outdoor recreation in Serra da Estrela Natural Park, Portugal

Sofia Bizarro, FCSH - UNL, Portugal, s_bizarro@hotmail.com

Ricardo M. Nogueira Mendes, CICS.NOVA/FCSH-UNL, Portugal

Teresa Santos, CICS.NOVA/FCSH-UNL, Portugal

Rui Pedro Julião, CICS.NOVA/ -UNL, Portugal

Introduction

Tourism and recreation in protected areas is rising in popularity globally, greatly challenging the management of conservation areas. The administration of these areas requires a growing number of monitoring and planning instruments aimed at enhancing management entities ability to conciliate user satisfaction with the protection of natural and cultural values.

Increasing of outdoor and sport activities has triggered the need to assess its environment impact. For instance, the repeated use of trails, highly accessible and informally disseminated, can represent a source of conflict and, therefore, make the environments where these activities are developed especially vulnerable.

The lack of information, the complexity of the visitor-related aspects, as well as the difficulties in monitoring its flows, interfere with the development of planning methods and instruments that can allow a better understanding of this extensive trend.

Using the information made available by new technologies and social networks specialized in this segment, the study proposes, based on Voluntary Geographic Information (VGI), the development of planning tools for an efficient characterization of this reality. The methodology intends to study, through an analysis of the available voluntary information, the users' preferences towards the trail system of Serra da Estrela Natural Park (PNSE). The study results will contribute to the definition of standard criteria used in the design of a trail network, optimized according to the users' profile and preferences.

Study Area

Serra da Estrela Natural Park (PNSE), is located in Portugal's central region, covering the mountainous area of *Cordilheira Central*, which is shared by the municipalities of *Celorico da Beira*, *Covilhã*, *Gouveia*, *Guarda*, *Manteigas* and *Seia*.

Created in 1976, the park is the second largest protected area in Portugal (with 89.132 ha) and has the highest altitude continental point (1.993m). It is characterized not only by its altitude but also by its morphological peculiarity, derived from quaternary period glaciations. Furthermore, the park boasts relevance for the presence of high cultural values, left by ancestral occupation and territorial humanization, as well as for its important fauna and flora, exclusive endemism integrated in the Rede Natura 2000 (PTCON0014) network and the RAMSAR reserve.

Its singular landscape, marked by the presence of snow, makes this park one of the most visited protected areas in Portugal. However, similarly to the remaining

classified areas in the country, the absence of an official entrance or delimitation translates into a complex evaluation the visitors' flow and distribution, resulting in a lack information to systematize the methodology to study this tendency.

Methodological Approach

Data treatment was subdivided in three distinct phases. Initially, inspired by Nogueira Mendes *et al* (2012, 2014), information was collected from the voluntary data made available by webshare services specialized in outdoor activities (GPSies, Wikiloc, Geobserver, etc.), in order to analyse the number, distribution (space and time), profile and preferences of the PNSE's trail users.

After geo-statistic treatment and data validation, it was possible to dize the criteria and preferences of the PNSE's users, defining models of attractiveness and stand-ard types of route (dimension, time, difficulty, etc.).

Finally, based on the statistical and space patterns obtained from the park's glob-al analysis, physically and ecologically optimal paths were projected for each user and route type through geographic modelling. The modelling was applied on part of the protected area and based on an ancestral trail network already existent, which was previously digitalized through historical cartography and its trails hierarchized according to their potential to constitute official trails.

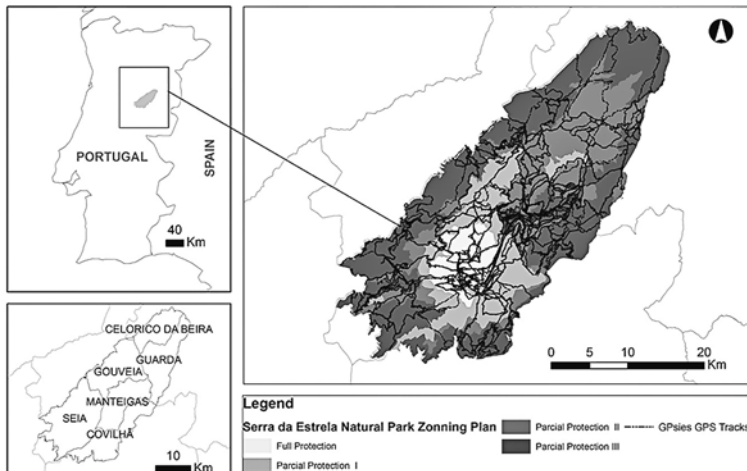


Figure 1. Serra da Estrela Natural Park Zoning Plan: Conservation areas and the informal traks

Conclusions

Methodology approach can be easily introduced in further planning and management models and replicated in other protected areas, offering dynamic and updated information to management entities that enables the monitoring of the recreation management, particularly inside open areas.

The diagnosis of the activities' dimension and distribution, as well as of the users' preference profile, allows the forecast of conflicts and impacts, thus contributing to a risk minimization.

A better understanding of the audience and settled dynamics makes it possible to define balanced management strategies, project a range of activities suited to the users' aspirations and set a regulated use of classified areas.

In the method adopted, the transposition of a global system of preferences into the reactivation of part of ancestral trails for hiking activities not only permits a re-functionalization of routes disabled by the decline in the agro-pastoral activity, but also allows the forethought of ecologic and property conflicts inherent to a brand new route's installation.

In this study and future ones, voluntary information holds potential for exploration. Protected areas in particular should enhance its application both for available data analysis and to increase users' participation and collaboration management, improving the planning system.

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