Conference Volume	5th Symposium for Research in Protected Areas 10 to 12 June 2013, Mittersill	pages 91 - 96

Landscape Observatories as Tools for the Management of Protected Areas: The Case of Sierra Nevada (Spain)

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Abstract

The rapid and profound changes of the territory in recent decades require implementation of new methodologies which would make monitoring and study of transformations of landscape possible. In this way the main dynamics of change can be detected ensuring the ultimate goal of facilitating territorial and landscape planning.

Protected Areas are spaces characterized by ecological uniqueness and by high susceptibility to changes. For these reasons systematic monitoring of the processes of transformation that affect their landscapes is especially important.

In this context, Landscape Observatories form optimal tools for monitoring of the landscape. They provide a basis for its synchronic and diachronic analysis through the use of photography which enables us to appreciate the visual aspect of transformations and to identify dynamics of change. Moreover, the use of photography at ground level, capturing human-eye perspective, permits the implementation of mechanisms of public participation. In this sense Landscape Observatories facilitate fomenting of awareness and involvement of the population in the management of Protected Areas. Through the emphasis on achieving public consensus, they provide an efficient foundation for successful protection and conservation policies.

We present here our experience of cooperation with the Protected Area of Sierra Nevada, focusing specifically on the subject of Public Participation. Through the involvement of experts, managers, administration, associations and the population in general in this process, the viability of the project and inclusion of the demands of the population in the planning documents are ensured.

Keywords

Landscape Observatory, Protected Areas, Public Participation, Sierra Nevada.

Introduction

Throughout the recent decade Protected Areas (PA) in Spain have been significantly extended, covering today more than 11% of the national territory (EUROPARC 2012). The increasing present social demands, political trends and guidelines enforced by the European Union through the ratification of the European Landscape Convention by the majority of member states (European Parliament 2008) all indicate that this tendency will be maintained in the future.

The landscape, viewed from a geographical perspective and as one of the most prominent elements of PA, may be used as an efficient instrument for studying and managing these areas (HIRSCHNITZ-GARBERS & STOLL-KLEEMANN 2011; HOUET et al. 2010; PEYRACHE-GADEAU & PERRON 2010). This project aims at developing a Landscape Observatory as a new methodological tool for effective management of PA consisting of monitoring landscape dynamics and creating mechanisms for public participation (CARRÉ & MÉTAILIÉ 2008; Ministère de l'écologie, de l'énergie, du développement durable et de l'aménagement du territoire 2008). The construction of the observatory is based on exhaustive fieldwork and the analysis of secondary data. The core of the project consists of research on current dynamics both ecological and socio-economic and a prospective study of the documents of spatial planning. Areas are selected for photographic monitoring according to their internal characteristics and detected dynamics. Through their systematic tracking, the methodology of the observatory aims at improving the strategies of governance that affect the conservation and preservation of natural characteristics of PA.

It is also designed as a participative tool given that in the final phase of the project an online landscape observatory web database of monitored zones has been created. It will serve as a platform for analysis of landscape dynamics for researchers and public administration as well as a source of information for local communities. The methodology described will be implemented in the Sierra Nevada Natural Park, a protected area with one of the greatest biodiversity in Europe.

Objectives

Profound territorial and socio-economic transformations have lead to visible alternations in the functioning and configuration of landscapes. In this context, landscapes serve as depositaries of heritage whose effective monitoring and governance should be guaranteed. The orientation of dynamic processes reassuring the

preservation of landscapes of quality is therefore a priority in the management of the resources of PA and in the planning of models of conservation and sustainable development (MARTÍNEZ DE PISÓN 2007; PANAREDA & AROZENA 2008).

The study of landscape dynamics allows understanding of the processes, both natural and socio-economic in character, which accelerate the transformation of environment and territory (CARDILLE et al. 2005; HERNÁNDEZ 2009). Furthermore, it permits the evaluation of local communities' perception of these changes, which serves as a base for the future development of these landscapes.

This research aims to conduct a methodological study for the introduction of landscape observatories in PA. According to the guidelines for the application of the European Landscape Convention, observatories constitute tools for the description and analysis of the state of landscapes and for the provision of elements for understanding the existing tendencies and construction of prospective scenarios. They also create a framework for establishing procedures for citizen participation (COUNCIL OF EUROPE 2000).

This project utilizes the Sierra Nevada Natural Park as a pilot area and aims to design a methodology applicable to other networks of PA.

The primary objective of this research consists of establishing the methodological fundamentals for the design of an observatory that will allow an effective monitoring of the evolution of landscapes in PA. The detection of main trends of change is not of less importance given that its aim is the sustainable future management of these landscapes according to the demands of population. By way of contributing to the implementation of the clauses included in the European Landscape Convention this research aims to assess the current state of landscape resources in Sierra Nevada PA and identify and evaluate the processes and dynamics with effect on the evolution of landscapes by detecting the principal alternations induced by them and their impact on the final configuration of the landscape.

Results of the design and implementation of the methodological project

The Landscape Observatory and Archive of the Sierra Nevada PA has been designed as an operational tool which implements a specific protocol for collecting, archiving and classifying data aiming at the systematic monitoring of the processes and dynamics which affect landscape. Furthermore it provides a base for identification of functions and values that the society attributes to their landscapes and therefore it contributes to raising awareness and participation in the management of landscape resources (CONRAD et al. 2011; MANNIGEL 2008). The final objective is to contribute to the elaboration of specific tools to provide technical support for public administrations in the process of decision making.

In order to conduct the study of landscape dynamics a method of photographic observation and photo-comparison has been applied. It is based on the systematic classification of landscapes, which are monitored by a periodic follow-up of these photographs from the same perspective. The basic principles of this technique have been validated in a range of studies related to the monitoring of ecological, geomorphological and urban processes (CARRÉ & MÉTAILIÉ 2008) and more recently to that of landscape evolution through the project OAPA (Observatorio y Archivo de los Paisajes de Andalucía/Landscape Observatory and Archive of Andalusia). OAPA, a project funded by the Government of Andalusia and developed during 2010 and 2011 by our research group, created a methodology which is the base for Landscape Observatory of the Sierra Nevada PA. This paper concentrates on the adaptation of the developed procedures of photographic observation to landscape analysis in the framework of PA.

The implementation of the Observatory consists of three main phases, preceded by a preliminary study. The last phase has a transversal character.

0. Preliminary study

The first part of the preliminary study aims at understanding the configuration and current characteristics of the landscapes of Sierra Nevada. It included a profound analysis of the bibliographical documentation of the historical evolution of the landscapes of the region (see JIMENEZ et al. 2010), and also the results of the processes of sectorization of the analyzed territory and of photointerpretation of two sets of aerial photographs: the series of 1999 and 2009.

The sectorization of the Protected Area has a triple functionality: it responds to the natural division of different types of landscape of the region, Yolanda JIMENEZ (1991); it structures the territory for subsequent configuration of the network of points for observation capturing the heterogeneity and richness of the region in terms of natural biodiversity and landscape; and, finally, it articulates the Sierra in a functional form, introducing already in this phase elements of the design of the processes of public participation.

The methodology of photointerpretation is not based in this case on a traditional individual reading of each of the series of aerial photographs and the subsequent extraction of statistics of the uses and land cover. It is based on the identification of changes. This process, using ArcGIS 9.3 of ESRI España, is conducted by superimposing the two sets of images. In this way we detect and mark on the most recent photo those areas that have been affected by transformations of land cover or of the elements of the landscape. This enables the identification of recent dynamic of change of the landscape of Sierra Nevada which took place throughout the last decade.

The last element of the preliminary study, which precedes the configuration of the network of fixed points for monitoring, is the analysis of the territorial planning documents. It enables the identification of possible changes and existing threats for the landscape assuring that the creation of the observation network is based on a solid knowledge of the past, present and future of our landscapes. It is, therefore, possible to make the first

approximation to the places that should be considered as possible sites for the application of systematic monitoring by photography.

Thanks to this processes of the analysis of the characteristics of the landscape and the existing dynamics of change, it is possible to address the identification of issues to be monitored.

1. Data collection

The configuration of the network of monitoring points of the landscape is based on exhaustive fieldwork. With the support of the results of the preliminary study and through the implementation of public participation processes, which are described below, the final network of points is established. This network, covering all landscape types and taking into account the dynamics of change identified and the territorial actions planned, forms the base for regular and systematic monitoring.

For each point of observation an information file is elaborated. It is composed by an image taken in each campaign of photography, technical information of the point and the analysis of the characteristics and dynamics of the landscape. This enables future repetition of the exactly the same image. In each point's file the periodicity for rephotography recommended is indicated.

Examples of images from the network of points for monitoring (Autor: Andrés Caballero Calvo):

Foto 1: "Rinconada de Nigüelas"
Abandonment and recuperation of agricultural areas

Foto 2: "Carretera de la Sierra"
Expansion of disperse constructions

Foto 3: "Siete Lagunas"
Landscape of exceptional natural values

Foto 4: Terraced slopes at Alpujarra
Landscape of exceptional antropical values

2. Interpretation

The analysis of the archives of images is conducted using the method of photointerpretation; comparing pairs or series of images.

The images from successive campaigns of rephotography form a database of landscapes. This database facilitates quantitative monitoring of landscape transformations and, above all, it allows qualitative analysis which is only possible through photos taken at ground level. In this sense, and in comparison to cartographic and aerial documents, photographs taken in the framework of the observatory will constitute a tool for the appreciation of landscape in terms of human perception (CARRÉ & MÉTAILIÉ 2008). It is this point which leads to the other branch of the Observatory: the Public Participation.

3. Public Participation

A series of different processes of Public Participation is transversal to the two previous phases. The Observatory is a tool for citizen participation through the creation of a space for dialogue on landscape values among key local actors such as the PA managers, researchers, professionals and general public (LAURIAN & SHAW 2009; NOGUÉ 2007; SGARD 2010). To ensure the participative character of the observatory, a specific methodology, which gathers information about the perception of the landscape for each of the areas of study, is designed. The selection

of the specific techniques to be applied took place after the initial phase of fieldwork, once the preliminary study of the area in question was finalized.

The OAPA website should be highlighted as a tool and source of information for researchers and public administration, as well as for local communities, creating a base for the debate on the necessities and the models of management of PA.

The creation of conditions for the debate on the necessities and models of management of PA respond to one of the main aims of the project which is to ensure the participatory character the territorial planning.

Conclusions

The presented project is a methodological project, based on the design of a scientific process of observation and analysis of the landscape of Sierra Nevada. It enables us to monitor the landscape evolution, to detect the dynamics of change and, therefore, to undertake actions which corroborate or counter the causes of these transformations.

Given the nature of the design, the Observatory will fully reach its objectives once several campaigns of rephotography are conducted. However, it is equally important, that this methodology has been already implemented successfully in other areas of observation of the province of Granada, such as the *Vega de Granada*, the *Hoya de Guadix* and the *Costa*. In all of these regions we have already conducted several photographical campaigns obtaining excellent results in terms of the analysis of landscape evolution.

In Sierra Nevada, thanks to the configuration of a network of points according to the results of the public participation, the establishment of the observatory has been completed (see the previous four photos as examples of the network of points for monitoring). It is therefore already functioning and will be used to aliment the database and provide material for photocomparation.

The simultaneous application of various mechanisms of public participation enables us to identify the preferences of the society and include them in the *Landscape Quality Objectives*, which is the base of the landscape planning and management of landscape resources.

Finally, it should be noted that a key element which ensures the viability of the project in this National and Natural Park, is the collaboration with the authorities of the *Sierra Nevada Protected Area*. Only with the involvement of the governing body it is possible to guarantee the sustainability of the project as well as the effective implementation of its results in the documents of territorial planning.

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