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In landscape management all of us have something to say. A holistic method for landscape Preservability evaluation in a Mediterranean region

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ABSTRACT

Landscape assessment methods have traditionally valued the landscape through a panel of experts with little or no participation of the population. However, after the adoption of the European Landscape Convention (ELC), the perception and the participation of the population has played an increasingly important role in landscape evaluation and planning. In this regard, the goal of this paper is to develop a model able to evaluate and integrate both the objective and subjective landscape factors into a new concept: the Preservability. This model, as well as selecting and classifying the landscape attributes according to the bio-geographic features of the study area i.e., Ricote Valley (Region of Murcia, Spain), includes two online surveys: one to assess the populationís landscape preferences and the other to obtain the specific weight of each objective and subjective landscape factor from a panel of experts. These landscape factors were incorporated into a GIS. To obtain the best model, the Preservability was assessed from three different approaches: objective, objective-weighted and weighted. The final results demonstrate how the Preservability weighted method returns different thresholds appropriate to the landscape attributes, the population's perceptual preference and the protected areas. The different thresholds allows for priority areas to be identified for protection, as well as the adoption of appropriate management and planning strategies according to the landscapes characteristics, current state and uniqueness.

1. Introduction

Landscape evaluation has evolved gradually over time until its present state. The European Landscape Convention (ELC) (Council of Europe, 2000) was the first policy which elevated its importance (Priore, 2007) and considered it an asset comparable to other resources (e.g., vegetation, soil, wildlife, etc...). As a result, this contributed to the development of a theoretical and practical framework for urban planning (De Montis, 2014).

According to the ELC, landscape is "an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors". It constitutes a scarce and valuable natural resource with a growing demand, but is easily depreciated and difficult to renew (Maero et al., 2011; Muñoz-Pedreros, 2004; Picher Fernández et al., 2006). Its importance to natural heritage, culture, quality of life and society is evident (Andrews and Withey, 1976; Antrop, 2000a; ELC). Therefore, its consideration and exhaustive evaluation is required despite the strong perceptual component that can impede its analysis.

According to several authors there are different methodologies for assessing landscape (e.g., Arthur et al., 1977; Briggs and France, 1980; Daniel and Vining, 1983; Zube et al., 1982). Lothian (1999) split the different approaches into two main paradigms of landscape evaluation: objective or physical and subjective or psychological. In the first methodology, it is assumed that beauty is an inherent quality of the landscape and is dependent on its intrinsic attributes. In the second methodology, it is the product of the multisensory composition of the visual receptor: "the eye of the beholder". By merging these two paradigms we are able to use a more effective method which focuses on the objective aspects using progressive quantification complemented by subjective studies (Buhyoff and Riesenmann, 1979; Wherrett, 1996).

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There is now a general consensus that both aspects (objective and subjective) are important and must be treated with the rigour and the scope necessary for the proper evaluation of landscape (Sheppard, 2005). However, the relative weight of each aspect is still unclear when trying to assess landscape. This uncertainty has led to various studies that focused separately on one of the two methods i.e., objective or subjective.

In regards to numerous subjective studies which have been conducted (e.g., Brown and Brabyn, 2012; Daniel, 2001; Misgav, 2000; Sevenant and Antrop, 2010; Zube et al., 1982), the visual perception is considered an essential component in understanding and appreciating landscapes which have a strong psychological and cultural dependency. Svobodova et al. (2012) distinguishes between two types of studies associated with visual perception. On the one hand we have the expert approach (Zube et al., 1982) or ecological model (Daniel and Vining, 1983), which is dominant in environmental management (Daniel, 2001) and where the evaluation is carried out by a group of experienced observers (e.g., Amir and Gidalizon, 1990; Bishop and Hulse, 1994). On the other hand, we have the participative or psychophysical approach (Daniel and Vining, 1983; Zube et al., 1982), where the evaluation depends on the general public (e.g., Arriaza et al., 2004; Barroso et al., 2012; Brown and Brabyn, 2012; Dramstad et al., 2006).

Therefore, the ELC has relegated the traditional methods of landscape evaluation by experts and prioritizes a more democratic method involving the population (Gulinck et al., 2001; Sevenant and Antrop, 2009, 2010). The recommendations by the ELC are understandable given the wide range of landscapes which have to be managed. However, these studies of perception by the population present a number of weaknesses: (1) the variation between landscapes is greater than between the judgments of observers (Daniel, 2001), (2) the significance of different intrinsic components that make up a landscape tends to be overlooked (Lothian, 1999), (3) there tends to be a positive bias in the results obtained from the inhabitants of the studied location (Zube et al., 1974; Dramstad, 1996), and above all, (4) using the results as a spatial criterion presents problems for land management and delimitation due to the lack of a recognizable limit.

From our study's point of view, we believe that these limitations of visual perception are overcome by integrating its strengths with an objective-based approach to create a new methodology within the quantitative holistic paradigm. According to Daniel and Vining (1983), this is the most rigorous and extensive approach to landscape evaluation. The main problem with this, however, is demonstrating which approach – i.e., objective or subjective – has the greatest impact on the final evaluation value. To resolve this issue we have used an expert consensus within the study. This merging of methods, recommended by Daniel (2001), has a twofold positive effect: Firstly, if the average or majority opinion of the experts is conducted correctly, it allows us to consider the weighting of physical and psychological values objectively, thus resolving the problems of the aforementioned method. Secondly, the role of the experts acquires greater relevance in relation to the visual preferences of the population, therefore minimizing the subjectivity of the method. In this way, the role of the expert can be defined as the reviewer of the selected model to assess the landscape.

Thus, the aim of this paper is to develop a method of landscape evaluation that combines the advantages of traditional objective procedures (inventory of intrinsic attributes) and subjective procedures (perception-based assessment) (Lothian, 1999), through a DELPHI survey conducted with a panel of experts. To determine what method fit better to reality, we are going to evaluate separately and together each one of the different objective and subjective procedures.

The methodology was applied in the Ricote Valley, in Southeastern Spain. The Valley shows high environmental and cultural landscapes as result of human intervention over the environment along the ages. The Valley's landscapes has a lot of similarities with another Mediterranean landscapes, with also displays some peculiarities, especially fluvial terraces where traditional orchards are located.

$$Pb = \frac{\sum_{i=1}^{n} Q_i + \sum_{i=1}^{n} F_i + \sum_{i=1}^{n} Ve_i + \sum_{i=1}^{n} Vq_i + \sum_{i=1}^{n} Vpf_i}{Sup_i}$$

Fig. 1. General equation for Preservability according to the proposed model.

2. Methodology and sources

The combination of explanatory variables selected to make up the landscape analysis model proposed in this paper allows us to revisit a concept defined by Bosque Sendra et al. (1997): the Preservability.

For Preservability (Pb) we understand "that landscape feature which allows us to determine on the basis of objective and subjective factors, the degree of protection each landscape unit deserves". It is a value used to classify the landscape hierarchically to determine its level of protection. It integrates the common objective factors of landscape like Quality (Q), Fragility (F) and Visual exposure (Ve), as well as the subjective Visual quality (Vq) and Visual perceptive fragility (Vpf) (Fig. 1).

Quality (Q) would be those features of the landscape that represent aesthetic, unique and natural values. The Fragility (F) is the capacity of the landscape to absorb physical changes without transforming its character significantly i.e. a way of establishing the vulnerability of the landscape (Muñoz-Pedreros, 2004). It is a term similar to that established by Amir and Gidalizon (1990) as Visual Absorption Capacity (VAC). For this paper the Q and F are an objective property inherent in the physical characteristics of the landscape (Lothian, 1999) and their value is calculated on the basis of the sum of the different attributes that make up the landscape. Visual exposure (Ve) is the part of the study area which is visible from specific viewpoints (Llobera, 2003). Preston (2001) demonstrated that the evaluation of scenic quality not only involved the populationís preferences, but also the degree of landscape visibility, as visible areas are more valued than non-visible areas (Brown and Itami, 1982). Due to the Ve factor compensating for the low scores of units nearest to the viewpoints, we applied a correction coefficient. This was done by multiplying the Ve value of those units whose Q value was less than their average minus the standard deviation by −1.

Visual quality (Vq) and the Visual perceptive fragility (Vpf) are the perceptual or subjective concepts which respectively express the subjective interpretation of the observer for each landscape unit (Lothian, 1999), and the sensitivity of a landscape unit to possible transformations. Finally, Sup represents the surface area of each landscape unit expressed in hectares whose estimation allows its results to be standardized, and i each pixels of the study area.

To obtain this model, a methodology is followed (Fig. 2) made up of four steps: (1) define the landscape units and delimit the study area, (2) conduct a survey of the landscape Visual Quality (Vq) and Visual Perceptive Fragility (Vpf) and an assessment of the results, (3) select the attributes of the landscape and (4) calculate the Preservability (Pb). We will now look at these steps in more detail.

The steps shown at Fig. 2 were evaluated and analyzed by the free GIS gvSIG Desktop 1.12 (http://www.gvsig.org), with the spatial extension Sextante and the Rstudio (R Core Team, 2014) statistical software.