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Original Article

Using social media photos to explore the relation between cultural ecosystem services and landscape features across five European sites

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ABSTRACT

Cultural ecosystem services, such as aesthetic and recreational enjoyment, as well as sense of place and local identity, play an outstanding role in the contribution of landscapes to human well-being. Online data shared on social networks, particularly geo-tagged photos, are becoming an increasingly attractive source of information about cultural ecosystem services. Landscape photographs tell about the significance of human relationships with landscapes, human practices in landscapes and the landscape features that might possess value in terms of cultural ecosystem services. Despite all the recent advances in this emerging methodological approach, some challenges remain to be explored: (a) how to assess a broad suite of cultural ecosystem services, beyond aesthetic beauty of landscapes, (b) how to identify the landscape features that are relevant for providing cultural ecosystem services and determine trade-offs and synergies among cultural ecosystem services. To address these challenges, we have developed a methodological approach suitable for eliciting the importance of cultural ecosystem services and the landscape features underpinning their provision across five different sites in Europe (in Estonia, Greece, Spain, Sweden and Switzerland). We have performed a content analysis of 1.404 photos uploaded in Flickr and Panoramio platforms that can represent cultural ecosystem services. Four bundles of landscapes features and cultural ecosystem services showed the relation of recreation with mountain areas (terrestrial recreation) and with water bodies (aquatic recreation). Cultural heritage, social and spiritual values were particularly attached to landscapes with woodpastures and grasslands, as well as urban features and infrastructures, i.e. to more anthropogenic landscapes. A positive though weak relationship was found between landscape diversity and cultural ecosystem services diversity. Particularly wood-pastures and shrubs were more frequently portrayed in all study sites in comparison with their actual land cover. The results can be of interest both for methodological purposes in the face of an increasing trend in the use of geo-tagged photos in the ecosystem services research and for the elicitation and comparison of landscape values across European cultural landscapes.

1. Introduction

The European Landscape Convention has acknowledged that landscapes are of importance for individual and societal well-being, whether in urban or rural areas and in outstanding or everyday landscapes (ELC, 2000). In Europe, landscapes are largely recognised because of their cultural value as they have been sculptured by human actions over centuries (Agnoletti and Emanueli, 2016) as well as because of their contribution to people's quality of life through the provision of ecosystem services and nature's benefits (Díaz et al., 2015). Among these, cultural ecosystem services (CES) such as aesthetics (Daniel, 2001), recreational and touristic values (Bell et al., 2007), and sense of place (Brown and Raymond, 2007; Manzo and Devine-Wright, 2013) play an outstanding role (Bieling et al., 2014).

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Different types of landscapes provide different services, and landscape heterogeneity can influence a variety of ecosystem function (Lovett et al., 2005). In addition to that, different parts of society value ecosystem services and functions differently, and this complexity generates a multitude of scholarly and societal questions (Bieling et al., 2014). Therefore, the assessment and valuation of ecosystem services is currently attracting attention both within academic and policy arenas.

Understanding how different landscape features contribute to the provision of diverse CES is essential for landscape planning, in particular for evaluating trade-offs around alternative trajectories of landscape change (Bieling et al., 2014; Plieninger et al., 2015). Ecosystem services valuation techniques are usually grouped in relation to the three main value domains to which they refer: monetary, biophysical and socio-cultural (Martín-López et al., 2014). These three approaches are meant to be complementary, but while monetary and biophysical approaches have attracted more attention in ecosystem services research (Nieto-Romero et al., 2014), socio-cultural valuation is particularly useful to explore human perceptions and preferences towards CES (Martín-López et al., 2012; Termorshuizen and Opdam, 2009). Despite recent advances in developing methods for the socio-cultural valuation of CES (e.g. Bieling et al., 2014; López-Santiago et al., 2014; Oteros-Rozas et al., 2014; Plieninger et al., 2013; Raymond et al., 2009; Gould et al., 2014; Van Berkel and Verburg, 2014), CES mapping and assessment still remains underdeveloped (Hernández-Morcillo et al., 2013; Milcu et al., 2013; Satz et al., 2013).

Elicitation of ecosystem services provided by landscapes through landscape photographs has developed in the last decades as a visual method for understanding rural landscapes (e.g. Tahvanainen et al., 2001; Pinto-Correia et al., 2011; López-Santiago et al., 2014; Junge et al., 2015; Milcu et al., 2014). Its relevance relies on the capacity of photographs to communicate through visual representations and stimuli (Jenks, 1995; López-Santiago et al., 2014). Focus has so far been on eliciting values and preferences on a given set of photographs, and to lesser extent on the actual photographs taken by people and their interpretation (Richards and Friess, 2015). Making a photograph when being in the landscape is a process of subjective experience of and practice with the landscape that has a perceptual and material dimension (Wylie, 2007: 177). Photographs account for historical, cultural and social ways of seeing the world, so they can stand-alone as data sources as expressions of the ideas themselves (Stedman et al., 2004). Landscape photographs communicate about the significance of human relationships with and within landscapes, about human practices and the processes of nature, and about physical and anthropogenic features, thus offering a basis for an integrated understanding of landscapes and the values that they provide to humans (Stephenson, 2008).

From photographs posted on social media, these meanings can effectively be interpreted through content analysis (Rose, 2007). Content analysis of landscape photographs is a systematic approach of coding and analysing the frequency of certain visual elements and attributes (in large data sets of images) that are treated independently, as stand-alone attributes (Albers and James, 1988). As it is based on defined categories to reveal patterns, content analysis has a quantitative coding dimension (Stepchenkova and Zhan, 2013). Content analysis has a focus on the image itself as a representation (Rose, 2007) so even if it has been more widely used with textual material than with images, analytically, photographs are analogous to verbal content (Stepchenkova and Zhan, 2013). Content analysis of social media photographs has demonstrated to be an adequate model to unravel CES at multiple spatial scales (e.g. Richards and Friess, 2015; Martínez Pastur et al., 2016).

Uploading and sharing photographs in social media platforms has become in fact increasingly prominent. The rapidly growing number of landscape photographs published in social networks such as Flickr, Panoramio, Instagram, Twitter or Facebook has a large potential for the elicitation of CES (Guerrero et al., 2016). Also, crowdsourced data offer the possibility to improve our knowledge on the collective image of landscapes (Dunkel, 2015) and to understand in visual terms which landscape features attract recreationists, visitors and other user groups (Huang et al., 2013). Compared to traditional data sources, crowdsourced geotagged photographs provide an otherwise unavailable perspective on the connections between humans and nature and facilitate understanding of how people perceive landscapes and experience CES. Also, crowdsourced spatial data can be used to identify trade-offs between CES by expressing contrary views and conflicting uses of nature. Such approach might have several advantages over conventional photograph elicitation, as it comprises large sample sizes and can allow for spatially explicit analyses across different regions, even including different languages (Huang et al., 2013), and across time (Thiagarajah et al., 2015).

Within crowdsourced data the term user generated contents (UGC) comprises a bunch of approaches and terms such as volunteered geographic information, contributed geographic information, collaborative information or citizen sensors that are used to crowdsource so-called passive data on peopleís interaction with the environment (Dunkel, 2016). These contents are being increasingly used, mostly in urban areas to explore tourism-related preferences (Garrod, 2007; MacKay and Couldwell, 2004) or green infrastructure perceptions (e.g. Guerrero et al., 2016). However, a small but growing number of studies has analysed crowdsourced geotagged photographs for assessing landscape features and CES. For example, UGC has been harnessed to quantify tourism and recreation at global (Wood et al., 2013), regional (Keeler et al., 2015) (Willemen et al., 2015) and local scales (Nahuelhual et al., 2013; Kádár, 2014; Richards and Friess, 2015). UGC analysis has also been applied for assessing landscape aesthetics (Casalegno et al., 2013; Depellegrin et al., 2012; Figueroa-Alfaro and Tang, 2016; Tenerelli et al., 2016), place attachment (Stedman et al., 2004; Gliozzo et al., 2016) or existence values and local identity (Martínez Pastur et al., 2016). Most of these studies have used the number of photographs taken from a particular site as a proxy for the intensity of the respective CES (Martínez Pastur et al., 2016; Tenerelli et al., 2016).

Because this emerging research field is still under development, there are methodological challenges to be addressed. Firstly, there is the need for advancing more precise methods that analyse the content of photographs to provide information about CES (rather than the absolute numbers of photographs or the content of tags or comments) and explore relationships between CES and landscape features. Secondly, studies performing comparative assessments of CES across different social media (Tenerelli et al., 2016; Willemen et al., 2015) are still rare and thus there is no information about the effect of social media on CES mapping. Third, comparative analyses across sites and landscapes that could reveal which common landscape features determine the provision of CES as well as which CES are more relevant according to the cultural and ecological context are still missing. To fill these knowledge gaps, this study aims to develop a methodological approach for eliciting landscape features and CES, as well as their relationships (challenge 1). To do so, we used crowdsourced geotagged photographs posted on Flickr and Panoramio (challenge 2), and applied this method across five contrasting study landscapes in Europe (challenge 3). Our specific goals are: (1) to identify the most frequent CES that are represented by landscape photographs and the associated landscape features in five different European landscapes; (2) to specifically explore how landscape heterogeneity is associated with CES diversity; and (3) to identify bundles of CES mediated by landscape features that emerge from diverse landscape perceptions. Finally, we also aim to assess the methodological approach by (4) analysing differences between

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