



BOOK OF ABSTRACT

- I. SESSION DESCRIPTION
- II. SESSION PROGRAM
- III. ABSTRACTS

I. SESSION DESCRIPTION

ID: T8

Making the intangible tangible: Using social media data to assess cultural ecosystem services

Hosts:

	Title	Name	Organisation
Host:	Mr.	Johannes Langemeyer	Universitat Autònoma de Barcelona
Co-host:		James Connolly	
Others involved:		Maxime Lenormand, Fulvia Calcagni	Irstea ICTA-UAB

Abstract:

Social media data provides extensive novel information on people's behaviour and preferences. Thereby, social media data provides new opportunities for assessing, mapping and valuing cultural ecosystem services (CES) – making them less intangible. A growing community of researchers is using social media data in the form of pictures and tags (from platforms such as Flickr, Panoramia and Instagram) to examine landscape aesthetics. Others have used geo-tracks to better understand the provision of recreational potentials, including for walking, running and cycling. Yet, we assume that the use of social media data in ecosystem service assessments is only in its infancy and many creative ways for exploring social media data to better understand CES will emerge in the future.

This session aims at providing a venue for studies that explore social media data for the assessment of CES. Our major but not exclusive interests lie in: (a) studies applying innovative social media assessments to understand CES beyond recreation and landscape aesthetics; (b) studies that create a better understanding of CES distribution among different demographic groups; and (c) studies that address the limitations in using social media data, e.g. understanding the bias in the data and comparing results with results from other methodological approaches.



Finally we want to provide a creative space for discussion on the multiple potentials in social media data to assess CES. We hope our session to contribute to new collaborations and the development of innovative CES assessment approaches, on a pathway towards a stronger and systematic recognition of intangible CES in ES-based policy and planning.

Goals and objectives of the session:

The main goal of our session is to showcase the use of social media data for the assessment of cultural ecosystem services (CES). Our specific interests lie in studies that:

- (a) assess social media data to understand CES (beyond recreation and aesthetics);
- (b) create a better understanding of CES distribution among demographic groups;
- (c) address limitations in using social media data.

Planned output / Deliverables:

This session is meant to foster a community of researchers who are using social media data in ecosystem services research. It further aims at coming up with innovative ideas for the use of social media data in assessing, mapping and valuing cultural ecosystem services.

Related to ESP Working Group/National Network:

[Thematic Working Groups: T8 – Cultural services & Values](#)

II. SESSION PROGRAM

Date of session: Thursday, 18 October 2018

Time of session: 14:30 – 18:00

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
14:30–14:45	Johannes	Langemeyer	Universitat Autònoma de Barcelona	Mapping the intangible: Using geolocated social media data to examine landscape aesthetics
14:45–15:00	Fulvia	Calcagni	Universitat Autònoma de Barcelona,	A tag is worth a thousand pictures: Social media metadata analysis to uncover



Time	First name	Surname	Organization	Title of presentation
			ICTA	plural cultural ecosystem services values
15:00–15:15	James	Connolly	Universitat Autònoma de Barcelona, ICTA	Cultural Ecosystem Services of Urban Green Infrastructure and their relationship with Green Gentrification in Barcelona
15:15–15:30	Ricardo	Moreno-Llorca	University of Granada	Exploring cultural ecosystem services and visitor types in mountain and wetland multi-functional protected areas: The potential of crowdsourced social media photographs to support decision making.
15:30–15:45	Pedro	Clemente	CENSE – NOVA UNL	Using social media photographs to model the distribution of cultural ecosystem services
15:45–16:00				Group discussion
16:30–16:45	Ken	Ohno	Mie University	Landscapes posted on SNS in Japan
16:45–17:00	Heera	Lee	Karlsruhe Institute of Technology	Quantifying cultural ecosystem services in Europe using crowd-sourced photos
17:00–17:15	Andrea	Baggio-Compagnucci	The James Hutton Institute	A methodological framework to derive landscape attractiveness from voluntarily submitted photographs
17:15–17:30	Anna	Cord	Helmholtz Centre for Environmental Research –	Geocaching data as an indicator for recreational ecosystem services in urban areas: exploring spatial



Time	First name	Surname	Organization	Title of presentation
			UFZ	gradients, preferences and motivations
17:30–17:45	Fulvia	Calcagni	Universitat Autònoma de Barcelona, ICTA	From “worth experiencing” to “worth sharing”: A literature review for revealing relational CES through social media
17:45–18:00				Group discussion / Wrap-up

III. ABSTRACTS

The abstracts appear in alphabetic order based on the last name of the first author. The first author is the presenting author unless indicated otherwise.

1. Type of submission: **Abstract**

T. Thematic Working Group sessions: T8 Making the intangible tangible Using social media data to assess cultural ecosystem services

A tag is worth a thousand pictures: Social media metadata analysis to uncover plural cultural ecosystem services values

First author: Fulvia Calcagni

Other author(s): Júlia Nogué Batallé, Francesc Baró, Johannes Langemeyer

Affiliation, Country: ICTA–UAB, Spain

The need to better understand the nuanced interactions that connect humans to their surrounding environments is probably a key challenge of the ecosystem services science. In particular, many of these relations are articulated through the provision of cultural ecosystem services (CES) such as outdoor recreation, landscape aesthetics or environmental learning. However, the intangible and subjective nature of CES have generally challenged previous attempts to comprehensively assess the plural values that people attach to them. Building on the emerging approaches inferring CES values through social media data, this research aims to advance the field by including metadata analysis of pictures retrieved from the photo-sharing platform Flickr. Pictures’ metadata, whose potential has poorly been explored so far, generally includes tags and description, but it can also contain authors’ gender, occupation and place of origin and residence. We analysed and coded metadata of



all the Flickr pictures (n=2,428) that were geotagged within the massif of Collserola, a protected periurban forest located in the metropolitan area of Barcelona, Spain, during the years 2004–2017. Subsequently, we performed a cross-tabulation and spatial correlation analysis in order to assess the attached CES values, trade-offs and distributional patterns, both in relation to the main landscape features (e.g. forest, scrubland) of the case study area and to the authors' profile. Our results show the potential of analysing social media metadata to reveal plural CES values and reduce the shortcomings generally affecting these approaches. In addition, the analysis has proven useful for testing the effectiveness of nature protection policies and the existing transport network in promoting periurban park's accessibility, inclusiveness and attractiveness. Yet, we call for a closer focus on the role of gender and place of residence in relation to these aspects for better informed periurban landscape planning and management.

Keywords: Cultural ecosystem services, Social media analysis, Periurban landscape planning, Urban environmental justice, Spatial correlation analysis

2. *Type of submission: Abstract*

T. Thematic Working Group sessions: T8 Making the intangible tangible Using social media data to assess cultural ecosystem services

From “worth experiencing” to “worth sharing”: A literature review for revealing relational CES through social media

First author: Fulvia Calcagni

Other author(s): Ana Terra Amorim Maia, James J. T. Connolly, Johannes Langemeyer

Affiliation, Country: ICTA-UAB, Spain

Many of the benefits to society that flow from ecosystem services (ES) cannot be easily observed or measured. For example, some benefits derived from social-ecological interactions are embedded in plural and situated values ranging from ethical norms and beliefs (transcendental) to acquired attitudes and opinions (contextual). These less-tangible benefits are a focus of Cultural Ecosystem Services (CES) literature that explores how “relationality” within and among social groups determines value ascribed to ecological resources. Spurred by people's interpersonal relationships and adherence to societal core values – such as justice, care, and reciprocity – relational values foster reflections on appropriateness and morality of preferences in contributing to collective flourishing and sustainability. Thereby, the relational dimension of CES goes beyond instrumental and



intrinsic approaches to valuing the environment, with implications for social justice and nature protection. Recently, several studies revealed the potential of using social media data for CES assessments. Social media can be understood as new arenas where relational values stemming from social–ecological interactions are negotiated and defined. As a consequence, these assessments are critically important to the developing framework for studying relational values in CES. In order to advance this framework, we conducted a systematic review, screening 140 publications and selecting 29 as relevant for exploring the extent at which relational CES values are inferable through social media. Our results show that most studies limit assessments to aesthetics and recreation, while issues of environmental justice and social–ecological resilience lack attention. We conclude that social media data can allow us to see how plural relational CES values are distributed and continually negotiated, but that work on their implications for sustainability needs to be extended.

Keywords: Cultural Ecosystem Services, Social Media analysis, Relational values, Systematic literature review, Sustainability Science

3. *Type of submission:* **Abstract**

T. Thematic Working Group sessions: T8 Making the intangible tangible Using social media data to assess cultural ecosystem services

Using social media photographs to model the distribution of cultural ecosystem services

First author: Pedro Clemente

Other author(s): Marta Calvache; Paula Antunes; Rui Santos; Jorge Orestes Cerdeira, Maria João Martins

Affiliation, Country: CENSE – NOVA UNL, Portugal

Developing spatially explicit models of Ecosystem Services (ES) distribution and diversity across the territory has been increasingly attracting the interest of researchers and policy-makers due to its potential to operationalize and mainstream the ES concept into existing planning and policy tools. In this paper we explore the use of social media photographs to model the spatial distribution of people preferences for cultural ecosystem services (CES), map their hotspots, identify the determinant variables as well as the spatial correlation between CES. This research was applied in the Sudoeste Alentejano and Costa Vicentina Natural Park (PNSACV) located in Southwestern Alentejo, Portugal. A collection of 1378 geo-tagged digital images taken inside the Park and posted in the Flickr web platform between



2004 and 2015 were analyzed and classified according to a tailored list of CES. To model CES spatial distribution it was used a species distribution model – Maxent – adapted to combine the observation of CES occurrence with biophysical and infrastructural variables. This method allowed us to identify and map the social preferences for CES in this area. The distance to ocean and distance to touristic and cultural infrastructure were the most determinant variables to explain CES distribution in PNSACV. The CES maps were then used to inform stakeholders and to assist the design of more balanced strategies to promote CES in different locations, in particular, the design of new hiking trail routes. Using social media data can be an expedite and cost-effective way to identify and map CES, although this approach embodies some challenges and biases that need to be considered. This was particularly clear concerning the social groups represented in these databases and by comparing it with other CES map methods (e.g. Estimap, collaborative mapping). Still, it can be particularly valuable to support the design of future scenarios and assist decision-making.

Keywords: Cultural ecosystem services; social media; territorial planning; species distribution models

4. *Type of submission:* **Abstract**

T. Thematic Working Group sessions: T8 Making the intangible tangible Using social media data to assess cultural ecosystem services

A methodological framework to derive landscape attractiveness from voluntarily submitted photographs

First author: Andrea Baggio Compagnucci

Other author(s): Alessandro Gimona, Marie Castellazzi, Laura Poggio

Affiliation, Country: The James Hutton Institute, Italy

Quantifying and mapping the non-material benefits people obtain from landscape is still in its initial stages. There is growing interest in the use of photographs submitted by a high number of users to services such as Panoramio, Flickr, or Google Maps, as indicator of recreation ‘service provision’. Despite potential bias, the advantage provided by these data over rigorous surveys is the large sample size. However, the methods proposed thus far fail to disentangle accessibility from attractiveness, and often disregard statistical problems typically presented by data sets derived from these sources, such as zero-inflation, non-



linearity of relationships, error autocorrelation. In this study of a 5000 Km² portion of central Scotland (Perth and Kinross), based on a simulation approach, and extensive view shed and spatial analysis, we show how we propose to address such problems. Our findings produce a more robust indicator based on submitted photographs and confirm the need, pointed out by many studies in spatial and social ecology, to control for accessibility.

Keywords: Intangible ecosystem benefits, Cultural service, Geo-tagged images, Recreational attractiveness, Accessibility

5. *Type of submission:* **Abstract**

T. **Thematic Working Group sessions:** T8 Making the intangible tangible Using social media data to assess cultural ecosystem services

Cultural Ecosystem Services of Urban Green Infrastructure and their relationship with Green Gentrification in Barcelona

First author: Ana Terra Amorim Maia, James Connolly

Other author(s): Johannes Langemeyer, Fulvia Calcagni

Affiliation: Universitat Autònoma de Barcelona, Spain

Cultural Ecosystem Services (CES), defined under the Millennium Ecosystem Assessment as the “nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experiences” are complex to measure, due to their abstract and intangible nature. Thus far, CES have been quantified, valued and mapped mostly through the use of surveys and questionnaires. However, these methods lack procedural inclusion and a comprehensive approach to value articulation. There is an ongoing push to overcome these limits through the use of social media data for assessing CES. Given the nature of the data, this approach is potentially more comprehensive and democratic, making it a promising pathway for understanding how CES shape the development of just, resilient and sustainable cities. In this study, we explore this pathway by linking emerging methods for social media assessment of CES with evaluation of the social-economic impacts of urban greening. We used geotagged photos from Flickr to measure the attractiveness of 18 parks in Barcelona, of which 9 were shown to have undergone green gentrification processes in previous studies. The entire dataset of photos uploaded to Flickr from the 18 parks was analyzed, following a protocol of categorization and systematic coding procedures. A total of 4320 photos were analyzed, of which 704 were



assigned to 4 categories of CES and a further 20 subcategories. Results indicate that scores obtained for recreation and aesthetic value show statistically significant variation between gentrified and non-gentrified parks. Meanwhile, the value attributed to “green” attributes within the data did not vary. The results help explain the intertwined social and ecological values attached to urban green spaces that contribute to green gentrification. These outcomes can help inform urban policies that seek a more equal and just green city.

Keywords: Cultural Ecosystem Services, Social Media Data, Green Gentrification, Urban Green Infrastructure, Aesthetics

6. *Type of submission:* **Abstract**

T. Thematic Working Group sessions: T8 Making the intangible tangible Using social media data to assess cultural ecosystem services

Geocaching data as an indicator for recreational ecosystem services in urban areas: exploring spatial gradients, preferences and motivations

First author: Anna Cord

Other author(s): Franz Roeßiger, Nina Schwarz

Affiliation, Country: Department of Computational Landscape Ecology, Helmholtz Centre for Environmental Research – UFZ, Germany

Outdoor recreation as a cultural ecosystem service offers an important opportunity for many people to experience directly the benefits that ecosystems provide, particularly in urban areas. The recent emergence of social media and other sources of ‘big data’ creates exciting possibilities for assessing how people use nature for recreational purposes. In this study, we focus on ‘geocaching’, a worldwide outdoor game in which the participants use a Global Positioning System (GPS) receiver to hide and seek containers called ‘geocaches.’ We use the city of Leipzig (Germany) as a case study and focus on nature-related geocaches to explore short-term recreation as a cultural ecosystem service. We use georeferenced localities of geocaches and their visit rates as quantitative measures and combine them with a content analysis, as well as with quantitative results of an online survey. Using this data, we distinguish between revealed and stated preferences. We found that the density of geocaches was highest close to the city centre and that geocaching is indeed a type of local recreation and an urban ecosystem service, as green areas and experiences in nature are important for this activity. Stated and revealed preferences, however, often did not match for



the different types of geocaches that we identified. While geocachers may have quite different motivations, the activity appears to be mostly done by young, well-educated people according to our surveys. In summary, geocaching data offer exciting opportunities to explore spatial gradients, as well as preferences and motivations regarding short-term recreation.

Keywords: Cultural ecosystem service, Global Positioning System, Spatial analysis, Urban green space, Questionnaire

7. *Type of submission: Invited speaker abstract*

T. [Thematic Working Group sessions: T8 Making the intangible tangible Using social media data to assess cultural ecosystem services](#)

Mapping the intangible: Using geolocated social media data to examine landscape aesthetics

First author: Johannes Langemeyer, Fulvia Calcagni

Other author(s): Francesc Baro

Affiliation, Country: Universitat Autònoma de Barcelona (UAB), Institute of Environmental Science and Technology (ICTA), Hospital del Mar Medical Research Institute (IMIM), Spain

The ecosystem services concept is increasingly gaining momentum in land-use policies and landscape planning. Yet, cultural ecosystem services often lack proper assessments. With this study, we aim for the mapping of the cultural ecosystem service landscape aesthetics through novel methodological approaches for its enhanced consideration in land-use policies. Our study uses expert-based participatory mapping and crowd-sourced (social media) photo data to examine the spatial distribution of landscape aesthetics in the Province of Barcelona, Catalonia. We distinguish landscape aesthetics capacity and landscape aesthetics flow. Landscape aesthetics capacity was assessed through spatial multi-criteria evaluation, consisting of a viewshed analysis and an expert-based selection and weighting of landscape features. Landscape aesthetics flow, i.e., people's actual appreciation of landscape aesthetics, was assessed by analysing a sample of 13,460 geolocated photographs from the social media platform Flickr. Our results uncover a substantial mismatch between landscape aesthetics capacity and flow. While landscape aesthetics capacity is widely distributed across the case study area, landscape aesthetics flow is (with few exceptions) mostly concentrated in urban and periurban areas. The main insights for land-use policies derived from our results are twofold. On the one hand, landscape aesthetics flow seems less dependent on 'pristine



nature' than experts and planners assume, while the complex integration of green and grey landscape features plays a critical role. On the other hand, urban and periurban landscapes as key landscape aesthetics providers that mediate the appreciation of other ecosystem services should receive additional attention in land-use policies.

Keywords: Cultural ecosystem services; Mapping ecosystem service; Landscape aesthetics; Social values; Social media data; Photoseries analysis

8. *Type of submission: Abstract*

T. Thematic Working Group sessions: T8 Making the intangible tangible Using social media data to assess cultural ecosystem services

Quantifying cultural ecosystem services in Europe using crowd-sourced photos

First author: Heera Lee

Other author(s): Bumsuk Seo, Sven Lautenbach, Mark Rounsevell

Affiliation, Country: Institute of Meteorology and Climate Research, Atmospheric Environmental Research (IMK-IFU), Karlsruhe Institute of Technology, Germany.

Quantification of Cultural Ecosystem Services (CES) is challenging compared to other Ecosystem Services (ES). Several indicators to quantify CES have been proposed, yet these are often subjective and cost ineffective. An alternative approach is to use landscape photos in analysing revealed preferences. Available crowdsourcing photo archives such as Flickr have become increasingly important as a data source for analysing how people use natural resources for leisure. However, thematic information about photo contents has been ignored. Thus far, only the number of usage days has been used without any classification or the photos have been manually classified. This hampers the credibility and the transferability of the results as well as their application beyond recreation and landscape aesthetics. We present a new approach for quantifying and classifying CES by analysing crowd-sourced photos using machine-learning algorithms. We apply convolutional neural network (CNN) to crowd-sourced photos acquired from Flickr in the EU 28 area (2005–2017). We reuse the feature extraction model (Inception v4) readily trained on ImageNet data to retrain the model using additional field data. Re-training uses photos that are manually tagged especially for CES information. The Flickr images are labelled using the retrained model. The characteristics of the CES tags are analysed using tag co-occurrence network analysis. Spatial distributions of CES tags are mapped across the EU area. The resulting map provides



more detailed information about different types of CES across the EU. The spatial distribution of different CES can be used to support specific policy applications.

Keywords: Mapping cultural ecosystem services, keyword network analysis, Social media photo archives, tagging, image classification

9. *Type of submission: Abstract*

T. Thematic Working Group sessions: T8 Making the intangible tangible Using social media data to assess cultural ecosystem services

Exploring cultural ecosystem services and visitor types in mountain and wetland multi-functional protected areas: The potential of crowdsourced social media photographs to support decision making.

First author: Ricardo Moreno-Llorca, Pablo Fernández Méndez

Other author(s): Revilla, E., Ros-Candeira, A., Alcalá-Segura, D., Santamaría, L., Bonet-García, F.J.

Affiliation, Country: Laboratorio de Ecología (iEcolab), Instituto Interuniversitario Sistema Tierra, Universidad de Granada, Granada Estación Biológica de Doñana (CSIC), Spain

Crowd-sourced photographs have been widely used to assess different aspects of cultural ecosystem services (CES). This data source is very interesting for managers in protected areas, where gathering information to guide environmental policies and decisions is difficult and expensive. Many studies used geographical location, social media metadata or manual analysis of the photo characteristics. However, to date there is a lack of analysis which combine manual and machine learning content analysis of pictures with validation through user consultation. The main objective of this work was to develop useful information and methodologies to help decision making regarding cultural ecosystem management. The study was developed in two Biosphere Reserves as members of a Global Change Observatory Network in the south of Spain: Sierra Nevada National Park, a mountain region, and Doñana National Park, a coastal wetlands region. We firstly performed a manual content analysis of a random sample of harvested photos for both regions stratified through a nature protection gradient, to characterize landscape features, ecosystem services and types of visitor (i.e. Flickr users), which we validated through a questionnaire sent to Flickr users. We then analyzed statistically the results of the previous step, to understand individually and comparatively, in both regions, the relationship between landscape features and ecosystem



services, as well as the degree of multi-functionality of the former in providing the latter. Afterwards, we performed an auto-tagging of photos based on machine learning and compared both methods as a way of evaluating the automatic approach. We conclude that this type of studies, using a combination of manual and automatic approaches, can effectively contribute to support the planning and management of CES in landscapes of protected areas networks.

Keywords: Cultural ecosystem services, crowdsourced social media, decision making, Biosphere Reserves

10. Type of submission: **Abstract**

T. Thematic Working Group sessions: T8 Making the intangible tangible Using social media data to assess cultural ecosystem services

Landscapes posted on SNS in Japan

First author: Ken Ohno

Affiliation, Country: College of Liberal Arts and Sciences, Mie University, Japan

Landscape preference is a basic concept for cultural ecosystem service. I analyzed images that were posted on Twitter. I have three reasons why Twitter was used. The one is that images on Twitter can be downloaded. The second is that Twitter is more popular than Instagram and Flickr in Japan. The third is that Twitter's tag can include adjectives. For example, I can find "beautiful landscape" images. I used some tags (beautiful landscape, superb view and so on) for collecting images. Because Japan has the four seasons, I collected one-week images of each season. As the result, I got 786 images. The biggest problem was to know where the images were. At first, I read the messages before and after the images. Then I searched the location using Google map and Street view. I could specify the locations of 603 of 786 images. Much number of the images were taken near the population concentration area, or along traffic arteries. I also analyzed landscape structures. The number of landscape elements included in one image was an average of 3.8 and a standard deviation of 1.5. The landscape element that were most included was a forest. Then, a plant, a mountain, a sea and so on. I carried out the correlation analysis between the number of images taken in a region and some statistical data in the region. The correlation coefficient between the length of railway line in the region and the number of images taken in the region was the biggest. The result of this study clarified a problem on using the SNS data for



an assessing CES. Because posted images are very influenced by population and traffic arteries, the number of posted images does not express CES appropriately.

Keywords: Landscape, SNS, Twitter, CES