



## BOOK OF ABSTRACTS

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### I. SESSION DESCRIPTION

ID: T9

Natural environments, ecosystem services and public health in a time of crisis

#### Hosts:

	Name	Organisation	E-mail
Hosts:	Jutta Stadler	German Federal Agency for Nature Conservation (BfN)	jutta.stadler@bfn.de
Co-hosts:	Aletta Bonn	Helmholtz Centre for Environmental Research – UFZ/German Centre for Integrative Biodiversity Research (iDiv), Institute of Biodiversity, Friedrich Schiller University Jena	aletta.bonn@idiv.de
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#### Abstract:

Blue and green spaces around us play an important role for human health and well-being. This was recognized particularly in urban areas during the COVID-19 lock downs in many European cities, during springtime 2020. Access to and use of nearby parks, urban forests or gardens have been key sources for physical activity, stress relief and cognitive recovery.

In an urban environment, space is a scarce resource. Policy makers, designers, planners and other practitioners face the challenge of designing public open spaces as well as preserving and improving natural resources that are important for maintaining and optimizing human well-being. Knowing which type of blue and green spaces, with which characteristics, are most beneficial for mental health and wellbeing is critical.

However, the majority of research has focused on the amount of, or proximity to green space or elements on human health. As such, less is known about which types or characteristics of blue and green space are important to enhancing human health. More knowledge of the importance of specific types and characteristics of blue and green space, may help to unlock its potential to contribute to human health and can thus usefully determine planning and management decisions.



This session looks for latest scientific evidence on the impacts of blue and green spaces on all aspects of human health and well-being, namely: physical, mental, social and spiritual factors, as well as practical guidance for the design and management of these areas. Specific attention is paid to the role of biodiversity in delivering health outcomes versus the mere presence of green or blue spaces. We will invite researchers and practitioners from different disciplines that investigate the public health effects of natural environments

### Goals and objectives of the session:

1. Scope and identify the specific types of green and blue spaces that benefit human health and well-being.
2. Understand how contact with nature and biodiversity can help people through a crisis like COVID-19.
3. Create practical guidance for practitioners regarding the conservation or creation of these types of environments.

### Planned output / Deliverables:

Initiate a network of researchers and practitioners on planning, designing, and conserving natural environments for cultural ecosystem services and public health in cities and rural areas.

### Related to ESP Working Group/National Network:

Thematic Working Groups: TWG 9 – ES & Public health

## II. SESSION PROGRAM

**Date of session:** Monday, 7 June 2021

**Time of session:** 13:30 – 17:00

### Timetable speakers

Time	First name	Surname	Organization	Title of presentation
13:30 13:45	Sarai	Pouso	AZTI	Contact with blue-green spaces during the COVID-19 pandemic lockdown beneficial for mental health
13:45 14:00	Angel	Dzhambov	Medical University of Plovdiv	Does greenery experienced indoors and outdoors provide an escape and support mental health during the COVID-19 quarantine?
14:00 14:15	Francesc	Baró	Vrije Universiteit Brussel & Universitat Autònoma de Barcelona	Even your houseplant helps! Exposure to nature and mental health outcomes during COVID-19 lockdown in Spain and Portugal
14:15 14:30	Charlotte	Nöel	Vrije Universiteit Brussel	Perceived health impact and usage of public green spaces in Brussels'



Time	First name	Surname	Organization	Title of presentation
				metropolitan area during the COVID-19 epidemic
14:30 14:45	Nadja	Kabisch	Humboldt-Universität zu Berlin	Impact of summer heat on urban park visitation, perceived health and ecosystem service appreciation
14:45 15:00	Femke	Beute	University of Surrey & German Centre for Integrative Biodiversity Research	Which types and characteristics of green and blue spaces have a positive impact on mental health?
15:30 15:45	Claudia L. Y.	Tan	National University of Singapore	Urban nature spaces, leisure activities, and human wellbeing: Unravelling the links in a tropical city-state
15:45 16:00	Martina	Zorić	University of Novi Sad	Specific content of volatile organic compounds in trees determine green spaces potential in terms of enhancing human health and well-being
16:00 16:15	Katherine	Irvine	James Hutton Institute	Cultural ecosystem services: exploring landscape characteristics and spiritual wellbeing
16:15 16:30	Julius Cesar	Alejander	Glasgow Caledonian University	Prescribing blue space interventions in health and social care settings: a systematic review using realist synthesis
16:30 16:45	Simone	Podschun	Leibniz Institute of Freshwater Ecology and Inland Fisheries	Collateral values of COVID-19? Exploring the use of STRAVA data to derive spatial-temporal patterns of recreation
16:45 17:00				Discussion

### III. ABSTRACTS

*Abstracts are ordered based on the session program. The first author is the presenting author unless indicated otherwise.*

#### 1. Type of submission: Abstract

T. Thematic Working Group sessions: T9 – Natural environments, ecosystem services and public health in a time of crisis

**Contact with blue–green spaces during the COVID–19 pandemic lockdown beneficial for mental health**



*First author:* Sarai Pouso

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There is growing evidence that ecosystem services and especially the exposure to the natural world (blue-green spaces) have potential benefits for mental health and well-being. The COVID-19 pandemic and the measures adopted to control it provide a natural experiment to investigate the links between nature exposure and mental health under extreme conditions. Using a survey distributed online, we tested the following hypotheses: 1) People will show greater symptoms of depression and anxiety under lockdown conditions that did not allow contact with outdoor nature spaces; 2) Where access to public outdoor nature spaces was strictly restricted, (2a) those with green/blue nature view or (2b) access to private outdoor spaces such as a garden or balcony will show fewer symptoms of depression and anxiety and a more positive mood. Based on 5,218 responses from 9 countries, we found that lockdown severity significantly affected mental health, while contact with nature helped people to cope with these impacts, especially for those under strict lockdown. People under strict lockdown in Spain (3,403 responses), perceived that nature helped them to cope with lockdown measures; and emotions were more positive among individuals with accessible outdoor spaces and blue-green elements in their views. These findings can help decision-makers in developing potential future lockdown measures to mitigate the negative impacts, helping people to be more resilient and maintain better mental health, using the benefits that ecosystem services are providing us.

*Keywords:* ecosystem services, nature's contributions to people, anxiety, depression, green-blue infrastructure

*2. Type of submission:* Abstract

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## **Does greenery experienced indoors and outdoors provide an escape and support mental health during the COVID-19 quarantine?**

*First author:* Angel Dzhambov



*Other author(s):* Peter Lercher, Matthew Browning, Drozdstoy Stoyanov, Nadezhda Petrova, Stoyan Novakov, Donka Dimitrova

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**Background:** The COVID-19 pandemic has profoundly changed people's ability to recreate in public green spaces, which is likely to exacerbate the psychological impacts of the pandemic. In the current study, we seek to understand whether greenery can support mental health even with insufficient outdoor exposure in times of physical isolation from the outdoor environment. **Methods:** Between 17 May and 10 June 2020, we conducted an online survey among 323 students from two universities in the city of Plovdiv, Bulgaria. We measured severities of depressive/anxiety symptoms, greenery experienced indoors (number of houseplants in the home and proportion of exterior greenery visible from inside the home) and outdoors (presence/absence of a domestic garden and availability of neighbourhood greenery). Perceived restorative quality of the home and the neighbourhood, engagement with outdoor greenery (frequency of different types of interaction) and perceived social support were treated as mediators. **Results:** The relative abundance of greenery visible from the home or in the neighbourhood was associated with reduced depressive/anxiety symptoms. Having more houseplants or a garden was also associated with some of these markers of mental health. As hypothesized, the mental health-supportive effects of indoor greenery were largely explained by increased feelings of being away while at home. Neighbourhood greenery contributed to neighbourhood restorative quality, which in turn facilitated social support and more frequent engagement with greenery, and that led to better mental health. **Conclusions:** Students who spent most of their time at home during the COVID-19 epidemic experienced better mental health when exposed to more greenery. Our findings support the idea that exposure to greenery may be a valuable resource during social isolation in the home.

*Keywords:* anxiety, depression, gardening, green space, houseplant

*3. Type of submission: Abstract*

**T. Thematic Working Group sessions: T9 – Natural environments, ecosystem services and public health in a time of crisis**

## **Even your houseplant helps! Exposure to nature and mental health outcomes during COVID-19 lockdown in Spain and Portugal**

*First author:* Francesc Baró



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To control the outbreak of the SARS–CoV–2 virus, countries around the world implemented lockdowns with varying intensities. Lockdowns, however, have been associated with a deterioration of mental health, including post–traumatic stress symptoms, anger and anxiety. Exposure to nature might reduce stress and provide relaxation opportunities. The objectives of this research were twofold: firstly, we aimed to determine which sociodemographic, housing and lockdown–related characteristics were associated with changes in exposure to nature during the spring 2020 COVID–19 lockdown in Portugal and Spain. Secondly, we sought to estimate the associations of these changes with mental health, and test whether these associations differed according to sociodemographic characteristics and between the two countries, which experienced different restrictions and epidemiological situations. A cross–sectional study was conducted between March 27 and May 6, 2020, using an online questionnaire to measure changes in exposure to different types of green and blue spaces (including private green space and other greenery, views of nature from home and public natural spaces); sociodemographic, housing and lockdown–related characteristics; stress levels; psychological distress; and somatization. Adjusted regression models were fitted to estimate associations. The study included 3,157 participants (1,638 from Portugal, 1,519 from Spain). In Portugal, maintaining/increasing the use of public blue and green spaces during the lockdown was associated with lower levels of stress and maintaining/increasing the frequency of viewing nature from home was associated with reduced psychological distress, somatization, and stress levels. In Spain, maintaining/increasing contact with private green space and greenery was associated with lower stress levels: for contact with indoor plants and for use of private community green spaces. In short, exposure to nature was associated with better mental health outcomes during lockdowns, but the natural features associated with improved mental health differed between the two countries. We contend that nature should be incorporated into urban planning interventions and housing design and exposure to blue and green space should be promoted during lockdowns.

*Keywords:* green and blue space, confinement, pandemic, mental health, COVID–19





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

T. Thematic Working Group sessions: T9 – Natural environments, ecosystem services and public health in a time of crisis

### **Perceived health impact and usage of public green spaces in Brussels' metropolitan area during the COVID-19 epidemic**

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To fight the COVID-19 virus, many countries implemented containment measures whereby physical distancing became the norm and restrictions on the use of public space were imposed. In countries where access to public green spaces (PGSs) was safeguarded, they were expected to partially counterbalance the negative health outcomes of these containment measures as they offered a unique opportunity to meet others, to break through isolation, and to move, play and relax at a safe distance. Research on PGS-use and its association with health during the COVID-19 epidemic is rather limited and is based on quantitative research methodologies. Quantitative research methodologies are useful to detect associations between PGS-use and health or between COVID-19 and PGS-use but fall short in explaining the observed associations. This qualitative research tried to fill in this gap by examining how PGS-users perceived the health advantages of PGSs and how the use of PGSs changed during the epidemic in the Brussels Capital Region, Belgium. In total, 23 individual face-to-face in-depth interviews were conducted in diverse PGSs. We found that while PGSs were initially perceived as a possible threat for health in the first period of the epidemic, they gradually got associated with both improved physical and mental health. Although the mechanisms behind this association were also present prior to the epidemic, they became more tangible and more universal. We also found that the use of PGSs changed during the epidemic due to measures and restrictions and to health risk perceptions. We distinguished 5 different health risk perception profiles about COVID-19: the denier, the fatalist, the negotiator, the conformer and the anxious. These different health risk perceptions impact on the use of and behaviour within PGSs.

*Keywords:* COVID-19, public green space, self-perceived health, health risk perceptions, qualitative research



*5. Type of submission: Abstract*

T. Thematic Working Group sessions: T9 – Natural environments, ecosystem services and public health in a time of crisis

## **Impact of summer heat on urban park visitation, perceived health and ecosystem service appreciation**

*Presenting author:* Nadja Kabisch

*Other author(s):* Roland Kraemer, Oskar Masztalerz, Jan Hemmerling, Catharina Pueffel, Dagmar Haase

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Urbanization, environmental change and ageing are putting human health at risk. In many cities, heat stress is projected to increase. Urban green spaces may be an important resource to strengthen the resilience of city dwellers against environmental stressors. At the same time urban green spaces are also threatened by challenges related to climate change – such as heat and drought, and urbanisation such as overuse, densification, etc. In this session, we will present results of a questionnaire survey which was conducted under summer heat conditions in two structurally distinct parks in Leipzig, Germany in 2019. We assessed the respondents' activity patterns in the two parks, their satisfaction with the existing natural and built infrastructure, how heat does impair their health, how they change their park use during heat and how they evaluate the role of parks for coping with heat stress. From our results, we conclude that green space management and planning should diminish usage barriers to ensure equal usability of urban parks for all city dwellers. Specific local environmental and sociocultural conditions, changing environments and climate adaptation have to be considered. In terms of adapting to climate change, urban planning should preserve older parks with large tree coverage to maintain natural processes and regulating ecosystem services such as cooling, while respecting demands for cultural ecosystem services which might require built infrastructure as well.

*Keywords:* heat, urban green space, perception, public health, behaviour, Leipzig

*6. Type of submission: Abstract*

T. Thematic Working Group sessions: T9 – Natural environments, ecosystem services and public health in a time of crisis





## Which types and characteristics of green and blue spaces have a positive impact on mental health?

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Green and blue spaces in cities have been put forward as potential nature-based solutions for good mental health. This is exemplified by the COVID-19 pandemic, during which people spent more time in natural environments. As space is a scarce resource in cities, knowing which types of blue and green spaces, with which characteristics, are most beneficial for mental health and wellbeing is important for policy and planning decisions. An EKLIPSE Expert Working Group (EEWG), supported by the World Health Organization, performed separate systematic literature reviews for green and blue space respectively, to determine which types and characteristics have a significant impact on mental health. Following PRISMA guidelines, a comprehensive literature search identified 134 eligible green-space articles, and 24 eligible blue-space articles. All articles were critically appraised for bias, and a narrative synthesis was conducted. Most green-space studies examined types (e.g. parks, forests), and few studied characteristics (mainly biodiversity). Beneficial effects were found in mental health for almost all green-space types. There was not one type of green space that consistently outperformed others. The majority of blue-space studies examined the effects of the coast on mental health. Studies looking at actual exposure to the coast showed more consistent positive results on mental health, than studies looking at coastal proximity. Only few studies looked at the mental health benefits of inland water, but based on these few studies the beneficial effects of the coast appear more pronounced than those of inland waters. The available evidence is not yet sufficiently specific enough to firmly guide planning and design. Future studies should directly compare the mental health benefits of different types and characteristics of green and/or blue space. Additionally, more high-quality research is needed on actual exposure to green and/or blue spaces, rather than availability/proximity.

*Keywords:* green space, blue space, mental health, systematic review, cultural ecosystem services



*7. Type of submission: Abstract*

T. Thematic Working Group sessions: T9 – Natural environments, ecosystem services and public health in a time of crisis

## **Urban nature spaces, leisure activities, and human wellbeing: Unravelling the links in a tropical city-state**

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With growing evidence of the benefits of nature to various aspects of human wellbeing, more cities have begun considering and experimenting with the incorporation of green and blue natural outdoor environments (NOEs) within the urban matrix. One of the proposed mechanisms of wellbeing benefit delivery is through the activities done within NOEs, such as through physical health benefits from exercising. However, there are still limited understanding in the nuances of the interactions between the different types of NOEs, the type and/or frequency of different types of activities, and their associations with different measures of health. To this end, we use Singapore, a highly urbanised tropical nation with a considerable number of NOEs, as a case-study to address these gaps. We used an online market research survey ( $n = 1509$ ), geographic information systems, and generalised linear regression models to investigate the relationship between NOE cover, sociodemographic factors, different sub-classes of activities (e.g., walking versus team-sports exercise) conducted in NOEs, and individual health measures (e.g., number of chronic illnesses one is diagnosed). By elucidating the associations between NOEs, activities, and health at a finer scale, findings could suggest potential NOE designs and guidelines that are better tailored to the concerns of different city populations, including the promotion of activities of interest and/or the boosting of public health outcomes.

*Keywords:* city design and planning, mental and physical health, nature dose, recreation, urban green-blue spaces

*8. Type of submission: Abstract*

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## **Specific content of volatile organic compounds in trees determine green spaces potential in terms of enhancing human health and well-being**

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In light of the ongoing pandemic, access to green spaces, the significance of plants and biodiversity has never been more important to global society. Forests are known to have positive effects on human health, specifically on the immune system functioning, cancer prevention, cardiovascular system, respiratory system, diabetes, and mental disorders. It is suggested that the volatile organic compounds (VOCs) derived from trees are the most creditable for this health-related ecosystem service (ES). The presented research was conducted to evaluate the potential of forests within National Park Tara in Serbia considering health-related ES, determined by the content of specific VOCs as natural resources for human health and well-being. Four common coniferous species, most represented in the observed area, were examined in terms of the content of specific VOCs that are known to have antiviral, antibacterial, and immune-boosting properties. To determine the potential presence of these compounds, herbal material from the genotypes of Austrian pine (*Pinus nigra*), Spruce (*Picea abies*), Serbian spruce (*Picea omorika*), and Silver fir (*Abies alba*) growing at the investigated area were examined using solid-phase microextraction-gas chromatography/mass spectrometry (SPME-GC/MS). The results of the laboratory analysis showed VOCs content variations not only between different species but also among examined genotypes belonging to the same species. Overall analysis showed that the most abundant compounds in the examined area were D-limonene,  $\alpha$ -pinene,  $\alpha$ -cadinol, and linalool that have immune-boosting and anti-inflammatory properties, while  $\alpha$ -cadinol is also used in antiviral therapy. The potential of investigated species for the emission of these specific VOCs and detected variability in its content among examined species and their genotypes could serve as practical guidance for the future design and management of green spaces used for human health and well-being improvement.

*Keywords:* green space, VOCs, health-related ES, human health, wellbeing

*9. Type of submission:* Abstract

**T. Thematic Working Group sessions: T9 – Natural environments, ecosystem services and public health in a time of crisis**



## Cultural ecosystem services: exploring landscape characteristics and spiritual wellbeing

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Government agencies, practitioners and researchers are interested in how to integrate these benefits into land management decisions in both rural and urban spaces. While the rubric of cultural ecosystem services (CES) is increasingly used to consider this challenge, the conceptualisation of CES is incomplete. Here we consider CES through the lens of spiritual wellbeing, which incorporates relational connections with self, community, the environment, and transcendent other(s). This study assessed the experience of landscape and spiritual wellbeing among members of the Scottish population. We implemented a national web-based survey reaching a geographically representative sample (by local government area) of the Scottish population (sampled by age and sex). We asked participants to identify a specific place where they felt they had had a 'spiritual (not necessarily religious) experience'. They then answered open and closed ended questions concerning the place and their experience. Participants (n=883) were 47% male; all adult age categories were represented although there were fewer younger (16–34 = 25%) than older (35–54 = 37%, 55+ = 38%) individuals who participated. Our analysis provides new insights concerning peoples' relationship with urban and rural green spaces. It sheds light on the landscape characteristics associated with spiritual experience, participants' familiarity with these places and the spiritual experience itself. The result is an understanding of spiritual ecosystem services that moves beyond previous conceptualisations of 'sacred' buildings and places. Emphasis is therefore placed on landscape qualities, which includes diverse features. Findings will inform development of spatially explicit maps of CES for decision makers in Scotland. Results will also shape new methods to investigate the spiritual dimension of people–environment interactions to inform CES evaluations and assist in the identification of types of green and blue spaces that benefit human health and wellbeing.

*Keywords:* spiritual experience, landscape, relational, wellbeing



*10. Type of submission: Abstract*

**T. Thematic Working Group sessions: T9 – Natural environments, ecosystem services and public health in a time of crisis**

## **Prescribing blue space interventions in health and social care services**

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The COVID–19 pandemic has compromised health and social care services and impacted the mental health of people. Evidence suggests how blue spaces support public health improvement, especially physical, mental, and social wellbeing. Experts have warned about a potential long–lasting mental health crisis as a result of COVID–19. Could blue prescriptions help depressurise mental health care services? Existing social prescribing pathways can be used to develop blue prescription models, yet research is limited on how blue prescriptions are delivered in health and social care facilities. Using a validated search protocol, 5447 records were identified from six databases to investigate blue prescription pathways already implemented in health and social care contexts. Fifteen studies were identified and analysed after screening using the PRISMA framework. A realist synthesis was employed to understand who benefits, what mechanisms will support implementation, and in what contexts do blue prescriptions work. Synthesised evidence described the implementation mechanisms of blue prescriptions and the attributes that influenced successful intervention delivery. Blue prescriptions were prescribed or referred by health and social care workers and health–trained professionals working in healthcare, social care, and specialised educational institutions. Individuals diagnosed with physical, mental, and social health conditions benefited from blue prescriptions. Attributes that described successful blue prescription were Patient Enrolment, Patient Engagement, Patient Adherence, Communication Mechanisms, and Programme Sustainability. Patient Enrolment, Engagement, and Adherence were influenced by provision of clear referral information reinforcing patient belief; provision of free blue space access, equipment, and transportation services; and trained and welcoming service providers. Sustainable blue prescription programmes were supported by effective communication channels, multi–stakeholder collaboration, financing, and employment and training of adequate link workers. Findings from this review underscore critical elements and mechanisms for the successful implementation of blue prescriptions in health, social care, and educational facilities.





**Keywords:** sustainable healthcare, social prescribing, blue prescription

*11. Type of submission: Abstract*

**T. Thematic Working Group sessions: T9 – Natural environments, ecosystem services and public health in a time of crisis**

## **Collateral values of COVID-19? Exploring the use of STRAVA data to derive spatial-temporal patterns of recreation**

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Freshwater ecosystems are among the most valued ecosystems in terms of cultural attachment, sense of place, and recreation. The spatial-temporal variation of recreational activities can cause conflicts between users and impacts on ecosystems depending on frequency of use and season (growing, breeding). We explored how usage dynamics can be described using STRAVA (mobile tracking) data analyzing the pattern of cycling (Ride) and pedestrian (Ped – run, walk, hike) activities under “normal” conditions (2017–2019) as well as in 2020 under COVID-19 restrictions. The studied Spree-Havel catchment stretches across large urban (Berlin) as well as rural areas in Brandenburg, showing differences in spatial patterns of activities. The number of users & activities continuously increased from 2017 (Ride: 24K & 0.5Mio; Ped: 38K & 0.3Mio) to 2020 (Ride: 60K & 1.5Mio; Ped: 66K & 1.3Mio), which is characteristic for social-media-data caused by rising popularity of the platform, thus number of users. For Rides a seasonal pattern can be observed with fewer trips in winter, increase in spring (Mar.–Apr.), highest values in summer (May–Sep.) and a decrease in autumn. For Ped the seasonal pattern is similar but much less pronounced, except for two peaks in April and Sep., caused by sport events. In 2020 the proportion of STRAVA activities by visitors dropped from 50 to 30% (Ride) and 70 to 40% (Ped). Nonetheless, during the first partial lockdown in March 2020 a strong increase in the number of leisure activities was observed. Compared to the previous years, Ride activities returned to a normal level by October. For Ped the activities dropped slightly in July, but showed another unexpected increase in October. Our findings underline the dynamic character of recreation activities, influenced by weather, activity type and changing public behavior. Understanding these dynamics is crucial to estimate effects on ecosystems and of management regulations.





*Keywords:* cultural ecosystem services, freshwater, social-media data, time series, Europe