BOOK OF ABSTRACTS

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I. SESSION DESCRIPTION

ID: T4b

Mapping ecosystem services to foster transformative societal change: looking at the past and the way forward

Hosts:

|	Name	Organisation	E-mail
Host:	Solen Le Clec'H	Wageningen University	solen.leclech@wur.nl
Co-host(s):	Miguel Villoslada	University of Eastern Finland	miguel.villoslada@uef.fi
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	Wieteke Willemen	University of Twente	l.l.willemen@utwente.nl

Abstract:

Ecosystem services (ES) maps have evolved into indispensable tools for conveying and enhancing awareness of the intricate relationship between human activities and a biodiverse, functioning environment. These maps serve to visualize the various values of Nature and inform analyses and planning processes that aim at mitigating the potential environmental impacts of human interventions. Consequently, ES maps could develop into leverage points for fostering transformative societal change. Against this background, we examined the potential of ES maps to drive transformative change by sharing experiences at the 2022 European ESP Conference. The results revealed that limited evidence exists regarding the direct impact of these maps on catalyzing transformative change.

Goals and objectives of the session:

Several relevant initiatives have been launched in the last years. Therefore, building upon our 2022 findings, we aim to discuss the most recent contributions of ES maps towards transformative change, assess the evolving contribution of such maps to urgently needed
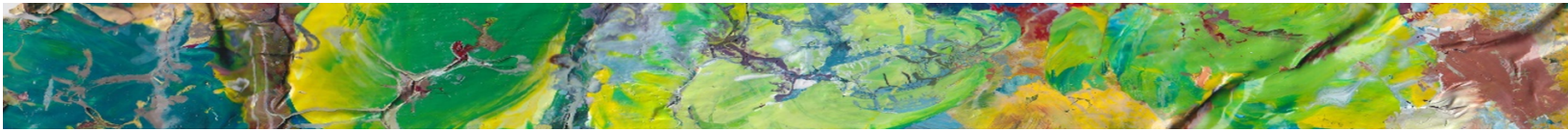
transformations and in particular whether the impacts of map have experienced a change since 2022, identify key challenges and opportunities, and promote innovative solutions to position maps as powerful tools for transformative change. Specifically, we aim to address the following questions: 1) Can ES maps facilitate transformative change? 2) In what ways have ES maps had a (positive) impact? 3) What strategies should be pursued moving forward to increase (the frequency of) these impacts?

Do you want to present your views on these topics to kick off the work café? Then, please submit your abstract in which you address at least one of the session topics.

Desired outcomes are:

1. An inventory of examples where ES maps have supported, driven, detected and/or informed positive impact (current);

2. An identification of success factors and common barriers or challenges;

3. A roadmap or strategy on the ways to go.

Planned output / Deliverables:

An overview of current knowledge gaps and possible ways forward, and an inventory of possible contributors of a joint paper or special issue (depending on the number and content of contributions).

II.   SESSION PROGRAM

Room: Expert Street 7

Date of session: 21st of November 2024

Time of session: 13:30–15:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
13:30–13:35	Benjamin	Burkhard	Leibniz Universität Hannover	Introduction to the session
	Miguel	Villoslada	University of Eastern Finland	
	Solen	Le Clec'h	Wageningen University	
	Wieteke	Willemen	University of Twente	

Time	First name	Surname	Organization	Title of presentation
13:35–13:55	Johannes	Langemeyer	Institute of Environmental Science and Technology, Universitat Autònoma de Barcelona, Spain	From ecosystem services to vulnerability mapping – Shifting paradigms in strategic planning
	Raúl	Hernández-Marchena	Department of Applied Economics, University of Salamanca, Salamanca, Spain	Nature-based Landslide Mitigation Economic Assessment
	Luis	Inostroza	Mendel University, Brno	Integrating ecosystem services into urban planning. Analysis, mapping and marginal valuation of ecosystem services in Bogotá, Colombia
13:55–14:15	Andrea Larissa	Boesing	Senckenberg Research Center	Accounting for spatial interactions in the upscaling of ecosystem services
	Bálint	Czúcz	Norwegian Institute for Nature Research, Torgarden, Trondheim, Norway	Modelling the honey provisioning capacity of ecosystems – a systematic review
	Marco	Lovric	Wageningen University and Research	Spatial patterns of income, supply and demand for forest ecosystem services in Europe
14:15–14:35	Louise	Willemen	Faculty of Geoinformation Science and Earth Observation, University of Twente, the Netherlands	A world of information: mapping decisions for sound decision making
	Stoyan	Nedkov	National Institute of Geophysics, Geodesy and Geography – Bulgarian Academy of Sciences, Acad. Sofia, Bulgaria	Integrated mapping of ecosystem services to support sustainable river basin management
	Lina María	Hoyos Rojas	Center for Innovation in Territory, Urbanism and Architecture – Technical Superior Institute from the University of Lisbon	Mapping Cultural Ecosystem Services and Willingness to Care in Mafra, Portugal: Insights from Participatory Spatial Analysis
14:35–15:15	All			World cafe
15:15–15:25	All			Plenary discussion

Time	First name	Surname	Organization	Title of presentation
15:25–15:30	Benjamin	Burkhard	Leibniz Universität Hannover	Wrap-up
	Miguel	Villoslada	University of Eastern Finland	
	Solen	Le Clec'h	Wageningen University	
	Wieteke	Willemen	University of Twente	

III. ABSTRACTS

First author is the presenting author unless indicated otherwise.

### 1. Accounting for spatial interactions in the upscaling of ecosystem services

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Maps of ecosystem service (ES) supply are frequently used to guide spatial planning and management. However, most attempts to upscale ecosystem services lack a strong mechanistic basis, and also neglect spatial biodiversity dynamics and interactions among landscape components that can modify ES provision. Here we used the comprehensive Biodiversity Exploratories database in Germany, to assess i) how strong a role do surrounding conditions play in driving ecosystem service supply and thus in upscaling predictions? ii) Which ecosystem services require a component of spatial context when upscaling? We evaluated 28 plot-level indicators of 14 ecosystem services in grasslands and developed semi-mechanistic statistical models for their upscaling using proxy drivers related to topography, soil attributes, plot-level management, landscape structure, landscape management, and biodiversity. We found that landscape aspects contribute between 34-50% of the explained variance of local-scale ES supply across regions. As expected, some services are primarily driven by physical and physiological processes, including soil carbon storage and nutrient cycling, while mobile organism-mediated ecosystem services, such as pest control and pollination, had a stronger
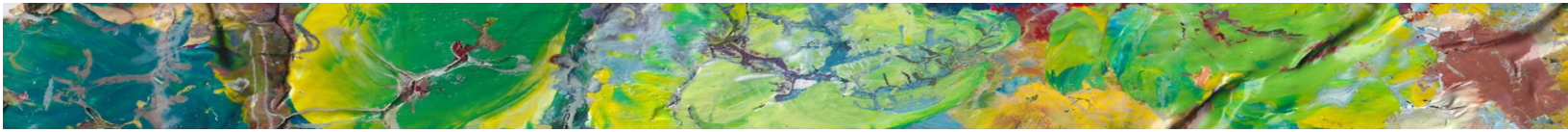
component of spatial context. These findings indicate that upscaling which accounts for the spatial configuration of landscape features is required for many ecosystem services, especially if results are to be used in spatial planning and decision making.

2. Nature-based Landslide Mitigation Economic Assessment

Presenting authors(s): Víctor J. Colino-Rabanal
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Landslides are processes that endanger human lives and economic assets in mountainous areas. Due to the orography, many populations are situated at the bottom of the valley, collecting an uphill slope area that runs the vulnerability to landslide. Existing vegetation provides a crucial role in stabilising these slopes, thereby mitigating the risk of landslides. In this study, we analyse the ecosystem service of landslide mitigation provided by various land cover (forest, shrubs, grass, screen) across Europe on a regional scale using GIS analysis. We assess the vulnerability of landslide according to heuristic methods, depending on the lithology, slope, climate and land cover conditions. By comparing the original vegetation cover to a hypothetical screen scenario, we quantify the capacity of vegetation to reduce the landslide risk. Additionally, we perform an economic evaluation of this ecosystem service in areas near populations or economic assets by estimating the replacement costs of installing fixed barriers along the slopes, adjusting the cost according to labour costs rates in each country. Our analysis provides evidence that 1,920,402 hectares of vegetated hillsides in Europe offer a cost-effective ecosystem service in areas with a landslide risk. The economic value of the ecosystem service of landslide mitigation averages 367 EUR per hectares and year for Europe, with the highest average value in Switzerland (479.77 $EUR \cdot ha-1 \cdot yr-1$) and the lowest in San Marino (35.24 $EUR \cdot ha-1 \cdot yr-1$). Furthermore, this mapping approach helps to identify potential restoration areas, thereby enhancing the natural capital of European mountainous regions.

3. From Ecosystem Services to Vulnerability Mapping – Shifting Paradigms in Strategic Planning

First authors(s): Johannes Langemeyer
Other author(s): Svea R. Busse, Agnieszka
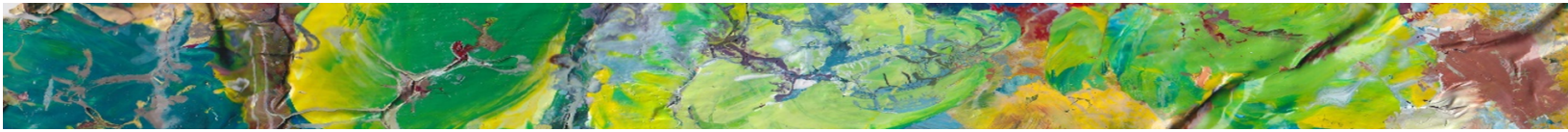*Affiliation:* Institute of Environmental Science and Technology, Universitat Autònoma de Barcelona, Spain
Contact: johannes.langemeyer@uab.cat

Ecosystem services assessments have traditionally guided strategic planning of nature-based solutions (NBS). However, these approaches often lack the conceptual and empirical rigor to fully represent the social and ecological complexities in the spatial diversity of needs for ecosystem services. This paper introduces spatial vulnerability mapping as an innovative method to enhance NBS planning rigor. Employing a stepwise, multi-criteria decision analysis, this approach stems from a co-created understanding of urban vulnerabilities, considering social and ecological sensitivities and their exposure to hazards.

The approach is demonstrated in the Metropolitan Area of Krakow (MK), Poland, in collaboration with MK planning bodies. An iterative co-creation process with stakeholders identified ten critical vulnerabilities, notably to river flooding, noise pollution, and droughts. The vulnerability assessment utilized a rich data environment with 47 spatial indicators to map social and ecological vulnerabilities in a detailed, spatially explicit manner. For each vulnerability criterion, both exposure (e.g., proximity to the Vistula River for flooding) and sensitivity (e.g., critical infrastructure distribution) indicators were defined. These were combined to produce comprehensive vulnerability maps, ultimately integrated into a single map reflecting stakeholder priorities.

This approach represents a paradigm shift in strategic NBS planning, moving from maximizing net ecosystem services benefits to focusing on mitigating complex vulnerabilities. By prioritizing needs-based NBS, this method integrates spatial justice considerations, promoting equitable benefit distribution and addressing specific vulnerabilities in line with diverse stakeholder preferences.

Keywords: Vulnerability mapping, nature-based solutions, strategic planning, spatial justice, multi-criteria decision analysis

4. Integrated mapping of ecosystem services to support sustainable river basin management

First authors(s): Stoyan Nedkov
Other author(s): Hristina Prodanova, Vanya Stoycheva, Mariyana Nikolova, Ivaylo Ananiev
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Ecosystem services maps quantify and visualize where and to what extent ecosystems contribute to human well-being. The mapping of ecosystems is the main building block of the whole process of the Mapping and Assessment of Ecosystems and their Services (MAES). The analyses of the ecosystem data produced during the implementation of the national methodology for mapping ecosystems in Bulgaria (MAES BG) reveal some problems that may cause confusion in cases of integrated assessment of all ecosystem types. To solve such problems, we developed an approach for integrated mapping of ecosystems and their services that enables to combine information from different spatial data sources in a topologically correct vector layer using an algorithm of consecutive GIS techniques. It has been applied to the upper part of the Ogosta River basin and the result is a topologically correct uniform spatial data layer that enables the production of better and more precise ES maps. The results of the test mapping with four water-related ES (flood regulation, erosion control, water quality regulation, and local climate regulation) are encouraging as they show a good correlation with other studies on these ES. The ecosystems database is an appropriate source for mapping ES at tier 1 but also as an input for ES models that can generate more comprehensive and precise results for the spatial distribution of these services. We will discuss the potential impact of the ES maps in the development of forest management plans that incorporate payment schemes for public ecosystem benefits.

Keywords: Ecosystem database, MAES, flood regulation, erosion control, water quality regulation

5. A world of information: mapping decisions for sound decision making.

First authors(s): Louise Willemen
Other author(s): Trinidad del Rio, Nina Schwarz
Affiliation: University of Twente
Contact: l.l.willemen@utwente.nl

For decades, the ecosystem services community has prioritized 'putting nature's benefits on the map'. The premise is that spatially explicit data on ecosystem services leads to more informed decisions, ideally in the context of transformative change. This presentation will showcase how mapping decisions can affect the contribution of ecosystem service maps to positive transformative change. While mapping decisions happen in phases from conceptualization to map design, in this presentation we will focus on the sensitivity of mapping methods and testing map usability. We will present examples of the effect of methodological choices on the spatial evaluation of intervention success and the need for usability assessments of maps with decision makers. We will place these examples in the context of two societal challenges: landscape restoration and healthy urban living. While there is no doubt that ecosystem service maps have an important role to play in decision making, this presentation gives hands-on and nuanced tips on how to work on and with ecosystem service maps, to allow for moving from data and information to knowledge and perhaps even transformative wisdom.

Keywords: Remote sensing, citizen science, visualization, geographic information

6. Spatial patterns of income, supply and demand for forest ecosystem services in Europe

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Forest ecosystems provide multitude services to the society. Indicator-based assessments focus on their supply and valuation studies look at their demand. Basic economics states that equilibrium is where supply meets the demand. Does it exist for Europe's forests? And how is the forest-based income distributed across provisioning, regulating and cultural ecosystem services? In this study we aim to answer these questions. Data for eleven forest ecosystem services is drawn from two Europe-wide surveys, where income and supply data is provided by

forestry practitioners and demand data is provided by general population. Income, supply and demand data is then further extrapolated on a 1-kilometer spatial resolution for almost all of Europe's forests through application of machine learning, which combines survey-data with Europe-wide geospatial data. Results show patterns of supply and demand across Europe, describe how forests could be clustered based on these patterns and also link supply and demand data to forest descriptors (e.g. growing stock, tree species composition, protection status, distance to the city, etc.). Aside these direct results, the study also advocates for the notion that some methodologically sound and comparable data on both supply of and demand for forest ecosystem services is needed to sustainably govern forest ecosystem services provision.

Keywords: forest ecosystem services, forest income, supply and demand for ecosystem services, payments for ecosystem services, European forest policy
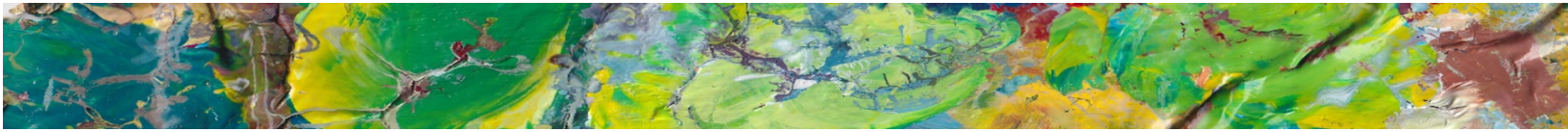
7. Integrating ecosystem services into urban planning. Analysis, mapping and marginal valuation of ecosystem services in Bogotá, Colombia

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Contact: luis.inostroza@mendelu.cz

Ecosystem services (ES) are the benefits of ecosystems that support human well-being. While integrating ES assessments into real urban planning and design remains challenging, in Latin America, the use of ES science in urban planning is still in its early stages. In this research, we present an assessment of ES provision and spatial distribution in an area north of Bogotá that has comprehensive urban planning (POZN) approved by the municipal authorities, including 14 approved partial master plans. The method makes a marginal evaluation of ES by comparing the current and the future supply, evidencing the changes introduced in the provision of existing ES due to the approved urban planning. The results show that the ES decreases for provisioning services, slightly increases for regulating services with a relocation of serving ES areas and greatly increases for cultural services, mainly due to the higher provision of public green space. Our analysis successfully integrates a real case of urban planning and design at the level of engineering with an assessment and mapping of ES that allows for improvements and adjustments to enhance the future provision of ES in this area. The method is straightforward and built upon consolidated ES science knowledge, ready to be used and transferred elsewhere,

showing that articulating scientific knowledge in urban planning can greatly contribute to sustainable urban development.

8. Modelling the honey provisioning capacity of ecosystems - a systematic review

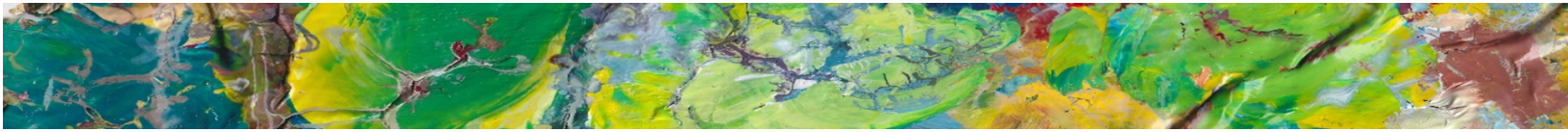*First authors(s):* Bálint Czúcz

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Ecosystem services refer to the essential contributions made by ecosystems to the well-being of society. The European honey bee (Apis mellifera L.) plays a crucial role in the supply of several ecosystem services, including pollination and honey provision. While pollination has received considerable attention in recent ecosystem service research, honey provisioning has been relatively neglected both in scientific research and policy-oriented assessments, despite the economic importance of this service in many regions of Europe, and the wealth of traditional and practical knowledge available from beekeepers.

In this study we present the results of a qualitative systematic review, which provides an overview of the methods used to map the honey provisioning capacity of ecosystems in concrete case studies published in the scientific literature. We found 18 such case studies, and we identified three main types of "honey provisioning capacity" models in them. Furthermore, we evaluated the strengths and weaknesses of these main approaches, connecting them to key decision points in the mapping and assessment process, including the consideration of different melliferous resources, the incorporation of fluctuations in weather and phenology, and the inclusion of landscape patterns. The results of our review contribute to clarifying the methodology for valuing honey provisioning capacity as an ecosystem service, providing a theoretical and methodological foundation for future assessments.

Our findings suggest that, in addition to the main honey flow resources, habitats offering a continuous and diverse source of nectar and pollen are crucial for honey provisioning capacity. Notably, the needs of honey bees in this regard align with those of wild pollinators,

emphasizing the necessity for the widespread adoption of nature-friendly landscape management practices.

9. Mapping Cultural Ecosystem Services and Willingness to Care in Mafra, Portugal: Insights from Participatory Spatial Analysis

First authors(s): Lina Hoyos-Rojas

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Recent studies have shown the significant impact of land use change on ecosystem functions. Thus, spatial planning plays a relevant role in halting environmental crises but still faces difficulties in engaging people's relationships in its processes. Cultural Ecosystem Services (CES) have been recently used in planning approaches to locate the nonmaterial benefits people derive from ecosystems, linking humans to the biophysical domain. The intangible nature of CES necessitates the use of interdisciplinary methodologies, such as Participatory Geographical Information Systems (PGIS), to capture its potential within spatial planning processes.

This communication will explore the concept of "Willingness to Care" (WTC) as an entry point for identifying potential pro-environmental behaviors in relation to CES. In this context, WTC is a novel approach for determining which elements trigger care in socio-ecological relationships. To do so, this study showcases the use of a participatory mapping tool for analyzing the correlation between the geo-localization of CES and participants' WTC. Using the digital tool Maptionnaire, a questionnaire was administered to 240 individuals from September to November 2023 in Mafra, Portugal. The data collected provided insights for statistical and geographical analysis, examining the attitudes related to locations where people engage in various outdoor activities.

The application of the mapping tool proved to be promising for correlating preferences, uses, and environmental attitudes. Its user-friendly experience made it an attractive option for respondents, encouraging widespread participation. The tool's efficiency in processing large datasets enabled the establishment of strong connections between territorial characteristics
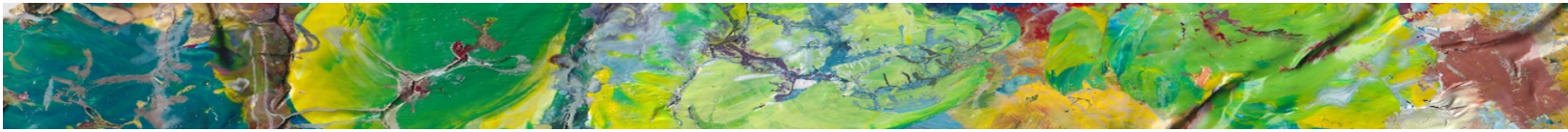
and people-environment attitudes, demonstrating its utility for planning purposes. Furthermore, it offers the potential to be complemented with other methods, enhancing the exploration of Willingness to Care (WTC) and providing a comprehensive understanding of environmental stewardship.

pacity. Notably, the needs of honey bees in this regard align with those of wild pollinators, emphasizing the necessity for the widespread adoption of nature-friendly landscape management practices.