



SESSIONS OVERVIEW

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5th ESP Europe Conference 18-21 November 2024

Monday 18	Success Avenue 1	Expert Street 2	Expert Street 3	Expert street 4	Expert street 5	Expert street 6	Expert street 7	Expert Street 8	Expert street 9
11:00-12:30	T17a	T20	S6b	T3	S6a	T1c	T13d	T18b	B8
14:00-15:30	T13b		B10a	S1d	T19b	B2	S1a		
16:00-17:30		O3							



Health



Transformative change

Tuesday 19	Success Avenue 1	Expert Street 2	Expert Street 3	Expert street 4	Expert street 5	Expert street 6	Expert street 7	Expert Street 8	Expert street 9
11:00-12:30	T13c	T1a	T2	B10c	S3a	T17b	T1b	T7	T1e-I
14:00-15:30					S3b				T12
16:00-18:00		B1	T8b	B10e	T1d	T5	T9a		T8a

Wednesday 20	Success Avenue 1	Expert Street 2	Expert Street 3	Expert street 4	Expert street 5	Expert street 6	Expert street 7	Expert Street 8	Expert street 9
11:00-12:30	T13a	T19a	O1	O4	O7	T6	T1e-II	T11	

Thursday 21	Success Avenue 1	Expert Street 2	Expert Street 3	Expert street 4	Expert street 5	Expert street 6	Expert street 7	Expert Street 8	Expert street 9
11:00-12:30	O2	B10f	S1b	T18a	S1e	S1c	B10d	T4a	O6
13:30-15:30				B10b	T9b	T1f	T4b		O5

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: B1

Coastal ecosystem management: the role of ecosystem services in decision-making and restoration actions

Hosts:

	Name	Organisation	E-mail
Host:	Evangelia (Valia) Drakou	Harokopio University of Athens, Greece	e.drakou@hua.gr
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	Ana I. Sousa	University of Aveiro, Aveiro, Portugal;	anaisousa@ua.pt
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Abstract:

Marine and coastal ecosystem services (MCES) research has been gaining ground within the academic community, enhancing our understanding of the benefits that marine and coastal systems provide to human wellbeing. Despite their importance, coastal and marine ecosystems are degraded at an unprecedented rate by the accelerated expansion and intensification of human activities and uses but also climate change, in these social-ecological systems. To mitigate the impacts of these changes, management, and restoration practices have been designed, developed and applied currently underpinned by the UN Decade on Ecosystems




Restoration (2021–2030) targets. Practices range from strictly managed seascapes, as it is the case for active habitat restoration strategies, to passive approaches that rely on the capacity of ecosystems to recover their natural state e.g., rewilding. The effectiveness of such approaches is usually evaluated at a local scale, on a case-by-case basis. A systematic framework that assesses the consequences on ES supply under different restoration approaches is currently missing. With the introduction of the new EU Restoration Law and along with it, the development of research programs to support its implementation, it is essential to develop a systematic way of evaluating the effectiveness of restoration practices in marine and coastal social-ecological systems, ensuring that their capacity to supply multiple ES can address the plural values society acquires from them. This is also extremely relevant at the national level, as more and more European countries design management and policy agendas within their coastal and marine areas to support Blue and Green Growth, without necessarily acknowledging and integrating the plural contributions and benefits that these areas provide to society acquires, or the way in which restoration practices and plans can enhance the supply of ES.

Within this session we encourage submissions of oral or poster contributions, regarding the assessment of the change in ecosystem service supply and flow/use, under different restoration practices. Inputs can range from practical and methodological applications to evidence from the field, as well as evaluation of different policies and approaches. On that regard, we welcomed contributions that focus on:

- The effectiveness of different management practices within coastal ecosystems, in delivering MCEs
- Understanding the challenges of capturing the plural values within areas of restoration in coastal and marine systems,
- Assessment of trade-offs and bundles across ecosystem services within restoration practices,
- Methods on cost-benefit analysis of different restoration practices,
- Temporal change assessment of seascapes and the generated ecosystem services across restored areas,
- The pros and cons of active versus passive restoration approaches in marine and coastal social-ecological systems.

Goals and objectives of the session:

To exchange knowledge, experiences and methodologies focused on assessing the effectiveness of coastal management and restoration approaches within a variety of marine and



coastal social–ecological systems, and to form a community of exchange, communication and practice on this topic.

Planned output / Deliverables:

A publication on evidence–based impacts of restoration practices on ecosystem services within marine and coastal social–ecological systems.

II. SESSION PROGRAM

Room: Expert Street 2

Date of session: 19th of November 2024

Time of session: 16:00–18:00

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
16:00–16:12	Annelies	Boerema	International Marine and Dredging Consultants (IMDC)	Monitoring coastal NbS success
16:12–16:24	Stefanie	Broszeit	Plymouth Marine Laboratory	Creating a toolbox for interdisciplinary working on ecosystem services – A confidence framework
16:24–16:36	Miguel	Inácio	Mykolas Romeris University	Application of the System of Environmental–Economic Accounting—Ecosystem Accounting (SEEA–EA) in coastal and marine ecosystems in Lithuania
16:36–16:48	Sebastian	Raimondo	Adapt@Ve, Fondazione Eni Enrico Mattei	Ecosystem Services of Venice Lagoon: Carbon Sequestration Dynamics in Salt Marshes and Seagrasses
16:48–17:00	Federico	Cornacchia	Department of Environmental Sciences, Informatic and Statistics, Ca' Foscari University of Venice	Integrated System Dynamics Modelling for the Economic Valuation of Manila clam Biomass Ecosystem Service in the Venice Lagoon

Time	First name	Surname	Organization	Title of presentation
			Fondazione Eni Enrico Mattei, Climate Change Adaptation Group (ADAPT@VE)	
17:00–17:12	Ana	Sousa	ECOMARE, CESAM – Centre for Environmental and Marine Studies, Department of Biology, University of Aveiro	Seagrass active restoration at a socio–ecological ecosystem
17:12–17:24	Sara	Pino Cobacho	Deltares	Climate adaptation in coastal regions: a digital dashboard tool for decision–support and MCES assessment
17:24–17:36	Annelies	Boerema	International Marine and Dredging Consultants (IMDC)	Added value of ecological measures for sustainable marine infrastructure
17:36–17:48	Sylvie	Campagne	Sorbonne Université, CNRS, Station Biologique de Roscoff, UMR7144, Adaptation et Diversité en Milieu Marin Fondation pour la Recherche sur la Biodiversité, Centre de Synthèse et d'Analyse sur la Biodiversité (FRB–Cesab)	Meta–analysis and stakeholders' perceptions analysis of changes in marine and coastal ecosystems services delivery
17:48–18:00	Clara	Villegas–palacio	Universidad Nacional de Colombia	Understanding the Complexity of Socio–Ecological Systems in Mangrove Forests: A Systems Dynamics Approach in a Case Study of the Colombian Pacific Coast



III. ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Added value of ecological measures for sustainable marine infrastructure

First author(s): Annelies Boerema

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The surge in marine infrastructure projects, including offshore wind farms, subsea cables, energy islands, and aquaculture facilities, underscores the urgent need to evaluate the ecosystem performance of these activities and the quest to enhance the sustainability of marine infrastructure. Critical to this evaluation is the incorporation of eco-friendly measures and nature-inclusive designs (NID) that mitigate environmental impacts. Different measures are possible in the different marine zones, depending on the occurrence of the infrastructure (seabed, subtidal, intertidal and supratidal). However, how effective are those measures?

This research aims to provide a comprehensive state-of-the-art review of best practices for marine infrastructure, focusing on the added value of eco-infrastructure measures. By drawing on the work of the Marine Ecosystem Performance (MEsP) initiative, which inventories such measures, describes their potential benefits, and proposes methods to quantify these benefits, the study seeks to establish a robust framework for quantifying the ecological contributions of marine business activities. We will be discussing a variety of examples of marine eco-measures, pros and cons of the measures, lack of monitoring data, upcoming evaluation studies, but also challenges and risk factors which complicate the assessment of its benefits, such as the temporal and spatial impact zone.

This evaluation will help to validate and enhance the sustainability of marine infrastructure projects, ensuring they contribute positively to marine ecosystems while meeting economic and operational objectives.

Keywords: Eco-design; marine infrastructure; positive impact; risk factors; sustainability



2. Literature review and stakeholders' perceptions of changes in marine and coastal ecosystems services delivery

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The urgent need to manage human use of nature in a sustainable manner requires improved knowledge of the interactions between biodiversity and ecosystem services, particularly in understudied and vulnerable marine coastal areas, which attract 40% of the world's population and support many cultural services. Two approaches, a meta-analysis and a perception analysis, were performed and compared to understand how global changes in the dynamics of marine and coastal ecosystems affect ecosystem services with a special attention on cultural ecosystem services (CES).

The meta-analysis of 223 effect sizes extracted from 59 articles assessing the impact of drivers of change on coastal and marine CES revealed that recreational CES is the most studied, in contrast to other important dimensions such as spiritual, cognitive or symbolic services. Our quantitative analysis also shows that while pollution has negative effects on recreation, it also has large but non-significant positive effects on religion, bequests and scientific opportunities. We confirm the strong negative impacts of climate change, land/sea use change and direct exploitation.

Through a perception analysis, we gathered the views of Marine Protected Area (MPA) managers on their knowledge of CES and its changes, from 78 interviews conducted with managers of 152 MPAs in metropolitan France. The managers mentioned a lack of knowledge about pollution regulation services, well-being and greenhouse gas sequestration, for which they need more resources to effectively carry out their missions. They perceived an increase in recreational CES, as well as a general increase in representational values of ecosystems.

Although the meta-analysis and perception analysis provide results at different scales, the results show that these approaches complement each other in providing information on all CES and on the different pressures affecting coastal and marine ecosystems.

Keywords: Meta-analysis; perception; recreation; marine protected area



3. Climate adaptation in coastal regions: a digital dashboard tool for decision-support and MCES assessment

First author(s): Bart Maas

Presenting author: Sara Pino Cobacho

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Coastal regions, which host some of the highest densities of population, assets, and cultural heritage globally, are experiencing rapid urbanization compared to inland areas. Despite their productivity and biodiversity, which provide substantial marine and coastal ecosystem services (MCES), these areas face progressive degradation. REST-COAST, an EU Green Deal project, aims to demonstrate the benefits of large-scale systemic restoration to enhance biodiversity and MCES delivery for European coasts using nature-based solutions. To evaluate the potential of systemic restoration and nature-based solution packages, a Quick Scan Tool (digital dashboard environment) has been created. Tested specifically at the Ems-Dollard estuary, a pilot area in the Netherlands, this dashboard enables the rapid assessment of MCES at landscape scales for various future climate and management scenarios. It supports and informs decision-making regarding restoration upscaling and adaptation pathway development. The core of the dashboard is the supply of MCES, which forms the basis for decision-making. The dashboard displays semi-quantitative rank scores for MCES supply from ecosystems present in the Ems-Dollard estuary and compares trends in MCES delivery under different modelled climate scenarios and restoration measures. These MCES are combined with governance and financial indicators to present an integrated assessment and highlight trade-offs and benefits between the different restoration strategies considered. In practice, the dashboard transforms complex datasets into interactive visualizations. This facilitates the communication of scientific findings and showcases project results, thereby supporting decision-making processes relevant to the adaptation and upscaling of restoration measures in European coastal zones.

Keywords: coastal regions, climate adaptation, decision-support tool, nature-based solutions, systemic restoration



4. Seagrass active restoration at a socio-ecological ecosystem

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Seagrass ecosystems are crucial for blue carbon sequestration, shoreline stabilization, and provide habitat for many species, contributing to the ecosystem sustainability and health. However, human activities, natural threats and climate change have threatened these blue carbon ecosystems and the services they provide, facing a global declining trend over decades. To reverse this trend and mitigate these impacts, underpinned by the UN Decade on Ecosystem Restoration (2021–2030) and the Nature Restoration Law targets, seagrass restoration is urgent. This study focuses on *Zostera noltei* seagrass restoration within a socio-ecological system, Ria de Aveiro coastal lagoon (Portugal) and its role in carbon storage and climate regulation. Using a citizen science approach, intertidal *Z. noltei* seagrass restoration was implemented at several sites at Ria de Aveiro using a pre-validated technique consisting on sod transplants. Seagrass contribution to blue carbon sequestration was assessed by comparing the blue carbon stock at the seagrass donor meadow, bare sediment and restored sites, at different locations at Ria de Aveiro. This collaborative approach (scientists and stakeholders) and community engagement is crucial to the upscaling and sustainability of the restoration plans, but also fosters the sense of ownership among coastal populations. By aligning restoration efforts with international conservation targets, this work supports the potential of seagrass restoration as a nature-based solution (NbS) for climate regulation and coastal resilience in socio-ecological ecosystems.

Keywords: Blue carbon, Climate regulation, Ecosystem restoration, Community engagement, Coastal resilience



5. Creating a toolbox for interdisciplinary working on ecosystem services - A confidence framework

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Climate regulation and bioremediation of nutrients are two key regulating services in temperate coastal habitats. Our understanding of these services is improving but important questions still remain, for example, how they interlink with biodiversity in the coastal seascapes. We also do not understand how we can aid their restoration through targeted blue financing mechanisms.

To address these questions, we have chosen two very distinct coastal areas in the UK: the Cromarty Firth, a small firth in Scotland and the relatively well-studied Solent in the South of England. The project was developed to allow the comparison between the two sites: one rich in natural sciences data, the other less so. And to compare the establishment of blue financing mechanisms (better developed for Climate regulation than for Bioremediation of nutrients). This approach allows us to learn from the more advanced and to contrast the different approaches used.

A key challenge encountered with the mixed approaches we have taken is the uncertainty in the data and how this can be transparently communicated within the team and ultimately with stakeholders. To address this challenge we created a confidence framework that can be communicated across different groups.

We will present how we created the framework and how it is applied.

Keywords: uncertainty, confidence levels, climate regulation, bioremediation of nutrients, interdisciplinary research,



6. Application of the System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA-EA) in coastal and marine ecosystems in Lithuania

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Coastal and marine ecosystems are essential in supporting socio-ecologic systems worldwide, especially in semi-closed regional seas like the Baltic Sea. The ecosystem services (ES) provided by coastal and marine ecosystems support coastal communities' economic and social development. Therefore, it is essential to maintain a sustainable supply of ES. Nevertheless, despite their importance, the supply of ES has been jeopardised due to multiple direct (e.g., pollution) and indirect (e.g., climate change) anthropogenic impacts. Ensuring the continuing contribution of nature, in this case coastal and marine ecosystem, to socio-economic development is the objective of multiple environmental policies, both regional (e.g., Baltic Sea Action Plan), European (e.g., Marine Strategy Framework Directive) and international (e.g., United Nations Sustainable Development Goals). To achieve such an objective, several frameworks have been developed. The System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA-EA) has recently been adopted as a global standard to assess nature's contribution to social and economic wellbeing in physical and monetary terms. In Europe, Member States will adopt and report on the implementation of SEEA-EA. The objective of this study is to, within the System of Environmental-Economic Accounting – Ecosystem Accounting in Lithuania (SEEAL) project, develop a set of methodological frameworks to assess and map physical ecosystem accounts (extent, condition and ecosystem services) to support the implementation of the SEEA-EA in Lithuania. The methodological frameworks will explore existing datasets (e.g., Copernicus Marine Service) to map and assess multiple ES (e.g., nutrient regulation) in coastal and marine ecosystems. This information will then be conveyed to authorities to support the full implementation of the SEEA-EA in Lithuania. Moreover, the information generated in the SEEA-EA physical accounts (mapping and assessment of ecosystem condition and services accounts) can support the implementation of other European policies, like the newly adopted European Nature Restoration Law, by unveiling priority areas for nature restoration efforts.

The work was supported by the project System of Environmental-Economic Accounting – Ecosystem Accounting in Lithuania (SEEAL), funded by the Lithuanian Research Council (Contract: S-PD-24-18).



Keywords: SEEA; ecosystem services; accounting; Baltic Sea; restoration

7. Integrated System Dynamics Modelling for the Economic Valuation of Manila clam Biomass Ecosystem Service in the Venice Lagoon

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The Manila clam (*Ruditapes philippinarum*), initially an introduced alien species, has become a cornerstone economic resource in the Venice Lagoon, with remarkable social and environmental consequences. This work aims at contributing to the economic assessments of harvested clam biomass, to provide informed support to local decision-makers. Its novelty lays in the integration of dynamic economic valuation with three ecological modelling approaches within the same system dynamics framework: (1) a tolerance landscape model assessing population mortality under extreme temperature events (Bertolini & Pastres, 2021), (2) an individual bioenergetic model simulating growth dynamics driven by temperature and nutrient availability (Bertolini et al., 2021), and (3) a stochastic demographic model dependent on the initial clam seeding density (Melià et al., 2004).

Our model incorporates three main forcing variables (lagoon trophism scenarios, sea level rise, and water temperature variations), and simulates their influence on the state variables, which include somatic tissue, reproductive tissue, and shell growth. By simulating the interaction of these variables, the model provides a comprehensive view of the population dynamics of the Manila clam according to alternative future scenarios.

Starting from a specific seeding density of X individuals per square meter, we can observe the final marketable population in response to different levels of food availability and future thermal shocks, such as heatwaves.

This dynamic quantification allows for rigorous analysis of the economic evolution of this essential resource in the Venice Lagoon. The policy implications are significant, offering clear



guidance on managing this resource in line with the triple bottom line: economy, society, and environment.

Keywords: Ecosystem services, Dynamic economic valuation, System Dynamics, Ecological modelling, Sustainable resource management

8. Ecosystem Services of Venice Lagoon: Carbon Sequestration Dynamics in Salt Marshes and Seagrasses

First authors(s): Sebastian Raimondo

Other author(s): Federico Cornacchia, Perla Rivadeneyra, Carlo Giupponi

Affiliation: Fondazione Eni Enrico Mattei

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This research unveils the hidden potential of Venice Lagoon's salt marshes and seagrasses in combating climate change through carbon sequestration. By modelling and economically evaluating these vital ecosystem services, we pave the way for innovative conservation strategies and sustainable coastal management.

Key Dynamics and Ecosystem Challenges – Salt marshes, with their high efficiency in carbon sequestration, are crucial for climate regulation, shoreline protection, and biodiversity support. The dynamics of these ecosystems involve sediment deposition and the impacts of tidal and climatic variations on their elevation. Accurate modeling of these processes is essential for predicting their capacity to adapt to sea level rise and for designing effective management interventions.

Seagrasses are another critical component of the lagoon's carbon sink, contributing significantly through organic matter accumulation. Their health is closely linked to sea level and temperature changes, which are increasingly affected by climate change. Modeling the resilience and adaptability of seagrasses is crucial for understanding their future carbon storage role and developing strategies to mitigate climate change impacts on these ecosystems.

Both salt marshes and seagrasses play pivotal roles in the lagoon's carbon dynamics. Therefore, a comprehensive understanding of their responses to environmental changes, coupled with an economic evaluation of the carbon sequestered, is essential to estimate their future contributions to carbon sequestration and develop informed conservation strategies.



Methodological Approach – Our comprehensive approach integrates key biophysical processes into a System Dynamics model. The model is segmented into modules addressing the MoSE (Modulo Sperimentale Elettromeccanico) flood protection system, sediment dynamics in salt marshes, and the biomass dynamics of seagrasses. By assessing the cumulative impacts of MoSE operations and various climate scenarios, the model describes the evolution of the lagoon's carbon stocks and their future economic value.

Significance and Contributions – Our simulation model of the Venice Lagoon's carbon sequestration dynamics provides valuable insights into the ecosystem services of coastal environments. By integrating biophysical modeling with economic valuation, our study offers a multidimensional perspective that informs conservation and management decisions. Our findings underscore the importance of preserving salt marshes and seagrasses to support climate change mitigation and adaptation strategies, highlighting their essential roles in the ecosystem's overall health and resilience.

Keywords: Carbon sequestration, Economic evaluation, Salt marshes, Seagrasses, System dynamics

9. Monitoring coastal NbS success

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Nature-based solutions (NbS) for coastal management have become a prominent topic, demonstrated by numerous pilot projects aiming to enhance coastal resilience and coastal ecosystem services (ES). However, there is a critical need for comprehensive quantification of the multiple benefits provided by these solutions, both before project implementation to support for example leverage decision making and financing, but also after project implementation for validation and knowledge development purposes.

A broad range of effects of NbS on coastal ecosystem services can be quantified such as carbon sequestration, water retention, coastal protection against flooding, food production, denitrification, and recreational benefits. However, those assessments are rarely validated. Therefore we want to discuss the possibilities for validation and post-implementation impact monitoring. Still significant challenges remain in monitoring the long-term success of NbS implementations. A key aspect of this challenge is identifying which effects can be reliably



monitored post-implementation and which cannot, necessitating an open and ongoing discussion among stakeholders and researchers. The validation of NbS impacts will be important to ensuring that the NbS projects achieve their intended outcomes and adapt to any unforeseen challenges.

This presentation aims to discuss how we can bridge the gap between theoretical benefits and practical outcomes, providing validated data through field monitoring to support the optimization and broader adoption of NBS in coastal areas. A clear understanding of the outcome of NbS is essential information for policymakers, project developers and financiers.

Keywords: Coastal nature-based solutions; coastal ecosystem services; quantification; validation; monitoring



BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: B2

Living waters: Ecosystem services of freshwater biodiversity


Hosts:

	Name	Organisation	E-mail
Host:	Helmut Habersack	University of Natural Resources and Life Sciences, Vienna (BOKU)	helmut.habersack@boku.ac.at
	Hanh H. Nguyen	Research Center One Health Ruhr, University Alliance Ruhr & Faculty of Biology, University Duisburg-Essen	honghanh.nguyen@uni-due.de
Co-host(s):	Phoebe Griffith	Leibniz Institute of Freshwater Ecology and Inland Fisheries	phoebe.griffith@igb-berlin.de
	Sonja C. Jähnig	Leibniz Institute of Freshwater Ecology and Inland Fisheries	sonja.jaehnig@igb-berlin.de
	Lisa Waldenberger	University of Natural Resources and Life Sciences, Vienna (BOKU)	lisa.waldenberger@boku.ac.at

Abstract:

Freshwater ecosystems – including rivers, lakes, wetlands, groundwater, and floodplains – are indispensable to human health and well-being, offering critical ecosystem services.

Freshwater biodiversity is integral to these services and underscores the substantial connections between human, environment, and biodiversity health. For example, provisioning services from small-scale inland fisheries are essential for food security, nutrition and poverty eradication for millions of people in developing nations. Regulating and supporting services, such as water



purification provided by aquatic plants, ensure clean water supplies, while culturally endemic species enhance human well-being through their spiritual and cultural value in many societies.

Despite their critical role, biodiversity in these ecosystems faces significant threats, with a third of freshwater species at risk and a concerning 83% decline in populations as reported in 2018. This decline surpasses that of terrestrial and marine species, attributed to inadequate protection and failure to recognize unique ecological values of freshwater biodiversity and their interconnected role in supporting human and environmental health.


There is a pressing need for a systemic, interdisciplinary approach to protect biodiversity and ecosystem services of inland waters as critical natural assets within the 'One Planet, One Health' framework.

Goals and objectives of the session:

The session's primary goal is to consolidate current understanding of the key ecosystem services provided by freshwater biodiversity across diverse taxa and geographic regions, with a particular focus on how these relate to the One Health framework. Additionally, this session aims to inspire greater interest and motivation for interdisciplinary research focused on understanding the factors contributing to the decline of ecosystem services, and enhancing the effectiveness of freshwater ecosystem restoration efforts. This includes synthesizing the challenges and opportunities in restoring biodiversity and its services.

Specific objectives include:

- Synthesize current knowledge on the range of ecosystem services provided by freshwater biodiversity and its linkage to human health and well-being, highlighting both well-documented and understudied ecosystem services and geographical regions.
- Identify and evaluate potential synergistic effects and trade-offs of ecosystem services provided by freshwater biodiversity, and their subsequent effects on local and global health outcomes.
- Review advanced methods for monitoring and quantifying ecosystem services provided by freshwater biodiversity. This incorporates the consideration if and how cultural services and their relationship to human and environmental health can be quantified and integrated in assessments.
- Evaluate the state of knowledge of the effects of climate change and other co-occurring anthropogenic drivers on the capacity of freshwater biodiversity to deliver essential services to human health and well-being, as well as challenges for the restoration of freshwater biodiversity and its vital services.

- 
- Identify research priorities to improve understanding of how protecting and restoring freshwater biodiversity can support both human health and well-being and environmental health, including non-material dimensions.

Planned output / Deliverables:

Freshwater biodiversity's ecosystem services are often overlooked in favor of focusing on the habitat itself rather than the life within it. We hope to challenge this perspective by fostering an interdisciplinary environment for researchers to share ideas, methodologies, and pinpoint gaps in the current knowledges of understudied ecosystem services provided by freshwater biodiversity.

We aim to identify key areas where the concepts of ecosystem services and ecosystem and human health intersect, as research priorities for future transdisciplinary work. In particular, we aim to identify non-material services and consider how such services, particularly cultural ecosystem services, can be included and considered alongside material contributions that are more easily quantifiable.

We hope that by identifying key areas of overlap for research, we will stimulate the development of transdisciplinary methods to more effectively monitor and assess the complex effects of simultaneous drivers on freshwater biodiversity and ecosystem services they offer. Outcomes from this session will inform a synthesizing opinion paper that guides future research and management strategies within the 'One Planet' health framework, looking beyond freshwater as simply a resource that provisions clean water and sanitation, but as an ecosystem with diverse benefits that require integrated management amid multiple co-occurring and emerging drivers.

II. SESSION PROGRAM


Room: Expert Street 6

Date of session: 18th of November 2024

Time of session: 14:00–17:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
14:00–14:15	Bence	Decsi	Budapest University of Technology and Economics, Hungary	Why do the Green Arteries of Danube River Basin shine in yellow? Exploring a major ecosystem services trade-off for



Time	First name	Surname	Organization	Title of presentation
				the riparian zones of Danube River Basin
14:15–14:30	Margot	Sepp	Catalan Institute for Water Research, Spain	Is streamflow intermittency deteriorating the dilution capacity of European river networks?
14:30–14:45	Jan E.	Vermaat	Norwegian University of Life Sciences, Norway	Mass development of aquatic plants: how does mechanical plant removal affect ecosystem services?
14:45–15:00	Fábio André	Matos	University of Aveiro, Portugal	Understanding the monetary value of water quality through ecosystem service
15:00–15:15	Jiří	Jakubínský	Global Change Research Institute, Czech Republic	Towards a precise evaluation of floodplain ecosystem services as a means of supporting environmentally favourable spatial planning and preserving biodiversity
15:15–15:30	Ágnes	Vári	McGill University, Canada	Ecosystem services at Lake Balaton – perceptions, environmental awareness and trade-offs between conservation and development
15:30–16:00				SESSION BREAK
16:00–16:15	Angélica	Hernández Goez	Federal University of Goiás, Brazil	Extractivism expansion of palm oil and its relation with freshwater ecosystem services. A study case in Colombia
16:15–16:30	Anda	Ruskule	Baltic Environmental Forum, Latvia	Comprehensive framework for assessment of freshwater cultural ecosystem services in Latvia
16:30–16:45	Linda	Rogge	Dresden University of Technology, Germany	Assessing natural and cultural heritage in fishery-managed pond landscapes in Upper Lusatia, Germany
16:45–17:30				Q&A /Panel discussion



III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Why do the Green Arteries of Danube River Basin shine in yellow? Exploring a major ecosystem services trade-off for the riparian zones of Danube River Basin

First author(s): Bence Decsi

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Riparian strips form a transition zone between terrestrial and freshwater ecosystems providing essential ecosystem services. Healthy strips are crucial for the stability and sustainability of ecological systems. Riparian zones have major environmental importance because these could be interpreted as collision zones of transporting pollutants (on both surface and subsurface) from the land to the freshwater. According to that riparian zones have irreplaceable effect on sediment- and nutrient mitigation and securing freshwater ecosystem biodiversity.

Despite their vital importance, the research community paid less attention on riparian strips. Policy-level regulation of land use and related pollutant emissions within strips is also lacks. As a result, degradation of riparian habitats is still increasing.

In this study, we determined of a critical delineation distance of riparian strip with a/the fixed buffer strip approach. This was based on the analyses of almost 5000 computed local groundwater – surface water gradients in four counties of the Danube River Basin. We evaluated the actual and past land use conditions within the derived riparian strips. To establish and understand the motivations and cause-effect relationship behind the land use arrangement, we examined the vegetation biomass production inside and outside the defined zone.

We highlighted in our results, that the proportion of agricultural areas exceeds national level ratios concerning natural land cover types within the riparian strips. For most countries of the Danube River Basin, the agricultural land use category shows 4 to 8% increase within the riparian strips compared to outer zones regarding a crop yield indicator. This means, that within the riparian strips, areas with significant potential for provisioning services are primarily



exploited, to the detriment of regulating services. This revealed conflict is also an opportunity that affects the feasibility of several European Union strategies (Water Framework Directive, Biodiversity Strategy until 2030), by pointing out potential restoration sites.

Keywords: freshwater ecosystems, riparian strips, vegetation productivity, land use conflict, ecosystem services trade-off

2. Extractivism expansion of palm oil and its relation with freshwater ecosystem services. A study case in Colombia.

First author(s): Angélica Hernández Goez

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Colombia is the fourth country in the world, and the first in Latin America, in palm oil production (*Elaeis guineensis*); 37% of its exports are destined for the EU market. In this country, the Magdalena Middle River basin region is the second one in importance with 30%, approximately, of processing and occupied area.

This basin expands around 36.000 km² where, approximately, one million of people live, of which, 35% live in rural areas. Furthermore, it is rich in wetlands and rivers that occupy 37% of its surface. There, the municipality of Puerto Wilches is the place of the first palm plantations and has the largest amount of processing plants in that region.

Thus, in this study, we ask for how the expansion of the extractivism of palm oil is affecting the freshwater ecosystem services in this municipality. We will use qualitative and quantitative tools such as documentary and bibliographic research through secondary sources, discourses analysis, processing and geoprocessing data. Furthermore, this study pretends to put in dialogue the extractivism descriptive concept and the conceptual framework of ecosystem services in order to find and introduce other kind of variables, like the property regimes, to the ecosystem services assessments.



As preliminary conclusions, it is suggested that this expansion has reducing the capacity of generating provisioning, regulating and cultural services such as food, access to drinking water, recreation, human and environmental health etc.

Keywords: oil palm, extractivism, ecosystem services, Puerto Wilches, Colombia.

3. Towards a precise evaluation of floodplain ecosystem services as a means of supporting environmentally favourable spatial planning and preserving biodiversity

First authors(s): Jiri Jakubinsky

Other author(s): Vilem Pechanec, Lenka Sterbova, Marcela Prokopova, Ondrej Cudlin, Renata Vcelakova, Jan Purkyt, Pavel Cudlin

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Floodplains can be considered one of the most valuable habitats in terms of ecosystem services provision, especially when maintained in their natural state. The main objective of this contribution is to present selected results of the ongoing project to develop a comprehensive methodological approach to determine the extent of floodplain disturbance under current conditions based on the identification and assessment of key floodplain ecosystem functions and services (EFS). Using the outputs of this work, it is possible to identify the approximate quality of the most important floodplain EFS in the Czech Republic, including the potential for improvement in the case of significantly degraded floodplains. Several widely used indicators are applied to evaluate the following EFS – flood control, soil water retention, carbon sequestration, local climate regulation, soil erosion regulation, habitat provision, connectivity with natural habitats, biomass production, recreation potential, and cultural (and aesthetic) values. An online map application has been developed to display the detected data for all defined floodplains (at a scale corresponding to 1:10,000), and to enable the EFS assessment and identification of at-risk sites.

Our research has shown that the ability of floodplains to provide ecosystem services is highly dependent on anthropogenic influences, such as the presence of levees and increases in channel capacity, which lead to floodplain degradation and changes in their functioning. Habitat provision and biodiversity are significantly negatively affected by land– use changes that result



in degradation or loss of floodplain and wetland habitats. In particular, the loss of alluvial forests significantly reduces the ability of floodplain habitats to store carbon and retain water.

The outputs of the project should preferably be used by local nature conservation authorities when deciding on construction permits and in the spatial planning process, which should consider the protection of environmental values.

Keywords: floodplain disturbance, human pressure, environmental change, nature protection, spatial planning.

4. Understanding the monetary value of water quality through ecosystem service valuation

First author(s): Fábio Matos

Other author(s): Peter Roebeling, Carlotta Quagliolo, Luiz Magalhães Filho, Max López-Maciél, Rita Mendonça

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Ecosystems are increasingly threatened by anthropic action in the forms of human interventions and climate change. With such phenomena negatively affecting ecosystems on a global scale, it is crucial to assess the natural services that are being lost. Humans obtain a number of ecosystem services (ES) from natural systems, including provisioning, regulating & maintenance and cultural services, that contribute to human health and well-being. Estimating the monetary value of these ES is an efficient way to transmit the importance of natural systems to stakeholders and policy makers who may lack in-depth understanding of their function, services and values. Despite this, ecosystem service valuation is a field of research where methodologies can be very diverse, and where not all topics are given the same amount of consideration. Water is a fundamental component of all ecosystems, and its quality (chemical; ecological) can have deep effects on ecosystem service provision from multiple standpoints. However, as a result of the complexity of these systems, measuring the value of water quality is a difficult task, and most studies attempt to do so in approximate or partial ways. This occurs for diverse reasons, namely, lack of access to rigorous water quality measurement data, incomplete understanding of the relations between water quality and ecosystem functions, and a general difficulty in finding effective methods to quantify the value of water quality. The objective of this study is to compile and understand the different methodologies employed by



the academic community to economically value water quality in the context of ecosystem services. To this end a systematic literature review is performed, using the SCOPUS database, expert-based review tools, and content analysis and synthesis. Based on this analysis, insights are gathered and discussed, so as to inform researchers and practitioners looking to assess water quality in ecosystem service valuation studies.

Keywords: Water quality, Ecosystem services, Monetary valuation, Systematic literature review

5. Title: Assessing natural and cultural heritage in fishery-managed pond landscapes in Upper Lusatia, Germany

First author(s): Linda Rogge

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The cultivation of carp has led to the creation of artificial pond landscapes that form cultural landscapes. These landscapes are characterized by their biological and structural diversity, overall ecological importance as well as their provision of ecosystem services such as fish for nutrition, water regulation or recreation. Moreover, they contribute to the natural and cultural heritage of people living in these areas. Natural and cultural heritage includes landscape elements that have a meaning for the present, which encompasses historical as well as non-historical objects, landscape features but also intangible aspects. Within the ecosystem services concept, natural and cultural heritage is understood as a cultural service. According to the Common International Classification of Ecosystem Services (CICES) natural and cultural heritage is described as natural elements that help people identify with the history or culture of where they live or where they come from.

The pond landscape in Upper Lusatia is one of the largest in Europe and characterizes the region's scenery. In order to assess how people perceive natural and cultural heritage, we combined different methodological approaches to explore which landscape elements people feel particular connected to and why, while making it spatially explicit. Our findings suggest that natural and cultural heritage is experienced through lived practices. It forms synergies with other cultural ecosystem services such as recreation or education and can contribute to the feeling of regional identity. Our methodological application aims to contribute to the assessment of cultural ecosystem services to acknowledge their value and contribute to a greater recognition in the context of decision-making. In the face of declining freshwater



biodiversity, it highlights the importance of safeguarding fishery–managed ponds to preserve cultural ecosystem services, while targeting conservation policy objectives. This way our findings can contribute to enhance the understanding of ecosystem health towards human well–being.

Keywords: Cultural landscape, cultural ecosystem services, assessment, human well–being

6. Comprehensive framework for assessment of freshwater cultural ecosystem services in Latvia

First author(s): Anda Ruskule

Other author(s): Anita Zariņa, Agnese Reķe, Maija Fonteina–Kazeka


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Freshwater ecosystems are vital for human well–being, providing a wide range of tangible and intangible benefits. The assessment of cultural ecosystem services (CES) offers a holistic framework for exploring human–nature relations, uncovering multiple dimensions of interactions and fundamental aspects of why people value water and waterscapes. However, water management policies, such as river basin management plans and monitoring programmes, mostly fail to integrate cultural values into the assessment of freshwater ecosystems.

In Latvia, a comprehensive CES indicator framework has been developed as integral part for monitoring the status and impacts to freshwater ecosystems and services they provide. The framework relates six CES classes (characteristics enabling active and passive interactions with freshwaters, scientific investigations and education, cultural heritage and symbolic/sacred meaning) to all components of ecosystem service “production chain” of the cascade model (Hernández–Morcillo et al., 2013), including: (i) condition indicators – biophysical and cultural preconditions underpinning CES; (ii) function indicators representing the potential of CES supply; (iii) indicators on mediation of service supply – amenities/infrastructure that enable access to CES; (iv) benefit indicators – CES–related tangible goods, events or informative products; (v) impact indicators reflecting physical, mental, social and economic well–being associated with cultural practices and landscape.

The indicator framework was tested on 6 small rivers, using landscape areas as service providing unit. The landscape areas were determined considering dominant topographic



features, land cover, degree of waterbody modification level and flood area. Data for quantification of indicator values were obtained from expert fieldworks, survey of freshwater ecosystem users and various spatial data sets.

The CES assessment framework was developed for the “LIFE Goodwater IP” project, aiming at improving the status of water bodies at risk in Latvia. The proposed framework is further explored within the “Water Cultures” project addressing people–water relations in Latvia.

Keywords: water management policy, human–nature relations, indicator framework, small rivers, landscape areas

7. Ecosystem services at Lake Balaton – perceptions, environmental awareness and trade–offs between conservation and development

First author(s): Agnes Vari

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Lake ecosystems, as all freshwater ecosystems, are highly vulnerable. Multiple pressures result among others from recreational uses, where people intending to engage with “nature”, seeking recreation at a lake, unintentionally affect directly and indirectly the lake ecosystem (e.g. directly through effects on wildlife, or indirectly via an enhanced demand for infrastructure). People’s awareness of environmental issues is essential in managing targets of conservation versus tourism and economic development. Their views are of paramount importance because they influence societal and political pressure on environmental management. We assessed preferences for ecosystem services (ES), recreational activities, shore types, and acceptance of increasing pressures in terms of shore modifications for Lake Balaton. Our survey involved 1500 respondents (tourists, vacation homeowners, and lake shore residents). Survey results show that the greatest importance was assigned to regulating & cultural ES, in line with the prevailing use as a place of recreation. Greatest differences were between locals and tourists, with environmental awareness as the strongest explanatory factor. Most frequent activities were simpler and close-to-nature (e.g. swimming, walking) and not high-profile activities like sailing, yachting or even angling. Preferred activities aligned well with preference for more natural shore types. Privatization of shores (as holiday resorts), further development of tourism infrastructure (including marinas, sailing and yachting opportunities) were not endorsed by the



broad public (58–61 % disliked these options). We identified trade-offs and related them to shore types. We discuss the results of this survey in relation to present trends in investments to tourism at the Lake and power relations in the space spanned by recognized ES and preferred activities in general.

Keywords: lake ecosystem services, recreation, tourism, conservation, trade-offs

8. Mass development of aquatic plants: how does mechanical plant removal affect ecosystem services?


First author(s): Jan Vermaat

Other author(s): Kirstine Thiemer, Bart Immerzeel, Susanne C. Schneider, Keneilwe Sebola, Julie Coetzee, Antonella Petruzzella, Samuel N. Motitsoe, Mathieu Baldo, Benjamin Misteli, Gabrielle Thiébaud, Sabine Hilt, Jan Köhler, Sarah F. Harpenslager

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Dense beds of aquatic plants are often perceived as nuisance and costly mechanical removal is a common measure. Such removal, however, may affect different ecosystem functions and consequently also the ecosystem services that benefit society. Five cases were studied: River Otra (Norway), River Spree (Germany), Lake Kemnade (Germany), Lake Grand-Lieu (France), and Hartbeespoort Dam (South Africa). In all, nuisance aquatic plant cover is managed, but dominant species, geographic setting and societal uses are different. We quantified 12 final ecosystem services as fluxes per area and year in biophysical and monetary terms. These services were: food and fodder production, commercial fisheries, hunting and gathering wild products, hydropower production, drinking and irrigation water production, flood prevention, carbon sequestration, different forms of active and passive recreation, and biodiversity conservation (non-use). These services were related to aquatic plant cover via a causal network of ecosystem functions, and the effects of three plant removal regimes were estimated on the different services and the total sum of their monetary estimates (Total Economic Value, TEV). The three regimes were ‘maximum removal’, ‘current practice’, and ‘do nothing’. TEV was dominated by recreation in all cases. In three out of five cases the different removal regimes had little effect on the estimated TEV. In Lake Kemnade, TEV dropped in the ‘do nothing’ regime due to a negative effect on esthetic appreciation above a threshold in cover. In Hartbeespoort Dam, boating and angling were negatively affected in ‘do nothing’. We conclude that effects on recreation should be a core consideration in the management of nuisance aquatic plants, since recreation dominated the estimated societal benefits, also in cases where



provision of hydropower, drinking water or irrigation water were relevant. Furthermore, benefits can be gained from incorporating variation in perceived nuisance among different categories of recreative users before engaging in costly removal.

Keywords: integrated aquatic weed management, keystone species, introduced invasive plants, ecosystem functions, questionnaires surveys.

9. Mass development of aquatic plants: how does mechanical plant removal affect ecosystem services?

First author(s): Margot Sepp

Other author(s): Mahdi Abbasi, Petra Döll, Anna Freixa, Rafael Marcé, Sergi Sabater

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Rivers provide numerous important ecosystem services, including fisheries, water purification, and recreation. Research on ecosystem services provisioning has focused almost solely on perennial rivers and knowledge about ecosystem services in non-perennial rivers remains limited. However, 51–60% of the world's rivers are non-perennial: they experience occasional, seasonal, or even permanent drying. Streamflow intermittency has increased and will continue to increase in many regions around the world due to climate change and intensive water abstraction. We studied the provisioning of one regulating ecosystem service, dilution capacity, in European river networks, including both perennial and non-perennial rivers. Dilution capacity is river's capacity to dilute effluents from wastewater treatment plants (WWTPs), contributing to water purification. We evaluated dilution capacity by Dilution Factor (DF), which is one of the main indicators of ecological risks originating from WWTP effluents. We calculated DF as the ratio between streamflow and sum of WWTP discharges in the river network upstream from the corresponding river. High-resolution time series of monthly streamflow were obtained by downscaling output of global hydrological model WaterGAP. WWTP discharge data were obtained from European Union database Waterbase-UWWTD. DF was calculated for 110,936 river reaches, 96,429 of them were perennial and 14,507 non-perennial. Overall, DF of non-perennial reaches was approximately 4 times lower than that of perennial reaches. During the driest summer months (July–August), DF of non-perennial reaches was even 6 times lower. DF was negatively related to the number of no-flow days of the river and to the higher proportion of non-perennial reaches in the upstream river network. This effect was strongest in South-Europe and during summer months. Increasing streamflow intermittency in the future will



deteriorate the dilution capacity of European rivers. Therefore, our results provide useful information on how to better manage WWTP discharges to support river ecosystem health and human health.

Keywords: regulating ecosystem services, water purification, wastewater discharge, European rivers, streamflow intermittency

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: B8

Ecosystem Services, Global Change and human health in Arctic and mountain regions:
 Challenges and solution

Hosts:

	Name	Organisation	E-mail
Host:	Uta Schirpke Miguel Villoslada	Eurac Research University of Eastern Finland	uta.schirpke@eurac.edu miguel.villoslada@uef.fi
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Abstract:

The recently created Tundras Biome Working Group aspires to become a platform for knowledge sharing and co-production in relation to tundra, arctic, alpine, snow- and permafrost-related ecosystem services, while advocating for tundra socio-ecological perspectives through transdisciplinary research.

In this first Tundras BWG session, we would like to address the major challenges currently faced by tundra ecosystems and the ensuing threats to the traditional livelihoods that depend upon these ecosystems. Biodiversity losses coupled with the fast-paced impacts of Climate Change could have far-reaching implications for ecosystem functions and services. Anthropogenic pressures have also become increasingly evident, with expanding infrastructure such as wind farms, petroleum industry, large mining projects, tourist resorts, and related network expansion



fragmenting the tundra environment, increasing the vulnerability of these valuable ecosystems. Moreover, healthy ecosystems contribute to the well-being and quality of life of local populations and surrounding areas, assuring safety, food and water security, and supporting physical, mental, and social health. To scope with the challenges emerging from global change pressures, there is an urgent need to improve the understanding of the relationships between the state of ecosystems and human health and to integrate such knowledge into decision-making.

The session includes presentations that address the ongoing challenges in tundra and mountain ecosystems from an ecosystem services perspective, comprising mapping and modelling approaches, transdisciplinary research, and socio-ecological perspectives. Simultaneously, we would like to map the current state-of-the-art regarding ecosystem services science, projects, and initiatives in tundra ecosystems. How well represented are tundra ecosystems in ecosystem services assessments? What are the methodological approaches currently in use? What is the role of transdisciplinarity and knowledge co-production in tundra research?

Moreover, we would like to discuss three key questions with regard to integrating human health in ecosystem services assessments. Which environmental aspects of ecosystem services are relevant for human health in tundra and mountain regions? Which physical or intellectual interactions with the environment contribute to an improvement of physical, mental, and social health? Which indicators used in ecosystem service assessments can be directly or indirectly linked to human health?

Goals and objectives of the session:

1. Deepen our understanding on ongoing challenges in tundra ecosystems from an ecosystem services perspective.
2. Map the current state-of-the-art regarding ecosystem services science, projects, and initiatives in tundra ecosystems.
3. Discuss key questions to support the integration of human health in ecosystem services assessments, bringing together scientists from different disciplines to identify related potentials and limitations.

Planned output / Deliverables:

A joint open access journal publication or a journal special issue (depending upon the content of presentations). The session will also be the basis for a common paper with interested participants on potentials and limitations of the concept of ecosystem services to integrate human health aspects in ecosystem service assessments. This will be further developed during and after the conference.

Session format:

Standard and short presentations and scientific debate.



II. SESSION PROGRAM

Room: Expert Street 9

Block 1

Date of session: 18th of November 2024

Time of session: 11:00 – 12:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
11:00 – 11:05				Introduction to the session
11:05 – 11:20	Mariana	García Criado	School of Geosciences, The University of Edinburgh	How will plant biodiversity change alter future ecosystem services in a warming Arctic?
11:20 – 11:30	Justine	Ramage	Stockholm University, Department of Physical Geography, Sweden	Mapping Arctic Permafrost Ecosystem Services
11:30 – 11:40	Stijn	Hofhuis	UIT, The Arctic University of Norway	Mesopredator management: Harvest data-based modelling workflow reveals drivers of tundra red fox population
11:40 – 11:50	Miguel	Villoslada	University of Eastern Finland	Leveraging synergies between UAV and satellite sensors to evaluate the impact of pale lichen biomass on land surface temperature in heath tundra ecosystems.
11:50 – 12:30				Focus Group Discussions



Block 2

Date of session: 18th of November 2024

Time of session: 14:00 – 15:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
14:00 – 14:10	Claudia	Caro	Universidad Nacional Agraria La Molina	Key ecosystem services in the high Andean ecosystems and their value to achieve Global Biodiversity Framework goals
14:10 – 14:15	Alberto	González-García	Université Grenoble Alpes	The deglaciation of the tropics, impacts on ecosystem services and emotionally-driven climate (in)action
14:15 – 14:20	Mattias	Gaglio	University of Ferrara	An Ecosystem Services Assessment towards the adoption of a Climate Change Adaptation Plan in the Province of Trento (Italy)
14:20 – 14:25	Ignacio	Diaz-Maroto	University of Santiago de Compostela	Cultural ecosystem services of communal temperate forests in the mountains of north-west Spain: livelihoods, human well-being and cultural-spiritual values
14:25 – 14:30	Agnieszka	Nowak-Olejek	Jagiellonia University	Mountains for Mental, Physical, and Social Health: Unveiling the Role of a Multisensory Landscape
14:30 – 15:30				Focus Group Discussions



III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Key ecosystem services in the high Andean ecosystems and their value to achieve Global Biodiversity Framework goals

First author(s): Claudia Caro Vera

Other author(s): Vasco M. Mantas

Affiliation: Universidad Nacional Agraria La Molina

Contact: ccaro@lamolina.edu.pe

The high Andean mountains play a fundamental role in the provision of essential ecosystem services such as water security, carbon sequestration, habitat maintenance and tourism opportunities. However, their difficult access and the existence of altitudinal gradients pose significant challenges for the identification and valuation of all the ecosystem services they provide, especially in areas with limited field data. To address this challenge, a methodology for the identification of Ecosystem Services (ES) in the Junín National Reserve, Peru, was proposed. This methodology was based on the combination of geospatial tools with selective field data collection and a systematic survey of service-providing units. As a result, more than 100 ecosystem services were listed, using the CICES system as a classification framework. This study has established a foundational database that captures the vast potential of high Andean ecosystems to provide a wide range of services, which were grouped into management categories that were analyzed in light of their relevance to achieving the objectives of the global biodiversity framework and sustainable development goals.

Keywords: Global biodiversity framewok, High Andean Ecosystems, Bundle ecosystem services



2. Mesopredator management: Harvest data-based modelling workflow reveals drivers of tundra red fox population

First author(s): Stijn Hofhuis

Other author(s): Chloé R. Nater, Matthew Grainger, Øystein Flagstad, Rolf A. Ims, Siw Killengreen, Dorothee Ehrich


Affiliation: Department of Arctic and Marine Biology, UIT – The Arctic University of Norway, Tromsø, Norway

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Expanding mesopredator populations that negatively impact biodiversity and are vectors of zoonotic diseases are an issue in many ecosystems. In the Arctic, expanding red foxes threaten endemic tundra species, and can thus be considered an ecosystem disservice. Intense red fox harvest is conducted as a management action, but its effect remains unclear. This is because we usually lack individual-based demographic data for estimating mesopredator population sizes and vital rates, hampering the assessment of management actions.

One potentially fruitful approach is to use harvest data within Integrated Population Models (IPM's). This allows for the integrated and unbiased analysis of multiple (incomplete) data sets obtained through harvest, expert knowledge or other published studies. Here we developed a versatile IPM workflow for studying population dynamics under different harvest regimes and environmental conditions. We applied this to an expanding red fox population in Arctic Norway. From 3678 harvested red foxes, we extracted data on age, reproduction, and genetic variation, and combined these data sources with data from opportunistic den surveys, informative priors on natural mortality, and environmental data. This allowed us to quantify red fox population dynamics over a period of 18 years, and to identify the drivers of changes in population growth rates using retrospective (LTRE) and prospective (PVA) analyses. We found that natural mortality and immigration were the main drivers of year-to-year changes in population growth rate. Among-year variation in vital rates could partly be attributed to variation in rodent abundance and constant harvest mortality likely contributed to limiting population growth.

These results provide valuable insights for the management of red foxes within vulnerable tundra ecosystems. Moreover, our accessible modelling framework can easily be transferred and adapted to other harvested species, facilitating the implementation of cost-effective population analyses that are of high relevance for informing management strategies and mitigating biodiversity loss.



Keywords: culling, demography, integrated population model, population dynamics, vulpes vulpe

3. The deglaciation of the tropics, impacts on ecosystem services and emotionally-driven climate (in)action

First authors(s): Ignacio Palomo

Presenting authors(s): Alberto González-García

Other author(s): Sofia Lana, Antoine Rabatel, Olivier Dangles

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Tropical glaciers are facing a severe decline and the majority of them are expected to vanish before the end of the century. The ecosystem services they provide, clean drinking water, climate regulation, recreation, sense of place and spirituality, among others, are being highly impacted. Simultaneously, new ecosystems emerge, providing the opportunity for the co-production of new ecosystem services. For the preparation of United Nations International Year of Glacier preservation 2025, we modelled the extent of 30 selected tropical glaciers during the little ice-age (mid XIX century) and for the year 2050. Our results show the dramatic changes in glacier extent in less than two centuries. We couple these results with 30 interviews of a diverse group of actors that benefit from ecosystem services from these glaciers and that must cope with the unprecedented changes in the cryosphere. We analyse how ecosystem service dynamics change for this group of actors as well as the adaptation and transformation responses that emerge as a result of a radical landscape change. Interestingly, a series of human emotions seem to mediate the responses that actors develop in the face of tropical glaciers loss.

Keywords: tropical glaciers, climate change, ecosystem services, emotions, agency.



4. Mapping Arctic Permafrost Ecosystem Services

First author(s): Justine Ramage

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Despite being critically important for communities living in the region, Arctic permafrost ecosystem services are not systematically classified and mapped, or aligned with the Sustainable Development Goals. This becomes increasingly urgent considering the unprecedented temperature rise and accelerated permafrost thaw in the Arctic. Permafrost thaw alters the livelihoods of permafrost communities by impacting infrastructure, exposing contaminants, and disturbing the supply of Arctic permafrost ecosystem services. While the impacts of permafrost thaw on infrastructure and contaminants are already under intense scrutiny, studies on Arctic permafrost ecosystem services are missing and are urgently needed. Recent research shows that permafrost communities are concerned about the consequences of permafrost thaw on their ecosystems, yet they have no tools to assess the impacts. The acute knowledge gaps in our understanding of the impact of permafrost thaw on local communities needs to be addressed. This paper presents a framework to identify, map, and value Arctic permafrost ecosystem services using community participatory approaches.

Keywords: permafrost, participatory mapping, ecosystem services, thawing

5. Leveraging synergies between UAV and satellite sensors to evaluate the impact of pale lichen biomass on land surface temperature in heath tundra ecosystems.

First author(s): Miguel Villoslada

Affiliation: University of Eastern Finland

Contact: miguel.villoslada@uef.fi

Lichens cover around 8% of the Earth's land surface. While possessing the ability to colonize almost all terrestrial habitats, they play a key role in various ecosystem functions particularly at high altitudes and latitudes. More specifically, pale lichens are believed to play an important role in regulating energy and carbon balance in high-latitude ecosystems, since they control soil temperature regimes through the reflection of shortwave radiation. Due to this reflectance properties, changes in lichen cover and biomass may result in shifts in surface and soil



temperature regimes, potentially affecting the release of carbon from the soil to the atmosphere.

In this study, we aim at understanding the role of pale lichens as regulators of land surface temperature (LST) in a heath tundra landscape located in the border between Norway and Finland. We used a combination of remote sensing techniques, namely Unmanned Aerial Vehicles and Landsat data to unveil the effects of pale lichens on LST across various spatial scales, and to assess whether pale lichens have a higher cooling effect than vascular vegetation.

Our results confirm that pale lichens in heath tundra ecosystems present significantly lower LST values than typical tundra heath plant species such as evergreen shrubs or *Betula nana*, confirming their critical role in regulating tundra microclimate dynamics. Moreover, thicker lichen mats are associated to lower LST values. Finally, our analysis revealed the important role of the spatial scale of analysis, with markedly different results between landscape and local-scale assessments. By integrating field observations with multi-scale remote sensing analyses, we provided empirical evidence for the cooling effect of pale lichen cover, highlighting its importance in shaping thermal regimes at both local and regional scales.

Keywords: Pale lichens, remote sensing, tundra, Arctic, microclimate

6. How will plant biodiversity change alter future ecosystem services in a warming Arctic?

First author(s): Mariana García Criado

Affiliation: School of Geosciences, The University of Edinburgh

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Plants are the foundation of terrestrial Arctic ecosystems. As the base of trophic chains, they determine ecosystem structure, function and the services they provide. Concurrent with rapid climate change, extensive vegetation change has been observed in the past few decades, including shifts in species abundance, composition and distribution. Specific mechanisms of change include northward advance of treelines, expansion of shrubs and graminoids, decreases in bryophytes and lichens, widespread species composition change and the creation of novel communities. However, considering the rapid pace of both climatic and biotic changes, and the observed high level of heterogeneous and individualistic responses to global change, documenting these impacts remains challenging, and more so understanding the consequences these might have for ecosystem services. Here, I present an overview of the current trends of



Arctic plant diversity change from a macroecological perspective, including functional traits, species distributions, diversity metrics, plant–herbivore interactions, and their relationship with climate change. Additionally, I discuss the effects these changes could have in the future of ecosystem services, including food provision, reindeer herding, climate regulation, carbon cycling, pollination, medicinal resources, and cultural and spiritual values. Overall, impacts on Arctic plants could be precursors of future changes in ecosystem function, wildlife habitats and livelihoods for Arctic people.

Keywords: plant biodiversity, Arctic tundra, ecosystem services, climate change

7. Cultural ecosystem services of communal temperate forests in the mountains of north–west Spain: livelihoods, human well–being and cultural–spiritual values

First author(s): Ignacio J. Díaz–Maroto

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The main goal of our research is to study the cultural function of European temperate forests in the sustainable development of local communities and people living nearby. This is a complex and multidisciplinary topic given that it involves socioeconomic, political and environmental aspects. So adequate coordination between all stakeholders (administrations, forest owners, neighbours, forest users...) is necessary. The multifunctional nature of forests promotes the creation of markets, both for timber and non–timber forest products. Also, the regulation services that depend on them and the cultural services linked to the well–being of the population. A livelihood includes both people and their capabilities, income, food, another natural resources... Policymakers, forest owners, and individual capacity are essential factors in generating possibilities for growth and integrating that knowledge into decision–making. The assessment of forest ecosystem services has prioritized economic values, including fresh water, carbon storage, production of food and medicines, and soil conservation, among others. Nevertheless, on too many occasions the cultural–spiritual value of forests has been ignored because their intangible nature hinders their economic estimation. The significance of these services not only has a critical scope as it implies a greater potential for conservation actions. In fact, several billion people value their forests mainly for their cultural–spiritual meaning. Our work analyses the ancestral role temperate forests, a lot of them communal, play in the sustainable development of rural communities in Galicia, northwest Spain. These forests are a



special model of collective property between community members and have a unique legal status. Therefore, community forests could be a driving force for general well-being, citizen empowerment, equity, employment and local development.

Keywords: stakeholders, livelihoods, intangible nature, rural communities, Galicia

8. Mountains for Mental, Physical, and Social Health: Unveiling the Role of a Multisensory Landscape

First author(s): Agnieszka Nowak-Olejek

Other author(s): Joanna Hibner, Joanna Hałys, Julia Zwolińska, Marcin Rechcinski

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Mountain regions are popular destinations that offer visitors a range of benefits, including physical, mental, and social well-being. However, the influence of landscape factors and activities on the provision of these benefits remains unclear. Additionally, these regions face various threats that can undermine their ability to provide these benefits (climate and land use changes, pollution, and over-tourism).

Our study aimed to investigate which landscape elements enhance the provision of physical, mental, and social well-being benefits, which elements limit this flow, and how interactions with the environment facilitate their provision. To achieve this, we conducted 20 semi-structured interviews with visitors to two mountain areas in the Carpathians, Poland: Beskid Niski and Pieniny.

Visitors perceived all investigated benefits; however, they seemed to prioritize mental health, particularly relaxation and recovery opportunities, calmness, and refuge (escape from everyday life). Interestingly, in terms of landscape elements, visitors mentioned “greenery” as one of the most important factors for recovery, regardless of the specific type. The interviewees underlined also the multisensory dimension of the landscape, especially the soundscape (the silence of the night, the sound of water and wind as well as birdsong), in providing mental health benefits. Conversely, the noise associated with crowded destinations was highlighted as a significant disbenefit. Interviewees identified clean air as a key factor for overall health, while mineral water was highlighted for its benefits to physical health.



Interviewees mentioned various interactions with nature, but health seemed to be enhanced the most by physical ones (sports and recreation, observing nature). Physical effort was indicated as important for both physical and mental health. Conversely, relaxation was associated with the simpler act of sitting and observing nature.

Recognizing the importance of the mentioned landscape elements can guide land management efforts to create destinations that enhance well-being while preserving the unique character of mountain regions.

The study was supported by the National Science Centre, Poland (OPUS-21; grant no. 2021/41/B/HS4/00648).

Keywords: health benefits, cultural ecosystem services, disservices, social-ecological systems, subjective well-being

BOOK OF ABSTRACTS

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I. SESSION DESCRIPTION

ID: B10a

Assessing health and well-being ecosystem service benefits from Nature-Based Solutions across urban/peri-urban landscapes

Hosts:

	Name	Organisation	E-mail
Host:	Peter Roebeling	University of Aveiro	peter.roebeling@ua.pt
Co-host(s):	Carlotta Quagliolo Luis Inostroza Luis Magalhães-Filho Myriam Lopes Rita Mendonça Fábio Matos	University of Aveiro Mendel University in Brno	carlotta.quagliolo@ua.pt luis.inostroza@mendelu.cz

Abstract:

Global change, including climate change, population growth and economic development, presents urgent challenges to socio-ecological systems worldwide. In particular cities need to deal with global change-related challenges, such as urban heating and air pollution, flooding and water pollution, biodiversity losses and ecosystem degradation, and sprawl, gentrification and real-estate devaluation, among others. These challenges impact on economic activities, human health and well-being and, hence, global change adaptation is crucial for cities of the future. There is increasing evidence that nature-based solutions (NBS) and strategies across urban/periurban landscapes, can provide effective solutions to these multiple challenges. The underpinning principle of NBS is the operationalization of the ecosystem services concept – providing multiple ecosystem services and benefits that contribute to human health and underpin well-being – hence not only mitigating but also adapting to global change challenges. Albeit the Final Report of the Horizon 2020 Expert Group on ‘Nature-Based Solutions & Re-Naturing Cities’



of the European Commission provides overwhelming evidence of the positive impacts of NBS on human health and well-being, evidence is mostly partial (i.e., focused on one or few ecosystem services), short-term (i.e., focused on direct impacts) and specific (i.e., focused on single solutions). Hence, there is a need for integrated approaches that allow for the assessment of multiple human health and well-being ecosystem service benefits provided by NBS across urban and peri-urban landscapes using a broad value approach as the one proposed by the IPBES value assessment. In this session we welcome contributions developing such integrated approaches, discussing associated methodological issues, and/or applying these approaches in actual case studies.

Goals and objectives of the session:

Researchers are invited to present their latest findings about approaches for assessing human health and well-being ecosystem service benefits provided by NBS across urban and peri-urban landscapes. This session aims to facilitate an interactive discussion where participants can exchange their diverse experiences about integrated NBS assessments.

Planned output / Deliverables:

Special Issue in Ecosystem Services.

Session format:

Between 1 and 1½ hours 10-minute pitches/presentations

II. SESSION PROGRAM

Room: Expert Street 3


Date of session: 18th of November 2024

Time of session: 14:00 – 15:30 & 16:00 – 17:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
14:00 – 14:05		Session organizers		Introduction to session
14:05 – 14:17	Luke	Brander	Leibniz University Hannover	Environmental degradation and mental health: A global analysis of societal costs

Time	First name	Surname	Organization	Title of presentation
14:17 – 14:29	Silvia	Ronchi	Politecnico di Milano	Governance mixes for sustainable peri-urban landscapes: insights from a survey on policy instruments
14:29 – 14:41	Pierre	Chopin	Vrije Universiteit Amsterdam	A conceptual framework to design and assess urban agricultural systems that provide multiple ecosystem services and benefits to society
14:41 – 14:53	Chiara-Charlotte	Iodice	ILS Research gGmbH, Dortmund	A healthier planet for all – green and blue spaces and their benefits for mental health: Co-creation approaches of the GreenME project
14:53 – 15:05	Mareike	Diekmann	Technische Universität Dortmund	Ecosystem Services to protect critical health infrastructure
15:05 – 15:17	Ellen	Hannes	UHasselt	The value of neighborhood greenspace for children using the life satisfaction approach
15:17 – 15:30		All participants		Session discussion (part I)
15:30 – 16:00		Coffee/tea break		
Time	First name	Surname	Organization	Title of presentation
16:00 – 16:12	Peter	Roebeling	University of Aveiro	Health disutility benefits from nature-based solutions for air quality improvement: a case study for Turin (Italy)
16:12 – 16:24	Aisling R. Sealy	Phelan	University of Padova	Economic evaluation of nature-based therapies – A pilot costing analysis and willingness to pay for nature-based rehabilitation of Chronic Obstructive Pulmonary Disease
16:24 – 16:36	Corinna	Patetta	Politecnico di Milano	Assessing ES for human health in the Forestami tree planting



Time	First name	Surname	Organization	Title of presentation
16:36 – 16:48	Carlotta	Quagliolo	University of Aveiro	Cultural ecosystem service benefits assessment of Nature-Based Solutions scenarios: the case of Aveiro (Portugal)
16:48 – 17:00	James	Obeng	University of Jyväskylä	Mapping young people's favorite environments and the association with wellbeing and social inclusion
17:00 – 17:12	Pinar	Pamukcu-Albers	University of Bonn	Quantifying Ecosystem Services in Renatured Floodplains: A Case Study of the Emscher River in Germany
17:12 – 17:22		All participants		Session discussion (part II)
17:22 – 17:30		Session organizers		Wrap-up of session, outlook and next steps

III. ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Ecosystem Services to protect critical health infrastructure

First author(s): Mareike Diekmann


Other author(s): Jennifer Oriwol, Justus Quanz, Marius Ehrmann, Leonie Krelaus, Johann Neuhard, Matthias Zimny

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Humans can benefit directly from nature in terms of health in many ways (e.g. Coutts & Hahn, 2015). In Grün4KRITIS, the next step is being taken to investigate the extent to which green infrastructure can help protect critical infrastructures (CI) in the health sector.

Some facilities in healthcare such as hospitals are identified as CIs. This can be seen from the perspective of the facility as a CI, but also from hosting vulnerable groups of people (BSI Kritis



Regulation; Federal Ministry of Health, 2023). In the event of a crisis, specific healthcare facilities must remain functioning. In the context of climate change, consideration of the potential risk resulting from the hazard, exposure, and vulnerabilities is of fundamental importance for the protection of CIs (IPCC, 2022). Cascading effects are a method used in the field of risk research to illustrate consequences. Based on a scenario, it is shown how the event affects facilities and what further effects a disruption or failure may result in, also considering influences on other CI-sectors (Kruse et al., 2021).

The project framework deals with extreme weather events. The consequences are investigated in a qualitative approach based on findings from previous projects, interviews, and workshops. Scenario-based cascades are developed as part of risk research. Interrupting them by implementing suitable ecosystem services (ES), is one of the main research interests. Furthermore, the protection of CI through green Infrastructure might be introduced as a new ES. In this way, infrastructures shall be better protected against extreme weather events. The investigation is taking place in the Ruhr area in Germany

The contribution will highlight findings on the innovative combination of both research fields and discuss how this can be further deepened. The focus will be on the methodological description of cascading effects and the potential for interruption by ES.

References


BSI-Kritis Regulation of April 22, 2016 (Federal Law Gazette I p. 958), last amended by Article 1 of the Ordinance of November 29, 2023 (Federal Law Gazette 2023 I No. 339)

Federal Ministry of Health (2023): Gesundheitsrisiko Hitze. Available: <https://www.bundesgesundheitsministerium.de/themen/praevention/hitze.html>, last checked on 24.12.2023.

Coutts, Christopher; Hahn, Micah (2015): Green Infrastructure, Ecosystem Services, and Human Health. In: International journal of environmental research and public health 12 (8), S. 9768–9798. DOI: 10.3390/ijerph120809768.

IPCC (2022): Climate Change 2022 – Impacts, Adaptation and Vulnerability.

Kruse, P.M.; Schmitt, H. C.; Greiving, S. (2021): Systemic criticality—a new assessment concept improving the evidence basis for CI protection. In: Climatic change 165 (1), p. 2. DOI: 10.1007/s10584-021-03019-x



Keywords: critical infrastructure protection, climate adaption, green infrastructure, cascades, interdisciplinary

2. Mapping young people's favorite environments and the association with wellbeing and social inclusion

First authors(s): James Obeng

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The health and wellbeing challenges among young people has heightened in recent times, especially in the face of the multiple crises such as climate change, COVID-19, and precarious labor market. Concurrently, urbanization and technological innovations are affecting the lifestyles of many young people, limiting their outdoor exposure and nature experiences which all bears on their wellbeing. In Finland, young people have reported symptoms of anxiety, depression, loneliness, and social isolation.

Meanwhile, there is increasing research that show that natural environments provide ecosystem services such as improving human health and wellbeing, helping to mitigate air pollution and climate change induced heat and in recent times providing the space for people to relieve stress during the COVID-19 pandemic. Though there are lots of nature in Finland and natural environments are common places for recreation activities, some young people do not consider nature important despite encouragements to go into nature (Rantala & Puhakka, 2020). Those who go into nature usually prefer outdoor recreation at notable distances from their residence and favor more sports-related activities (Fagerholm, 2022; Laatikainen et al., 2017).

To enhance young people's utilization of ecosystem services, more understanding is needed on their nature experiences. As such, we combined the Public Participation Geographic Information Systems (PPGIS) tool with survey questions and asked young people living in Northern Finland to map their favorite environments and activities in those environments and examined how these factors associate with their mental wellbeing, social inclusion, nature relatedness. Results from the study will contribute to developing tailored nature-based interventions for young people and support spatial land use planning.

Keywords: Favorite environment, PPGIS, social inclusion, wellbeing, young people in Finland



3. Quantifying Ecosystem Services in Renatured Floodplains: A Case Study of the Emscher River in Germany

First author(s): Pinar Pamukcu–Albers

Other author(s): Antonia Deistler, Mariele Evers

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Renatured floodplains provide critical ecosystem services, including enhanced water filtration, increased biodiversity, and improved flood mitigation. By restoring natural habitats, these areas support wildlife, improve water quality, and offer recreational and aesthetic benefits to local communities. This study utilizes the River Ecosystem Service Index (RESI) method to quantify and compare ecosystem services in renatured floodplains along the Emscher River in Germany. The Emscher River has experienced significant anthropogenic impacts, primarily due to its historical use as a sewage channel and the effects of coal mining activities. Our research makes the ecosystem services of the new floodplains visible and quantifiable. Furthermore, this study tests and potentially adapts the applicability of the RESI method for rivers with relatively small watersheds, and the variable techniques on segmentation. The primary results show that the method enables the identification of trade-offs and synergies between individual services, and dependencies on land use, floodplain characteristics, and current nature-based solutions and measures, facilitating the prioritization of actions in flood-prone areas. The RESI method proved useful in supporting decision-making within a watershed approach for restoration planning, despite some inherent challenges and limitations of the methodology itself.

Keywords: Ecosystem services, renaturation, floodplains, nature-based solutions, flood measures.

4. Assessing ES for human health in the Forestami tree planting

First author(s): Maria Chiara Pastore

Other author(s): Claudia Ida Maria, Parenti, Corinna, Patetta

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Cities face numerous challenges in the social, urban and environmental context due to densification and the effects of climate change. Among these, the Milan metropolitan area, one



of the densest areas in Europe, deals with challenges such as harmful air quality levels and heat waves that significantly affect the most vulnerable populations.

In this critical context, the Forestami project aims to plant three million trees, proposing an adaptive strategy to activate a sustainable network to increase NBS and improve citizens' quality of life.


Since 2018, 59 interventions have been carried out for almost 58,500 trees and shrubs planted in urban and peri-urban contexts, engaging municipalities and different public and private institutions operating in the territory. These planting activities were investigated in relation to the accessibility maps to open green spaces to evaluate their contribution to the citizens' psychophysical well-being.

This research assesses and quantifies the tree planting activities to communicate the influence and relevance of afforestation projects to decision-makers and disseminate their value to people.

It compared different evaluation methods in four Forestami projects implemented along roadways, in compact industrial urbanisation, between dwelling units and agricultural fields and on the edge of the urbanised. The proposed approach is a MCA, which refers health-related ES with environmental and context-based criteria, proposing a brief discussion on cultural ES through a survey. This interpretation provides a systematic and integrated method highlighting the potential and limitations of the tools and methods available today.

The complexity of the Forestami tree planting and the models applied, therefore, intends to initiate a reflection on the need to implement and develop new ways to enhance the importance of nature in urban spaces, leaning towards an integrated dialogue between planners, designers and decision-makers, also considering the growing market demand by private companies, stakeholders and citizens to quantify plants' ES.

Keywords: #urbanforestry#multicriteriaanalysis#ESculturaldissemination



5. Cultural ecosystem service benefits assessment of Nature-Based Solutions scenarios: the case of Aveiro (Portugal)

First author(s): Carlotta Quagliolo

Other author(s): Peter Roebeling, Luiz Magalhães Filho, Max Lopez Maciel

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There is growing empirical evidence on the notion that people more connected with urban nature and that engage physical activities in nature, report higher general well-being in terms of happiness, life satisfaction and quality of life. Social and cultural impacts of Nature-Based Solutions (NBS) are directly linked to human health and well-being co-benefits. While there are numerous primary valuation studies assessing cultural ecosystem service (ES) values from urban nature, there are only a few studies that develop spatially-explicit simulation approaches to assess the cultural ES benefits from NBS. Hence, the objective of this study is to develop and apply a spatial environmental-economic approach to assess the cultural ES benefits from NBS for urban global change adaptation. The approach integrates the InVEST Urban Nature Access model (InVEST-UNA) and meta-analytic value function transfer methods (MA-VFT) into a spatially-explicit GIS-based approach. A case study is provided for the city of Aveiro (Portugal), considering green roofs, street trees and urban park NBS scenarios. Results show that albeit existing urban nature access is low, urban green spaces provide important cultural ecosystem service values to residents. The establishment of NBS is expected to provide significant cultural ES benefits, in particular in areas where existing urban nature access is low. Largest cultural ES benefits are observed in higher-income and densely populated areas. Hence, the integrated spatial environmental-economic assessment approach aims to inform urban planners and policymakers regarding decisions on where to invest in NBS in order to achieve the maximum well-being benefits across all urban residents.

Keywords: Urban nature access, Well-being, Spatially-explicit assessment, Nature-based solutions scenarios



6. Health disutility benefits from nature-based solutions for air quality improvement: a case study for Turin (Italy)

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Climate change, population growth and economic development present urgent challenges for cities in the 21st century, leading to residential, industrial and infrastructure development, associated increases in surface sealing and air pollutant emissions, and subsequent consequences for urban heating and air pollution. Air pollution has been associated with cancer, cardio-vascular and respiratory diseases (morbidity) that, in turn, imply resource (medical expenses), opportunity (productivity losses) and disutility (pain and suffering) costs. While morbidity costs associated with resource and opportunity costs are well established, those associated with disutility are less well established. Hence, these challenges impact on human health and well-being and, thus, global change adaptation is crucial for resilient cities of the future. Nature-based solutions (NBS), which provide multiple ecosystem functions, services and values that contribute to human health and well-being, are considered to provide effective solutions to these multiple challenges. The objective of this study is to assess the health disutility benefits from nature-based solutions for air quality improvement, with a case study for green/blue spaces, street trees and green roofs in Turin (Italy). Therefore, an integrated assessment method is developed, combining air quality models (to assess the impacts of NBS on air quality), dose-response functions (to assess the impacts of air quality on morbidity) and value function transfer (to assess the impacts of morbidity on disutility), and using city statistical data (from ISTAT) and randomization of variables (using R). Results show that current disutility costs amount, on average, to ~3,300 Euro/person/year. Disutility benefits from NBS range, on average, between ~300 (green roofs) and ~550 (green/blue spaces) Euro/person/year. Comorbidity increases disutility costs and NBS disutility benefits by up to 5 times. Hence, it is shown that disutility costs from air pollution related morbidity are large and that NBS lead to significant reductions in disutility costs (on average up to -15%).

Keywords: Air pollution, Morbidity, Disutility, Human health, Nature based solutions



7. Governance mixes for sustainable peri-urban landscapes: insights from a survey on policy instruments

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Peri-Urban Landscapes (PULs) are defined as transitional areas that include both natural and anthropic areas. While the unsustainability of these landscapes is well-known and recognized, governing PULs still remains particularly difficult. Habitat fragmentation, biodiversity degradation and urban sprawl are common processes that exacerbate the difficulty of managing PULs sustainability.

The research moves from the assumption that addressing the sustainability challenges of PULs requires a combination of Policy Instruments (PIs) that can respond to different needs and provide effective solutions to various challenges. The rationale behind is that no single PI can effectively address the multifaceted issues of PULs, but a coordinated policy mix is needed to tackle different aspects of sustainability.

An online survey was developed to collect case studies of existing PIs implemented in PULs. Respondents described the selected PIs in terms of objectives, stakeholders' involvement, modes of implementation, and associated barriers. In addition, the survey sought to investigate which combinations of PIs are adopted to tackle specific categories of sustainability challenges.

Data from fifty valid answers were collected and analysed, covering 47 PULs from 26 countries. The analysis revealed the presence of a policy mix approach for addressing sustainability challenges in PULs, suggesting the need for a plurality of PIs to govern the dynamics and complexities of PULs. The results indicate an important role of the regional governance level and a dominating presence of top-down instruments. Moreover, prevalent features and common shortcomings of PIs adopted in PULs emerged, including the prevalence of regulatory approaches, a high dependency on public funds, and a still low level of involvement of citizens in policymaking processes.

Reflecting on the findings and considering the existing literature on governance experimentation, the research suggests governance mixes for PULs as potential approaches to address some of the shortcomings of the analysed policy mixes.



Keywords: policy mix, sustainability challenges, planning, governance

8. Environmental degradation and mental health: A global analysis of societal costs

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Human activities are causing global environmental degradation and there is increasing evidence of consequences for both physical and mental health. Mental disorders have major negative economic impacts in the form of treatment costs, loss of productivity, and impaired wellbeing – collectively described as societal costs. This paper presents the results of an explorative global analysis of the societal costs of mental disorders attributable to projected future changes in climate, air pollution and access to green space. The analysis applies meta-analytic value transfer methods to identify and quantify the key determinants of the prevalence and costs of mental ill health; and to subsequently model future changes in societal costs attributable to environmental degradation. Two regression analyses are used to quantify 1. the rates of mental health disability adjusted life years (DALYs) at a country level; and 2. the cost of mental disorders (USD/DALY) as a function of natural hazards, air pollution, access to green space and other predictor variables. The results provide country level estimates of the monetary value of the costs of mental health disorders attributable to changes in climate hazards, air pollution and access to green space over the period 2020–2050. Globally, the additional annual societal costs of mental disorders due to changes in these environmental factors are estimated to be almost USD 47 billion in 2030 and rising to USD 537 billion in 2050, relative to a baseline scenario in which environmental conditions remain at 2020 levels. The paper serves to provide evidence to motivate policy makers to integrate environmental considerations in policy responses to address mental ill health; and concomitantly to integrate the costs of mental ill health within broader environmental public policy debates.

Keywords: mental health, climate change, air pollution, green space, societal cost



9. The value of neighborhood greenspace for children using the life satisfaction approach

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Across the globe, urbanization is increasing, intensifying the pressure on greenspaces, which affects all its users, including children. This is potentially concerning since exposure to nature enhances children's health and well-being. With regard to well-being, while robust evidence is present on the positive relationship between exposure to nature and well-being of children, currently no monetary valuation of the well-being benefits exists, making them more difficult to appropriately include in public decision-making regarding greenspace development. This study, for the first time, puts a monetary value on neighborhood greenspace exposure for children using the life satisfaction approach (LSA). This approach has been employed for the monetary valuation of environmental goods and issues but has not been extended yet to value the well-being of children. The LSA quantifies the influence of neighborhood greenspace on children's life satisfaction (LS) and compares it to the impact of other determinants of their LS that can be valued in monetary terms. In that way, the LSA calculates the amount of money to offset a change in neighborhood greenspace to keep the child at the same level of LS. As a result, the LSA does not require children or their parents to assign monetary values themselves. Data were gathered from 430 parent-child pairs in 29 different primary schools in Flanders (age range of children 10–12). The monetary value will be determined based on the tradeoff between the impact of the exposure of neighborhood greenspace on children's LS and the impact of working hours of parents and time children spend with their parents on children's LS. This time will be valued using the market replacement cost and opportunity cost method. The results of the study reveal the monetary value of neighborhood greenspace in terms of improvements in children's self-reported LS.

Keywords: Neighborhood greenspace, Life satisfaction, Valuation, Children



10. Economic evaluation of nature-based therapies – A pilot costing analysis and willingness to pay for nature-based rehabilitation of Chronic Obstructive Pulmonary Disease

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As modern and developed societies become increasingly urbanised, digitalised and detached from the natural world, we are increasingly facing problems with regards to poor physical and mental health. At the same time, there is a growing recognition of the potential benefits for human health of interacting with nature. Within this context, nature-based health interventions have been growing in popularity in the western world. Despite increasing scientific evidence on the physical and psychological health benefits of interacting with nature, there remains a lack of knowledge from an economic perspective. Some evidence suggests that these types of interventions could be a cost-effective way of providing public health benefits, however, we lack examples of robust economic evaluations. We address this knowledge gap, undertaking an economic evaluation alongside a randomised control trial testing the effects of nature-based therapy for Chronic Obstructive Pulmonary Disease (COPD) patients. This study evaluates the costs of providing such a therapy, and the value of the benefits experienced by participants. Micro-costing methods were used to undertake an economic evaluation in three ways: (i) costing analysis to identify and where possible value the total costs of the trial, (ii) costing analysis of the costs relevant for evaluating cost-effectiveness of trial, and (iii) an estimation of future “roll out” costs. The benefits of the programme will be assessed using the contingent valuation method, employing a willingness to pay approach. After completing the trial, participants will be asked their marginal willingness to pay for the programme compared to the conventional therapy offer currently available indoors at rehabilitation clinics. This will allow us to assess whether or not this type of therapy is valuable from a patient orientated perspective, and subsequently the estimated value can be compared to the costs of providing the therapy.

Keywords: Economic evaluation, Cost analysis, Nature-based therapy, Nature-based health



11. A conceptual framework to design and assess urban agricultural systems that provide multiple ecosystem services and benefits to society

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Europe's rural and urban areas are facing increasing negative impacts from climate change, biodiversity loss, unsustainable resource use, and a growing disconnect between urban and rural citizens. Throughout Europe's cities, various forms of urban farming, such as gardens, rooftop farming, and vertical farming, have emerged. These could provide impactful responses to these threats through climate regulation, habitat for biodiversity, nutrient cycling, and community cohesion, while also enhancing well-being, economic benefits, and reconnection between rural, peri-urban, and urban areas. Policymakers and practitioners urgently need knowledge about the services, benefits, and risks of urban farming to help them shape policies and legal frameworks that can foster benefits and mitigate risks.

In the Horizon Europe project FOODCITYBOOST (<https://foodcityboost.eu/>), we collaborate with more than 100 stakeholders from six case studies, using a living lab-based approach to learn from current urban agriculture developments. This is done by representing urban agriculture functions to understand the ecosystem services produced by different types of urban agriculture and exploring the governance and policy factors that drive these functions. Using a participatory process, FOODCITYBOOST proposes a method to redesign urban farming systems, combining design methods inherited from rural agriculture and urban development, foresight analysis to imagine future cities, and assessment tools grounded in ecosystem services assessment. The project will produce an array of knowledge-based decision-support tools, including (i) multi-service assessment tools for urban farming at farm, regional, and EU scales, and (ii) guidance on policy instruments that foster the development of urban farming.

FOODCITYBOOST furthermore brings together expertise in social, land use, environmental, and ecological sciences to expand the knowledge base on urban farming and stimulate the development of a varied landscape of urban farming that optimally fulfills community needs while minimizing negative impacts and risks.

Keywords: Urban agriculture, Ecosystem services, Food system transformation, Urban design, Multi-functionality



12. A healthier planet for all – green and blue spaces and their benefits for mental health: Co-creation approaches of the GreenME project

First author(s): Chiara–Charlotte Iodice

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In a world characterised by increasing human populations and the negative effects of advancing climate change, human health is increasingly becoming the focus of city and regional planning. Climate change can have a negative impact on people's mental health, but Nature-based solutions (NBS) have proven to be a promising way to tackle the interlinked environmental and social challenges. By integrating natural elements into urban environment, NBS have the potential to unlock a wide range of ecosystem services with a profound impact on human health and well-being. Green and blue spaces such as parks and gardens are becoming increasingly important for health and equity. They not only contribute to recreation and relaxation, but can also improve the mental health and wellbeing of exposed individuals.

This paper is based on a Horizon Europe funded project, GreenMe, which aims to comprehensively assess the benefits of NBS for residents' mental health and well-being in multiple European countries and the U.S. Using a multidisciplinary approach, GreenME aims to reshape our understanding of how contact with nature can promote mental health and to bring a paradigm shift that leads to more sustainable and equitable green and blue spaces, promoting mental health and well-being for all.

In this project, the co-creation method is applied in six European countries and the U.S. to expand our community and create national schemes and guidelines to inform decision makers and empower actors. To achieve this, country representatives are working together to develop country chapters that include a diverse group of 10 to 15 stakeholders, as well as co-creating a methodology for participatory workshops that will be both country-specific and international.

By integrating different perspectives and expertise as part of the co-creation approach, actor-oriented solutions can be developed that promote NBS and equity in our regions to create healthier environments for everyone.

Keywords: Nature-based solutions; Health promotion, Co-creation; Mental health equity

BOOK OF ABSTRACTS

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- III. ABSTRACTS

I. SESSION DESCRIPTION

ID: B10b

Adaptation to urban climate change through ecosystem services: a critical journey to integrate ecosystem services into climate-sensitive planning for a multi-risk purpose

Hosts:

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Abstract:

This session aims to address climate change adaptation in cities through the ecosystem-based approach, including Nature-based solutions (NbS). The nexus climate risks-ecosystem services has been explored and evaluated in the literature especially from the theoretical perspective, while in practice cities are still lacking in the implementation and upscale of adaptation measures, also in spatial planning. NbS are measures that make use of ecosystems and maximize the provision of ecosystem services in response to a specific challenge and are a promising tool for addressing multi-hazard dynamics in the spatial planning process. In fact, ecosystems enable the provision of multiple services for cities, including adaptation services, that are exposed to multi-hazard (e.g. heavy rainfalls, heatwaves, storm surges, wind gusts and tornadoes) and multi-impact (e.g. droughts, sea level rise, vector-borne diseases) conditions – compound effects



of climate and non climate-related extremes are also important to consider (e.g., heatwaves and sandstorm, heatwaves and pollution).

On this basis, scholars from the fields of urban planning, ecosystem services, climate and weather risk assessment, and climate change adaptation are invited to provide innovative insights and state-of-the-art methods for integrating multi-risk perspectives into ecosystem-based adaptation for cities. In particular, the session welcomes theoretical and practical contributions, which address the following research questions:

On the incorporation of the ecosystem service concept into climate risk assessments.

Where in the risk equation ecosystem services fit better? e.g. exposure, sensitivity, vulnerability.

- How to spatialize ecosystem services into the assessment?
- NbS implementation in the public urban spaces.
- How can NBS retrofit the urban fabric for a multi-risk purpose?

NbS at the service of urban adaptation.

- Are NbS (in)effective for adaptation purposes?
- Do NbS provide (social, cultural, economic) downsides, despite their climate risk minimization?
- Are there cases of adaptation disservices or maladaptation through NbS?

The challenge of monitoring and evaluating adaptation policies and plans with ecosystem service-related criteria.

- Which key performance indicators are suitable for adaptation?
- Which metrics are able to monitor and evaluate adaptation through NbS?

Goals and objectives of the session:

Collect, discuss and share experiences in implementing urban adaptation measures in spatial planning for multi-risk purposes. The session aims to deliver general recommendations and suggestions on practical approaches to address these issues through examples and case studies

Planned output / Deliverables:

Possible joint opinion paper or special issue in a peer-reviewed scientific journal



II. SESSION PROGRAM

Room: Expert Street 4

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 – 13.40	Blal	Adem Esmail	Ruhr University Bochum	Investigating nature-based solutions potential to mitigate urban pluvial flooding: A case study in Bochum, Germany
13.40 – 13.50	Chiara	Parretta	University of Trento	Assessing the contribution of private gardens to urban water flow regulation using Storm Water Management Model (SWMM)
13.50 – 14.00	Mattia	Bertin	University IUAV of Venice	Ecosystem performance of the diffuse city. A quantitative analysis of sustainability outlook in north-eastern Italy
14.00 – 14.10	Andrea	Ortiz Vargas	United Nations University	Opportunities of ecosystem service assessments to inform the different phases of disaster risk management
14.10 – 14.20	Alessandra	Longo	University IUAV of Venice	In the pursuit of urban climate adaptation: an NbS planning toolkit for decision-makers
14.20 – 14.30	Davide	Longato	University IUAV of Venice	What policy instruments can be used to promote nature-based solutions in urban plans? A review of real-world cases
14.30 – 14.40	Federica	Isola	University of Cagliari	Integrating Ecosystem Services into Planning: A Methodological approach for Mapping and Assessing Habitat Quality and Climate Regulation
14.40 – 14.50	Stefano	Salata	Politecnico di Milano	How Ecosystem Mapping can support Climate Neutrality. The case of Turin (Italy)



Time	First name	Surname	Organization	Title of presentation
14.50 – 15.00	Annelies	Boerema	International Marine and Dredging Consultants (IMDC)	Quantify the multiple benefits of climate mitigation measures in urban regions
15.00 – 15.10	Federica	Leone	University of Cagliari	Carbon capture and storage within climate change mitigation measures: An assessment concerning the functional urban areas of three Italian Regions
15.10 – 15.30				Wrap-up and final discussion

III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Investigating nature-based solutions potential to mitigate urban pluvial flooding: A case study in Bochum, Germany

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Global warming is associated with rising precipitation intensities, which present a challenge to urban drainage systems worldwide. Highly sealed and densely populated cities and metropolitan regions are at high risk of pluvial flooding. Nature-based Solutions (NbS) have been identified as a promising and multifunctional approach to mitigating the impact of pluvial flooding.

This study aimed to investigate the pluvial flood mitigation potential of different NbS implementation scenarios, as well as a green-grey infrastructure hybrid solution, in a neighbourhood scale case study in Bochum Langendreer, Germany. Flood and runoff reduction rates were computed by simulating different sub-hourly storm events for current and future



reference periods, and different return intervals, in an integrated 1D–2D drainage model in PCSWMM.

The green–grey hybrid solution was the most successful measure in all simulations in terms of flood area and depth reduction. Of the NbS, permeable pavement reduced flood area and depth the most, followed by rain gardens and tree pits. All NbS measures were able to fully prevent pluvial flooding in design storms with return intervals of 10 years. Runoff reduction rates exhibited relatively stable behaviour throughout different precipitation intensities, suggesting that the NbS potential to reduce runoff exceeds the standard design applications. The investigated NbS were most associated with regulating ecosystem services. The variety of co-benefits of rain gardens is higher than the number of co-benefits of permeable pavement, followed by tree pits. The results indicate that NbS are effective measures against pluvial floods in Bochum Langendreer. The study concluded that single NBS, together with technical solutions, can help reducing the exposure of vulnerable infrastructure. However, substantial contributions to urban resilience against pluvial flooding will require the scaling up and mainstreaming of NBS applications in suitable locations throughout the entire city fabric.

Keywords: urban resilience, urban pluvial flooding, rain gardens, permeable pavement, three points approach

2. Ecosystem performance of the diffuse city. A quantitative analysis of sustainability outlook in north–eastern Italy

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Considering the challenges set by the European Green Deal policies concerning the achievement of climate neutrality by 2050, the paper analyses the existing spatial relationships between the housing market, energy consumption and CO₂ emissions. The hypothesis is that in the North–East of Italy the città diffusa (spread city) presents peculiar characteristics for climate neutrality. The overlapping of urban cores, green environment and the water network, outline synergies and resilience possibilities never considered as a potential ecosystem approach to spatial planning. The most important result for the North–East concerns the global climatic regulation capacity of the fabric. Perhaps due to its conformation as a diffuse city, the territory has an



unexpectedly good balance in the relationship between the capture and emission of climate-altering substances compared to other European areas similar in extension and economic development. The maps show many climate-neutral or near-neutral territories where greenhouse gas emissions from human activities are partially balanced or offset by actions that remove the same amount of greenhouse gases from the atmosphere.

Keywords: climate change adaptation; performance indicators assessment; territorial design for neutrality

3. Integrating Ecosystem Services into Planning: A Methodological approach for Mapping and Assessing Habitat Quality and Climate Regulation.

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The Ecosystem Service (ES) approach is becoming increasingly influential in shaping policy and legislative frameworks. Recognizing the multiple benefits provided to humanity, the European Commission emphasizes the key roles of ESs and green infrastructures (GIs) in planning.

This study is part of the project “Definition of a Guidelines Handbook to Implement Climate Neutrality by Improving Ecosystem Service Effectiveness in Rural and Urban Areas,” funded by the NRRP, M4C2, Investment 1.1, Call for Tender 1409/2022, and EU – NextGenerationEU – CUP F53D23010760001, with Grant Assignment Decree 1378/2023 by the Italian Ministry of University and Research.

The aim is to develop a methodology to characterize a GI that support the provision of multiple ESs through modelling and spatially assessment. This paper particularly focuses on preserving habitat quality and regulating micro and regional climate through mitigation of land surface temperature (LST).

The methodological approach is applied to the Italian regions of Basilicata, Campania and Sardinia.



Habitat quality is assessed using the InVEST model developed by Stanford University as part of the Natural Capital Project. The model integrates Corine Land Cover maps with data on habitat threats and responses, producing a detailed habitat quality map. The resulting map allows for the identification of areas where conservation efforts will most effectively enhance natural systems and safeguard threatened species.

LST spatial distribution data are accessed through the United States Geological Survey (USGS)'s Earth Explorer interface, specifically utilizing the Landsat 2 – Level 2 collection, which provides 30-m LST raster maps.

Thanks to its flexibility and adaptability, this approach can be applied across a variety of contexts, providing decision makers with valuable insights to balance biodiversity conservation goals with societal needs, leading to enhanced nature protection, environmental sustainability, and the enrichment of the natural and cultural capital in rural and coastal areas.

Keywords: Ecosystem services, Carbon neutrality, Sustainability, Habitat quality, Land surface temperature

4. Carbon capture and storage within climate change mitigation measures: An assessment concerning the functional urban areas of three Italian Regions.


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Carbon capture and storage (CCS) is a regulatory ecosystem service (ES) provided by a variety of ecosystems through their ability to fix greenhouse gases, albeit to varying degrees, in ways that are contingent on the ecosystem naturalness. CCS contributes to global climate regulation and plays a key role in climate change (CC) mitigation and adaptation strategies regarding the risks associated with greenhouse gas emissions. Therefore, improving and conserving carbon pools is a significant CC mitigation strategy. Moreover, integrating CC adaptation and mitigation measures into policies and strategies at different scales requires an in-depth knowledge of CCS and its mapping. To this end, this study aims to define a methodological approach related to



the mapping of the CCS at the urban scale, using the cases of Basilicata, Campania and Sardinia. The goal is to improve the knowledge base to provide policymakers and planners with possible actionable strategies to enhance this ES, including nature-based solutions, thereby facilitating research-to-practice translation, offering insights for other regions facing similar challenges.

This study was carried out: i. within the RETURN Extended Partnership and received funding from the EU Next-GenerationEU (National Recovery and Resilience Plan – NRRP, M4C2, Investment 1.3 – D.D. 1243/2022, PE00000005); ii. with the financial support under the NRRP, M4C2, Investment 1.1, Call for tender 1409/2022 by the Italian Ministry of University and Research (MUR), funded by the EU – NextGenerationEU – Project Title “Definition of a guidelines handbook to implement climate neutrality by improving ecosystem service effectiveness in rural and urban areas” – CUP F53D23010760001 – Grant Assignment Decree 1378/2023 by MUR; iii. within the PhD program in Sustainable Development and Climate Change at IUSS Pavia & University of Cagliari, Cycle XXXIX, with the support of a scholarship financed by the Ministerial Decree 118/2023, based on the NRRP – funded by the EU – NextGenerationEU – M4C1.

Keywords: Carbon capture and storage; climate change; nature-based solutions, ecosystem services

5. What policy instruments can be used to promote nature-based solutions in urban plans? A review of real-world cases

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Urban plans can promote the implementation and scaling up of nature-based solutions (NbS) through the adoption of specific policy instruments. These can be applied to different typologies of NbS interventions, depending on the transformations allowed by the plan and property regime of the different areas. Through a review of real-world applications, especially focused on the implementation of solutions to tackle climate challenges, we provide an overview of policy instruments that can be used to promote NbS implementation in urban plans.



We identify and present different typologies of policy instruments, including regulatory, incentive-based, and information-based instruments. Their possible applications and suitability to promote different typologies of NbS interventions are then revealed based on the review findings and according to the documented information of real-life applications. Regulations can be especially used to integrate NbS early on in new development areas, while incentive-based instruments are suitable to promote NbS in retrofitting and renovating the built environment.

Finally, we discuss the differences among the instruments and how they can be combined to achieve the desired policy goals and climate adaptation of cities, supporting a wider implementation and scaling up of NbS through urban planning.

Keywords: Urban policies, ecosystem services, climate adaptation, risk reduction, urban greening

6. In the pursuit of urban climate adaptation: an NbS planning toolkit for decision-makers


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With the increasing frequency of climate change-induced natural disasters, primarily affecting urban areas, spatial planners are tasked with promoting climate adaptation and providing information and assistance to decision-makers. Since Nature-based solutions (NbS) have the potential to address various societal challenges by sustainably managing ecosystem services (ES), they have been recognized as innovative, cost-effective, resource-efficient and “no regrets” options. Their implementation could enhance adaptive capacity if promoted across different sectors in cities. Despite this promising picture, their effectiveness is hardly proven and mainstreaming in spatial planning is still limited. This study aims to guide decision-makers in choosing NbS that can foster cross-sectoral actions in urban climate policies in response to local climate impacts. To do so, a methodology that links spatially explicit demand for ES that can support climate change adaptation with their potential provision by NbS is proposed. The demand is expressed in those ES that are potentially not provided by the territory according to land cover analysis. The methodology is structured in three main steps: (i) determining ES supply by NbS from a literature review and qualitative content analysis, (ii) defining ES demand in urban areas for 16 natural and socioeconomic sectors, and (iii) identifying suitable NbS that



can help increase the resilience of cities by providing the required ES. These steps are tested in the Autonomous Region of Friuli Venezia Giulia, north-eastern Italy. The results show the potential of the interdependence between the concepts of ES and NbS, as ES can be used to identify a demand for NbS, just as NbS can promote the integration of ES in adaptation actions, transforming them from exposed to adaptive factors in cities. This transdisciplinary and cross-sectoral approach provides decision-makers with a toolkit to go beyond the one-solution-fits-all idea and foster cooperation.

Keywords: Nature-based solutions, urban adaptive planning, decision-support tool

7. Opportunities of ecosystem service assessments to inform the different phases of disaster risk management


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Ecosystem service assessments (ESA) have proven to be powerful tools for integrating ecological knowledge into relevant decision-making processes. As disaster risk (DR) becomes an increasing global concern, enhancing Disaster Risk Management (DRM) efforts through alternative approaches becomes essential. While the knowledge created by ESA offers significant potential for advancing DRM, its relevance has not been systematically established. This study addresses this gap by first identifying how current literature connects ESA results to the various phases of DRM: preparedness, response and relief, recovery and reconstruction, risk assessment and planning, mitigation and risk reduction, and prevention. We then develop a typology of evidence-based opportunities for ESA to inform DRM phases. Our findings reveal that ESA results can significantly inform practical aspects of DRM, offering specific insights for the different DRM phases. The proposed typology underscores the need for further research linking ESA and DRM, and highlights the need for addressing underrepresented DRM phases to ensure a more balanced and comprehensive integration of ESA across all phases. Our research highlights the importance of integrating ESA into DRM, providing a scientific basis for this integration. Furthermore, our study demonstrates that the contributions of ecosystems to society extend beyond the delivery of ES, as ecological knowledge can influence planning and decision-making processes in DRM. We call for increased collaboration between the DRM and ES fields to leverage the full potential of ESA, fostering innovative solutions and comprehensive strategies to better protect communities and create resilient societies.



Keywords: relief; recovery; risk assessment; mitigation; prevention; preparedness

8. How Ecosystem Mapping can support Climate Neutrality. The case of Turin (Italy)

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This work wants to present an innovative “Urban Planning and Climate Neutrality Framework” developed within the H2020 CLIMABOROUGH project, which aims at defining a common framework of Key Performance Indicators (KPIs) to guide urban planning strategies towards Climate Neutrality.

Urban environments are dynamic and complex systems shaped by interactions between natural and anthropic elements. The definition of “Urban environment capital” includes the intrinsic value of these elements, and encompasses both the capacity and the potential of the environment with respect to urban metabolism. In delineating the components of urban environment capital, two distinct dimensions emerge: eco-system capacity and system capacity. Understanding and quantifying eco-system capacity is essential for assessing the contributions of urban ecosystems to cities' path to climate neutrality.

Eco-system capacity pertains to the invaluable benefits derived from natural capitals, encompassing the role and functions of ecosystems within urban areas. These ecosystems, ranging from urban forests and wetlands to green spaces and water bodies, provide essential services such as air purification, water regulation, climate mitigation, and biodiversity conservation.

We mapped the eco-system capacity of Turin (Italy), drawing upon sub-factors related to the mapping of five ES values based on available data at city level by means of Integrated Evaluation of Ecosystem Services and Tradeoffs (InVEST) and i-Tree: EC1 Carbon Sequestration/Storage; EC2 Air Purification; EC3 Habitat Quality; EC4 Cooling Capacity; EC5 Water regulation (Urban Flood Risk Mitigation). The 5 factors present spatially explicit analysis, using maps as information sources and producing maps as outputs. The input-output indicators return results in biophysical terms (e.g., tons of carbon sequestered) with a flexible spatial resolution,



allowing users to address questions at local, regional, or global scales. The models are based on production functions that define how changes in an ecosystem's structure and function are likely to affect the flows and values of ES across cities.

Results are used to support the decision-making process along the design of the new city land use plan, while integrating the ecosystem capacity as the key element to set up the local green infrastructure able to mitigate climate change and adapt the city toward its neutrality.

Keywords: Ecosystem Services, Climate Neutrality, Adaptation, Urban Planning, Urban Metabolism

9. Quantify the multiple benefits of climate mitigation measures in urban regions

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The growing need for effective water management strategies has led to the development of various water-related measures in urban and suburban regions, such as rainwater and drought management plans. This research aims to quantify the added value of these measures, not only for water management but also for their impacts on urban heat island effect, ecology, and other areas. Indeed, multiple benefits of water management measures should be validated.

Based on an in depth analysis of two case studies of regional water management plans in Flanders (Belgium), this study seeks to comprehensively evaluate the multiple benefits of these measures. The research focuses on identifying relevant indicators to assess benefits related to water buffering, urban heat island effect, and ecology, and reviewing available methods for evaluating these measures. Additionally, it includes a discussion on the possibilities for monitoring the benefits of nature-based solutions (NbS), aiming to establish a framework for their effective implementation and assessment in urban water management.

Keywords: Urban resilience; water management; assessment methods; spatial analysis; validation



10. Assessing the contribution of private gardens to urban water flow regulation using Storm Water Management Model (SWMM)

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Cities are facing multiple challenges related to climate change, including intense rain events that overload the sewage system and cause urban flooding, with serious economic and safety implications. Moreover, soil sealing and urban expansion reduce stormwater infiltration, putting additional pressure on existing infrastructure. Most studies so far have focused on the benefit of public urban green spaces, such as parks and street trees, with limited attention paid to how other widespread green spaces, such as private gardens, influence the provision of specific ecosystem services. The aim of the study is to assess the contribution of private gardens to urban water flow regulation using the city of Trento (Italy) as a case study. To this purpose, private gardens are identified and their characteristics (land cover and vegetation structure) detected through an object-based approach applied to very-high-resolution (30 cm) Pleiades Neo satellite imagery. We then use the detailed information from the characterization as input for the dynamic rainfall-runoff simulation Storm Water Management Model (SWMM) to predict stormwater quantity using single-event simulation and assess the contribution of fine-scale data about private gardens in reducing peak flow and runoff volume. Lastly, we analyse the results of the model against different characteristics resulting from the classification. Results will be discussed in terms of:

- effects of fine-resolution data about private gardens on urban water flow regulation modelling;
- potential use for the design of different types of nature-based solutions for stormwater regulation;
- contribution to the development of urban greening plans and green space management tools.

Keywords: urban water flow regulation, private gardens, Storm Water Management Model, very-high-resolution satellite

BOOK OF ABSTRACTS

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I. SESSION DESCRIPTION

ID: B10c

Tools and approaches for integrating ecosystem services and nature-based solutions in landscape and urban planning and policy

Hosts:

	Name	Organisation	E-mail
Host:	Roy Remme Ulla Mörtberg	Leiden University KTH Royal Institute of Technology	r.p.remme@cml.leidenuniv.nl mortberg@kth.se
Co-host(s):	Christian Albert Blal Adem Esmail Carl Anderson Clara Veerkamp Esmee Kooijman Francesc Baró Johannes Langemeyer	Leibniz University Hannover Ruhr University Bochum Leibniz University Hannover PBL Netherlands Environmental Assessment Agency Dutch Ministry of Agriculture, Nature and Food Quality Vrije Universiteit Brussel Universitat Autònoma de Barcelona	albert@umwelt.uni-hannover.de Blal.AdemEsmail@ruhr-uni-bochum.de anderson@umwelt.uni-hannover.de Clara.Veerkamp@pbl.nl e.d.kooijman@minlnv.nl Francesc.Baró@vub.be johannes.langemeyer@uab.cat

Abstract:

A main challenge for sustainable development is the ongoing degradation of ecosystems, and complex challenges including climate change, biodiversity loss, and pressure on public health and well-being, due to unsustainable land use change and urbanization. This calls for stronger integration of nature-based solutions and the ecosystem services they provide into planning and policy on all levels. Efforts are ongoing to include these in current international and European policy developments. Notably, the Kunming-Montreal Global Biodiversity Framework




included an explicit target to enhance nature in cities, emphasizing the protection of urban biodiversity and ecosystem services, and the necessity for nature-inclusive urban planning. Likewise, the European Biodiversity Strategy 2030 strives to enhance green spaces in urban and peri-urban areas, encouraged by recent developments on a new legal policy instrument, namely the EU Nature Restoration Law. Such international strategies, agreements, and laws can create fertile grounds for significant and much-needed changes for more nature-based and resilient cities. International policy developments also inspire policies, initiatives, and actions at more local scales, ranging from national strategies (e.g., Agenda Natuurinclusief in The Netherlands or the Spanish National Plan for Adaptation to Climate Change 2021–2030, PNACC) to city-scale plans (e.g., Barcelona Nature Plan), and on-the-ground actions (e.g., Operatie Steenbreek (NL) which facilitates facade gardens by local residents).

To support and assess the implementation and adoption of such policies as well as landscape and urban planning, a broad and growing set of approaches and tools are available. A key challenge remains how such approaches and underlying tools can most effectively be implemented to support real world decisions. The knowledge gaps and questions may be differently identified by researchers and policy makers or planners. In order to effectively generate knowledge on nature-based solutions, ecosystem services, and biodiversity, alignment of scientific and policy questions is needed. An important step in such a process is understanding mutual interests, priorities and mismatches between research, policy, and practice.

In this session we focus on how different approaches contribute to more effective policy and planning of both cities and landscapes, addressing different topics in two sub-sessions. The first sub-session focuses on how approaches, ranging from highly quantitative to more qualitative, can be better leveraged to inform and improve urban policy and planning. The second sub-session assesses how geodesign as a methodological approach is used in landscape and urban planning.

For the first sub-session, we invite speakers to present their current scientific research on urban ecosystem services, displaying the broad array of available approaches (e.g., empirical research, participatory approaches, modeling, policy evaluation). We are specifically interested in research that directly links to or assesses urban policies, plans, or strategies. We ask speakers to reflect on how the research responds to needs of policy-makers and practitioners and where disconnects exist. We also invite speakers involved in or working with policy and practice to reflect on the scientific knowledge and its effectiveness in order to be policy-supportive. All session speakers will be involved in an interactive debate to identify key leverage points for better and more targeted quantitative research to improve effectiveness of nature-based solutions in cities and catalyze transformative change for future-proof cities.



The second sub-session delves into the role of geodesign in planning. Geodesign is a set of concepts and methods used to involve scientific knowledge, stakeholders and various professions in collaboratively designing [and realizing] sustainable solutions for spatial challenges in built and natural environments. Geodesign tightly couples the creation of proposals for change with impact simulations informed by geographic contexts and by systems thinking, with great potential for supporting sustainable planning practices. From a scientific point of view, ecological and socio-economic conditions are increasingly being monitored, mapped and modeled, and indicators are developed, promising to provide a basis for effective and smart integration of ES in urban and landscape planning. However, how to integrate such assets into the planning and decision making processes is not trivial but comes with many challenges. For instance, digital planning support tools need to fit scales, targets, legislation and interests imposed by the planning situation, as well as being accurate and sufficiently detailed from a scientific point of view. In addition, nature-based solutions need to be designed on par with and interact with other planning goals, be it urban development with needs for housing, urban services and transportation, new energy facilities, or other ongoing land use developments. Among challenges for implementing geodesign tools are the management of boundaries between different knowledge holders, accounting for the complex trade-offs and interactions of different scenarios, and facilitating participatory procedures. Overall, more knowledge in the science-technology-planning interfaces is needed for full integration of knowledge-driven nature-based solutions in planning practices.

Goals and objectives of the session:

The overarching goal of this session is to synthesize and discuss how to bring together different kinds of knowledge, such as quantitative data (e.g. field measurements or model outputs) and qualitative data (e.g., description of people's perceptions/values from interviews or observations) in nature-based solutions and ecosystem service assessments to make information useful for urban and landscape policy and planning.

The overarching goal will be addressed by focusing on (1) links between research and urban policy needs, and (2) the use of geodesign for landscape and urban planning, in two sub-sessions that collectively address the overarching goal. Speakers will present their research and reflect on their contribution to planning and policy. The latter will be done in their talks and in an interactive panel discussion.

Planned output / Deliverables:

We will set up a 'science brief', a short text that aims to inform researchers on how to better tailor their research to planning and policy needs. The brief outlines the needs from policy and planning as discussed during the session, as well as how current research does (not) align with this. The



briefs will provide clear guidance on what researchers need to do to produce research that is relevant to planning and policy.

Session format:

The session will be split into two sub-sessions, one focused more on research for policy, and one focused more on geodesign approaches for planning. The session will follow this structure:

- General session introduction
- Sub-session on ecosystem service assessments for urban policy
 - Policy introduction
 - Oral presentations
 - Panel discussion
- Sub-session on geodesign for landscape and urban planning
 - Planning introduction
 - Oral presentations
 - Panel discussion
- Session wrap-up by hosts

Throughout the session the audience will be provided opportunity to contribute discussion points and broad questions that will be addressed during the panel discussions

II. SESSION PROGRAM

Room: Expert Street 4

Date of session: 19th of November 2024

Time of session: 11:00 – 12:30 & 14:00 – 15:30

Timetable speakers

Sub-session I: Integrating research into policy

Time	First name	Surname	Organization	Title of presentation
11.00	Roy	Remme	Leiden University	Session introduction
11.05	Esme	Kooijman	Dutch Ministry of Agriculture, Nature and Food Quality	The needs of policy makers from ecosystem service research



Time	First name	Surname	Organization	Title of presentation
11.15	Lianne	van Ruijven	Rebel group	Financial exploration of green spaces in and around the city
11.25	Gerid	Hager	IIASA	Measuring and assessing urban green infrastructure with citizens: stories from Urban ReLeaf cities
11.35	Joeri	Morpurgo	Leiden University	Field evidence on multiple ecosystem services in urban green infrastructure. Heat reduction, air remediation, water regulation and biodiversity, do they co-exist?
11.45	Harald	Zepp	Ruhr University Bochum	EnhancES – An Open Source GIS-based Toolbox for Assessing, Mapping and Enhancing Ecosystem Services
11.55	Thea	Wübbelmann	Leibniz University Hannover	Assessing the transformative power of policy strategies towards healthier cities in four European case studies
12.05	Interactive panel discussion Integration of ecosystem service and nature-based solution research into policy			

Sub-session II: Geodesign approaches for landscape and urban planning

Time	First name	Surname	Organization	Title of presentation
14.00	Ulla	Mörtberg	KTH Royal Institute of Technology	Session introduction
14.05	Blal	Adem Esmail	Ruhr University Bochum	Planning for transformative change with nature-based solutions: a geodesign application in Stockholm
14.15	Carl	Anderson	Leibniz University Hannover	Geodesigning sponge landscapes to address floods, droughts and biodiversity loss
14.25	Ming	Fricke	Norman Foster Institute	Linking social challenges, spatial planning, and multifunctional green infrastructure design through an



Time	First name	Surname	Organization	Title of presentation
				ecosystem services lens to enhance urban resilience and health
14.35	Sana	Jajeh	Leibniz University Hannover	Collaborative Planning of Sponge Measures for Climate Adaptation at the Landscape Scale: Exploring the Potential of Geodesign
14.45	Agnese	Reke	Baltic Environmental Forum	Integrating cultural ecosystem services in Urban Nature Plans through Participatory Approaches: A Case Study of Riga
14.55	Javier	Babi Almenar	Politecnico di Milano	Biophysical and monetary modelling of air filtration by urban vegetation across Europe
15.05	Interactive panel discussion Integration of geodesign with ecosystem service and nature-based solution into planning			
15.25	Session wrap up			

III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.



1. Biophysical and monetary modelling of air filtration by urban vegetation across Europe

First author(s): Javier Babí Almenar

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Poor air quality, especially due to particulate matter (PM), remains a major concern in urban areas due to its impact on premature human deaths. This concern is addressed by the revised Air Quality Directive and amendments to the European Environmental Economic Accounts Regulation, aiming to improve air quality and monitor PM levels and dry deposition by vegetation. In this research, we develop a combined biophysical and monetary method to model air purification by vegetation across European urban areas. PM10 dry deposition is used as a proxy for this ecosystem service. The method is tested for the year 2018. For the biophysical valuation, we use a mechanistic model based on the electrical resistance analogy, along with earth observation data from Copernicus Services, to estimate the flow of PM10 deposited over time. This flow, together with boundary layer height data, allows estimation of changes in atmospheric PM10 levels ($\mu\text{g}/\text{m}^3$) attributable to vegetation. Using dose–response functions, changes in PM10 levels estimate annual variation in mean population exposure to PM10 and the risk of premature human deaths across Europe. The economic valuation employs a Value Transfer approach. We use a Meta–analysis function transfer to predict the Value of Statistical Life (VSL) as a measure of willingness to pay for mortality risk reduction. The VSL welfare estimate is adjusted using the cost of illness approach. Initial results illustrate that in some countries (e.g., Austria, Poland), vegetation's capacity to filter PM10 is limited during high pollution periods. In contrast, other countries (e.g., Greece, Spain) show a better match. Notably, southern Nordic areas, with lower atmospheric PM10 levels, exhibit higher air purification capacity and are better equipped to meet future stricter thresholds proposed in the revised EU Air Quality Directive. This method helps to evaluate the effectiveness of urban vegetation as air–purifying nature–based solutions across European urban areas.

Keywords: urban ecosystem; urban sustainability; human health; remote sensing; ecosystem services flow;



2. Measuring and assessing urban green infrastructure with citizens: stories from Urban ReLeaf cities

First author(s): Gerid Hager

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People living in cities are increasingly exposed to severe environmental stresses exacerbated by the climate crises. Nature-based solutions (NbS) can provide cooling effects, decrease air pollution, and improve mental health, amongst other important ecosystem services (ES) and health-related benefits. Ambitious plans, such as the pledge to plant 3 billion trees in the EU, the European Green Deal, or the Green City Accord support the direction towards NbS and ES implementation in cities. This implementation, however, requires transformative changes to overcome business as usual approaches. The Urban ReLeaf project innovates together with public authorities and local communities to jointly shape green infrastructure actions. Six pilot cities co-create citizen-centric innovations for participatory urban greenspace monitoring and planning in pursuit of urban climate resilience. This presentation showcases data and policy mapping activities to identify opportunities for citizen participation in urban planning and policy as well as illustrating stories of the six Urban ReLeaf cities. Athens is undergoing a greening transformation with a new, citizen-powered tree registry providing critical data for better management of greenspaces. Cascais engages citizens in sharing perceptions and thermal comfort levels while using greenspaces to validate the effectiveness of its parks. In Dundee, a city facing increasing grey infrastructure in deprived areas, actions to enhance the accessibility of greenspaces are co-developed with citizens and stakeholders. Mannheim has a heat action plan to safeguard its most vulnerable residents but has identified critical data gaps for tree infrastructure maintenance. Citizen observations of trees and heat stress aid the delivery of climate adaptation measures. Riga engages diverse audiences to measure and address concerns about air pollution and greenspace usage, to ensure better informed policies. Finally, in Utrecht, data on temperature, humidity and heat stress, collected by and for citizens, will help shape effective mitigation strategies.

<https://urbanreleaf.eu/>

Keywords: citizen science, participation, greenspace, urban planning, policy



3. Field evidence on multiple ecosystem services in urban green infrastructure. Heat reduction, air remediation, water regulation and biodiversity, do they co-exist?

First author(s): Joeri Morpurgo

Other author(s): Roy, P. Remme, Mingming Hu, Peter, M. van Bodegom

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Urban environments face significant challenges exacerbated by climate change, in the domains of the Urban Heat Island (UHI), flooding, air quality and biodiversity loss. Several types of Urban green infrastructures have been proposed as a Nature-based Solutions to remediate these problems, by providing cooling, regulating stormwater-runoff, filtering contaminants out of the air and supporting biodiversity. While urban green infrastructure has been shown to be capable of addressing these challenges separately, little research exists on measures delivered simultaneously, leaving uncertainty about the synergies and trade-offs that exist within green infrastructure.

Our research, encompassing over 160 sites in a broad range of green infrastructure types in The Hague (NL), aimed to simultaneously measure ecosystem services provided by green infrastructure. Our findings indicate that green spaces play a vital role as Nature-based Solutions by mitigating the UHI effect, improving air quality and to supporting biodiversity. Our results show that biodiversity and air pollution levels were consistently better in areas with substantial green coverage. Trees were found to significantly reduce ambient temperatures and yet were also associated with a reduction in biodiversity and air quality. Despite these synergies, our research also revealed a trade-off where best practices for heat reductions are not in line with best practices for air quality and biodiversity enhancement. Interestingly, our analysis shows that water infiltration is unaffected by the type of green infrastructure.

To address the multifaceted challenges of UHI, flooding and air quality, cities must integrate diverse and strategically planned green spaces. UHI is reduced best by increasing tree cover. This tree cover also provides the additional benefit of increasing permeable soil, increasing the capacity of soil to let stormwater-runoff infiltrate. In contrast, increasing tree cover is not the best method of improving the air quality, where grassy vegetation seems to be better.

These results highlight the need for a diverse and strategic implementation of different types of urban green infrastructure. The design of green infrastructure in the cities should be adapted to



the needs for ecosystem services, while understanding the synergies and trade-offs between them.

Keywords: Climate adaptation, Nature-based Solutions, Biodiversity, green space design, field data

4. Integrating cultural ecosystem services in Urban Nature Plans through Participatory Approaches: A Case Study of Riga

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With over 70% of Europe's population residing in urban areas, for many people interactions with nature predominantly occur within city environments. This makes urban green spaces essential for the well-being of city dwellers. However, despite their importance, human-nature interactions have been largely overlooked in urban policymaking. The EU Biodiversity Strategy requirement for cities with at least 20,000 inhabitants to develop Urban Greening plans (now called Urban Nature plans) offers a unique window of opportunity to incorporate these interactions into policy frameworks.

Our study utilized participatory approaches, including PGIS surveys and workshops, to assess urban cultural ecosystem services (CES) in Riga, as well as to identify problem areas where climate change related issues such as heat islands and flooding occur. This study is a part of a comprehensive green infrastructure assessment that is being developed for Riga's Greening plan.

Home to over 610,000 people, Riga represents more than 30% of Latvia's population and is the largest city in the Baltic States. Despite being a relatively green city, Riga faces many challenges including pluvial flooding, the heat island effect and uneven accessibility to green spaces.

This presentation will highlight the main results of the assessment, demonstrating how participatory approaches can effectively evaluate urban CES for policy documents. We will also share key lessons learned from our attempt to embed CES into municipal planning, demonstrating the potential and challenges of this integrative approach.



The study is supported by the LIFE LATESTadapt project (101074438).

Keywords: urban cultural ecosystem services, urban nature plans, green infrastructure planning, participatory approaches, Riga

5. Assessing the transformative power of policy strategies towards healthier cities in four European case studies

First author(s): Thea Wübbelmann


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Urban natural environments are often degraded, facing limited biodiversity, and high sealing rates, while being required to offer opportunities to connect citizens to nature and health-promoting environments with benefits for human health and wellbeing. It is becoming increasingly evident that climate change has a significant impact on human health, which can be reduced by climate mitigation and adaptation measures through the provision of ecosystem services by natural environments such as Nature-based Solutions (NbS). European and national policy frameworks have emerged in recent years to address this challenges, with a range of initiatives to promote mitigation, adaptation and resilience to climate change. However, are local adaptation strategies for cities transformative enough to meet the needs in the context of biodiversity loss and increasing impacts of climate change to support citizens health? To fill this gap, we build on the planetary health framework and operationalize it by focusing on climate, biodiversity and health (CBH) policy goals with particular attention to synergistic effects and trade-off across the CBH nexus.

In four case study cities – Klagenfurt, Cork, Valetta and Lahti –, we examine the strategies, goals, and targets, including NbS, in urban policy and planning documents whether cities' stated goals and targets are transformative enough to meet the global challenges related to climate change and urbanisation. Our integrated approach based on textual analysis is used to assess interactions between health, biodiversity, and climate adaptation and mitigation to identify potential synergies and conflicts between policy goals thereby empirically defining sustainability transformations in city governance. The outcomes illuminate the coherence among the policy goals and should provide recommendations to city stakeholders to improve the integration of biodiversity and health and well-being to the adaptation and mitigation of climate change.



Keywords: Planetary health, urban environmental governance, climate–biodiversity–health nexus, sustainability transformations

6. EnhancES – An Open Source GIS–based Toolbox for Assessing, Mapping and Enhancing Ecosystem Services

First author(s): Harald Zepp

Other author(s): Luis Inostroza, Malte Bührs, Lars Gruenhagen, Christin Busch, Nannan Dong

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The transfer of ES assessments to real–world decision–making in the public and private spheres is still lagging. In this contribution, we introduce EnhancES, a toolbox for mapping and assessing ES developed with the open–source software QGIS. We demonstrate how biophysical ES modelling can be integrated into a multi–step spatial planning process using EnhancES.

EnhancES can currently assess 10 ES (base flow regulation; flash flood regulation; temperature regulation (cooling intensity); carbon sequestration and storage; particulate matter (PM10)–filtration; visual screening; pollination; activities promoting recuperation through active or passive interactions with nature; aesthetic experiences). EnhancES is being applied and tested in case studies covering a range of scales from building blocks to regions.

The real–world example presented here comes from the city of Bochum, Germany, where a mixed–land–use area shall be transformed into a residential area. We used real information and compared the expected changes of six ES that emerged from three different urban planning designs submitted as part of an official urban planning competition organized by Bochum’s Cityhall. The competition’s jury selected one of the plans, which was revised according to specific requirements defined by Bochum’s planning department.

For each plan EnhancES calculated and produced maps displaying six ES (base flow regulation; flash flood regulation; cooling intensity; carbon sequestration; (PM10)–filtration; pollination). To allow meaningful comparisons between different ES that are expressed in different biophysical units, EnhancES includes a standardization procedure for each ES with the maximum being 1. The gains and losses of standardized ES performances convey clear messages. By averaging all ES, it becomes clear that an overall gain of ES is only possible with the revised plan. Acknowledging ES as a fundamental basis for human well–being should put them at the centre



of decision-making, for what marginal valuations over different development alternatives is the way forward.

Keywords: • urban ecosystem services, real-world example, quantitative assessments, planning and decision-making, marginal valuation

7. Financial exploration of green spaces in and around the city

First author(s): Jonne Velthuis

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There is an urgency to start working on a green built environment – because this is where population growth, biodiversity loss, and climate adaptation converge. Additionally, a new EU regulation on nature restoration requires that by 2030, there should be no net loss of urban green spaces and urban tree canopy cover.

The government wants and needs to invest in a green built environment. The focus lays on increasing biodiversity in urban developments. Linking green spaces to housing development is promising, but the costs and benefits are not yet fully known: this research focuses on the costs and benefits of three scenarios:

Scenario 1 – Compensating for 2,147 hectares of green space and 240,800 trees lost due to urbanization until 2030. The costs are €6.32 billion against €4.61 billion in monetizable benefits;

Scenario 2 – Green grows together with the city by adding 4,477 hectares of public green spaces and ecosystem green for 900,000 homes. The costs are €12.91 billion against €8.91 billion in monetizable benefits; management and maintenance amount to €3.7 billion, making it a significant expense.

Scenario 3 – Green grows towards a healthy and climate-resilient city by planting 23 million trees and over 48 million square meters of pergolas to provide shade for 40% of all major routes in the city. Costs and benefits of this scenario were not calculated.



The largest monetizable benefits are health, climate mitigation, and avoided water damage. Biodiversity and some health benefits are not monetizable but have a significant impact. Therefore investment decisions should not only be based on a comparison of costs and monetizable benefits.

The benefits analysis provides a good overview but contains uncertainties – the assumptions made in the calculations can significantly influence the outcomes. Sensitive assumptions include the time horizon, property value, CO2 price, and water damage.

Keywords: financing, benefits, invest, urban, building

8. Planning for transformative change with nature-based solutions: a geodesign application in Stockholm

First author(s): Blal Adem Esmail

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Advancing towards urban futures in which both human communities and ecosystems can thrive requires transformative change (TC). Spatial planning can serve as a backbone for inspiring and fostering the desired transformation of cities. However, at least three key interrelated challenges exist for spatial planning to support this transformation: creating unconventional plans, accounting for the complex trade-offs and interactions of different scenarios, and facilitating participatory procedures. A promising approach for addressing the challenges is Geodesign as it couples spatial co-design with impact simulations. This paper aims to explore how, and with what effects, geodesign can support the co-creation of transformative urban plans. A geodesign process was developed and deployed for a case study neighborhood in Stockholm, Sweden. Fourteen planning stakeholders divided into three groups developed and explored the impacts of two alternative futures. The study findings indicate that the geodesign process enabled participants to develop transformative plans that address housing needs while also promoting biodiversity and ecosystem services through nature-based solutions. Participants showed high perceived desirability of TC but were mostly skeptical regarding the plausibility and probability of future implementation. The study findings also confirmed that



Geodesign may provide effective planning support for managing ‘boundaries’ between knowledge holders, by integrating data and knowledge, and facilitating effective stakeholder collaboration. All geodesign steps enhanced communication by promoting discussions and collective reasoning, albeit to different degrees. Participants acknowledged contributions to knowledge co-production and decision-making by mediating between different perspectives and opinions. Data quality was identified as critically affecting perceived credibility. Reservations were expressed regarding the translation function. We recommend practical applications of geodesign to strategically involve key stakeholders throughout study conceptualization, scenario development, and model generation for better context consideration. Enhancing geodesign tools for user-friendliness is also crucial. Research should focus on scaling up collaborative geodesign for complex challenges in metropolitan and landscape planning.

Keywords: Boundary management, Impact assessment, Knowledge co-creation, Land use change, Planning support, Scenario planning, Suitability Analysis

9. Geodesigning sponge landscapes to address floods, droughts and biodiversity loss

First author(s): Christian Albert

Other author(s): Sana Jajeh, Carl C. Anderson, Ellis Penning

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Increasing risks for floods and droughts and the rapid decrease in biodiversity values present substantial challenges in Europe. Addressing these challenges will require a paradigm shift in water management and spatial planning away from a focus on rapid water discharge towards the development of sponge landscapes with substantially enhanced water retention capacities in surface water bodies, soils and aquifers. To advance this paradigm shift, knowledge and know-how is needed for how large-scale transformative change of land and water management can be initiated and fostered.

The aim of this contribution is to introduce a novel collaborative geodesign approach and first results for advancing collaborative planning and exploration of sponge landscapes. The approach consists of co-generating systems understanding, co-creating plausible scenarios of how case landscapes might transform in the next three decades, co-exploring potential scenario impacts on the landscape hydrological cycle, and co-generating sponge strategies for



long-term adaptive implementation with actions at local, regional and national levels. Large scales demonstrators in Pinios river basin, Greece, the Lèze basin, France, and the Vecht basin, The Netherlands and Germany, serve as case studies. First results highlight case-specific flood and drought challenges, innovative sponge measures already implemented or envisioned, and sponge scenario archetypes as elaborated with diverse knowledge holders. Finally, lessons-learned and recommendations for future applications are derived.

The presentation builds on insights from the SpongeScapes and SpongeWorks projects, two EU Research and Innovation Actions to demonstrate practical, effective, economically feasible and inclusive approaches and solutions towards enhancing the water retention capacity of interconnected groundwater, soil and surface water systems at regional scale.

Keywords: Water challenges, Biodiversity, Ecosystem Services, Geodesign, Landscape Planning

10. Linking social challenges, spatial planning, and multifunctional green infrastructure design through an ecosystem services lens to enhance urban resilience and health

First author(s): Marcus Ming Fricke

Other author(s): Gareth Simons, Roy Remme, Kent Larson, Norman Foster Institute Cohort 2024

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Urban areas globally face socio-demographic shifts and tensions among social groups. Climate change exacerbates these challenges by increasing the need to mitigate heat stress and risks from severe weather events. Poor infrastructure, limited green spaces, and inadequate public amenities and programs further intensify these issues. Data-driven analysis can identify strategic locations for interventions to enhance resilience and well-being.

This study presents a framework integrating urban analytics and space syntax network analysis with ecosystem services mapping and modeling for green infrastructure. Understanding spatial configurations and their impact on movement and interactions, together with the benefits provided by urban ecosystems, allows for evaluating current conditions in vulnerable areas, designing evidence-based interventions, and allocating targeted nature-based solutions. Public engagement and participatory processes can expand the socio-demographic demand analysis, spatial quality assessment of existing urban fabric, preferred intervention design, and help



evaluate performance over time to effectively complement the methodology with qualitative data.

The framework's application is illustrated through the Norman Foster Institute's collaborations with the city administrations of Bilbao, Athens, and San Marino. Despite differing contexts and objectives, the ecosystem services concept proves to be an effective common analytical lens that can communicate potential intervention outcomes to diverse stakeholder interests, such as enhanced urban thermal comfort, conservation of peri-urban cultural landscapes, and strengthened social cohesion. The interventions provide various ecosystem services while supporting disadvantaged communities, including habitat provision for urban biodiversity, micro-climate regulation to mitigate urban heat island effects, food provision stimulating local economy and stewardship, and recreational spaces contributing to urban health.

The authors propose an innovative approach to city planning that can actively involve citizens in addressing multiple, often intangible, societal challenges. Jointly designing spatial interventions can deliver a diverse array of ecosystem services simultaneously, thereby redefining community interpretation and expectation of public service and value generation.

Keywords: Urban Resilience, Urban Ecosystem Services, Green Infrastructure, Participatory Planning, Socio-Demographic Changes

11. Collaborative Planning of Sponge Measures for Climate Adaptation at the Landscape Scale: Exploring the Potential of Geodesign

First author(s): Sana Jajeh

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Rural European landscapes face escalating risks of floods and droughts exacerbated by unsustainable land use practices and climate change. Sponge measures are particularly promising to address such challenges from a participatory and social-ecological perspective. Sponge measures are nature-based solutions (NbS) that preserve, restore, enhance, or create ecosystems to increase landscape and soil water retention while providing co-benefits for people and nature through biodiversity and ecosystem services.



Effective design and planning of NbS require overcoming challenges such as developing a shared understanding of their spatial impacts among stakeholders, considering their co-benefits and trade-offs, and evaluating effectiveness across different scales and future scenarios. Geodesign offers an iterative, multidisciplinary, and stakeholder-driven framework to address these challenges by integrating stakeholder inputs, geospatial data, and technology to generate real-time feedback and inform decision-making. Despite promising applications in urban and landscape planning, knowledge is lacking on how geodesign can best be applied to facilitate the planning of sponge measures at a landscape scale.

As part of ongoing PhD research within the SpongeScapes project (spongescapes.eu), we aim to assess the utility of geodesign to upscale sponge measures on a landscape scale in two European case studies. We present insights from the first workshop conducted in the Netherlands, which focused on co-generating a shared social-ecological system understanding and identifying priority sponge measures. Preparations are ongoing for the second workshop during which sponge measures will be placed in opportunity spaces based on geospatial data and stakeholder input to eventually inform collaborative discussions on future scenario narratives. With increasing NbS implementation in response to climate change across Europe, our research aims to provide insights into the potential of geodesign to optimize the co-design of sponge measures, support policy creation, and inform decision-making.

Keywords: Geodesign; Ecosystem services; Climate change adaptation; Stakeholder engagement; Landscape Planning

BOOK OF ABSTRACTS

- I. SESSION DESCRIPTION
- II. SESSION PROGRAM

I. SESSION DESCRIPTION

ID: B10d

Challenges and barriers of integrating ecosystem services science into urban planning for preventive public health

Hosts:

	Name	Organisation	E-mail
Host:	Kate Farley	UK Centre for Ecology & Hydrology	katfar@ceh.ac.uk
Co-host(s):	David Fletcher Mart Verwijmeren	UK Centre for Ecology & Hydrology Dutch National Institute for Public Health and the Environment	dfletcher@ceh.ac.uk mart.verwijmeren@rivm.nl

Abstract:

You are invited to join this World Cafe session to explore reasons for the failure to integrate ecosystem services thinking and public health protection. The guided discussion will be driven and shaped by participants' experience, likely covering topics such as challenges in harmonising concepts and terminology, translation of evidence and structural barriers.

Expansion and densification of urban areas typically lead to declines in environmental conditions, a number of which constitute significant impediments to the health and wellbeing of inhabitants. Examples include air, water and noise pollution, extreme heat, flooding and a scarcity of natural green space for physical exercise and to support mental wellbeing. These environmental pressures can be particularly acute in cities, where the high spatial variation in pressures, can lead to localised impacts, with significant implications for health inequalities.

A number of important steps towards addressing these acute urban-associated threats have been made over last decade, the foremost being the establishment of the SDG framework and the New Urban Agenda, both of which explicitly recognise the pivotal role of urban planning and policy in



addressing health, wellbeing and inequality. In particular, emphasising the importance of inclusive, accessible, multi-functional green spaces in urban settings, to provide a variety of benefits, including health and well-being to residents. In this sense, natural green and blue spaces within cities can be considered Nature-Based Solutions, providing an array of Ecosystem Services to city dwellers and beyond.

Public health policy, especially preventative public health, could be improved by greater integration of ES expertise in public health decision making as it relates to travel policies, planning for green spaces for heat management, or education and leisure interventions to improve mental and physical health. However, best practices and efforts to tackle such challenges are hindered largely by a lack of understanding, collaboration, and communication between ES science and decision making. Challenges to effective integration may include competing interests, political agendas, knowledge, norms and competencies (Saarikoski, 2021). A challenge is not only the language that is used, but also how can we visualise/simplify complex results (e.g. maps of multiple interacting ES), and how can they be used to provide recommendations for nature-based solutions. Effective communication of ES knowledge and generation of data that can be easily applied to public health policies is needed.

We invite participants with an interest and experience in any dimension of the intersection of human health and ES benefits from green and blue space. Including but not limited to physical and mental health, interventions to reduce health impacts of pressures such as heat, noise, air or water pollution, and the potential of green prescribing. We particularly welcome participation from those who have worked directly in health settings or environmental, social scientists or economists or NGOs who have collaborated with health professionals.

The session will be run as a guided discussion of the challenges around this issue, shaped by the experience of participants. The session will result in a set of recommendations on how to better integrate ES science in decision making around public health. With the possibility of bolstering the findings through follow-up interviews with key stakeholders, if participants feel this would be appropriate.

Goals and objectives of the session:

This session aims to explore the challenges in bridging the translation gap between ecosystem system services research and urban public health policy, and to shape research priorities. This session will also be an opportunity for networking with a view to develop future research collaborations for ecosystem services research that can be better integrated into public health policy making. The expertise of those convening this session spans ecosystem services modelling to social sciences and health research.

Planned output / Deliverables:

- Identification of key challenges and barriers preventing the integration of ecosystem services science into public health policy making.



- We see this as the start of a process and ongoing collaboration for those interested
- Development of recommendations to resolve these barriers, and subsequent summary into a discussion paper (to be developed post-event).

Session format:

World Cafe. Session is proposed to last at least 1.5 hours.

II. SESSION PROGRAMME

Room: Expert Street 7

Date of session: 21st of November 2024

Time of session: 11:00–12:30

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: B10e

Assessing ecosystem conditions, services, and biodiversity in Urban Nature Plans: targets, methods, and indicators

Hosts:

	Name	Organisation	E-mail
Host:	Chiara Cortinovis	University of Trento	chiara.cortinovis@unitn.it
Co-host(s):	Davide Geneletti	University of Trento	davide.geneletti@unitn.it
	Jarumi Kato Huerta	University of Trento	jarumi.katohuerta@unitn.it

Abstract:

Target 14 of the EU Biodiversity Strategy for 2030 called on European cities and towns above 20,000 inhabitants to develop ambitious Urban Greening Plans, now called “Urban Nature Plans” (UNP). The aim is to promote transformative urban planning processes that systematically incorporate and promote green infrastructure thinking and nature-based solutions. UNP should include “measures to create biodiverse and accessible urban forests, parks and gardens; urban farms; green roofs and walls; treelined streets; urban meadows; and urban hedges”.

In the framework of the Biodiversity Strategy, greening actions coordinated by UNP in urban and peri-urban areas should contribute to the European Union’s long-term plan of to restore degraded ecosystems. However, the Biodiversity Strategy itself did not define any restoration targets to be achieved through the implementation of these plans. Specific targets for cities and towns are currently being discussed in the draft proposal of the EU Nature Restoration Law. The latest formulation of the text prescribes “no net loss” of urban green space (total national area) and tree canopy cover (in each urban area) by the end of 2030 compared to 2021, and a mandatory increase in both indicators thereafter. Member States will be responsible for allocating



quotas and monitoring the progress at the national level, while cities and towns will be required to define and implement actions on the ground.


At the local level, UNP will be the main instrument to coordinate greening and restoration efforts to achieve such targets. To this end, they must develop long-term vision and goals, analyse the current state of nature and biodiversity, set indicators and targets, agree on priorities and actions, and establish a monitoring and evaluation system. The session is centred on the technical aspects related to the mentioned tasks and invites contributions from researchers and practitioners that can inspire future UNP. Recent scientific advancements in the assessment of urban ecosystem conditions, services, and biodiversity can offer important contributions to setting the conceptual and methodological frameworks of UNP. At the same time, valuable experience can be drawn from several best practices linked to the drafting of a wide range of local policy instruments used to promote greening and nature-based solutions at the urban scale, including biodiversity plans, stormwater management plans, climate adaptation plans, and green space management plans, among others.

Goals and objectives of the session:

The session aims to stimulate the debate around the technical aspects of drafting “Urban Nature Plans” (UNP) as introduced by the EU Biodiversity Strategy for 2030. It focuses on three main topics that ambitious and transformative UNP need to address: the assessment of urban ecosystem conditions, services, and biodiversity. Concerning these topics, the goal of the session is to identify suitable methods and indicators that local authorities can adopt in the planning process. To this aim, we invite contributions presenting ongoing efforts directed to the drafting of UNP or other similar plans at the urban scale, as well as conceptual and methodological studies that can support this endeavour.

We welcome contributions that address one or more of the following topics:

- condition indicators that can be used to inform on the state of urban ecosystems and biodiversity;
- targets and reference levels for condition indicators to identify urban ecosystems in good/favourable or bad/unfavourable states;
- the inclusion of ecosystem services supply and demand assessments in the drafting and monitoring of UNP or other biodiversity/greening plans at the urban scale;
- the formulation of urban greening and nature restoration scenarios that consider external and internal drivers such as climate change and other urban transformations;
- suitable indicators to assess the expected impacts of and compare urban greening and urban nature restoration scenarios;

- 
- approaches to design urban greening and restoration actions that both benefit urban biodiversity and improve relevant ecosystem services for citizens;
 - methods to prioritise urban greening and restoration actions;
 - case studies and best practices of local policy instruments that show potential for transformative change (e.g., in the type of data used and approaches for data collection, in the methods and indicators adopted for the assessment, in the variety of perspectives (including more-than-human) integrated into the planning process, ...).

Furthermore, we invite reflections on the technical aspects of the role assigned to Member States in the latest version of the EU Nature Restoration Law, especially concerning:

- methods to allocate to cities and towns fair quotas within the overall national targets for urban green spaces;
- potential impacts of alternative allocation approaches on biodiversity and ecosystem service provision;
- reporting frameworks and monitoring methods and indicators to track the progress towards national and local targets.

Planned output / Deliverables:

Outputs will be discussed and agreed upon with speakers and participants to the session. Depending on the contributions and the interest, the main outcomes of the session could be summarised in a perspective paper or a policy brief. In both cases, we will explore possible links and synergies between the envisioned output and related activities carried out within BioAgora, the EU-funded project that is developing the architecture and functionality of the new European “Science Service for Biodiversity” using urban nature-based solutions and urban nature plans as one of its test cases (<https://bioagora.eu/>).


II. SESSION PROGRAM

Room: Expert Street 4

Date of session: 19th of November 2024

Time of session: 16:00–18:00

Timetable speakers



Time	First name	Surname	Organization	Title of presentation
16:05 – 16:15	Danial	Owen	UK Centre for Ecology & Hydrology	Towards transformative urban nature-based solutions: the 3–30–300 rule
16:15 – 16:25	Giulia	Jelo	University of Catania, Department of Civil Engineering and Architecture	Multi-scale GIS approach to assess land suitability to host greenery in compact euro-mediterranean cities
16:25– 16:35	Ivo	Vinogradovs	University of Latvia	Application of Spatial Conservation Prioritization Urban Green Infrastructure Planning
16:35– 16:45	Viviana	Pappalardo	University of Catania, Department of Civil Engineering and Architecture	Modeling approaches for spatial planning and decisions with nature-based solutions: applications in a Sicilian case study
16:45– 16:55	Ralf-Uwe	Syrbe	Leibniz Institute of Ecological Urban and Regional Development	Updating national indicators on the accessibility of green spaces in German cities
16:55– 17:05	Asef	Ayatollahi	Politecnico di Milano, Department of Architecture and Urban Planning	Integrating Urban Biodiversity and Ecosystem Services Indicators into Social Impact Assessment of Re-Naturing Measures in Urban Areas
17:05– 17:15	Michael	Leone	Research Institute for Nature and Forest (INBO)	A strategy for community-based Urban Nature Monitoring
17:15– 17:25	Joeri	Morpurgo	Leiden University, Department of Environmental Biology	It is all about the vegetation: Assessing the condition of urban invertebrate biodiversity through DNA analysis, and mapping the capacity for urban green infrastructure to enhance biodiversity
17:25– 17:35	Claudia	Dworczyk	Leibniz Institute of Ecological Urban and Regional Development	Monitoring the supply of local climate regulation of urban trees using fine scale canopy height model data in Munich, Germany
17:35– 17:45	Chiara	Cortinovis	University of Trento, Department of Civil, Environmental and Mechanical Engineering	Monitoring the impacts of urban greening policies: a comparative application of NDVI-based methods



III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Integrating Urban Biodiversity and Ecosystem Services Indicators into Social Impact Assessment of Re–Naturing Measures in Urban Areas

First authors(s): Asef Ayatollahi

Affiliation: National Biodiversity Future Center PhD fellow, Laboratorio di Simulazione Urbana Fausto Curti, Department of Architecture and Urban Planning, Politecnico di Milano, Italy


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Cities are scenes of daily complex interactions between humans and nature with dynamic interdependencies that require in–depth evaluation to aid planners in decision–making. While knowledge of social values and impacts of re–naturing measures is progressing, a notable gap exists in integrating urban biodiversity (UBD) and ecosystem services (ES) into assessments and simulations. The increasing recognition of UBD values raises questions about how biodiversity emerges as a new primary parameter in assessment. What are the leading indicators of ES in assessing the social impacts of re–naturing cities? To address these questions, this study undertakes a systematic literature review utilizing a repurposed social–ecological framework as a guiding concept. Focusing on regulating ES, we analyzed publications between 2000 and 2024 to identify and extract indicators for SIA procedures. By elaborating on extractions, we introduce new categories of indicators for SIA based on biodiversity and the services of ecosystems in urban areas.

Ultimately, matching these indicator categories to variables within the social–ecological framework provides a context for simulation modeling, enabling the assessment of different development scenarios through system dynamics. This integration aids planners in the long–term evaluation, including ecosystem services supply and demand assessments, in the drafting and monitoring of Urban Nature Plans (UNP) or other biodiversity/greening plans at the urban scale.

We conclude with emphasis on existing limits of scientific references on regulating ES indicators for social impact, as well as minor attention paid by scholars to the role of UBD, which requires further research on the comprehensive integration of UBD and ES in SIA.

Keywords: urban ecosystem service, social impact assessment, urban biodiversity, evaluation indicators



2. Monitoring the impacts of urban greening policies: a comparative application of NDVI-based methods

First author(s): Chiara Cortinovis

Other author(s): Grazia, Zulian, Dagmar, Haase, Davide, Geneletti

Affiliation: University of Trento

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Policies at multiple levels promote urban greening as a strategy to address urban challenges. In Europe, the Urban Nature Plans introduced by the EU Biodiversity Strategy for 2030 are the main instruments to coordinate planning and implementation of greening interventions in urban areas. As such, they will play a key role in meeting the targets for urban green space and tree canopy cover recently set by the Nature Restoration Law (NRL).

Despite the NRL identifies potential datasets to keep track of the changes at the European level, there is a need for methods and indicators to monitor the implementation of greening policies at the local level. Earth observation data can be used to study land cover changes and vegetation dynamics, but their use to monitor local-level policies is still limited.

In this contribution, we focus on methods based on NDVI, a popular remote-sensing index often adopted to investigate urban vegetation trends. The aim is to compare different methods for vegetation change detection that can be used to analyse NDVI temporal series, highlighting their pros and cons.

After discussing simpler approaches, we focus on two recently published algorithms that apply non-parametric statistical analyses to NDVI greenest pixel composites: the approach based on the Sen's slope implemented by Zulian et al. (2022) and the segmentation algorithm by Cortinovis et al. (2023). We test the methods on a 30-year Landsat series of Berlin between 1988 and 2017.

Both methods reveal a prevailing greening trend during the three decades and highlight critical areas affected by major vegetation losses. The Sen's slope offers an overview of significant positive and negative trends. The segmentation algorithm distinguishes between gradual and abrupt changes. We discuss how the methods can support the monitoring of urban greening policies, including the progress towards the target set by the NRL.



Keywords: ecosystem conditions, policy support, tree planting, browning, planning

3. Monitoring the supply of local climate regulation of urban trees using fine scale canopy height model data in Munich, Germany

First author(s): Claudia Dworczyk

Other author(s): Markus Münzinger, Ralf Uwe Syrbe

Affiliation: Leibniz Institute of Ecological Urban and Regional Development


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Cities around the world face the adverse impacts of climate change, such as heat stress, necessitating the development of urban areas that can effectively mitigate these impacts. Urban forests play a central role in this mitigation by providing shade and cooling effects that reduce heat stress. This presentation examines the modelling of the supply of the urban ecosystem service "local climate regulation" in Munich, using high-resolution canopy height models (CHM) from 2012 and 2022, and a Climate Cooling Assessment (CCA).

The CHM facilitates detailed assessment of small-scale changes in urban trees, enabling the determination of parameters such as canopy height, cover, and volume. These parameters are essential for monitoring and assessing ecosystem services like local climate regulation. The Climate Cooling Assessment estimates cooling capacity from data on land use, canopy cover, soil cover, green space size, and the local climate region. Areas with low cooling capacity values highlight zones where the population might face increased heat stress during hot days.

Our findings reveal changes in tree heights, canopy cover, and green space distribution in Munich between 2012 and 2022. The overall canopy cover increased by 3%, reaching 29.1% in 2022. However, this gain is unevenly distributed, with major construction activities causing significant canopy loss in some areas. Tree planting and natural crown expansion contributed to canopy cover gains, enhancing the city's cooling capacity in these areas.

This study highlights the importance of detailed vegetation data and standardized methodologies, which allow for the establishment of clear measures to monitor and assess ecosystem conditions and services, as well as implement nature-based solutions. Aligning with the Kunming-Montreal Global Biodiversity Framework and the European Biodiversity Strategy 2030, these measures target the enhancement of urban green spaces and canopy cover,



facilitating the design of urban greening actions that benefit both urban biodiversity and ecosystem services.

Keywords: Ecosystem services, Canopy height model, Urban forest, Local climate regulation

4. Multi-scale GIS approach to assess land suitability to host greenery in compact euro-mediterranean cities

First authors(s): Giulia Jelo


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Many euro-mediterranean cities are characterised by different challenges such as high degree of impervious surfaces, scarce green spaces endowment and high exposure to natural risks like urban heat islands and pluvial floods. To cope with these issues, Nature-based Solution (NbS) have emerged as a strategy to deploy and manage urban ecosystems through the provision of a wide set of urban ecosystem services. The basic idea is that using components that mimic natural processes in the built environment can generate a wide number of benefits in cities, and produce equal, safe and livable urban environment. It is a challenge to imagine green-oriented transformations in euro-mediterranean cities since, in addition to the objective limitations of compact urban centres, there is the presence of historic centres to consider. These are extremely complex parts of the contemporary cities, particularly from a morphological, architectural and cultural point of view, where a significant proportion of land may be occupied by sites designated as heritage to be protected and conserved. This study analyses the characteristic of dense Mediterranean urban cities to explore the suitability of different urban morphological types to host new NbS through a GIS-based multiscale methodology consisting of three steps: (i) a set of preliminary analyses to select the land-cover patches potentially suitable to host NbS; (ii) a set of functional analyses in order to assign transformability scores to each selected patch; (iii) a land transformability scenarios assessment, according to the transformability scores assigned to each land patch, in order to better understand which are the components of urban fabrics that can be transformed with different levels of technical, economic and social viability. The method is applied on a set of medium-sized euro-mediterranean compact cities, chosen on the availability of the data required by the method.

Keywords: compact cities, historical centres, Nature-based Solutions, urban morphologies, natural risks mitigation



5. A strategy for community-based Urban Nature Monitoring

First author(s): Michael Leone

Presenting author: Stephanie Anchaluisa

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INBO developed a prototype monitoring strategy for a new Flemish policy instrument for urban nature called ‘Nature Fabric Planning’ (NFP). Through NFP, local coalitions define and implement their own goals, visions, actions and monitoring with the ultimate goal to create more sustainable and equitable places to live. The monitoring strategy serves two separated but connected needs: (1) local coalitions being able to monitor the socio-ecological progress in the neighborhood, and (2) monitoring their own governance to reflect upon and improve the functioning of the coalition. Both elements aim to allow the coalition to follow up the project and adjust where necessary. The strategy aims to equip local coalitions with knowledge and tools to evaluate their project to increase ownership, relevance and long-term commitment.

Based on a socio-ecological assessment of the site, local coalitions create desired images of their neighborhood that are feasible and technically possible to achieve. These images are the reference point for monitoring. We depart from a plural valuation and the local coalition decides which diverse values of urban nature should be followed up for the monitoring. This requires a holistic assessment, a collaborative way of working and a disposition of reflection about the process. An adaptive set of indicators is then established, tailored to the specific context and needs of the neighborhood.

To support the governance within the coalition, we also provide tools to evaluate, among others, their ambitions, capacities, decision-making, fair distribution of power, benefits and burdens of the projects. The focus on justice aspects helps to address inequalities and promotes inclusive urban development. Decision-making will rely on consensus-building techniques and requires a commitment from the involved authorities to a community-based approach. Engaging a diverse group of stakeholders as actors-in-charge, NFP aims to increase robustness and resilience.

Keywords: Urban Nature, Plural Valuation, Adaptive Monitoring, Community-Based Approach, Social Justice



6. It is all about the vegetation: Assessing the condition of urban invertebrate biodiversity through DNA analysis, and mapping the capacity for urban green infrastructure to enhance biodiversity.

First author(s): Joeri Morpurgo

Other author(s): Roy P. Remme, Quinten Mudde, Emilie A. Didaskalou, Kornelia J. Serwatowska, Krijn Trimbos, Mingming Hu, Peter M. van Bodegom

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Rapid urbanisation provides novel challenges for biodiversity. Simultaneously, local governments are increasingly focussing on protecting and enhancing urban biodiversity through the promotion of Nature-based Solutions and urban green spaces. However, little is known about the capacity of urban green spaces to harness biodiversity and the assembly of invertebrate species into communities. This understanding is vital in managing and designing urban green spaces that support biodiversity well.

New DNA-based sampling methods combined with species distribution modelling provide a way to quantitatively estimate important features of green spaces for many species. We investigated urban green spaces in The Hague (the Netherlands) by sampling DNA, collecting data on invertebrate occurrence with traditional trapping (bulk; $n = 205$) and a novel Environmental DNA method (eDNA; $n = 207$). After DNA sequencing, species were identified using Operational Taxonomic Units (OTUs). Subsequently, individual species presence and absence were used in Species Distribution Models, based on spatial information on vegetation and anthropogenic influences.

The results show a difference in coverage of sampling methods (bulk vs. eDNA), indicating their complementary information. The models on species distributions were mostly significantly better than random models but few performed adequately enough to reliably map a species distribution. Our results show that density and structure of vegetation, as well as distance to water are more important for urban invertebrate distribution than direct anthropogenic pressures.

This suggests that having a variety of urban green infrastructures available may be most important to attract many of the species observed, while human impacts may be less important.



Hence, ensuring sufficient and suitable green infrastructure in the urban environment should be the first priority to enhance and conserve biodiversity in and around the urban environment.

Keywords: Biodiversity, DNA, green infrastructure design, field study

7. Towards transformative urban nature-based solutions: the 3–30–300 rule.

First author(s): Danial Owen


Other author(s): Alice Fitch, David Fletcher, Kate Farley, Laurence Jones, Julius Knopp, Gregor Levin, Gianni Vesuviano

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Within towns and cities, there is often unequal access to, or a lack of urban green and blue spaces. This results in increasing pressures on ecosystems and presents challenges to both the environment and to human health and well-being. Addressing this requires ambitious transformative urban greening plans. One such guideline for urban greening that has been recently introduced and which is gaining traction worldwide within urban planning and among policy makers, is the 3–30–300 rule. This ambitious, transferrable, and easy-to-understand guideline aims to promote equitable access to urban green space within towns and cities by setting three key targets: every household, workplace, and school should have 3 visible trees, 30% tree canopy cover within their neighbourhood, and access to a green space of 1 ha within 300 m. While a number of studies assess whether cities currently meet these guidelines, none have evaluated their feasibility. In this presentation, we explore the feasibility of implementing the 3–30–300 rule (with minor adjustments to the thresholds). We quantify the land cover change that would be required using a GIS rule-based approach in three contrasting European cities: Paris (France), Aarhus (Denmark), and Velika Gorica (Croatia). In our implementation to meet the rule, substantial changes were needed in all cities: 12.6% of Paris, 10% of Aarhus, and 18.4% of Velika Gorica's urban footprint were converted to grass or tree cover, with implications for >100,000 buildings and >900,000 inhabitants. We also present modelling assessments of the ecosystem service benefits that would be achieved by meeting the rule in each of these cities, with examples from surface water run-off flow, cooling and noise mitigation.

Keywords: 3–30–300, urban greening, ecosystem services, equity, GIS



8. Updating national indicators on the accessibility of green spaces in German cities

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Green infrastructure in urban areas contributes to key aspects of life quality. It fulfils urban ecological functions, provides urban ecosystem services (ESS) and offers opportunities for recreation, exercise and experiencing nature. However, open spaces are becoming to get rare in growing cities. To derive sound urban planning and nature conservation targets and to identify areas of interest, indicators are needed that provide comparable information thanks to up-to-date data.

For the evaluation of the ecosystem service "recreation in the city", the three indicators 'green content', 'green supply' and 'green accessibility' were redesigned, calculated, mapped and interpreted considering extended, updated data bases for German cities with 20,000 inhabitants or more. The indicators make it possible to evaluate comparisons between cities and, in some cases, neighbourhoods and districts and, when calculated repeatedly, to monitor trends for the urban green.

Keywords: Geodata, green infrastructure, nearby recreation, greening

9. Application of Spatial Conservation Prioritization Urban Green Infrastructure Planning

First author(s): Ivo Vinogradovs

Other author(s): Anda Ruskule, Agnese Reķe, Anita Zariņa

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Spatial conservation prioritization is a well-documented but under-utilized approach for decision support in planning urban green infrastructure (UGI) to produce high-quality "Urban Nature Plans." It employs computational methods and decision analysis to identify priority areas



for conservation and green infrastructure. The process involves setting conservation targets, analysing spatial configurations, and optimizing resource allocation to maximize both ecological and social benefits. This approach is particularly effective in balancing biodiversity conservation with other ecosystem services.

In this study, based on case study of Riga, Latvia, we explore both traditional applications to designate the most valuable areas for green infrastructure allocation and the novel approach of prioritizing problem areas. Special emphasis is given to the latter due to its innovative nature. In three case studies, we paraphrase the classical Zonation approach to propose the goal: "Maximizing retention of weighted, range-size adjusted problem feature richness." Here, feature richness refers to the variety of different problem features present in a study area, with higher feature richness indicating greater severity and/or concentration of issues.

We will address challenges related to selecting appropriate criteria and approaches for assigning weights, as well as the specifics of "range-size" when considering urban green infrastructure (e.g., comparing small severe problems versus widespread issues). Additionally, we will provide a comparison with other prioritization methods to highlight the strengths and weaknesses of each approach in the context of urban green infrastructure planning.

Keywords: spatial conservation prioritisation, Zonation, prioritisation methods, urban green infrastructure

10. Modeling approaches for spatial planning and decisions with nature-based solutions: applications in a Sicilian case study

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Current performance-based planning approaches and modeling can represent a valuable tool for the enhancement of nature-based solutions in city regeneration toward enhanced urban quality.

Model simulations can be used in ex-ante design/plan evaluations but an effective use in operational urban planning is still missing.



Urban planning with NBS is multidimensional and multi-objective in scope. Still, most studies related to NBS, tend to reduce their assessment to single issues and specific aspects the urban system deals with, often disregarding the complexity of impacts and trade-offs.

Functional and spatial modeling approaches can better allow NBS complexity to be investigated at different temporal and spatial scales and prevent ineffective resource use and environmental injustice potentially caused by inappropriate spatial planning and siting of NBS.

To fully capitalize on the potential and functionality of NBS, the evidence of the effectiveness of NBS in terms of generated benefits needs to be spatially explicit and visualized, and has to be diffused among policymakers, city planners, and inhabitants of many cities. For the same purpose, the level of accuracy of modeling and methods for the analysis and selection of the most appropriate and effective NBS need to be more accessible by practitioners, as well as carefully considered compared to the planning aim, for a proper deployment staff and budget resources.

This study applies existing NBS modeling tools in a Sicilian case study.

The models' applicability for designing comprehensive spatial and planning decision support systems (SP-DSS) to capture and evaluate the spatial complexity and geographic diversity of the benefits produced by different NBS is discussed, and further recommendations for considering NBS modeling integration into SP-DSS are provided.

Specifically, the criticalities and potentialities of these models against the planning contexts and constraints, the model characteristics, capabilities, and suitability to address specific challenges in cities, temporal and spatial scales, data input and resolution, output informational possibilities, and end-users needs are investigated.

Results of the study have also been gathered to obtain examples of the modeling integration into SP-DSS, to seize early insights on barriers and opportunities for improved spatial planning/decision support systems.

Keywords: modeling tools, spatial planning, decision support systems, nature-based solutions, urban contexts

BOOK OF ABSTRACTS

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I. SESSION DESCRIPTION

ID: B10f

Urban form and ecosystem delivering capacity – relations and implications for urban planning and governance

Hosts:

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Abstract:

The pressing need for the development of climate-resilient and liveable cities requires a comprehensive overhaul of urban design parameters. This includes such characteristics as density, land-use mix, connectivity, accessibility, and the quality and quantity of green spaces, alongside a shift in energy production methods, the enhancement of natural capital at the district level, as well as a major revision of objectives and techniques for the management of urban green and blue infrastructure. This holistic approach aims at fostering Environmental Well-being (EW) in cities, with a focus on climate change mitigation and adaptation, as well as just and inclusive character of urban space. An integral part of this paradigm shift involves incorporating ecosystem performance-based design techniques. They prioritize citizens' vulnerability and exposure to climate risks, while also considering the varying preferences of citizens regarding urban green



and blue infrastructure and its components. It is important therefore, in addition to ecosystem services also to acknowledge the role of ecosystem disservices (EDS) – functions and properties of ecosystems that cause discomfort to citizens. While ecosystems provide valuable services, such as clean air, water and noise suppression, the presence of EDS can detract from urban livability and health through such factors as allergens, falling deadwood, stain on surfaces, fears of dark and/or unmanaged green spaces, unwanted biodiversity, mosquitos, barriers and accessibility issues associate with nature protected areas etc etc. EDS are extremely context-specific and value-laden, even when compared to ecosystem services. Therefore, effective management of EDS requires a nuanced understanding of the views and vulnerabilities of various social, age, gender and other groups regarding urban nature. It also requires consideration of the acceptability and feasibility of design and management solutions under various socio-economic and biophysical factors.

The EW paradigm can be practically applied to urban planning and design within this perspective. Rethinking of the current urban form of cities towards a more adaptive one for mitigating climate change and ensuring the acceptability and accessibility of urban green and blue infrastructure is currently at the center of scientific and academic debates. To effectively address the human-centric perspective, urban adaptation to climate change should be optimized by ecosystem performance-based design techniques (i.e., criteria or parameters) focused on citizens' vulnerability and exposure. Likewise, EDS need to be understood and addressed while designing inclusive urban space and prescribing management strategies for urban green and blue infrastructure.

Goals and objectives of the session:

The session aims to address contemporary challenges in developing ecosystemically-compatible and inclusive projects at the district scale (Salata, 2019; Skryhan and Shkaruba, 2022) through a systematic investigation of urban systems at the block level, and involving the identification and analysis of ecosystem disservices (EDS) at any relevant planning levels. These criteria apply to both existing parts of cities and new transformation areas, aligning with the ambitious targets set by the UN Sustainable Development Goals (SDGs) for sustainable city and community development (United Nations, 2015).

In this session, urban form, ecosystem delivery capacity, and EDS will be approached in a holistic and integrated manner, considering socio-ecological systems that encompass mobility, public space, the built environment, ecology, well-being, and social cohesion. The focus will be on designing new urban organizational units to regenerate contemporary cities in an adaptive and resilient manner while ensuring their inclusive character, especially for vulnerable groups.

Key topics of inquiry will include methodological approaches, field and analytical techniques for understanding the interplay between urban form, associated socio-cultural systems, and ecosystem properties and functions at the district scale. This interplay results in a variety of



ecosystem services and disservices. The session's objective is therefore to review relevant observation, mapping, monitoring, and evaluation techniques, as well as planning and management practices that support urban design and governance solutions for more climate-aware, liveable and inclusive cities. Additionally, the session will explore how EDS can facilitate citizen engagement in urban and spatial planning processes. Finally, it will examine the utility of participatory GIS and living labs in identifying and evaluating ecosystem services versus ecosystem disservices, offering insights into innovative approaches to addressing urban challenges.

Planned output / Deliverables:

The session aims to attract contributions that advance the understanding the interplay of between urban form, associated socio-cultural systems, and ecosystem properties and functions (including such as ES and EDS) and demonstrate how this approach can enrich spatial and urban planning. By addressing citizens' concerns regarding undesirable aspects of urban nature and integrating these considerations into planning and governance processes, the session seeks to foster a more harmonious relationship between urban environments and their inhabitants.

Building on the outcomes of the session and the quality of contributions received, the organizers plan to develop an overview paper or propose a special issue to an international peer-reviewed journal. This initiative aims to disseminate the insights gained from the session to a broader audience, thereby contributing to ongoing discourse and informing future research and practice in urban planning and governance.

Session format:

The session shall feature talks of 10 minutes with 5 minutes discussion, followed by a moderated discussion (preferably in small breakout-groups) on cross-cutting issues and future steps.

Two thematic session streams will be organized around two main topics of discussion. One will focus on EDS identification and analysis, while the second will explore the urban form in relation to ecosystem delivery capacity at the district scale. An overarching topic of both streams concerns implications for climate-aware and inclusive planning.



II. SESSION PROGRAM

Room: Expert Street 2

Date of session: 21st of November 2024

Time of session: 11:00 – 15:30

Timetable Speakers

Time	First name	Surname	Organization	Title of presentation
11:00 11:10	Giedrius	Dabasinskas	Vytautas Magnus University	Spatial and Temporal Changes in Supply and Demand for Ecosystem Services in Response to Urbanization: A Case Study in Vilnius, Lithuania
11:15 11:25	Pham Trung	Kien	Université Gustave Eiffel	Integrating ecosystem disservices into urban food garden planning: management strategies based on food–water–soil nexus perspective
11:30 11:40	Sabrina	Lai	University of Cagliari	The Influence of Urban Form on Regulating Urban Ecosystem Services
11:45 11:55	Beatrice	Mosso	Politecnico di Milano	Climate Adaptation in Normative Planning
12:00 12:10	Click here to enter text.	Click here to enter text.	University of Camerino	Wild boars, feral dogs, ticks and mites: ecosystem disservices are entering our cities. A comparison between the compact urban fabric of historic centers within city walls, the modern sprawl
12:15 12:25	Ruthi	Veibiakkim	Estonian University of Life Sciences	Integrating Ecosystem Disservices into urban planning and design: a systematic review to identify gaps and directions for the future
Lunch Break				
13:30 13:40	Anton	Shkaruba	Estonian University of Life Sciences	Ecosystem Disservices as a tool for community engagement to the planning process

Time	First name	Surname	Organization	Title of presentation
13:45 13:55	Ruthi	Veibiakkim	Estonian University of Life Sciences	Understanding Ecosystem Disservices: a cross-Eurasian perspective
14:00 14:10	Abhishek Kumar	Verma	Forest Research Institute, Dehradun, India	Community Preferences and Perceptions of Urban Trees for Maximizing Ecosystem Services: A Survey-Based Study in Varanasi, India
14:15 14:25	Janneke	van Oorschot		Optimizing green and grey infrastructure planning for sustainable urban development
14:30 14:40	Marcin	Spyra	University of Ostrava y	Ecosystem Services Trade-offs in Peri-urban Landscapes: Drivers, Governance Obstacles and Improvements
14:45 14:55	Shamik	Chakraborty	Hosei University	Emerging patterns of urban sustainability through urban blue/green spaces: Navigating problems and prospects through empirical cases
15:00 15:10	Beatriz	Fernández de Manuel	University of the Basque Country	MuGIP: an Index to assess multifunctionality of nature-based solutions in a World Heritage City
15:15 15:30	Organizers			WRAP UP

The first author is the presenting author unless indicated otherwise.

1. Spatial and Temporal Changes in Supply and Demand for Ecosystem Services in Response to Urbanization: A Case Study in Vilnius, Lithuania

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Intensification of urbanization is changing the supply capacities and demand levels of ecosystem services (ESs), and their mismatch has become a major problem for the sustainable development of urban areas. In this study, spatiotemporal changes of three ecosystem services (food provision, C sequestration, recreation) were quantified and imbalances between their supply and demand were identified in Vilnius County (Lithuania) in 2000–2020. The most significant land use transformation was the increase in forest and urbanized land at the expense of agricultural land. The lowest supply and the highest demand for food, carbon sequestration, and outdoor recreation were in the urban center. The urban land ratio had a negative impact on the provision of ecosystems' services during the study period, most notably affecting food supply. Urbanization indicators—population density and urban land area—showed a negative relationship with the provision of ecosystem services. The balance of supply and demand changed during the 2000–2020 period—the growth of suburbs led to the distance of the supply areas from the city, and the area of the intense demand increased. The results of the study highlight the importance of spatial scale in determining the impact of urbanization on ecosystem functions.

Keywords: ecosystem services, suburbanization, urban sprawl, land cover change



2. Integrating ecosystem disservices into urban food garden planning: management strategies based on food-water-soil nexus perspective

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Addressing the multifaceted challenges of urbanisation usually involves a variety of interdisciplinary strategies and solutions across different sectors. Among them, nexus approaches have been being developed and starting to be examined in scholarly works or small-scale experiments. However, while the ecosystem perspective is essential for sustainable resource management and receives growing interest, it is not well connected to the nexus assessment. Earlier research has been working on the integration of ecosystem services in nexus approaches, but none has addressed the lack of ecosystem disservices (EDS) for better objective decision-making. The lack of clarity is rooted in the entanglement of ecosystem services and disservices for human well-being, despite they are viewed as equally important for urban ecosystem planning. Focusing on the urban food gardens (UFGs), this study clarifies the interlinked relationships between the food-water-soil nexus and EDS derived from UFG systems. From this perspective, we argue the strong role of EDS in UFGs management and illustrate a clearer picture incorporating the food-water-soil nexus concept.

Keywords: urban food gardens, urban resource assessment, food water soil nexus, urban resilience, ecosystem disservices



3. The Influence of Urban Form on Regulating Urban Ecosystem Services: An Empirical Analysis from Cagliari, Italy

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In urban contexts, the provision of regulating ecosystem services (RES), such as regulation of climate, heat, and flood, is of high significance to ensure the local communities' safety, health, and wellbeing.

This study seeks therefore to analyze the relationships between the provision of the three above mentioned RES and the characteristics of urban areas. By taking the Italian city of Cagliari as the study area, RES's interplay with the spatial configuration of green spaces and of the built environment is assessed. Green areas are classed based on vegetation height, whereas the built environment and socioeconomic characteristics here considered refer to size of buildings, share of sealed land, residential density, and education level of the residents.

The spatial assessments of the three RES and of the analysis of the physical and socioeconomic features are carried out at the census tract level and feed into an inferential model, whose estimates provide information on direction and strength of the relationships.

Treed areas showed no significant impact on carbon storage and a positive influence on temperature mitigation; larger shrubby areas lead to higher supplies of carbon storage and flood control; higher shares of sealed soils are unsurprisingly associated with lower provisions of the three RES. On these results, policy implications aimed at improving urban RES supply are finally identified.

This study was carried out: i. within the RETURN Extended Partnership and received funding from the EU Next-GenerationEU (National Recovery and Resilience Plan – NRRP, M4C2I1.3 – D.D. 1243/2022, PE0000005); ii. with the financial support under the NRRP, M4C2I1.1, Call for tender 1409/2022 by the Italian Ministry of University and Research (MUR), funded by the EU – NextGenerationEU – Project Title “Definition of a guidelines handbook to implement climate neutrality by improving ecosystem service effectiveness in rural and urban areas” – CUP F53D23010760001 – Grant Assignment Decree 1378/2023 by MUR.



Keywords: urban ecosystem services, regulating ecosystem services, urban form, urban green areas, spatially-explicit assessments

4. Climate Adaptation in Normative Planning. A Performance Based Design approach for Ecosystem Zoning in Varese city (Italy).

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The global poly-crisis we are witnessing, driven by political instability and ongoing wars, inflation, energy crises, high levels of inequality and poverty, and technological innovation, is closely linked to cities, where these effects are amplified and multiplied as the world's most densely populated areas.

The study of ecosystem services and their benefits for living beings' health, previously confined to an in-depth theoretical understanding, experiences the pressing need to be integrated in the regulatory aspects of the implementation process, able to shape a climate-adaptive planning, capable of preventing mitigating the catastrophic effects of climate change in urban environments.

Within these premises, the research proposal carried out by the Department of Architecture and Urban Studies (DASU), related to the revision of the Municipality of Varese's General Territorial Plan, develops an in-depth analysis dedicated to identifying the performance of the city to cope with climate change effects and investigating its vulnerability to intense rain phenomena.

The scientific activity represent an opportunity to innovatively shape the decision-making process by introducing an experimental planning tool, the Ecosystem Zoning. This allows a new categorization of the municipal territory based on the biophysical performance of each regulated parcel while employing a semi-automatic classification of a composite ecosystem services map composed by habitat quality, sediment delivery, urban cooling and stormwater retention.

Each ecosystem framework shaping the zoning is characterized by different ecosystem delivery capacities, allowing the definition of site-specific and tailored interventions to maintain or enhance the existing ES supply directly affecting the urban regeneration and transformation



processes. The integration of research findings within the broader context of urban planning enriches our understanding of the intricate relationship between ES, climate change effects and urban planning, aligning the research with global efforts to create resilient, ecologically conscious cities that prioritise the well-being of both inhabitants and the natural environment.

Keywords: Resilient planning, ecosystem zoning, extreme weather events, adaptive capacity, antifragility

5. Ecosystem Disservices as a tool for community engagement to the planning process

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Ecosystem Disservices (EDS) are functions and properties of ecosystems delivering discomfort to citizens. In cities they can be at least as important for citizens as ecosystem services (ES), and even more noticeable at times, as many EDS can be seriously disturbing in urban contexts. This further leads to the call for the solutions whereas ES as well as EDS are integrated in planning designs delivering comfortable urban environment to citizens, and ensuring their co-existence with ecosystems and biodiversity.

Understanding the potential of EDS as a communication tool for sustainable urban governance, in the ongoing Horizon Europe BetterLife project we came up with and EDS-based tool for community engagement to the planning process, which is a part of BetterLife toolkit for supporting socially-engaged life sciences research (<https://www.better-life-digital.eu/toolkit/>). The tool includes three steps: (1) measuring perceptions of urban nature by citizens using quantitative or qualitative sociological tools (depending on the capacity of the analytical group), (2) implementation of citizens' perceptions into spatial planning designs by deploying a decision-making tree guiding decision-making logic for different EDS types, and (3) integration of citizens's perceptions, spatial planning designs, and governance policies through co-creation sessions with multiple stakeholder groups.

The core part of the tool, the EDS decision-making tree, has been tested in multiple geographical, socio-ecological and managerial contexts, whereas the decision-making logics have been discussed both for the cases demonstrating the failure to preserve urban



ecosystems, as well as successful ones. This included 3 cases in Belarus and 3 in Estonia, with further ones being developed in Italy. As yet, case studies demonstrate the validity of the decision-making tree and the EDS categorisation used for it in a variety of contexts. The first trials outside Europe (India, Mongolia) suggest that they may require fine-tuning, while the overall structure is likely to remain valid.

Keywords: Ecosystem disservices, urban planning, socially-engaging research, liveable cities, stakeholder involvement

6. Wild boars, feral dogs, ticks and mites: ecosystem disservices are entering our cities. A comparison between the compact urban fabric of historic centers within city walls, the modern sprawl and other urban forms.

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In history, city walls served to protect not only from enemies, but also from the wild nature that constantly threatened to enter the urban environment. During time, those walls have been demolished or crossed over, and the city boundaries are increasingly less recognizable and marked, regardless cities are actually growing or shrinking. Urban expansion has incorporated agricultural and semi-natural areas, grabbed land and left at the same time many residual areas in total abandonment. Green and blue infrastructures are deliberately introduced today within urban areas as ecological corridors to bring in certain kinds of ecosystem services and mitigate the harmful effects of pollution and climate change. However, when planning the urban change, cost-benefit analyses are rarely carried out regarding ecosystem services acquired and potential disadvantages. Could the shape of the city, and especially its border, play a role in keeping away, far outside the urban environment, those ecosystem disservices that are now not only evident to all but also studied by scientists?

Through the analysis of case studies and examples from various Italian cities with different history, shape and spatial configuration, some answers are proposed. In particular, we discuss how imposing a well-defined limit on the city is a way not only to stop land take, but also to limit certain ecosystem disservices whose spread is today driven by climate change, which we would like to mitigate just through green and blue infrastructures in the city. Without having to



give up natural elements, this contribution though highlights how most of ecosystem services on which the city depends are actually found and provided far outside the urban context. It also points out how, to ensure those ecosystem services typically provided within urban contexts, we can actually adopt very different strategies, possibly avoiding anyway the worst tendencies towards abandonment or wilderness.

Keywords: ecosystem disservices, urban form, city walls, climate change, ecological corridors.

7. Integrating Ecosystem Disservices into urban planning and design: a systematic review to identify gaps and directions for the future

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Ecosystem Disservices (EDS) are functions and properties of ecosystems that negatively affect human well-being. While the concept of ecosystem services (ES) has long guided urban planning and design toward fostering sustainable, resilient, and livable cities, EDS is often overlooked, despite their impact on quality of life. Nevertheless, there is a significant gap in comprehensive understanding of the development of urban planning designs that address ecosystem disservices. To bridge this gap, this study comes up with a systematic review focused on analyzing EDS and their integration into urban planning process.

The systematic review draws on existing literature and data on city planning and design. The literature searches were conducted in the Web of Science (WoS) database (n=7698), and through a systematic screening procedure; 59 papers were selected for an in-depth qualitative analysis. The focus was on papers that addressed EDS in inclusive urban planning process. First, all significant ecosystem disservices in urban areas have been identified. Second, public perceptions and expectations of urban green infrastructure and city design that addressed their needs for a good quality of life have been synthesized. Third, recommendations for inclusive urban planning designs that can mitigate EDS and meet public needs have been made.

Preliminary findings highlighted the need for planning and management practices that incorporate EDS into planning frameworks. Most EDS addressed in the papers were from urban



green spaces, primarily in Europe. Innovative strategies to tackle EDS included wildlife corridors, flood-resilient buildings, landscape barriers, and the integration of blue spaces to minimize urban pressure on the environment and biodiversity while improving quality of life. This study can serve as a baseline for urban planners and policymakers in making informed decisions on land use, urban planning, and policy formulation to safeguard the well-being of urban populations, particularly vulnerable groups.

Keywords: Ecosystem disservices, urban planning, environmental policy making, resilient cities, green and blue infrastructure

8. Understanding Ecosystem Disservices: a cross-Eurasian perspective

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Ecosystem Disservices (EDS) include all ecosystem functions and processes that negatively impact quality of life. This study aims to understand the diversity of EDS and their drivers across Eurasia, with its broad gradient of biogeophysical and socio-cultural contexts, as well as how this is reflected in relevant policies, planning and management practices.

This paper utilizes a comparative qualitative analysis, gathering data from local mass media, social networks, policy statements as well as urban planning and management grey literature. The study includes cities of České Budějovice, Ostrava (Czechia), Mahilioŭ (Belarus), Can Tho (Vietnam), Delhi, and Chennai (India). Information was collected for each city, according to EDS types, each assigned a score ranging from 0 to 4. A score of 0 indicates that EDS does not occur (or not perceived as EDS) in the region, while scores of 2 to 4 reflect varying levels of societal concern or impact, with 4 indicating significant disturbance causing economic losses or human health impacts. The study also examines relevant policy and management responses.

Findings reveal that mosquito-borne diseases, floods, algal blooms, viral transmission from animals, allergies from plants, waste in green areas, and crimes associated with urban parks are the most prevalent EDS in Asian cities. In contrast, risks of aging trees and branches falling,



poor conditions of unpaved paths and alleys in green spaces, unmanaged vegetation, invasive species, floods, and transportation and pedestrian connectivity issues due to green and blue spaces are the common EDS in European cities, which imply that EDS vary significantly, reflecting regional differences in environmental challenges and societal impacts. These contrasting EDS profiles also suggest that local environmental management strategies and policies need to be tailored to address specific regional challenges effectively, highlighting the importance of understanding local contexts and priorities in designing sustainable urban development and environmental policies.

Keywords: Ecosystem disservices, Qualitative Analysis, Environmental Policy, Sustainability, Urban green and blue infrastructure

9. Community Preferences and Perceptions of Urban Trees for Maximizing Ecosystem Services: A Survey-Based Study in Varanasi, India

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The aim of the study was to investigate community preferences and perception regarding urban trees, focusing on identifying the ecosystem services most valued by residents of Varanasi, Uttar Pradesh, India. Rapid urbanization has significant impacts on human well-being and the environment, often leading to a decrease in air quality, loss of green spaces, and biodiversity decline. Urban forestry has emerged as a promising solution to counter these detrimental effects by positive ecosystem services.

To understand this, we used the Best Worst Scaling method to prioritize ecosystem services and traits provided by trees which are more suitable for urban planting. Our findings indicate a strong preference for trees that provide oxygen, highlighting the community's concern for air quality and environmental health. Trees with medicinal properties were the second most preferred, reflecting thankfulness for health benefits and traditional uses. Trees of religious significance also garnered considerable preference, indicating the cultural and spiritual values associated with urban forestry. We also used Likert-scale method to assess the perception of people regarding urban forests. The overall perception of urban forestry among the community was positive, suggesting strong public support for initiatives aimed at increasing urban green



spaces in view of their ecosystem services to the urban population. Notably, a substantial portion of our responses came from students, offering a unique perspective on urban forestry preferences.

The findings from this study are valuable for policymakers and urban planners so that they can incorporate those species which are more preferable and accepted by the local people for better coherence between trees and people. This alliance of urban forest and urban residents can foster more effective and inclusive practices that can enhance urban environment, ecosystem services and resonate with residents' values and needs.

Keywords: Urban forestry, Urban greening, Urban Planning, Urban Policy, Climate Change

10. Optimizing green and grey infrastructure planning for sustainable urban development

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The anticipated increase of 2.5 billion in the urban population by 2050 poses significant environmental challenges. While various studies examine environmental impacts individually, integrated approaches are rare. This study introduces a spatially explicit model to assess urbanization's effects on ecosystem services (green infrastructure availability, cooling, stormwater retention) and the environmental impact of building construction (material demand, greenhouse gas emissions, land use). Applied to the Netherlands from 2018 to 2050, our results show that integrating green infrastructure development with building construction could increase green areas by up to 5% and stabilize or increase ecosystem service provisioning. Dense building construction with green infrastructure development is generally more beneficial across the Netherlands, reducing resource use and enhancing ecosystem services. Conversely, sparse construction with green infrastructure is more advantageous for newly built areas. These findings offer insights into the environmental consequences of urbanization, guiding sustainable urban planning practices.

Keywords: ecosystem services, urban planning, spatial analysis, building materials, circular economy



11. Ecosystem Services Trade-offs in Peri-urban Landscapes: Drivers, Governance Obstacles and Improvements

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Trade-offs in ecosystem services (ES) manifest when the enhancement of one service leads to the diminishing of another. These trade-offs pose a notable challenge, impacting the sustainability of particular socio-ecological systems peri-urban landscapes (PULs). This issue arises from the dynamic processes associated with peri-urbanization, posing threats to natural ecosystems and their services in peri-urban areas. Additionally, the escalating demand for ecosystem services in PULs contributes to these trade-offs. Policy making and planning concerning ecosystem ES trade-offs in PULs should prioritize the promotion of a balance between conflicting services and foster synergies among them. However, it is noteworthy that ES trade-offs in PULs are not given high priority on policy and planning agendas. Knowledge regarding policy development and planning for ES trade-offs in PULs often remains concealed within specific country and regional case studies. Consequently, this research seeks to characterize the ES trade-offs in the selected PUL case studies, with the objective of identifying potential commonalities among them. Furthermore, the study aims to identify: (i) the factors driving ES trade-offs, (ii) challenges pertaining to how policy-making and planning address ES trade-offs in PULs, and (iii) recommendations for enhancing governance practices to better manage peri-urban ES trade-offs. We designed a semi-quantitative survey and collected information about 23 different case studies, located across the world. Answers from this survey were analyzed with the help of Principal Component Analysis approach. The results showed that the most common trade-off occurred between “cultural and provisioning” and “regulating and provisioning” ES. It was found that urban development is the basic driver behind emerging of the examined trade-offs. To tackle this issue at the governance level, the study recommends establishing mechanisms to facilitate collaboration among stakeholders. This should be accompanied by robust dissemination efforts and the promotion of awareness among actors regarding the fundamental concepts of ES and PULs.

Keywords: awareness; conflict; planning; principal component analysis; similarity patterns



12. Emerging patterns of urban sustainability through urban blue/green spaces: Navigating problems and prospects through empirical cases

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While it is well noted that our present world has become increasingly urban, with the majority of the population living in urban areas; probing the sustainability components in urban areas is still in its infancy. Urban areas are also often crosscut important biodiversity areas including protected areas, that are key to maintaining ecosystem and human health. Urban areas today, thus, are at a crossroads between both ecosystem degradation and sustainability. These are given by unsustainable resource use, social conflicts, and negative human developments such as poor health quality on one hand, while by potential refugia for biodiversity, and spaces that support multiple ecosystem services and human well-being components on the other hand. The present paper carries out a literature review revealing key socio-ecological components that are emerging under the umbrella of urban ecology while citing key examples from empirical research in Japan, and the Philippines. The paper suggests that understanding, interpreting, and enhancing the urban socioecological components that are ecologically multi-functional such as urban blue/ green spaces can be catalysts in pushing urban socio-ecology towards sustainability with multiple human well-being components. The study is especially useful in drawing attention to reducing further deterioration of urban ecosystems that provide multiple ecosystem services and are bound especially by livelihood-based values and cultural values.

Keywords: Urban ecology, urban blue/green space, urban socio-ecological system

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: S1a

Leveraging ecosystem services for agroecological transitions


Hosts:

	Name	Organisation	E-mail
Host:	Helena Freitas	Centre for Functional Ecology, Associate Laboratory, TERRA, University of Coimbra	hfreitas@uc.pt
	Paula Castro	Centre for Functional Ecology, Associate Laboratory, TERRA, University of Coimbra	pcastro@ci.uc.pt
Co-host(s):	Alexandros Tataridas	Centre for Functional Ecology, Associate Laboratory, TERRA, University of Coimbra	a.tataridas@gmail.com
	Joana Costa	Centre for Functional Ecology, Associate Laboratory, TERRA,	jcosta@uc.pt

Abstract:

Agroecological transitions mark an essential step towards sustainable agricultural systems. However, in moving towards a decisive feature of sustainable agriculture, it is crucial to adopt a comprehensive and interdisciplinary approach that recognises the multifaceted benefits agriculture offers beyond mere food provision (provisioning services). This entails acknowledging and integrating various ecosystem services, including regulating and maintenance functions such as pollination, nutrient cycling, pest control, soil fertility, and erosion prevention, alongside cultural ecosystem services like recreation, heritage preservation, and agro-tourism

This session, proposed within the framework of the European Research project GOOD – Agroecology for weeds (<https://www.goodhorizon.eu/>) (Grant agreement ID: 101083589), aims



to foster the discussion on how ecosystem services may enable and boost agroecological transitions. Understanding the natural processes in which agriculture/agroforestry thrives and how reliance on biodiversity and their relationships can help combat environmental degradation while fostering resilience and implementing sustainable food production patterns is pressing.

By embracing agricultural and agroforestry management practices centred around ecosystem services, we not only contribute to biodiversity conservation but also cultivate economic and social prosperity. However, various challenges persist, ranging from trade-offs between ecosystem services to institutional barriers and knowledge gaps, all of which require attention and resolution within the proposed session

Goals and objectives of the session:

Research question: How can ecosystem services be effectively integrated in agroecological transitions?

Participants will be invited to (session goals):

1. Map challenges around the importance of ES in agroecological transition;
2. Discuss solutions to overcome barriers (e.g., knowledge gaps), biases and other identified challenges;
3. Propose frameworks for the harmonised integration of ES into agroecological transitions

Planned output / Deliverables:

Publication of an opinion/research article with the main findings/results of the sessions.

II. SESSION PROGRAM

Room: Expert Street 7

Part 1

Date of session: 18th of November 2024

Time of session: 14:00–15:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
14.00–14.10	Helena	Freitas	Centre for Functional Ecology – Science for People & the Planet, TERRA Associate Laboratory, Department of Life Sciences, University of Coimbra, Portugal	Host presentation and explanation of the session
14.10–14.15	Alex	Tataridas	Centre for Functional Ecology – Science for People & the Planet, TERRA Associate Laboratory, Department of Life Sciences, University of Coimbra, Portugal	Leveraging ecosystem services for agroecological transitions: the role of the GOOD Project
14:15–14:20	Mario	Balzan	Institute of Applied Science, Malta College of Arts, Science and Technology. Paola, Malta	Assessing trade-offs in managing pollinators and pollination ecosystem services in the Maltese Islands
14:20–14:25	Jan	Brabec	Faculty of Social and Economic Studies, Jan Evangelista Purkyně University in Ústí nad Labem	Overcoming Barriers: Enhancing Nature-Based Flood Mitigation Strategies through Policy and Practice
14:25–14:30	Sheila	Holz	Centre for Social Studies – CES – University of Coimbra	The Green Deal Pathway for Farmers: Regulatory and Policy Barriers to Implementing Agroecology
14:30–14:35	Metaxia	Kokkini	Agricultural University of Athens, Greece	VALERECO: Valorization of LEGumes Related Ecosystem Services
14:35–15:40	Anabela	Paula	Centre for Functional Ecology – Science for People & the Planet, TERRA Associate Laboratory, Department of Life Sciences, University of Coimbra, Portugal	Co-creation of sustainable development strategies for agroecological transition based on ES framework
15:40–14:45	Mónica	Pinto	CITAB, Universidade de Trás-os-Montes e Alto	Insights from preliminary field observations: pollinators diversity



Time	First name	Surname	Organization	Title of presentation
			Douro, Inov4Agro, Portugal	with different crops and plants in agroecosystems
14:45–14:50	Laura	Riggi	Department of Ecology, Swedish University of Agricultural Sciences, Sweden	From blurry maps to clear solutions: mapping pest control services for agroecological transition
14:50–14:55	Philippa	von Nathusius	1Agroscope, Research group Extension Arable Crops, Reckenholzstrasse 2ETH Zurich, Sustainable Agroecosystems, Switzerland	Quantification of ecosystem services of narrow-leaved lupins and lentils in mixed cropping systems
14:55–15:00	Vasileios	Gkisakis	Hellenic Agricultural organisation (ELGO) – DIMITRA, Institute of Olive Tree, Subtropical Crops and Viticulture	One Health approaches to support Agroecological transformation and the provision of Ecosystem Services in peri-urban farming: the experience from west Africa.
15:00–15:30	All participants	Group discussion on topics 1 & 2: Map challenges around the integration of ecosystem services (ES) in agroecological transitions and how to overcome barriers and biases		

Part 2

Date of session: 18th of November 2024

Time of session: 16:00–17:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
16.00–16.10	Paula	Castro	Centre for Functional Ecology – Science for People & the Planet, TERRA Associate Laboratory, Department of Life Sciences, University of Coimbra, Portugal	Welcome and explanation of the session
16:10–15:20	ALL	Group discussions to propose frameworks for harmonising ES into agroecological transitions to facilitate a transformative change in agri-food systems		



Time	First name	Surname	Organization	Title of presentation
17:20–17:30	ALL	Final conclusions and validation of the proposals		

III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.


1. Assessing trade-offs in managing pollinators and pollination ecosystem services in the Maltese Islands

First authors(s): Mario V Balzan

Affiliation: Malta College of Arts, Science and Technology

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The abundance of pollinators is important for the delivery of pollination ecosystem services but functional divergence between species traits is also considered important and maintaining non-overlapping trait distributions could benefit crop pollination and yield. This research evaluates the influence of local and landscape habitat variables on honeybee abundance and wild bee functional group abundance and richness, and potential trade-offs between beekeeping and functional group abundance and richness. This study is carried out in Malta, a Central Mediterranean small island state, characterised by high agricultural (51%) and urban (30%) land use and a high honeybee hive density (12.86 hives/Km² in 2019). Timed surveys of plant-bee interactions were carried out in belt transects (2 x 25m) between April and June for 4 years. For each specimen, functional traits associated with morphological characteristics, pollen transport, sociality and nesting type were identified. Preliminary results indicate a positive association between plant richness and wild bee species and functional diversity. There was no significant impact of honeybee abundance on wild bee abundance and richness, but a negative association with functional diversity parameters was recorded indicating that honeybee abundance may impact the functional diversity of pollinators at the local scale. These results are presented in more detail, and the implications for more holistic management of local and landscape habitat characteristics, as well as interspecific interactions, when planning measures for the conservation of bee diversity and pollination ecosystem services, are explored.



Keywords: bees, wild bees, *Apis mellifera*, socio–ecological systems

2. Overcoming Barriers: Enhancing Nature–Based Flood Mitigation Strategies through Policy and Practice

First author(s): Jan Brabec

Other author(s): Jan Macháč

Affiliation: Faculty of Social and Economic Studies, Jan Evangelista Purkyně University in Ústí nad Labem

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Sustainable strategies are required to mitigate the impacts of climate change, particularly the increased occurrence of natural hazards. Traditional approaches may not be sufficient to address the recurring threats to agricultural land posed by events such as floods. Existing solutions rely on governmental investments in large grey infrastructure, but these efforts should be complemented by effectively integrating small–scale nature–based solutions on private land that provide a range of ecosystem services. Such solutions can be implemented by local farmers. However, farmers often lack significant motivation to do so. While they are generally aware of the substantial benefits associated with ecosystem services, they recognize that implementing a nature–based solution typically means a loss of income. Farmers need to dedicate a portion of their land to these solutions, which reduces their yield. In a world where payments for ecosystem services (compensations) are nearly nonexistent, this creates a significant barrier to the development of mitigation strategies based on nature–based solutions.

Moreover, this is not the only barrier that slows down the transition to nature–based flood mitigation. Local farmers expressed their concerns in semi–structured interviews conducted within the Czech project Taxonomy (2022–2025). The results indicated that while financial barriers are significant, they are not the most pressing issue. What troubled farmers the most were various administrative burdens. The amount of paperwork, combined with the lack of time available for administration, was viewed as the main barrier. Additionally, existing legislation does not facilitate the implementation of nature–based solutions. The third type of barrier repeatedly mentioned by farmers was complicated property rights. In Czechia, agricultural land is particularly fragmented, and implementing a series of meaningful nature–based solutions that work well together requires extensive negotiation, significantly increasing transaction costs.

Keywords: nature–based solutions, farmers, ecosystem services, barriers, interviews



3. The Green Deal Pathway for Farmers: Regulatory and Policy Barriers to Implementing Agroecology

First author(s): Sheila Holz

Affiliation: Centre for Social Studies (CES), University of Coimbra

Contact: sheilaholz@ces.uc.pt

This communication will explore the regulatory and public policy obstacles that EU farmers encounter when implementing agroecological and agroforestry practices in response to the panel's research question, "How can ecosystem services be seamlessly integrated into agroecological transitions?". This proposal will be incorporated into one of the objectives of the H2020-PHOENIX project, aiming to gain a comprehensive understanding of human and non-human relationships in achieving the European Green Deal (EGD). The core idea behind PHOENIX is that this transition necessitates a collective effort and a different approach to human-nature interactions.

Agriculture, a fundamental human activity, heavily relies on nature while significantly impacting it. Moreover, agriculture is affected by climate change. Agroecological farmers play a pivotal role in safeguarding ecosystems by adopting ecologically sustainable practices, representing a relationship of care with nature.

The EU recognises agroecology as a potent tool for addressing the world's climate, biodiversity, environmental, economic, and social challenges. It is endorsed in the Farm to Fork and Biodiversity Strategy for 2030 and is financially supported by the Common Agricultural Policy (CAP) through direct payments to agroecological farmers. The EU has recently introduced eco-schemes into the CAP to provide financial incentives for adopting agroecology to biodiversity and ecosystem services.

However, despite the favourable regulatory framework, farmers still encounter obstacles in implementing agroecological practices. These barriers are associated with various factors, such as the necessity for expertise in diverse areas (crop and livestock management, technical skills, regulatory compliance), insufficient research, education, and advisory services, increased labour requirements for farm operations, and the availability of suitable seeds and breeds.

This proposal aims to identify the institutional barriers farmers face when embracing agroecology and explore potential measures to surmount these challenges.



Keywords: European Green Deal; Farm to Fork; Agroecology; Farmers; Challenges

4. VALERECO: Valorization of LEGumes Related Ecosystem Services

First author(s): Metaxia Kokkini

Other author(s): Ilias Travlos, Spyros Fountas, Jan Kiers, Agnoli Lara, Daniele Antichi, Daniel de Jong, Ann-Kathrin Koessler

Affiliation: Agricultural University of Athens

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VALERECO is a Horizon project including 14 partners and coordinated by the Agricultural University of Athens and Professor Ilias Travlos, started on June 1, 2024. The project aims to promote the adoption and understanding of the value of legume crops, facilitating a shift towards sustainable, productive, climate-neutral, environment-friendly, and resilient farming systems. The project seeks to quantify and enhance the environmental and economic value of ecosystem services provided by 12 legume crops. Identification will be achieved through a comprehensive analysis of the legacy of ecosystem services and investigating pathways for integrating legumes and their associated ecosystem services into the new Common Agricultural Policies (CAP). Valorization will occur through nine Living Labs established in six countries across Europe for three growing seasons. These Living Labs are multi-actor open-innovation spaces that will employ behavioral design strategies towards the adoption of legumes in healthier and more sustainable diets, conduct on-station participatory trials to assess the performance of legume crops, quantify multiple ecosystem services, and incorporate farmers' perspectives by evaluating indicators for the economic and environmental benefits in diversified farming systems. Furthermore, the Living Labs will demonstrate and co-create technically, economically, and environmentally assessed solutions for integrating legumes into cropping systems. All outcomes will be available via a Digital Legume Information Hub (DLIH), designed to maximize the uptake of project's results. This hub will serve as a 'One-Stop-Shop' for legume ecosystem services, containing training and capacity-building materials, technical solutions for legume adoption, a knowledge database on ecosystem services, and policy recommendations along with a Decision Support System (DSS) as an independent web tab.

Keywords: Legumes, Ecosystem services, Valorization



5. Co-creation of sustainable development strategies for agroecological transition based on ES framework

First author(s): Anabela Paula


Other author(s): Natália Roque, Paula Castro, Diogo Martinho, Paulo Fernandez, Albano Figueiredo, Silvia Castro, Luciana Frazão, Helena Freitas

Affiliation: Centre for Functional Ecology – Science for People & the Planet, TERRA Associate Laboratory, Department of Life Sciences, University of Coimbra, Portugal

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Rural agricultural landscapes provide a comprehensive range of ecosystem services (ES) vital to local populations' support, development and well-being. However, those areas face multiple challenges (e.g. agricultural abandonment or intensification) that require the co-creation of sustainable solutions toward agroecology that might be supported by the ES framework. Additionally, these issues should be discussed with local stakeholders and be included in decision-making processes. To meet this gap, the 'CULTIVAR' research and innovation project for the sustainable development of the agri-food sectors in the Portuguese Beira Interior region included a co-creation strategy to address the vision and interests of local actors. Using participatory methodologies, including workshops, face-to-face and online surveys, primary ES perceived by stakeholders in the territory were identified. Twelve key services were selected for mapping based on secondary data. These maps were then presented and discussed with stakeholders in participatory workshops to validate the results and promote a discussion on sustainable development strategies, including a participatory SWOT analysis and a "reverse engineering" approach (TWOS) to help defining suitable strategies to enhance the territory's ES and support the transition to agroecology, aiming to restore the traditional agroforestry mosaic that used to characterises the region few decades ago.

Keywords: ecosystem services, participatory methodologies, agroecology, agroforestry mosaic,



6. Insights from preliminary field observations: pollinators diversity with different crops and plants in agroecosystems

First author(s): Mónica Q. Pinto

Other author(s): Simone Varandas, Sandra Sarmento, Edna Cabecinha

Affiliation: CITAB, Universidade de Trás-os-Montes e Alto Douro, Inov4Agro, Quinta dos Prados, 5000-801, Vila Real, Portugal

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Agroecology and ecosystem services (ES) are closely linked, promoting sustainable management of agroecosystems. There is growing interest in agroecology as a sustainable innovation, crucial for transitioning towards sustainable agriculture. This study investigates the diversity and abundance of pollinators across different plant species, highlighting the importance of pollination as a key ES.

Field observations were conducted during the flowering periods of different plant species (juniper, lavender, fennel, rockrose, strawberry tree, and cistus) and crops (vines, orange tree, almond tree and, olive tree), with each observation lasting ten minutes and repeated five times. Data were collected on honeybees, wild bees, hoverflies, and butterflies. Preliminary results revealed significant variations in pollinator diversity and abundance among plant species. Honeybees were most common, notably abundant in orange trees [16;30] and least abundant in juniper [4;10]. Wild bees exhibited high diversity in almond trees [12;26] and lavender [8;20] but were absent in vines and orange trees. Hoverflies were frequent in vines, lavender, and fennel [2;14]. Different butterflies' species were present across all plant species, with notable diversity in lavender and rockrose.

The results highlight the importance of plant diversity in supporting a wide range of pollinators. In this study, plants such as lavender and almond trees were essential for promoting ecosystem resilience. However, the presence of invasive species can attract pollinators away from native plants, posing a threat to local biodiversity

The study underscores the need for agroecological practices that enhance pollinator diversity and abundance. By ensuring a variety of flowering plants within agroecosystems, sustainable agricultural practices can be supported, increasing ecological balance and resilience. Future policies should focus on protecting pollinator habitats and mitigating the impacts of invasive species to preserve vital ecosystem services.

Keywords: Agroecology, ecosystem services, pollinators, crops, plant-pollinator interactions



7. From blurry maps to clear solutions: mapping pest control services for agroecological transition

First author(s): Laura Riggi

Other author(s): Guillermo Aguilera, Pierre Chopin

Affiliation: Swedish University of Agricultural Sciences, Uppsala, Sweden

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Agricultural intensification has led to significant biodiversity loss and a decline in essential ecosystem services, such as natural pest control. Despite its importance, natural pest control is poorly mapped, with only 1% of studies addressing it spatially*. To support agroecological transitions and reduce pesticide use, our study developed an expert-based moving window model to predict natural pest control potential at the landscape scale. This model integrates insights from 52 European experts and considers the impact of landscape and agricultural practices on the abundance of generalist and specialist predators and parasitoids.

Our model was validated against field data, explaining 11% of the variation in generalist carabid predator abundances, though it performed less satisfactorily for other groups. This highlights significant challenges in mapping natural pest control services and understanding their interactions at multiple scales.

Our findings show that our indicator integrating the magnitude of adoption of different ecological intensification practices correlates positively with carabid abundance, despite considerable variation in predictions. This indicator could identify areas with low levels of ecological intensification practices where natural pest control services are expected to be low.

To improve predictions, models must include more specific associations between field and landscape-scale habitat interactions. Experimental research and meta-analyses investigating multiple ecological intensification practices along land-use gradients are needed to quantify these interactions. Additionally, to support farmers' decisions and shift towards low-pesticide agriculture, models need to be trained and tested with accessible, spatially explicit field data made available in online databases.

Ultimately, developing similar spatially explicit models that integrate landscape and field management interactions for multiple ecosystem services, and considering the interplay between pest control and other services like pollination, is crucial. This approach will leverage



multiple ecosystem services for agroecological transitions, supporting sustainable agriculture, biodiversity conservation, and reduced pesticide reliance.

* Englund et al. 2017. 0.1016/j.ecolind.2016.10.009

Keywords: Expert based models, spatial explicit model, multiple scales, ecosystem service mapping

8. Quantification of ecosystem services of narrow-leaved lupins and lentils in mixed cropping systems


First author(s): Philippa von Nathusius

Other author(s): Andreas Kägi, Georgios Karagkounis, Johan Six, Susanne Vogelgsang

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Introducing legumes into crop rotations can play a key role for sustainable agricultural systems. Their potential of biological nitrogen fixation can be used to reduce the application of synthetic fertilisers and due to diversification of crop rotations, the overall disease and pest pressure can be decreased, resulting in reduced application of pesticides. Furthermore, grain legumes, rich in proteins, are highly valuable for human nutrition especially within plant-based diets. Nevertheless, cultivation of grain legumes can be associated with a high risk for farmers. The low competitiveness of the pure stands and high tendencies of lodging in lentils are limiting factors for widespread cultivation. Intercropping legumes has shown potential in buffering those risks and increasing the land use due to niche differentiation, increased diversification and reduced synthetic inputs. Still, the benefits of introducing legumes in intercropped systems into crop rotations are rarely quantified and ready-to-use tools for farmers are missing. The European project LEGENDARY (www.legendaryproject.eu) addresses these issues. To quantify the ecosystem services of legumes in different management systems, we are conducting field experiments cultivating lupins (*Lupinus angustifolius*) and lentils (*Lens culinaris*) in intercrops with oats as well as in pure stands. While focusing on regulating and provisioning ecosystem services, pre-harvest assessments for quantifying the weed, disease and pest pressure are performed. Furthermore, the abundance of pollinators during flowering of the legume and the abundance of beneficial insects as well as the impact on the soil fertility and structure including the erosion potential is investigated. To assess the land use, yield and yield quality parameters



are determined. Focusing on nutrient availability and uptake, the legacy effect of the legumes and the cropping systems will be assessed by sowing barley as a subsequent crop and analysing soil and plant samples. Preliminary results from the first season will be presented.

Keywords: Sustainable agroecosystem · ecosystem service · legume · intercropping

9. One Health approaches to support Agroecological transformation and the provision of Ecosystem Services in peri-urban farming: the experience from west Africa.

First author(s): Vasileios Gkisakis

Other author(s): Argyro Kalaitzaki, Ioannis Koufakis

Affiliation: Hellenic Agricultural organisation (ELGO) – DIMITRA, Institute of Olive Tree, Department of Olive and Horticultural Crops Subtropical Crops and Viticulture,

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One Health is an integrated approach that recognizes the health relationship among ecosystems, plants, animals and people while it ensures that multiple sectors work together to tackle respective health threats. This interconnection becomes important due to the increasing world-wide adoption of urban and peri-urban farming. Indeed, a migration of rural people to cities is prominent, particularly in areas like Western Africa, which besides the advantages of peri-urban farming, it also raises concerns about sanitary issues and environmental degradation. The URBANE is a Horizon Europe project applying a One Health approach to study issues related to the application and intensification of peri-urban agriculture built around the principles of agroecology. It aims to explore links between farming practices and health, for tackling issues related to the application & intensification of peri-urban farming and the health of animals, humans and ecosystem as a whole. URBANE designs real-world case studies that cover different farming zones in six Western African countries; Specific pilot sites are selected following a series of assessments, registering capabilities and potential impact of the project approach in these farms considering both agro-environmental factors but also socio-economic ones. The project supports that applied agroecology allows the achievement of better health of humans, animals and the ecosystem & respective services by promoting improvements in their physical and psycho-emotional states. It has already developed an integrated strategy for the promotion of agroecological farming practices, in combination with the development of novel technologies and Decision Support Systems, as well as the formulation of policy



recommendations to allow expanding the reach of the approach and positively influence and support of its broader adoption.

Keywords: One-health, agroecology, peri-urban, Africa

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: S1b


Assessing trade-offs between ecosystem services in agroecological transitions of agrifood systems

Hosts:

	Name	Organisation	E-mail
Host:	Livia Madureira	UTAD/CETRAD (Centre for Transdisciplinary Development Studies)	lmadurei@utad.pt
Co-host(s):	Carla Ferreira Monica Dantas Mário G. Santos	UTAD/CETRAD UTAD/CETRAD UTAD/CITAB (Centre for the Research and Technology of Agro-Environmental and Biological Sciences)	carlacf@utad.pt monicadantas@utad.pt mgsantos@utad.pt

Abstract:

Agroecology and ecosystem services are closely linked, with agroecological practices promoting the sustainable management of agroecosystems. There is growing interest in agroecology, as a sustainable innovation, that plays a crucial role in the transition towards sustainable agriculture (Bilali, 2019). Agroecology also provides the scientific and methodological basis for transitioning to new paradigms of rural development, emphasising the importance of farmer-led participation and extension (Lianu et al., 2023). Thus, this transition process requires changes in practices, knowledge generation, social and economic relations, and institutional conditions (Gliessman, 2018). Therefore, specific policy frameworks are essential to support agroecology and to establish sustainable strategies in the face of climate change and development pressures. Given the multifaceted nature of agroecological transitions and the need for a holistic approach that considers social, political, economic and environmental aspects, a discussion on the trade-offs of agroecological transitions in agrifood systems is needed. Several authors emphasise the need



to understand the internal and external factors influencing the transition process and propose methodologies to assess human capital, management capacity, agroecosystem quality and transformability (Darmaun et al., 2023; Ong & Liao, 2020). In addition to these research strands there is an interesting room to explore and to assess the trade-offs between ecosystem services involved by the agroecological transitions (e.g. fire risk and non-tillage eco-functional farming practices). The choices regarding these trade-offs and co-benefits involve social-ecological systems under uncertainty and different socio-cultural perspectives.

This session welcomes abstracts for brief presentations (5 min) that will foster collective discussions on the following topics:

- Approaches, frameworks, methods, and tools for assessing socio-ecological trade-offs and co-benefits between ecosystem services in agroecological transitions.
- Metrics and indicators for assessing agroecological transitions built on the ecosystem services approach.
- Policies, strategies, and practices supporting the design of agroecological transitions as transformative changes towards more sustainable, resilient, healthy, and ethical agri-food systems.

The overall aim of the session is to strength a transdisciplinary community linking ecosystems services approach to agroecological agrifood systems transitions, including the edition of a special issue on “Trade-offs between ecosystem services in agroecological transitions of agrifood systems: Assessment and measurement approaches”.

References:

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- Ong, T.W., & Liao, W. (2020). Agroecological Transitions: A Mathematical Perspective on a Transdisciplinary Problem. *Frontiers in Sustainable Food Systems*, 4



Goals and objectives of the session:

This session welcomes abstracts for brief presentations (5 min) that will foster collective discussions on the following topics:

- Approaches, frameworks, methods, and tools for assessing socio-ecological trade-offs and co-benefits between ecosystem services in agroecological transitions.
- Metrics and indicators for assessing agroecological transitions built on the ecosystem services approach.
- Policies, strategies, and practices supporting the design of agroecological transitions as transformative changes towards more sustainable, resilient, healthy, and ethical agri-food systems.

The overall aim of the session is to strength a transdisciplinary community linking ecosystems services approach to agroecological agrifood systems transitions, including the edition of a special issue on “Trade-offs between ecosystem services in agroecological transitions of agrifood systems: Assessment and measurement approaches.

Planned output / Deliverables:

The overall aim of the session is to strength a transdisciplinary community linking ecosystems services approach to agroecological agrifood systems transitions, including the edition of a special issue on “Trade-offs between ecosystem services in agroecological transitions of agrifood systems: Assessment and measurement approaches.

Session format:

1 hour: max. of 5 presentations (5 min. each) + 20 min discussion + 10 min collaborative wrap-up (including future work)

1:30 hours: max of 10 presentations (5 min. each) + 30 min discussion + 10 min collaborative wrap-up (including future work)

II. SESSION PROGRAM


Room: Expert Street 3

Date of session: 21st of November 2024

Time of session: 11:00 – 12:30 & 13:30 – 15:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
11:00	Lívia	Madureira	UTAD/CETRAD	Introduction to the SS
11:10	Nicole	Cecchinato		The importance of land management practices for ecosystem services evaluation in Europe: a literature review
11:20	Cian	Blaix		Agroecological interventions contribute to greater climate change mitigation and biodiversity in Europe
11:30	Youssef	Wang-Touri		Improving soil quality while preserving farmers' income: An ecosystem services-centered conceptual framework
11:40	Lívia	Madureira	UTAD/CETRAD	Integrated Assessment Framework for Socio-Ecological Trade-offs in Agroecological Transitions
12:50	Frédéric	Joly		Inferring regulating ecosystem services supplied by animal production systems from life cycle assessment
12:00	all	all		Discussion (Approaches, frameworks, methods, and tools; Metrics and indicators)
13:30	Claudio	Petucco		Coupling Agent-Based Modelling, Life Cycle Assessment, and ecosystem modelling for the sustainability assessment of agricultural systems: an application to farmer clusters
13:40	Marco	Moretti		An evaluation of the crop sequences adopted by potato growers in Flanders, Belgium



Time	First name	Surname	Organization	Title of presentation
13:50	Sylvia	Vetter		Carbon dioxide removal through Enhanced Rock Weathering: impacts on ecosystem services
14:10	Ana	Márquez–Barrenechea		Microbial diversity in tomato rhizosphere soil under varying agroecological management
14:20	Megan	Critchley		Mapping the potential for cocoa agroforestry as an NbS in Ghana: can national scale ES assessments support transformational change?
14:30	Suvangi	Rath		Spatio-temporal Dynamics and Valuation of Agricultural Ecosystem Services in Eastern India
14:40	all	all		Discussion (Metrics, indicators, Policies, strategies, and practices)
15:00				End of the session

III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Microbial diversity in tomato rhizosphere soil under varying agroecological management

First authors(s): Ana Márquez Barrenechea

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Soil microorganisms contribute to numerous ecosystem services that are essential to the sustainable functioning of agroecosystems. They may increase crop yield, contribute to carbon and nutrient cycles, and enhance food web interactions. Cropping management leads to changes in the soil environment, giving preference or preventing the development of certain



microbial communities. Agroecological practices –such as reduced tillage or green manure– are agricultural practices aiming to produce significant amounts of food while being based on ecological processes and ecosystem services. Our study aims to explore the effects of agroecological practices on soil microbiome. During July 2024, three representative samples were collected in 15 tomato plots under varying agroecological management, placed in two plains of the SE of the Madrid region (Spain). We determined microbial abundance (DNA extraction and real-time PCR), microbial diversity (Illumina MiSeq sequencing on 16S rRNA and ITS marker regions), and soil physicochemical properties. We identified variate communities of fungi and bacteria present in tomato rhizosphere soil in all samples. The use of mineral fertilisers and pesticides affected microbial communities, resulting in significantly enhanced biological and functional diversity in plots under agroecological management. Agricultural practices such as crop rotation or organic amendments, influenced microbial communities' abundance, as they induce changes in soil organic matter quantity and quality. Overall, these findings provide empirical evidence on the positive effects of agroecological practices on microbial communities under real farming conditions, contributing to the transition towards sustainable and resilient agroecosystems.

Keywords: Agroecology, Ecosystem services, Horticulture, Microbial communities, Soil biodiversity

2. Agroecological interventions contribute to greater climate change mitigation and biodiversity in Europe


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Considering the impact that the agricultural sector currently has on biodiversity and the environment, alternative agricultural systems are needed. There is a need for agriculture to look beyond maximising production yields by also focusing on the public goods that it can provide. Agroecology is based on a set of principles associated with sustainable food production. Adherence to some of the principles pertinent to the field and agroecosystem scale should in theory lead to more environmentally-friendly practices and increase ecosystem service provision. A meta-analysis was conducted using data from 172 studies across Europe to test if adopting agroecological systems or practices (henceforth both are referred to as interventions)



results in an increase in biodiversity and climate change mitigation compared to conventional interventions in Europe. We found that agroecological interventions had a positive effect on biodiversity and climate change mitigation in general. For biodiversity, significant positive effects were found for all five functional groups identified except for macro-decomposers. Effects were positive for taxa abundance, richness, and diversity indices (e.g. Shannon) apart for taxa evenness. A positive effect was also found for carbon storage and for the reduction of N₂O emissions. Biodiversity and climate change effects were positive in herbaceous cropping systems, perennial systems, and grasslands, but no significant effects were found in market garden systems, possibly due to the lower number of studies found which were conducted in that system type. These results demonstrate the importance of agroecology in providing ecosystem services and further effort should be made to implement sustainable food systems in a bid to tackle climate change and preserve farmland biodiversity by developing European and national policies to facilitate the scaling up of agroecology.

Keywords: meta-analysis, ecosystem service, environment, sustainable farming

3. The importance of land management practices for ecosystem services evaluation in Europe: a literature review


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Agroecology integrates scientific disciplines, practical techniques and socio-political movements, offering a sustainable approach that enhances ecosystem services through practices (Tittonell et al., 2020; Wezel et al., 2009) aiming to reduce environmental impacts while improving biodiversity, soil health, and water quality for instance (HLPE, 2019). A systematic literature review was conducted to evaluate the importance of land management practices in agroecosystems for ecosystem services production at a European scale. Conventional practices (e.g. soil tillage, monoculture) were compared with agroecological practices (e.g. intercropping, agroforestry) based on their impacts on specific ecosystem services such as carbon sequestration, soil quality, water regulation, and biodiversity (Wezel et al., 2014; European Commission, 2021). The review analyzed 206 papers published between 2000 and 2023, categorizing 74 as qualitative and 132 as quantitative. The data were compiled in an Excel file for database creation, with quantitative assessments using R modeling and



spatial representation planned for subsequent phases of the project. Tools such as QGIS and TEEBAgri-Food Framework can be employed to quantify the benefits of agroecology, facilitating the development of an Evaluation Framework Tool (EFT) for systematic assessment.

As shown, agroecological practices present numerous positive ecological impacts across different scales by strengthening the agroecological systems and increasing resiliency towards environmental stress due to their diversified and ecologically balanced nature (Tittonell, 2014). Despite of these benefits, they also may present limitation and potential negative impacts (e.g. higher competition for nutrients), when there is an improper implementation of the agroecological practices (Pittelkow et al., 2015).

In conclusion, agroecology holds significant promise for enhancing ecosystem services, promoting agricultural sustainability, and addressing global challenges such as food security, biodiversity loss and climate change in European agroecosystems. Collaborative efforts from policymakers, researchers and stakeholders are essential to overcome barriers and facilitate the transition to more resilient agricultural systems (Smith et al., 2021).

Keywords: land management practices, ecosystem services, agroecological practices, Evaluation Framework Tool (EFT), European scale.

4. Mapping the potential for cocoa agroforestry as an NbS in Ghana: can national scale ES assessments support transformational change?

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Cocoa is a major cash crop in Southwest Ghana and supports the livelihoods of hundreds of thousands of smallholder farmers. Conventional practices, such as monoculture plantations, can result in low long-term yields while negatively impacting biodiversity and the surrounding environment. Current production practices further reduce the wellbeing and climate-resilience of cocoa farmers by eroding the provisioning of ecosystem services, which fundamentally underpin cocoa yields. Using an ecosystem services approach, we can identify opportunities to implement nature-based solutions (NbS) to address challenges related to farmer livelihoods, climate change and biodiversity loss at scale. This project aimed to provide data and evidence



in the form of spatial maps to support the implementation of more sustainable, climate-resilient cocoa agroforestry land use practices, that contribute towards alleviating multidimensional poverty while enhancing nature.

We modelled the potential outcomes of transitioning existing cocoa areas towards agroforestry practices across Ghana. Ecosystem services and biodiversity modelling were used to map areas where the expansion of agroforestry practices would be most beneficial. It found opportunities to increase tree coverage across nearly two million hectares of low-shade cocoa plantations. Establishing appropriately shaded and well-managed cocoa plantations in proposed areas alongside restoring forest reserves has the potential to protect at least 4,000 tonnes of sediment from erosion each year and store an additional 52 million tonnes of carbon. However, institutional and socio-economic barriers to scaling changes in agricultural systems remain. Questions remain over whether national scale modelling exercises are sufficient for catalyzing action on the ground. Although they cannot capture the full biogeographical and socioeconomic conditions in these dynamic landscapes, they can contribute towards advancing knowledge and evidence. Therefore, this presentation will also discuss the next steps required to ensure large-scale ecosystems services and NbS assessments can drive positive agroecological transitions that enhance the livelihoods of people on the ground.

Keywords: Agroforestry, Ecosystem services, Spatial planning, Agro-ecological transitions, Trade-offs

5. Inferring regulating ecosystem services supplied by animal production systems from life cycle assessment


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Life cycle assessment (LCA) and ecosystem services assessment (ESA) are often used for environmental evaluation. LCA appeared in the 1960s and it is commonly used to estimate the negative environmental impacts of human activities (e.g. CO₂-eq emissions and energy consumption). It can rely on well-established databases and software. ESA originates from ecology and economy and grew popular by the 2000s; and it focuses on positive impacts. LCA established that one kg of human edible protein (HEP) generated higher impacts when it was



provided by ruminant livestock than when it was provided by monogastric animals. Here we applied both methods to a selection of twelve contrasting meat animal production systems, six ruminants (RUM) and six monogastrics (MON), including one agroecological organic pastoral system. We used the LCA inventory approach and Agribalyse database to characterize the land occupation of the systems, i.e. the list of land cover types they used (e.g. croplands and grasslands). From this list and quantification of six regulating ES according to covers, following the ES capacity matrix approach, we conducted ESA. We confirmed that ruminant systems had higher LCA impacts than monogastric systems for one kg of HEP (e.g. energy consumption was 351 vs 189 MJ for RUM and MON, respectively), and the trend was opposite for LCA impacts per m² of land occupied (i.e. 0.71 vs 3.63 MJ for RUM and MON, respectively). We also observed a higher capacity to supply regulating ES for ruminants than monogastrics, with mean scores of 2.4 and 1.2, due to the presence of grasslands of different types in ruminant systems. We finally observed strong correlations between regulating ES and several LCA impact indicators per m² of land occupied (R^2 from 0.78 to 0.85). It suggests that LCA and related tools could be used to generate proxies of regulating ES.

Keywords: Agri–food system, pastoral system, human–edible protein, life cycle assessment, regulating ecosystem services

6. Integrated Assessment Framework for Socio–Ecological Trade–offs in Agroecological Transitions

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Agroecology and ecosystem services are closely linked, with agroecological practices promoting the sustainable management of agroecosystems. There is growing interest in agroecology as a sustainable innovation, playing a crucial role in the transition towards sustainable agriculture. Agroecology also provides the scientific and methodological foundation for transformative paradigms of rural development, emphasizing community–led participation and local knowledge. Agroecological transitions require changes in practices, transdisciplinary knowledge generation, social and economic relations, and institutional innovations. Assessing trade–offs in ecosystem services, including food production, regulation, and cultural services, through trade–off analysis and data–driven scenarios submitted for community analysis and deliberative



choice, will help bridge the gap between global policies (e.g., EU Green Deal) and the transition paths desired by farmers and communities at the local level. Here, we present an integrated assessment framework aimed at evaluating the socioeconomic benefits and socio-ecological trade-offs of sustainable and resilient agriculture and agrifood systems by combining data with stakeholders' subjective evaluations. The framework is being developed within the Horizon project AgroServ (agroserv.eu). The Douro Socio-Ecological Living Lab, led by UTAD, hosts the testing and pilot implementation of this framework in the context of the ongoing agroecological transition in the Douro Mediterranean mountainous wine region in Portugal. One of the framework's steps involves outlining feasible and desirable transition paths for rural landscapes using a socio-technical transition scenarios approach, encompassing the multidimensionality of the transition, triggers, and drivers (e.g., agro-production systems, technology, regulation, policy incentives, market and consumer preferences, societal pressures).

Keywords: Agroecological transition, Assessment framework, Ecosystem Services, Socio-Ecological, Trade-off Analysis

7. Coupling Agent-Based Modelling, Life Cycle Assessment, and ecosystem modelling for the sustainability assessment of agricultural systems: an application to farmer clusters

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In the last decades, there has been an increased interest in understanding the role of ecosystem services as factors of production. In the context of the FRAMEWORK project (European Union's Horizon 2020 research and innovation programme under grant agreement No 862731), the creation of farmer clusters is proposed as an innovative paradigm to achieve sustainability and conservation goals. For that purpose, this study analyses the dynamics and the effects that the provision of ecosystem services can have as factors of production in the environmental sustainability of agricultural systems. For this, we integrated farmer's behaviours and cooperation, as well as market conditions and policies with ecological models that represent the contribution of natural ecosystems to agriculture. We measured relevant indicators such as the substitution rate between technological and natural capital (e.g., pesticides vs natural predation), and its relationship with the environmental sustainability of the agricultural system using Life Cycle Assessment (LCA) (e.g., EF v3.0). We modelled farmers that interact among



each other and with the market at a landscape scale. Moreover, we simulated the enhancement and conservation of ecosystem services provision in the form of public goods originated by biodiversity sensitive farmer clusters. Finally, our ambition is twofold. Firstly, we aim to explore the initial conditions that ensure the emergence, viability, and maintainability of farmer clusters. Secondly, we seek to transfer these findings to landscape actors and audience networks and decision makers to make them accessible and useful by providing simplified surrogate models through the Recodo platform.

Keywords: Biodiversity, Farmer Clusters, Landscape, Agent Based Model, Life Cycle Assessment

8. Improving soil quality while preserving farmers' income: An ecosystem services–centered conceptual framework


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While farmers can enhance soil quality by modifying their production management, this can lead to trade-offs with farm income, which constitute a challenge that can restrain farmers from improving soil quality. To alleviate these trade-offs, focusing on improving ecosystem services (ESs) rather than soil quality could offer the potential for improving soil quality and preserving farm income as ESs can be marketed. In this context, it is fundamental to understand the exact consequences for farmers' income and soil quality if farmers attempt to improve ESs. Several studies have approached part of the problem, however, studies that consider ESs at the center of the decision-making process are lacking, and/or are poorly addressing the problem as a whole. We developed a conceptual framework that provides a holistic qualitative understanding of the problem and a blueprint for quantitative analysis. The framework consisted of setting the objective as 'Improving ESs' while considering soil quality, production management, and farm income as influenced by this objective. From this approach, it appeared that 'Improving ESs' results in a sequence of requirements and consequences that affect farm income: (1) 'Improving ESs' requires changing production management; (2) changing production management influences soil quality; (3) 'Improving ESs' indirectly influences soil quality through production management; and (4) 'Improving ESs', production management and soil quality have a combined effect on farm income. Each relation was then described qualitatively based on literature and using 19 ESs, 50 farming practices, and 19 soil quality indicators. Finally, using the conceptual framework, the paper presents several major insights and a blueprint for



quantitative analysis that can contribute to developing sustainable (people: ESs, planet: soil quality, profit: farm income) farm business models. In particular, it becomes obvious that synergies between ESs and soil quality offer the potential to reduce the marginal costs of further improving soil quality.

Keywords: Farming practices, Ecosystem services, Soil quality, Farm income, Trade-offs

9. An evaluation of the crop sequences adopted by potato growers in Flanders, Belgium


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Healthy soils play a fundamental role in the provision of many ecosystem services (ES). Some of the main factors influencing soil health are the agricultural practices adopted by farmers, such as the sequence of crops grown through time in a given field. In fact, these sequences have a major impact on the soil and its ability to provide services essential to human life and the health of many ecosystems. Understanding how farmers make decisions about crop sequence is therefore essential to promote crop sequences that can positively influence the provision of ES from the soil. These sequences can range from complex crop rotations to the simple monoculture; generally, more diverse sequences are expected to have positive effects on soil health and biodiversity. Potatoes are a good example of a western European cash crop that can have a significant impact on soil health. The aim of this article is to study and evaluate the crop sequences implemented by potato growers in Limburg and in Flemish Brabant, Belgium, between 2008 and 2021. First, the number of crops in a sequence, or crop diversity, and their return times were evaluated for all the sequences. Second, this information was combined to obtain a Rotational Complexity Index (RCI), which was used to evaluate the change in complexity of these sequences between the periods 2008–2014 and 2015–2021. Third, a more detailed analysis of the evolution of the return time for potato was performed. Between the two reference periods, there was a general increase in the RCI, with sequences characterised by a greater variety of crops. The return time for potatoes has also changed, with the 4-year return time that significantly increased. The methodology of this research can be successfully applied by researchers and policy makers studying crop choice and rotation practices.



Keywords: Soil health, Crop rotations, Crop sequences, Land management, Sustainable agri-food management

10. Carbon dioxide removal through Enhanced Rock Weathering: impacts on ecosystem services

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Practices promoting the sustainable management of agroecosystems include carbon dioxide removal (CDR) technologies, which can have large impacts on helping to regulate the carbon dioxide (CO₂) emitted to the atmosphere and therefore the climate. Enhanced rock weathering (ERW) as a CDR technology is used by accelerating the natural geological process CO₂ removal through the application of crushed silicate rocks to agricultural soils. Besides the CO₂ removal potential, the calcium and magnesium-rich rocks have co-benefits and trade-offs. The whole life cycle of using ERW from mining rocks, grinding, transportation, and application on the soil impacts several ecosystem services (e.g. soil functions, nutrient cycle, energy use, and raw materials). Large-scale implementation of ERW could remove up to net 2 Gt CO₂ yr⁻¹ via the whole supply chain. The implication of the large-scale implementation on soil parameters and agricultural production is analysed by reviewing existing studies focusing on soil impacts and yield through different rock mix applications, meta-analysis, and modelling. As the composition of silicate rocks differs, the analysis focused on the amount of chemicals that are applied to the field. Results show a relationship between the amount of silicon dioxide (SiO₂) and potassium oxide (K₂O) that is applied to a change in yield. The meta-analysis showed that yield increases with rock dust application up to an optimum amount (depending on soil and vegetation type) but could decrease with higher application rates. Spatial modelling shows results for Europe with differences for the regions where, based on the soil type, CDR can be maximized under an increase in yield, highlighting the co-benefits of the CDR method.

Keywords: Enhanced rock weathering, agriculture, yield, spatial modelling, carbon dioxide



11. Spatio-temporal Dynamics and Valuation of Agricultural Ecosystem Services in Eastern India

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Demographic, economic, social, and climatic changes are exerting increasing pressure on natural resources due to growing global demands for energy, food, and water. This threatens the well-being of the ecosystems we rely upon. To shift towards sustainable development, strategic decisions on natural resources need to be better valued and responsibly managed. Given that ecosystems can provide mitigation and adaptation services, the policies and local initiatives related to ecosystem management should integrate both climate change strategies and avoid trade-offs between them. Our study aims to map and study the land use land cover (LULC) dynamics of ecosystem services in the rainfed and irrigated ecosystems of Eastern India using ArcGIS and the equivalent factor valuation method. The LULC change revealed that the agricultural ecosystem did not increase over the years rather in Bungapali village, there was a decrease in the agricultural ecosystem due to conversion into built-up areas. The absolute change in the values of different ecosystem services between 2005 and 2020 was \$66431/ha/year. We also estimated the monetary values of irrigated and rainfed paddy ecosystems. It was concluded that the irrigated paddy ecosystem delivered higher net ecosystem services (\$4107/ha/year) than rainfed paddy ecosystems. Our study suggests that policies should mainstream the valuation and preservation of ecosystem services into national development plans, promote sustainable agricultural practices, and enhance climate resilience through ecosystem-based approaches. Incentivizing farmers through payment for ecosystem services is necessary to enhance the supply of ecosystem services to society. Further, incorporating ecosystem service valuation into economic decisions, strengthening environmental governance, and increasing public awareness are critical steps. This integration will not only support specific SDGs related to poverty, hunger, health, and climate action but also foster a holistic approach to achieving all 17 SDGs, leading to a more resilient and sustainable development of agroecosystems..

Keywords: Agriculture, Ecosystem Services, Land use/cover change, Valuation

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: S1c

Agroecology and nature-based solutions as transformative pathways towards sustainable agriculture

Hosts:

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Abstract:

The historical pursuit of hyper-efficient and productive goals has trapped European food systems in an unsustainable trajectory, underpinned by inequitable tele-coupled social-ecological dynamics with severe negative impacts on ecosystem services in Europe, and beyond. Some major consequences include a general homogenization of agricultural landscapes, the decline of biodiversity, and the increasing impoverishment of rural communities. Despite policy goals aimed at addressing key issues such as biodiversity loss, water quality degradation, and climate change mitigation, achieving meaningful progress towards achieving these goals remains a challenge within the confines of conventional agricultural paradigms. In this session, we advocate for a transformative shift towards food systems dominated by agroecological principles and nature-



based solutions tailored for farming systems, which could revitalize rural communities while contributing to ecosystem services and food security.

Central to this transformation is the pivotal role of farmers as agents of change. By embracing agroecological principles and nature-based solutions, farmers can catalyze a shift towards environmentally conscious practices, enhancing their resilience and productivity. This transformative potential spans ecological benefits, such as biodiversity conservation and soil health restoration, economic advantages through alternative business models and income diversification, and social gains by fostering community engagement.

In this context, it becomes evident that successful transitions to more sustainable farming practices necessitate a holistic understanding that integrates the ecological, economic and social dimensions.

There are multiple studies and initiatives that could serve as examples of best practice. However, these initiatives are often isolated, and there is not a completely clear overview of how the principles of agroecology are being applied.

By examining both successes and failures, as well as identifying potential blocking factors (ecological, social, economic, political or other), we can develop a more comprehensive understanding of the challenges and opportunities associated with advancing towards a more sustainable agricultural future. These insights not only inform policy-making but also empower stakeholders to navigate the complexities of agricultural transformation with greater efficacy.

Goals and objectives of the session:

By bringing together experts on nature-based solutions, agroecology, ecosystem services and transformative change, the objectives of the session are:

- Facilitate the exchange of knowledge and experiences on agroecology-related research and implementation, showcasing successful case studies and initiatives that demonstrate its transformative potential for supporting ecosystem services.
- Foster collaboration and networking among participants working towards common goals in promoting nature-based solutions and agroecology and sustainable food systems.
- Highlight shared challenges to mainstreaming nature-based solutions and agroecological principles in food systems, as well as opportunities for overcoming them.

Planned output / Deliverables:

Depending on the interest of participants in the session, the session will kickstart the process of working together in a synthesis scientific manuscript focused on the topic of the session



II. SESSION PROGRAM

Room: Expert Street 6

Date of session: 21st of November 2024

Time of session: 11:00–12:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
11.00– 11.05	Johanna	Schild	PBL Netherlands Environmental Assessment Agency	Session introduction
11.05– 11.17	Susana	López Rodríguez	Wageningen University & Research	Diversified agricultural systems as a nature based solution to increase biodiversity and productivity
11.17– 11.29	Sophie	Meier	Leinbniz Institute of Ecological Urban and Regional Development	Assessing wild bee habitat from landscape features
11.29– 11.41	Jiri	Louda	Jan Evangelista Purkyne University in Usti nad Labem	The farmer's and resident's perspectives on implementation of nature-based solutions on agricultural land
11.41– 11.53	Ton	de Nijs	National Institute for Public Health and the Environment (RIVM)	Social cost-benefit analysis of field margins in the Hoeksche Waard, the Netherlands
11.53– 12.20	Solen Marjolein	le Clech' Lof	Wageningen University & Research	Co-creation discussion about challenges and opportunities from different perspectives in small groups
12.20– 12.30	Mario	Torralba Viorreta	VU University Amsterdam	Wrap-up



III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Social cost–benefit analysis of field margins in the Hoeksche Waard, the Netherlands

First author(s): Ton de Nijs

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Field margins are strips of land with grass or flowers on which no crops are grown. They are located between fields or between a field and a ditch. When designed for this purpose, field margins support natural pest control. As a result, there are fewer pests, less crop protection products need to be used, and less of these products end up in ditches. Field margins support the natural control of pests by insects. As a result, fewer pests. The field margins also increase biodiversity and pollination. They also limit the nitrogen and phosphate run off into the ditch. In addition, a more attractive landscape for recreation is created. The European Union wants to encourage the creation of field margins. RIVM has therefore calculated whether the benefits of field margins outweigh the costs over the course of 30 years (2025–2055). This so-called social cost–benefit analysis (SCBA) was done for the Hoeksche Waard because of its large amount field margins. In this SCBA, the effects on eight themes have been calculated. These include crop production, pollination, pest control, water quality, climate, recreation and biodiversity. The benefits of field margins for people, nature and the environment appear to be about the same as the costs. Basically, a more attractive landscape and lower costs for the water board to purify surface water outweigh a smaller cropping area and the costs for farmers to create the margins. Two 'benefits' that cannot be expressed in monetary terms and have therefore been assessed ecologically are also greater with field margins. It concerns biodiversity and the self-cleaning capacity of water and soil. Twelve variants have been calculated for this study in order to be able to take uncertainties into account. Seven of the twelve variants showed higher benefits than costs, such as the effects on health and less crop protection products in ditches, could not be included in this SCBA. If it had, the calculated benefits would probably have been greater. An additional advantage is that field margins along ditches help to achieve the goals of the Water Framework Directive for plant protection products. The costs now lie mainly with farmers and co-financing government bodies. RIVM sees opportunities to create new revenue models in which the costs and benefits are distributed more fairly among the various parties involved.



This can make it more attractive for farmers to build field margins. This SCBA can be used for this.

Keywords: social cost benefit analysis, field margins, functional agrobiodiversity, sustainable agriculture, Hoeksche Waard.

2. Assessing wild bee habitat from landscape features

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Pollinating species such as wild bees contribute both to produce crops and to maintain biodiversity and ecosystem functions. Wild bees are strongly linked to diverse landscapes and agricultural intensification is a challenge for them to find appropriate habitat. A wild bee habitat indicator was developed that consisted of a map with the potential spatial distribution of wild bees which is supposed to function as a proxy for the ecosystems' pollination services in Germany (Meier et al. 2021). This indicator was developed based on the ESTIMAP pollination indicator (Zulian et al. 2013). Hereby, experts estimated the habitat quality of different ecosystem types, considering both nesting and feeding opportunities for wild bees.

To validate the ESTIMAP expert assessment, we assessed the link between wild bee occurrence and the proportion of different ecosystem types in studies conducted in Germany and neighboring countries in a meta-analysis. Hereby, we collated results from field studies conducted between 2012 and 2022.

The meta-analysis indicated that semi-natural habitat, groves, and extensive grassland is preferred by wild bees in some cases even for flowering crops. At the same time in crop land, intensive grassland and forest the wild bee abundance and richness is less stable and could fluctuate more strongly during the vegetation season. The meta-analytical results of the field studies go more or less in line with the expert-based assessment of the different potential of ecosystems to provide wild bee habitat and pollination service. Potential research gaps are discussed, as well as limitations concerning generalizing field studies.

In the future, information that could not been assessed in a meta-analysis will be synthesized qualitatively, such as effects of topography on wild bees, small-scale habitat characteristics and



management practices. Furthermore, the results from studies measuring the link between habitat characteristics and pollination service will be collated.

Keywords: Ecosystem service, Spatial analysis, Biodiversity

3. Diversified agricultural systems as a nature based solution to increase biodiversity and productivity

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Nature based solutions for agriculture such as diversification provide an alternative to conventional practices that can lead to a transformation towards sustainable agriculture. Diversified systems combining different crops, integrating non-crop vegetation and agroforestry have been proved to increase biodiversity in agriculture. Additionally, because of the diversity of products obtained, diversified systems increase the resilience of farmers against crop failure. However, diverse systems are not appealing to farmers as they have been associated with low productivity. When comparing diversified and simplified systems though, often only the productivity of the main crop is considered, overlooking the diversity of products obtained in diversified systems. The aim of this research is to evaluate the productivity of diversified agricultural systems considering all the products obtained.

We performed a global meta-analysis comparing the productivity of different diversified systems against simplified control systems. We used Land Equivalent Ratio (LER) as an indicator of productivity. LER was developed to measure the productivity of intercropping considering all the products obtained, and we adapted it to apply it to diversified agricultural systems including crop rotation, orchards with herbaceous soil cover, intercropping and different forms of agroforestry. LER measures the relative land needed in simplified systems to produce the same output as diversified systems, that is, it measures the relative productivity of the land.

We found that diversified agricultural systems are in general more productive than simplified systems. All systems but orchards with soil cover (compared to bare soil) needed less land to produce the same output as in simplified systems. Intercropping, crop rotation and alley cropping are significantly more productive than simplified sole systems. Diversified systems are



therefore a nature-based solution for agriculture that not only benefits biodiversity and acts as an insurance against crop failure, but it can also help to improve productivity.

Keywords: Agroforestry, intercropping, crop rotation, productivity, soil cover

4. The farmer's and resident's perspectives on implementation of nature-based solutions on agricultural land

First authors(s): Jiri Louda

Other author(s): Jan Machac, Jan Brabec, Lenka Dubova

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Long-term pressures on agricultural efficiency, based on synthetic fertilisers, pesticides and intensive technologies, are reducing biodiversity and the ability of landscapes to provide ecosystem services (ES). In the same time the risk of natural hazards due to climate change is increasing and threatening farmers. Changes in farming practices (organic fertilisers, crop rotation, promotion of local production, implementation of nature-based solutions (NBS) can reverse this negative trend. Introducing these changes may increase costs for farmers. Their willingness to make these changes depends on many factors, which are the focus of our research. Perceptions of ES by farmers, and barriers hindering their willingness to implement NBS were studied using semi-structured interviews with farmers, but also the willingness of residents to participate in these changes e.g. by accepting a price increase of agricultural production. Farmers were asked to rank selected ES based on the perceived usefulness for their business. The results show that regulation of hazards and extreme events is of a low priority for majority of them because they value other ES more (production of food; formation/protection of soils). Administrative burden and complicated ownership structure are most important barriers. People's preferences towards sustainable agriculture (including implementation of NBS) were investigated using the choice experiment. We will present the results of the synthesis of the three above mentioned methodological approaches to show the holistic view on the use of ecosystem services concept to foster nature based solutions implementation in agroecology.

Keywords: nature-based solutions; farmers; barriers; interviews; choice experiment

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: S1d

Co-designing biodiversity measures with farmers: Dos and Donts


Hosts:

	Name	Organisation	E-mail
Host:	David Kleijn	Wageningen University and Research	david.kleijn@wur.nl
Co-host(s):	Ignasi Bartomeus Vincent Bretagnolle Kati Haefner Erik Öckinger Simon Potts Lena Schaller Felix Herzog	Agroscope	nacho.bartomeus@gmail.com vincent.bretagnolle@cebc.cnrs.fr kati.haefner@zalf.de Erik.Ockinger@slu.se s.g.potts@reading.ac.uk lena.schaller@boku.ac.at felix.herzog@agroscope.admin.ch

Abstract:

Various approaches have been tried to maintain and improve farmland biodiversity and associated ecosystem service delivery. These include control and command approaches, financial incentives, media campaigns, labels but, so far, haven't resulted in larger scale adoption of biodiversity management by farmers. The most recent approach, that is recommended, is co-design. By involving farmers in the formulation of biodiversity and production goals and in the design of measures to be implemented, this should increase their motivation and hence also improve the biodiversity benefits. Ideally, there will even be win-win solutions, that maintain agricultural yields while increasing farmland biodiversity.

In this session, we will review empirical evidence on the success of the co-design approach. It will be centered around the experience gathered from 10 co-design studies that were conducted across Europe, involving 200 farmers, in the Horizon-2020 project SHOWCASE (showcase-project.eu), but it will be open to reports from additional co-design studies. Contributions will



be focused on the co-design process, on the benefits obtained for farmland biodiversity and for agricultural yield, and on the communication between researchers, farmers and the wider public.

Goals and objectives of the session:

The objective of the session is to answer the following questions:

1. What are the main learnings available to date for farmland biodiversity co-design projects?
2. Can we recommend to roll out the co-design approach in the context of the CAP and – if so – how could this be approached?

Planned output / Deliverables:

Participants will be invited to contribute to an opinion paper on the prospects of farmland biodiversity co-design

II. SESSION PROGRAM


Room: Expert Street 4

Date of session: 18th of November 2024

Time of session: 14:00–17:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
14:00–14:15	Elena	Velado–Alonso	Wageningen University & Research, Netherlands	Lessons learned to effectively co-design biodiversity-friendly interventions in agriculture
14:15–14:30	Sonja	Kay	Agroscope, Switzerland	Agro4esterie: Agroforestry Living Labs in Switzerland
14:30–14:45	Iris	Bohnet	Czech University of Life Sciences, Czech Republic	Co-design as a key strategy to support biodiversity sensitive farming across Europe – Insights from the FRAMEwork project
14:45–15:00	Louise	Vercruysse	INBO, Belgium	Factors for a successful co-design of agri-environmental contracts: experiences from Contracts2.0



Time	First name	Surname	Organization	Title of presentation
15:00– 15:15	Ferdaous	Rezgui	Leibniz Centre for Agricultural Landscape Research (ZALF), Germany	Stakeholders evaluate co–designed diversified Mediterranean farming systems
15:15– 15:30	Verena	Scherfranz	BOKU University, Austria	It’s not only about the money – Economic and non–economic costs of biodiversity measures for farmers
16:00– 16:15	Vincent	Bretagnolle	CNRS, France	Experimenting nature–based solutions with farmers to improve yield, revenue and farm biodiversity
16:15– 16:30	Philippe	Jeanneret	Agroscope, Switzerland	Implementing agroecological practices and biodiversity–based solutions to reduce pesticide use: successes and challenges of a co– design approach in the Swiss context
16:30– 16:45	Niamh	McHugh	Game and Wildlife Conservation Trust, UK	Identification of Farmland Bird Indicator Species for Practitioner Monitoring in the United Kingdom
16:45– 17:00	Reinier	de Vries	Wageningen University & Research, Netherlands	Loss of income constrains management for ecosystem services in agricultural grasslands



III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Co-design as a key strategy to support biodiversity sensitive farming across Europe – Insights from the FRAMEwork project

First authors(s): Iris C. Bohnet

Other author(s): Niamh McHugh, Graham Begg

Affiliation: Czech University of Life Sciences, Faculty of Environmental Sciences, Department of Landscape and Urban Planning

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Building on the Farmer Cluster approach which has evolved over the past decade in the UK as a solution to address ecosystem degradation and biodiversity loss at the landscape-scale, FRAMEwork, a Horizon-2020 project, established a network of 11 Advanced Farmer Clusters (AFCs) across Europe representing diverse farming systems in different social-ecological contexts. A new level of technical and scientific support is offered to the AFCs to provide space for collaboration, co-design, co-innovation, peer-to-peer learning, monitoring and evaluation via transdisciplinary learning processes. Farmers and land managers are central in these transdisciplinary research settings since they are actively intervening in the real-world by implementing (co-designed) biodiversity measures on their farms. However, evidence from the 11 AFCs suggests that involving a diversity of actors in the AFCs, including researchers from different disciplinary backgrounds and societal actors, for example, government officials, policymakers, value chain actors, social entrepreneurs, community groups, and civil society is critically important to their overall success. Illustrative examples from the 11 AFCs will be presented and implications discussed.

Keywords: landscape-scale management, living labs, biodiversity friendly farming, farmer collaboration, collaborative governance



2. Experimenting nature-based solutions with farmers to improve yield, revenue and farm biodiversity

First author(s): Vincent Bretagnolle


Other author(s): Jerome Faure, Jean-Luc Gautier, Antonin Leluc, Sabrina Gaba

Affiliation: CEBC CNRS, 79360, Beauvoir sur Niort, France

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Modern agriculture requires a paradigm shift to make global food production sustainable while mitigating social and environmental externalities. Despite the recent implementation of various policies to limit the use of agrochemicals in the European Union, the use of both pesticides and fertilisers has remained fairly constant. In the European SHOWCASE project, we set up innovative experiments with farmers to explore a portfolio of Nature-based Solutions (NbS) options that offer pragmatic ways of simultaneously meeting food production and biodiversity conservation objectives while maintaining economically viable farming systems. NbS included reductions in pesticides and fertilisers, variations in sowing densities and modulations in soil management, and aimed to improve below- and above-ground biodiversity and ecosystem functioning through the provision of key ecological services. Experiments have been conducted with and by both organic and conventional farmers, and a panel of biodiversity and ecosystem function indicators have been monitored by the research team. Preliminary analysis shows that NbS either had no effect or slightly (but not significantly) reduced yields, demonstrating that reducing reliance on pesticides, fertilisers or soil treatments does not compromise crop production. Furthermore, quantification of gross margins from winter cereal and oilseed rape production showed that NbS is economically viable at field level in the short term, as current farm management in both organic and conventional farming (i.e. relying on agronomic practices) is not sufficient to offset the additional costs of its use. Our study thus helps to fill an important gap in our knowledge of NbS and provides hope for the implementation of win-win strategies for farmers and the environment.

Keywords: Biodiversity, Experiment, farmers, revenue



3. Loss of income constrains management for ecosystem services in agricultural grasslands

First author(s): Reinier de Vries

Other author(s): José van Paassen, Jochen Kantelhardt, Lena Schaller, Gertjan Holshof, Nico Polman, David Kleijn

Affiliation: Plant Ecology and Nature Conservation Group, Wageningen University, Wageningen, the Netherlands

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Ecosystem services are at the very basis of agricultural production, yet few farmers manage for ecosystem service delivery by biodiversity. Instead, conventional farming relies on external inputs that are costly and often negatively affect biodiversity and associated ecosystem services. Enhancing biodiversity could provide win-win solutions for farmers and society, but farmers benefit only if ecosystem service benefits to farming outweigh the costs of biodiversity measures –including management and opportunity costs. We examined how the delivery of multiple ecosystem services relates to agricultural production and income for farmers in grasslands along a management intensification gradient in the Netherlands. To this end we measured ecosystem service delivery in the field and obtained yield and management data from farmer interviews.

We found a significant contribution of legume cover to production which can partially replace fertilizer inputs, and thus reduce environmental impacts whilst maintaining productivity. Nevertheless, ecosystem service contributions to forage production were relatively minor while management intensity maximized productivity as well as farmer income. This implies that most ecosystem services have to be considered public goods, most of which strongly trade off against farmer income. Maintaining these public goods is thus costly for farmers while their degradation causes societal costs. Our results indicate that halting the degradation of ecosystem services on farmland is unlikely to happen without societal support for public good delivery, that would make ecosystem service-enhancing management on farms economically rewarding.

Keywords: Ecosystem services, land-use intensity, public goods, biodiversity, carbon storage



4. Identification of Farmland Bird Indicator Species for Practitioner Monitoring in the United Kingdom

First author(s): Niamh McHugh

Other author(s): Eleanor Ness, Rachel Nichols, Gill Banks, Alon Zuta, Mark Young

Affiliation: Game and Wildlife Conservation Trust


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Bird monitoring initiatives dedicated to the monitoring of common species during the breeding season commenced in the 1960s in Europe, growing to include around fifteen thousand volunteer birdwatchers, across 28 countries. Participating in a breeding bird survey can be challenging for novice birdwatchers as the methods employed are often complicated and require a high level of skill. This may limit their appeal and application, excluding potentially valuable participants such as farmers. Practitioner monitoring is an important activity carried out by Farmer Clusters, where groups of neighbouring farmers work together to deliver landscape-scale environmental benefits, but monitoring typically tends to focus on priority species making it difficult to interpret the wider meaning of these species trends.

There has been a growing appreciation of the role of indicator species in monitoring and assessing farmland ecosystem health. Indicator species are often more easily recognised by novice surveyors and using a narrower range of species in monitoring programs reduces expert surveyor costs and allows communication to focus on specific 'flagship' species whose conservation provides wider benefits to ecosystem health. Indicator species are, however, often selected without clear scientific justification or without clearly demonstrating their appropriateness as indicators of the taxa they are acting as a surrogate for (e.g. wider biodiversity).

Drawing on field data collected through the FRAMEwork project, a multi-institute, pan-European project assessing the impacts of Farmer Clusters on farmland biodiversity, possible farmland bird indicator species for lowland mixed farmland are identified. Their suitability as indicator species is assessed by evaluating relationships between these species and measures of specialist bird abundance and richness, as well as their relationships with wider bird abundance and richness. Monitoring of the selected indicator species was trailed by one Farmer Cluster and feedback sought to determine how willing and able farmers are to participate in indicator species monitoring.

Keywords: Farmer engagement, Citizen science, Biodiversity, Co-design, Ornithology



5. Visions for Biodiversity – Awareness of biodiversity and biodiversity measures of farmers and foresters: A case study from Germany

First author(s): Marion Mehring

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Ongoing environmental changes, such as biodiversity loss and climate change, also affect agriculture and forestry. At the same time, these are key sectors for the conservation and improvement of biodiversity. In Germany, 50 % of land use is accounted for by agriculture and 30 % to forests. However, so far, little is known about the perception and willingness of these actors to conserve biodiversity in the future.

We have thus carried out a socio–empirical study examining the attitudes and objectives of the actors with regard to nature and ecosystem services, the awareness of biodiversity loss as well as the willingness to actively implement biodiversity–promoting measures. We employed a quantitative survey with 500 farmers and 500 foresters in Germany.

The results show a high level of biodiversity awareness in agriculture and forestry. At 2.27, the value in forestry is slightly higher than in agriculture with 2.09 (scale 0–3). A large majority in both stakeholder groups have a high problem awareness (83% forestry, 67% agriculture), recognizes the urgency of biodiversity loss and feels personally responsible for doing something to protect biodiversity (81 % forestry, 85 % agriculture). In both groups, there is a positive correlation between biodiversity awareness and the valuation of ecosystem services: those who see a high benefit in biodiversity also have a greater awareness for the preservation of biodiversity. The main challenges are the implementation of biodiversity–promoting measures rather than doubting the meaningfulness of the respective measures.

Bending the curve of biodiversity loss requires a broad commitment and new alliances between all actors involved. Our study provides a better understanding of how transformative practices and actions towards biodiversity conservation can be achieved by developing common objectives based on shared motivations for the protection of biodiversity.

Keywords: Biodiversity awareness, Forestry, Agriculture, Survey, Social–ecological research



6. Stakeholders evaluate co-designed diversified Mediterranean farming systems

First author(s): Ferdaous Rezgui

Other author(s): Louise Blanc, Daniel Plaza-Bonilla, Jorge Lampurlanés, Christos Dordas, Paschalis Papakaloudis, Andreas Michalitsis, Laure Hossard, Fatima Lambarraa-Lehnhardt

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The quest for agricultural productivity has certainly increased the production, but it has come at the cost of natural resources (Egidi et al., 2022). To promote higher ecosystem services and biodiversity, diversifying rotations with legumes has been proposed as a viable measure (Reckling et al., 2023). Involving local actors when designing and evaluating those alternatives can enhance their transferability and likelihood of implementation (Chopin et al., 2021).

During a first workshop with local stakeholders, diversification options with grain legumes for specialized cereal systems were co-designed in Greece and Spain (Hossard et al., 2024). Using a set of agri-environmental, social and economic indicators, we assessed the performance of designed options in comparison to continuous cereal cropping. During a second workshop, stakeholders were presented with the assessment results and were asked to rate i) the importance of the assessment indicators and ii) the performance of the assessed systems.

In this study, we aim at presenting the results of the stakeholder's ratings using an Importance-Performance matrix (IPM) that measures the satisfaction of stakeholders (Phadermrod et al., 2019) towards the assessed farming systems (with and without legumes).

Greek and Spanish stakeholders rated economic indicators as most important, but not the actual economic performance of the systems (with and without legumes). Conversely, they ranked agri-environmental indicators as less important despite agreeing on the cropping systems performing better in terms of agri-environmental impacts. The stakeholders rated the farming systems highly for social performance, but they gave little importance to social indicators.

Legume integration as a co-design measure to support biodiversity is insufficient for stakeholders if it fails to generate a profit, regardless of how well the farming systems perform in terms of social or environmental impacts. Participatory processes offer stakeholders the opportunity to gain actionable knowledge, that affects their capacity for change and beforehand their willingness to change.



Keywords: diversification, legume, co-design, multi-criteria assessment, stakeholders

7. It's not only about the money – economic and non-economic costs of biodiversity measures for farmers

First author(s): Verena Scherfranz

Other author(s): Henning Schaak, Jochen Kantelhardt, Karl Reimand, Michael Braitto, Flaviu V Bodea, Cristina Costache, Razvan Popa

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This study aims to provide a comprehensive understanding of the economic and non-economic costs perceived by European farmers when implementing biodiversity measures under voluntary biodiversity programs. Recognizing the importance of farmers' long-term engagement for the effectiveness of these programs, we investigate diverse cost perceptions that might influence their continued participation. Given the heterogeneity of farming systems and farmer groups across Europe, the study employs Q methodology across four European regions: Estonia, Romania, the United Kingdom, and the Netherlands.

Through a combination of literature analysis and expert interviews, a Q set of 41 cost aspects was developed. 34 farmers participated in in-person interviews where they ranked these cost aspects, creating individual Q sorts reflecting their holistic views on the costs involved. These sorts were analyzed using the KADE software, which identified five distinct factors grouping farmers with similar cost perceptions. Elicited viewpoints showed that experiences are most impacted by perceived uncertainty, unproductiveness, lack of support, administrative burden, underpayment, or social non-conformity. Each factor thereby encompasses multiple cost types, indicating that perceived costs are multifaceted, involving economic, psychological, social, and management-related dimensions.

This exploratory approach reveals the complexity and plurality of farmers' viewpoints on costs, suggesting that policy adjustments are needed to address both monetary and non-monetary costs to ensure the sustainable participation of farmers in biodiversity programs. While financial compensation is crucial, this study highlights that it is not sufficient alone to address all costs. Management impracticalities and psychological burdens, such as administrative hassles and the loss of social and cultural capital, also play significant roles. Adjustments in program design,



such as result-based compensation to increase on-farm flexibility and biodiversity awards to enhance social appreciation, could mitigate non-economic costs. Further research is necessary to validate these findings and examine the impact of specific cost aspects on the continuation of these programs.

Keywords: Q-methodology; farmers' perceptions; biodiversity measures; monetary and non-monetary costs

8. Lessons learned to effectively co-design biodiversity-friendly interventions in agriculture


First author(s): Elena Velado-Alonso

Other author(s): Amelia SC, Hood

Affiliation: Plant Ecology & Nature Conservation Group, Wageningen University

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Integrating biodiversity conservation into agriculture is a priority issue in our society. Integrating biodiversity into agricultural management has been shown to promote conservation and secure nature's contribution to people. Transdisciplinary approaches are considered beneficial to address the complexity of interacting factors that determine the success of biodiversity-friendly interventions in agricultural landscapes. As a result, co-design of these interventions has gained momentum worldwide in recent decades. Many benefits are expected from the co-production process, such as knowledge sharing among stakeholders, behavior change among practitioners, and increased opportunities access to rare resources for researchers, such as sites. However, there are often associated disadvantages, such as tokenistic involvement, increased financial costs or time commitment. In this paper, a group of 20 researchers from different disciplines (including natural and social sciences) with extensive experience of co-production processes in the biodiversity-agriculture nexus reflect on the difficulties and solutions they have found in their practice. Together we have developed specific and practical guidelines to stimulate ideas, expand research and impact opportunities, and mitigate risks in participatory research with farmers and other agri-environmental stakeholders. We share our experience on how to select project facilitators, participants and intermediaries to ensure project development. We also provide practical advice on how to promote stakeholder engagement, reduce unwanted conflict and create a project legacy by assessing the feasibility of engagement, establishing common goals, managing conflicts of interest and using effective



communication strategies that tap into social networks. These ideas are based on the experience of 9 different research projects developing co-design in 12 different countries from Africa, Asia, Europe and South America, and literature reviews.

Keywords: Agriculture, Biodiversity, Co-design, Conservation, Participatory research

9. Factors for a successful co-design of agri-environmental contracts: experiences from Contracts2.0.

First author(s): Louise Vercruysse

Other author(s): Boldizsár Megyesi, Erling Andersen, Claudia Sattler, Annabelle Lepage, Céline Dutilly, Francis Turkelboom, Inés Gutiérrez Briceño, Jennifer Dodsworth

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In pursuit of innovative strategies to achieve biodiversity goals in agricultural landscapes, as proposed by the CAP, numerous initiatives are now incorporating policy co-design alongside farmers. However, the success of these projects varies significantly (Oliver et al., 2019).

The Horizon 2020 project Contracts2.0 was launched to enhance the effectiveness of agri-environmental contracts by co-designing new contracts incorporating elements such as results-based payments, collective contracts, and land tenure agreements. This initiative involved the establishment of 11 Contract Innovation Labs and 9 Policy Innovation Labs across 9 European countries, where farmers and other stakeholders collaborated with researchers and policymakers to develop and implement "dream contracts" through participatory methods.

Following the project's conclusion, several partners committed to evaluating the co-design process of Contracts2.0. This evaluation aimed to identify key factors essential for successful co-design, while also considering the political position and power relations among the involved stakeholders, an element often left out (Turnhout et al., 2020).

By analyzing interviews with lab coordinators, reports generated by the innovation labs, and the overall project evaluation, we identified critical elements that contribute to a "successful" co-design process. The term "successful" is subjective, and the initial phase of our analysis focused on how coordinators and participants define this concept. Generally, successful co-design



encompasses a combination of material outcomes (e.g., the creation of new contracts) and relational benefits (e.g., fostering social capital). The paper presented examines the realization of these outcomes across three domains of the co-design process: the design and coordination of the process, the actors involved (research partners and action partners), and the interactions among these actors (e.g., facilitation, knowledge exchange, reciprocity and agency). Finally, the salient factors are discussed and compared to the existing literature concerning policy co-design. In our presentation, we look forward to compare and discuss our findings to other projects, such as Mosaic and the Showcase project, following a similar approach.

Oliver K, Kothari A, Mays N: The dark side of coproduction: do the costs outweigh the benefits for health research? *Health Res Policy Syst* 2019, 17:33 <http://dx.doi.org/10.1186/s12961-019-0432-3>.

Turnhout E., Metze T., Wyborn C., Klenk N., Louder E.: The politics of co-production: participation, power, and transformation. *Current Opinion in Environmental Sustainability*, Volume 42, 2020, Pages 15–21, ISSN 1877–3435, <https://doi.org/10.1016/j.cosust.2019.11.009>.

Keywords: co-design, participatory research, agri-environmental contracts, biodiversity, innovation labs, policy co-design

10. Implementing agroecological practices and biodiversity based solutions to reduce pesticide use: successes and challenges of a co-design approach in the Swiss context

First author(s): Philippe Jeanneret

Other author(s): Judith Wirth, Alexander Zorn, Susanne Vogelgsang, Thomas Steinger

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By joining SHOWCASE (Horizon 2020) and PestiRed (Swiss Federal Office of Agriculture) projects, biodiversity-based solutions and agroecological practices have been implemented on 65 farms of three arable regions on the Swiss plateau since 2020, following a 6-year crop rotation.



The first step of the co-design process consisted in workshops gathering scientists, extension services, and farmers interested to reduce pesticide use. Condition for participating in the project are: reduce by 75% the pesticide use without cutting yield by more than 10% by implementing agroecological practices e.g. wildflower strips, undersowing on one field in which practices, yield, and noxious organisms (weeds, pests, diseases) are recorded as well as on a control field conventionally managed. A flat-rate package is being paid the farmers for monitoring activities whereas practice-specific payments are allocated. Secondly, 1–2 yearly regional workshops were conducted. Thirdly, field days were organised with farmers tackling issues regarding a given crop.

After four years, outcomes of the co-design approach show: 1) yearly workshops produced highly valuable discussions about successes and failures of specific practices and stimulate farmers to exchange in structured meetings; 2) support of extension services to innovative farmers is intensified; 3) farmers are informed by scientists on results at regional and national scale; 4) scientific narrative helps farmers understand biodiversity and its crucial role for sustainable production.

Challenges are: 1) farmers were initially resistant to change arguing their rotation was already agronomically optimized to respond to economic constraints of the Swiss agriculture; 2) some practices targeting biodiversity (e.g. wildflower strips) are not convincing, frequently due to implementation failure; 3) every farm and field is a particular case of environmental conditions such as soil types which render generic implementation difficult; 4) farmers are keen to receive particular recommendations which is time consuming for advisors and scientists; 5) farmers have little time for monitoring of practices and noxious organisms.

Keywords: SHOWCASE, agroecology, co-design, pesticides, agricultural practices



12. Agro4esterie: Agroforestry Living Labs in Switzerland

First author(s): Sonja Kay

Other author(s): Giotto Roberti

Affiliation: Agroscope

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Modern agroforestry systems are known for their contribution to promoting the environment and mitigating climate change. While scientists are in favour of their implementation because of their ecosystem service benefits, farmers see both opportunities and challenges.

The transdisciplinary research programme "Agro4esterie" was launched in 2020, funded by the Swiss Federal Office for Agriculture and four cantons, to support around 100 farmers during the first six years of the practical start-up of agroforestry fields and ensure a regular transfer of knowledge (practice, science, administration). The developments are co-designed and monitored over eight years.

In the starting phase, farmers needed significant support to familiarise themselves with these production systems and it took several years between idea and implementation. Farmers valued the input by farm advisers and scientist, and also the exchange among themselves. However, the cooperation was not always easy, as different expectations met different ways of working. E.g. practitioners expected scientific results after only 1–2 months, from an intensive 4 months data collection campaign by scientists. On the other hand, scientists expected to have unhindered access and that measurements would not be disturbed by farm management activities, while in practice the only sunny week for recordings was also used by the farmers for harvesting.

Overall, we can say that the co-design process requires a lot of effort and openness from both sides and that we still have a long way to go. But we have also had and continue to have, positive and motivating collaborations. The presentation will highlight some very practical – and all the more relevant – challenges that we faced and present lessons learned for both, science and practice.

Keywords: agroforestry, co-design-process, environmental impacts, climate change, policy advise

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: S1e

Operationalizing Ecosystem Services for agroecosystem One Health: data-driven insights, limits and interdisciplinary prospects

Hosts:

	Name	Organisation	E-mail
Host:	Dimitris Bormpoudakis	Beyond Centre of EO Research & Satellite Remote Sensing, National Observatory of Athens	dim.borb@noa.gr
Co-host(s):	Nikos Stathopoulos	Beyond Centre of EO Research & Satellite Remote Sensing, National Observatory of Athens	n.stathopoulos@noa.gr
	Dora Aifantopoulou	EDGE In Earth Observation Scien	dora@eo-edge.com

Abstract:

The sustainability of agroecosystems is deeply implicated with One Health principles (Durso and Cook 2019; Mission Board for Soil Health and Food 2020). Ecosystem Services as an interdisciplinary, holistic framework, is uniquely positioned to help operationalize the nexus of soil, plant, animal, microbial, ecosystem and human health that comprises the One Health provocation. Taking this as a starting point, we seek to present and critically evaluate data-driven methodologies for data collection, integration, and analysis for using Ecosystem Services to operationalize One Health for agroecosystems. We are interested in papers on data collection (e.g. audio sensors, social media Big Data, Earth Observation, microbiomics), data integration (e.g. Linked Open Data, Federated Data, ontologies), and modelling and prediction (e.g. causal



inference, bioinformatics, spatial statistics, Machine/ Deep Learning) frameworks and methods that can serve as building blocks for monitoring, understanding and predicting One Health in agroecosystems. We would particularly welcome papers on:

- Data-driven One Health assessments of sustainable agricultural systems and practices (e.g. cover crops, integrated pest management, rotational diversity, regenerative agriculture) using Ecosystem Services
- How do we link the various aspects of One Health (soil, animal, plant, ecosystem, microbial, human) through Ecosystem Services
- Limits of the Ecosystem Services framework in relation to the One Health provocation
- New ontologies for linking the Ecosystem Services and One Health frameworks; can we integrate the relational aspects of Ecosystem Services – One Health ontologies?
- Data integration and modelling methods for cross-scale data in the context of One Health (e.g. molecular microbial diversity and Earth Observation data)
- Conceptual frameworks and theoretical papers on the limits of data-driven One Health perspectives (e.g. Big Data ethics, social studies of algorithms and modelling), especially considering the environmental justice aspects of One Health (Murray et al. 2022)
- Future prospects and challenges

References

Durso, L. M., & Cook, K. L. (2019). One health and antibiotic resistance in agroecosystems. *EcoHealth*, 16, 414–419.

Mission Board for Soil Health and Food (2020) Caring for soil is caring for life. <https://www.novamont.com/public/modello-novamont/Mission%20Soil%20Health%20and%20Food%20-%20report%20EN.pdf>

Murray, M. H., Buckley, J., Byers, K. A., Fake, K., Lehrer, E. W., Magle, S. B., ... & Schell, C. J. (2022). One health for all: advancing human and ecosystem health in cities by integrating an environmental justice lens. *Annual Review of Ecology, Evolution, and Systematics*, 53, 403–426.

Goals and objectives of the session:

In this session, through a careful combination of 7 invited and submitted presentation and a final summarizing plenary presentation, we aim to unify and integrate the Ecosystem Services and One Health perspectives for agroecosystems in a single operational framework. Emphasis will be placed on the operational aspects of this integration, and the data collection, integration, and analysis methods that will be required for monitoring, understanding, and predicting One Health



outcomes in real agroecosystems. The interdisciplinary aspects of One Health will be highlighted, and critically explored through a combination of empirical and theoretical presentations.

Planned output / Deliverables:

Depending on the quality, quantity and coherence of the invited and submitted papers, we have a two-fold aim for planned outputs:

- At a minimum, we envisage a perspective paper co-authored by session organizers and participants that reviews the literature and presents the case for linking Ecosystem Services, One Health, and Environmental Justice perspectives for operational, data-driven agroecosystem management.
- If the presentations are of high quality and coherence, and the participants agree, we would organize a SI for a suitable venue that would include the paper outlined above, but with key empirical / theoretical studies backing it up.

Session format:

The proposed format is a quasi-typical conference presentation panel. As mentioned above, we envisage 7+1 presentations, with roughly 15 minutes allocated to each.

II. SESSION PROGRAM

Room: Expert Street 5

Date of session: 21st of November 2024

Time of session: 11:00 – 12:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
11:00 11:5	Dimitrios	Borpoudakis	National Observatory of Athens	Advancing agroecosystem resilience holistically: advancing a critical framework that links One Health, data-driven ecosystem science, and multispecies justice
11:10 11:20	Simone	Martino	The James Hutton Institute	The use of wellbeing and natural capital indicators as a foundational step towards a “One Health” approach in farming
11:25 11:35	Dimitrios	Sainidis	National Observatory of Athens	From trapping mosquitos to ecosystem disservices estimation: High-resolution, AI-based mapping of mosquito-related



Time	First name	Surname	Organization	Title of presentation
				epidemiological and entomological risk in agroecosystems and rural ecosystems
11:40 11:50	Jonathan	Madeira Rocha	Federal University of Rio Grande do Sul	Multispecies health and digital agribusiness in the southern Brazil landscapes
12:55 12:05	Dora	Aifantopoulou	EDGE in Earth Observation Sciences	Mapping agroclimatic extremes and their impact on ecosystem services across the Mediterranean using climate reanalysis, climate projection and Earth Observation data
12:10 12:20	Helle	Hestbjerg	Danish Technological Institute	The impact of soil management and climate stressors on soil biodiversity and multifunctionality

III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Mapping agroclimatic extremes and their impact on ecosystem services across the Mediterranean using climate reanalysis, climate projection and Earth Observation data

First author(s): Dora Aifantopoulou

Other author(s): Alexia Tsouni, Dimitrios Bormpoudakis

Affiliation: EDGE in Earth Observation Sciences

Contact: dim.borb@noa.gr

In the face of climate change, resilient agroecosystems are crucial for sustaining multiple ecosystem services, including among others productivity, soil moisture, soil carbon content, crop health, and human health. Our research focuses on understanding the relationship between climate extremes and these services within the One Health framework. Utilizing ERA-5 land reanalysis and regional EURO-CORDEX climate projections, we map past and future climate extremes across the Mediterranean region. We leverage Earth Observation (EO) indices as proxies for ecosystem services data. We model the relationship between climate extremes and



ecosystem services using a multifunctionality index derived from EO indices and historical ERA-5 land reanalysis data. This multifunctionality index is then projected under future climate scenarios using EURO-CORDEX projections. Our study encompasses a broad Mediterranean approach and includes five regional/local case studies: southern France and Italy, eastern Spain, and northern Algeria and Egypt. These case studies allow us to investigate the spatial variability in the impact of climate extremes on ecosystem multifunctionality at both regional and local scales. Our approach is designed to be inclusive, utilizing only open/free data and software, thereby ensuring accessibility for lower-income countries. The findings reveal that climate extremes significantly reduce the resilience and capacity of ecosystems to provide multiple services. However, the impact of these extremes is not uniform; it varies spatially even within sub-national contexts. This highlights the necessity for integrated, locally meaningful management strategies that enhance ecosystem resilience and adaptability to climate variability.

Keywords: Resilient agroecosystems, climate projections, multifunctionality, One Health

2. The impact of soil management and climate stressors on soil biodiversity and multifunctionality

First author(s): Helle Hestbjerg

Other author(s): Markus Gorfer, Salva Lladó, Crisina Yacoub, Martin Hartmann, Tania Galindo, Santiago Soliveres

Affiliation: Danish Technological Institute

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Plant production systems constitute the foundation for a wide range of ecosystems services (ES) related to economic, social and environmental wellbeing. Soil biodiversity provides multiple ES and is crucial for supporting plant production in the agro-ecosystem.

The SOILGUARD project aims at boosting the sustainable use of soil biodiversity for ES. The project focuses on the influence of agricultural management practices and climate stressors as two main drivers of land degradation and thereby loss of soil health and biodiversity. To investigate the impact, multiple activities have been carried out within SOILGUARD. A cross-biome network of 234 sites in 10 countries has been established and soil samples herefrom have been analyzed for a range of physical, chemical, bio-chemical and biological parameters, the latter ranging from microscopy to PFLA, enzymes and eDNA. The included biomes are



arable fields, grasslands and forests, managed conventionally or with an alternative practice. Sites span three soil degradation levels.

Another activity simulated drought periods and heatwaves at 14 sites in seven European countries using open shelters and heaters. Soil as well as rhizosphere samples were analyzed.

The total data sets comprise more than 80 parameters. The large amounts of data are analyzed with the aim of describing community compositions and revealing connections and patterns between different groups of organisms, e.g. bacteria, fungi, archaea, nematodes, and collembola in relation to management practice and land degradation. This data-driven approach leverages advanced analytical methods, to provide insights into the complex interactions within soil ecosystems.

The outline of the SOILGUARD project and selected results will be presented. Emphasis will be on results from the drought experiment in Denmark in 2022 and the impact on the rhizosphere.

These results will be viewed in a holistic context, connecting soil biodiversity to the health and wellbeing of nature and humanity.

Keywords: Soil biodiversity, soil degradation, biogeographical regions, soil food web, soil management

3. The use of wellbeing and natural capital indicators as a foundational step towards a “One Health” approach in farming

First author(s): Simone Martino

Other author(s): Rachel, Nichols; Niamh, McHugh; Ellie, Ness; Jayna, Connelly, Claudio, Petucco, Clare, Buckerfield, Alastair, Simmons, Trinity, Ndlovu; Graham, Begg

Affiliation: The James Hutton Institute

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This research, carried out as part of the H2020 FRAMEwork project, shows how to combine social, economic, and environmental indicators to assess the health and wellbeing of a farming system at the landscape scale through Farmer Clusters i.e. groups of neighbouring farmers working together to deliver landscape-scale environmental benefits. The environmental



indicators were selected, guided by our internally produced Natural Asset Profiling approach (NAP), to assess the impacts and dependencies of farming on natural capital. The NAP was formulated by merging considerations from the Natural Capital Accounting for business (Natural Capital Protocol) and the System of Environmental Accounting–Ecosystem Accounts framework (SEEA–EEA).

In this study we carry out the health analysis of the Cranborne Chase (UK) Farmer Cluster using indicators referring to natural, social, and human domains (or capitals). Dependencies and impacts of different enterprises (arable, livestock, etc.) on natural capital are proposed and compared against a benchmark to understand what aspects of the farming system could be improved to increase farming sustainability. Using linear correlations and analysis of variance we identified key variables related to Farmer Clusters management that drive positive changes in biodiversity and other aspects of their natural capital.

The NAP can be considered a foundational step towards the formulation of the One Health approach that can be reached by including indicators referring to soil and animal health. We will show how to expand the framework to provide evidence of these indicators by collecting and analysing qualitative and quantitative proxies. These proxies do not require specialized skills but utilize local knowledge of the farming context, making them accessible and practical for broader application.

Keywords: biodiversity, natural capital, farmer cluster, accounting, One–Health

4. Multispecies health and digital agribusiness in the southern Brazil landscapes

First author(s): Jonathan Madeira Rocha

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The Pampa biome is more than a geographic shared space between Argentina, Brazil and Uruguay. It's also a cultural area (Leal, 1997; 2021). The Pampa has always been related to a specific relation between man (the gaúchos), animals (cattle and horse) and landscape. Fostering a local imaginary that remains nowadays, it highlights a certain multispecies Pampa. However, since the 2000's, the advancement of soybeans in these areas has been increasingly modifying it. It's attributed to the economic advantages of this activity in relation to other temporary crops and extensive livestock farming (Painel do Agronegócio do RS, 2022). This



article discusses how agribusiness initiatives, specially based on new technologies, are shaping the landscape and local cultures in southern Brazil areas. Known for its rich green plains, where cattle, men and horses coliving, the Pampa is increasingly being occupied by large enterprises linked to the cultivation of genetically modified soy (Leguizamon, 2022). Despite all the proven environmental damage, agribusiness is largely accepted in this region and described as a necessary activity for the Brazilian economy and food system. In the first part of this article, we highlighted how a new imaginary about agribusiness has been promoted since the 1990s, specially through agricultural trade fairs, and how this has intensified due to the recent entry of new technologies. We argue that digitalizing agriculture promotes the idea of sustainability as it introduces digital devices and cloud computation to managing and controlling agriculture activities. Then, as a part of an ongoing research that took place on agricultural trade fairs and farms in the Pampa region, we discuss, through an ethnographic approach, how agribusiness leaders, farmers and local population experiences this transformation. We expect to collaborate with the discussions on how technological innovations on agrosystems affect multispecies lives in local contexts.

Keywords: Multispecies health; Pampa biome; Sustainability; ethnography; agribusiness

5. From trapping mosquitos to ecosystem disservices estimation: High-resolution, AI-based mapping of mosquito-related epidemiological and entomological risk in agroecosystems and rural ecosystems

First authors(s): Dimitrios Sainidis

Other author(s): Argyro Tsantalidou, Konstantinos Tsaprailis, Nikolaos Stathopoulos, Charalampos Kontoes

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Mosquitos carry and transmit Mosquito-Borne Diseases (MBDs), a key ecosystem disservice, affecting approximately 700 million people and are responsible for around a million deaths annually worldwide. Without vaccines or treatments, the best countermeasures against MBDs are accurate mosquito population and epidemiological risk maps serving as Early Warning Systems for health and other related authorities. Furthermore, mosquitoes impact One Health by transmitting diseases to animals and humans, influencing ecosystem health through their role in the food web, and being affected by agricultural practices like irrigation and pesticide use. Climate change and socioeconomic factors also play a role in ecosystem change and thus mosquito prevalence and disease outbreaks. Furthermore, land and soil degradation often leads



to increased mosquito breeding sites (e.g., through the formation of stagnant water bodies, changes in water quality, or altered vegetation cover). Effective surveillance and integrated control measures are essential for maintaining the health of humans, animals, and the environment in these systems. However, the distribution of vector-borne diseases is influenced by complex environmental features, such as soil moisture, vegetation type, ground morphology, weather conditions, etc., alongside demographic and social factors such as global travel or trade, making them hard to predict with absolute certainty. In this work, dynamic big Earth Observation data are fused with in-situ mosquito abundance, infected human population, and site-specific morphological and ecosystem features to train a neural network and produce monthly mosquito population 2x2 km gridded maps in several rural areas in Greece. The output of the mosquito abundance model is subsequently used, in combination with the previous data and demographic data, to produce a disease susceptibility map for MBDs in the same 2x2 km grid. We discuss the potential of this type of model in advancing One Health perspectives in agroecosystems toward effective operationalization by policymakers and practitioners.

Keywords: Vector-borne diseases, mosquito abundance, artificial intelligence, agroecosystems, ecosystem disservices

6. Advancing agroecosystem resilience holistically: advancing a critical framework that links One Health, data-driven ecosystem science, and multispecies justice

First author(s): Dimitrios Bormpoudakis

Other author(s): Nikos Stathopoulos, Charalampos Kontoes

Affiliation: National Observatory of Athens

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In the context of climate change and its profound impacts on agriculture, advancing agroecosystem resilience holistically is crucial. This paper presents a framework that operationalizes the nexus of soil, plant, animal, microbial, ecosystem, and human health within the One Health paradigm, drawing critically from the interdisciplinary scholarship on Ecosystem Services, nature's contributions to people and multispecies justice. We present a practical framework that systematically integrates various methodologies and perspectives and focuses on agroecosystems. By integrating One Health we ensure that One Health components are considered and managed synergistically, leading to more sustainable and effective health outcomes. Data-driven ecosystem services science exploits advances in Earth Observation, data handling and fusion technologies, and causal inference to ensure that decisions are based on



robust, transparent empirical evidence. Diverging from past approaches, our framework also centres multispecies justice, i.e., an ethical dimension of agroecosystem management, ensuring that the interests and well-being of all species within the ecosystem are considered. We explore the implications of this framework in the Mediterranean, and consider how the framework can advance how we monitor, assess, implement, and live-with sustainable agricultural practices. By focusing on the Mediterranean, we acknowledge the unique environmental, cultural, and socio-economic conditions of the region, thereby the framework becomes more relevant and effective, addressing the particular challenges and opportunities of Mediterranean agroecosystems.

Keywords: Holistic management, political ecology, multispecies, environmental justice, agroecology



BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: S3a

Forests for a better world: ecosystem, human and economic perspectives

Hosts:

	Name	Organisation	E-mail
Host:	Claudia Carvalho-Santos	University of Minho	c.carvalho.santos@bio.uminho.pt
Co-host(s):	Rita Sousa-Silva	University of Leiden	a.r.de.sousa.e.silva@cml.leidenuniv.nl
	Jan Machac	University of Jan Evangelista Purkyně in Ústí nad Labem	machac@ieep.cz
	Jan Brabec	University of Jan Evangelista Purkyně in Ústí nad Labem	brabec@ireas.cz

Abstract:

Forests play a crucial role in conserving biodiversity and providing many ecosystem services that are essential for human well-being. From providing medicinal resources to opportunities for mental and physical restoration, climate and water regulation, and socio-economic sustenance, forests embody and exemplify the interconnectedness of human, animal, and environmental health—in essence, One Health. The effectiveness of policy instruments promoting the provision of ecosystem services is not solely dependent on natural conditions. Specific aspects, such as relationships among various stakeholders, legislative barriers, public acceptance, and more, must also be considered.

In this session, we aim to bring together researchers studying the role of forests within the One Health framework. Specifically, we invite contributions focused on (1) mapping and modelling the environmental impact of forestation strategies on human, animal, and/or environmental health; (2) developing tools to assess and quantify the benefits of forests in both urban and rural settings; and (3) proposing innovative schemes to incentivize forestation efforts. We strongly encourage



submissions that reflect diverse geographical contexts and especially welcome contributions from early-career researchers.

Goals and objectives of the session:

Understand the multiple values of forests in urban and rural areas, especially bringing concrete examples and applications. Discuss perspectives to foster sustainable and resilient forestation solutions for both people and the planet.

Share experiences related to the development and implementation of serious games that focus on or support environmental management and promote the provision of ecosystem services.

Publicize the working-group ESP TWG 16A – Tree-based PES (PESFOR–W).

Attract new members to the working group ESP TWG 16A – Tree-based PES (PESFOR–W) interested in this thematic.

Planned output / Deliverables:

The outcomes of this session--a summary of the session with information about the participants, the topics presented and the take-home messages from each oral and poster communication--will be advertised on social media, on the webpage of the ESP TWG 16A – Tree-based PES (PESFOR–W), and the ESP monthly newsletter. We also aim to explore the possibility of a joint publication or dedicated special issue based on the contributions and insights shared during the session (Potential titles: i) Forests (Forestation strategies) in an era of One Health; or ii) Promoting One Health through Forests).

II. SESSION PROGRAM

Room: Expert Street 5

Date of session: 19th of November 2024

Time of session: 11:00–12:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
11:00 – 11:02	Claudia	Carvalho–Santos	UMinho, PT	Welcome /Introduction
11:03– 11:13	Dumitru–Mircea	Dușcu	University of Bucharest, RM	Mapping the cultural ecosystem services provided by urban forests using public participation. Case study Băneasa Forest, Romania



Time	First name	Surname	Organization	Title of presentation
11:15– 11:25	Rita	Sousa– Silva	University of Leiden, NL	Health and environmental benefits of urban street tree stewardship
11:27– 11:37	Lisa	Best	Wageningen University and Research, NL	Urban green space and wellbeing in the tropics: understanding challenges, conditions, and values through serious games
11:39– 11:49	Jan	Brabec	Jan Evangelista Purkyně University, CZ	Sponge Solutions: Navigating Flood Negotiations Through Serious Gaming
11:50 – 12:30				Joint Discussion

III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Mapping the cultural ecosystem services provided by urban forests using public participation. Case study Băneasa Forest, Romania

First author(s): Dumitru–Mircea DUȘCU

Other author(s): Geta RÎȘNOVEANU

Affiliation: University of Bucharest, Faculty of Biology, Doctoral School of Ecology

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Urban areas face significant pressures from urbanization and climate change that is why urban green infrastructure (urban forests, parks, street trees etc.) becomes increasingly relevant for landscape planning and management, due to their ability to provide ecosystem services. Our research aimed to assess and map the cultural ecosystem services provided by Băneasa Forest using Public Participation Geographic Information System (PPGIS) and emphasize its important contribution to the health and well-being of the population. The potential of the forest to provide cultural ecosystem services was assessed based on the citizens' stated preference. We applied the georeferenced survey method, using the online survey tool Maptionnaire. 816 respondents have marked 882 points on the Băneasa Forest map that they consider to be the most important for the provision of cultural ecosystem services. Based on the points, we



created high-resolution maps with hot spots of cultural ecosystem services offered by the only urban forest in Bucharest, Băneasa Forest. This study underscores the complexity of interactions and relevance of the local context for cultural ecosystem services distribution and reaffirms the critical importance of urban forests in providing cultural ecosystem services and contributing to urban social resilience and environmental sustainability, in the context of rapid economic development, real estate pressures, and climate change. Our results support forest managers to adapt management according to public preferences, anticipate potential conflicts and set management priorities for the conservation of Băneasa Forest.

Keywords: Băneasa Forest, Cultural ecosystem services, PPGIS, Urban forests

2. Health and environmental benefits of urban street tree stewardship

First author(s): Kelly Baldwin Heid

Other author(s): Rita Sousa-Silva


Affiliation: Department of Biology–Geobotany, University of Freiburg, Germany

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As urbanization accelerates and population density increases, the importance of provision of green spaces where people live becomes ever more important. Integrating nature-based solutions (NBS) into urban settings offers a practical approach to enhancing both human and environmental health. In this talk, we will present the results of a project on citizen stewardship of street tree beds, highlighting the role of urban trees as one of the main tools available in cities to face current and future health and environmental challenges within the One Health framework.

Through surveys and interviews, we found that stewards are driven by a desire to promote positive environmental behavior and to support their community. They reported various benefits, including a stronger sense of place, deeper connections to nature, and improved mental health. Stewards also view street tree beds as personal gardens, suggesting these spaces can serve as restorative areas that improve public health and social cohesion.

These findings underscore the significant role urban trees and forests can play in promoting One Health. As many people living in cities lack access to a balcony or backyard for gardening or even to community gardens, tree beds, which are abundant in most cities, offer a practical solution to this lack of green space. Our research also connects these findings to the practice of



nature-based social prescribing (NBSP), which uses community-based activities in natural settings to address health and social care needs.

This research provides valuable insights for policymakers and practitioners aiming to integrate nature-based solutions and nature-based social prescribing practices into urban planning and public health initiatives. By doing so, cities can create healthier and more sustainable environments, benefiting both people and ecosystems.

Keywords: urban trees, urban forests, mental health, well-being, nature-based social prescribing

3. Urban green space and wellbeing in the tropics: understanding challenges, conditions, and values through serious games

First author(s): Lisa Best

Other author(s): Erika N. Speelman, Nina Schwarz

Affiliation: Wageningen University and Research, Laboratory of Geoinformation Sciences and Remote Sensing

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Urban green spaces supply ecosystem services and benefits that are vital for wellbeing in urban and peri-urban landscapes. The necessary conditions to enable the provision of urban ecosystem services and what this entails for urban planning is underexplored in developing countries in Latin America and the Caribbean (LAC). Lack of inclusion, a lack of knowledge on urban ecosystem services and benefits, and green space maintenance needs hamper the optimization of urban green space. Consequently, potentially foregoing opportunities to address multiple urban challenges. In our study, we use a serious game for exploring urban planning in Paramaribo, a coastal city in South America. Our research aims to better understand the conditions for optimizing benefits from urban green spaces and assess the role of instrumental and relational values of urban green. We i) Developed a serious game to interact with groups ranging from government, environmental NGO's, neighborhood and place-based organizations, women's organizations, youth, to academics, ii) Facilitate interaction and explore opinions of participants on urban green, ecosystem services and disservices, and iii) Analyze debriefing discussions and game results to gather insights into instrumental and relational values associated with the players' strategies. In the game, participants can develop a part of the city by allocating land cover and investing in the maintenance of infrastructure and green space. We expect that the game will be useful for engaging with participants, and test to what



extent it can contribute to fostering shared understanding of the problems surrounding urban green space in the tropics, and potential steps to address them. The results from our study will contribute to knowledge on urban ecosystem services in the LAC region, and to the growing body of literature on the use of serious games in natural resource management contexts.

Keywords: Urban green space, serious games, ecosystem services, wellbeing, urban planning

4. Sponge Solutions: Navigating Flood Negotiations Through Serious Gaming

First author(s): Jan Macháč

Other author(s): Steven Forrest, Jan Brabec

Affiliation: Faculty of Social and Economic Studies, Jan Evangelista Purkyně University in Ústí nad Labem

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One of the many adverse effects of climate change is the increased frequency and severity of floods. The evidence that traditionally used grey infrastructure is insufficient in reliably protecting human settlements is more compelling than ever. There is a need to support grey infrastructure with additional means of flood risk reduction, such as nature-based solutions. These small-scale measures are a valuable complementary tool that can be distributed along the river flow to temporarily retain floodwater when necessary. This so-called sponge effect, however, is challenging to implement due to the scattered nature of land ownership and the differing motivations of upstream landowners and downstream residents. Along with issues related to urban development and political priorities, this results in conflicts regarding the financing of these measures. Landowners often feel no need to mitigate flood risk (and potentially forego part of their revenues) while endangered cities do not own the land required for implementing these measures.

A possible negotiation process can be demonstrated in a serious game called the Flood Game, in which participating players assume the roles of mayors of settlements in a river basin. During several rounds, which differ mainly in the assignment of responsibility for floods in the basin (property rights), players discover the existing barriers to establishing an effective solution and the power of negotiation. The experience and results from playing the game could lead to increased engagement from politicians and a higher number of tools that support negotiation and implementation of sponge measures on both public and private land. Effective support schemes should be one of the outputs of the ongoing Horizon project Spongeboost. This



contribution aims to introduce the game and showcase the shift in opinions about flood responsibility that occurs after playing the Flood Game.

Keywords: Flooding, upstream downstream, negotiation, serious game, policy tools

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: S3b

Financing and certifying forest- and tree-based ecosystem services


Hosts:

	Name	Organisation	E-mail
Host:	Sofia Corticeiro	Centre for Environmental and Marine Studies and Department of Environment and Planning, Universidade de Aveiro, PT	sofiacorticeiro@ua.pt
	Oliver Wolf	Office for Environment, Switzerland	oliver.wolf@bafu.admin.ch
Co-host(s):	Helena Vieira	Universidade de Aveiro	helena.vieira@ua.pt
	Ana Lillebø	Universidade de Aveiro	lillebo@ua.pt
	Annerieke Sleurink	FSC Netherlands	andreas.bernasconi@panbern.ch
	Andreas Bernasconi	Pan Bern Inc.	luis.inostroza@mendelu.cz
	Luis Inostroza	Mendel University Brno	

Abstract:

Europe has seen a rise in demand for certified forest products and forest certification in recent years. Major global issues like the need to reduce carbon emissions and mitigate climate change, as well as economic and social demands for fairer trading and nature-based solutions, explain the growing importance given to forest ecosystem services to sustain human well-being and a resilient economy.

However, finance for sustainable forest management and for the development and scaling up of business models based on forest ecosystem services is a bottleneck. The potential of sustainable finance to support the sustainability transition of the sector remains underexploited. Under the concept of sustainable finance, a wide range of environmental, social and governance (ESG)



considerations can be considered when making investment decisions in the financial sector. Different sustainability assessment approaches lead to more or less impactful and long-term investments in sustainable economic activities and projects. There are widespread credibility issues with mainstream decision-support tools expected to guide sustainable investment decisions. This leads to issues of poor targeting of financial resources, unsatisfactory sustainability impacts and in some cases, outright greenwashing concerns.

Forest certification is a case in point. While on the one hand, a number of forest certification schemes have emerged as enabling tools for promoting sustainable forest management and ecosystem services valorization, on the other hand their real impact on harnessing forest ecosystem services and generating new revenue streams for forest owners remains uncertain.

By delving extensively into the complex relationship between forest certification and ecosystem services and their valorization and payment schemes, this session hopes to provide valuable insights, evaluations, and directions for further research. Through empirical research, theoretical frameworks, and real-world case studies, this session will explore novel approaches to understand the potential of forest ecosystem services to drive the development of sustainable business models and to maximize the benefits that forest certification and new funding mechanisms bring to the ecosystem services and altogether to forest owners.

Goals and objectives of the session:

To explain and present practical experiences of tree-based business models;

To discuss relevant models and instruments of sustainable financing;

To develop criteria for successful long-term partnerships and transformative change;

To assess and understand the impact of forest certification on ecosystem services and their changes;

To analyze trade-offs between ecosystem services under certification and strategies for optimizing benefits;

To explore socio-economic implications and valorization of forest certification;

Planned output / Deliverables:

Presentations; summary report of the session including the findings of the discussion; inputs of the interested authors for the upcoming Special Issue of the Ecosystem Services journal on this topic.

II. SESSION PROGRAM


Room: Expert Street 5

Date of session: 19th of November 2024

Time of session: 14:00–15:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
14.00– 14.05	Sofia	Corticeiro	Centre for Environmental and Marine Studies and Department of Environment and Planning, Universidade de Aveiro, PT	Welcome/Introduction
	Clémence	Dirac	FOEN	
14.05– 14.20	Annerieke	Sleurink	FSC Netherlands	FSC Verified Impact on Ecosystem Services: an added value for forest managers and companies.
14.20– 14.30	Claudio	Petucco	Luxembourg Institute of Science and Technology	Multisilva: a web-based decision support system to assess and simulate the provision of forest ecosystem services at the property level
14.30– 14.40	Laqiqige	Zhu	Trinity Business School, Trinity College Dublin	Enhancing Afforestation in Ireland: Insights from a Choice Experiment Survey and Interviews Among Farmers
14.40– 14.50	Sofia	Corticeiro	Centre for Environmental and Marine Studies and Department of Environment and Planning, Universidade de Aveiro, PT	A European View on Forest Certification and Economic Considerations
15.50– 15.00	Ziri	Louda	Jan Evangelista Purkyne University in Usti nad Labem	From nature-based solutions to nature-based governance: behavioural approach to understand human and non-human interactions
15.00– 15.25				Discussion



Time	First name	Surname	Organization	Title of presentation
15.25– 15.30	Sofia	Corticeiro	Centre for Environmental and Marine Studies and Department of Environment and Planning, Universidade de Aveiro, PT	Closing remark
	Clémence	Dirac	FOEN	

III.ABSTRACTS

first author is the presenting author unless indicated otherwise.

1. A European View on Forest Certification and Economic Considerations

First author(s): Sofia Corticeiro


Other author(s): Gonçalo Brás, Margarida Tomé, Ana Lillebø, Helena Vieira

Affiliation: Centre for Environmental and Marine Studies and Department of Environment and Planning, Universidade de Aveiro, Campus Universitário de Santiago, 3810–193 Aveiro, Portugal

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In recent years, there has been an increasing demand for forest certification and certified forest products in Europe. This trend is related to major worldwide challenges, such as the need to de-carbonize the economy and mitigate climate change but also social and consumer demands for wider fair trade. But can forest certification itself influence investment and economic valorization in forestry? The aim of this study is to determine the level of forest certification in Europe and to highlight the link between forest certification and investment or economic valorization in forest-related markets. Therefore, a complementary methodological approach was adopted, combining empirical inference with knowledge synthesis based on a scoping review.

The findings confirm that certification has not only grown in significance throughout Europe but also suggest that forest certification can indeed be a driver of investment in the sector. Forest certification can support public policies related to the economic, environmental, and social sustainability of the European forest while allowing access to international markets and drive positive change. This study offers new perspectives to natural and social scientists, combining a multidisciplinary approach, and to industry and policy makers by proving



contextualized data to support decision making. By connecting the scientific research, the economic trade-offs of forest certification, and the market value of forestry-related products, this work provides hints for further studies and policy guidelines on sustainable development and impact of forest certification schemes.

Keywords: Forest management; sustainability; FSC; PEFC; research; market share

2. Multisilva: a web-based decision support system to assess and simulate the provision of forest ecosystem services at the property level.

First author(s): Claudio Petucco

Other author(s): Jacek, Stankiewicz, Jérémy, Ludwig, Tomás, Navarrete Gutiérrez

Affiliation: Luxembourg Institute of Science and Technology

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Forests provide a range of ecosystem services (ES) that enhance societal well-being. The provision of these services is closely linked to the structure and dynamics of forest ecosystems, which are significantly shaped by forest management practices. With societal demands for ecosystem services on the rise, it is crucial to understand and incorporate these complex ecological dynamics into forest management and planning. Furthermore, the recent emergence of ES certification schemes—such as those for carbon, water, biodiversity, and recreation—has also underscored the need to collect information and data to design and plan management actions, as well as to comply with certification procedures. This presents a significant challenge for forest planners. We introduce Multisilva, a decision support system (DSS) designed to facilitate multifunctional forest management. This web-based application features two main tools: the Mapping tool and the Simulation tool. The Mapping tool offers spatial statistics and maps that detail the current provision of ES at the forest property level, utilizing existing ES indicators to identify and highlight ES hotspots. These hotspots are essential for guiding multifunctional management strategies. The Simulation tool, built upon the established 3PGmix forest growth model, incorporates additional modules that assess ES flows and simulate the impact of management actions designed to enhance ES provision. This tool allows users to compare two management scenarios over time, delivering biophysical estimations of ES and calculating both direct and opportunity costs associated with each scenario. Enhanced by its capability for automatic retrieval of soil and meteorological data, Multisilva supports effective management and certification of ecosystem services in Europe.

Keywords: Forest management, Decision support system, Simulation, Mapping, Certification.



3. Enhancing Afforestation in Ireland: Insights from a Choice Experiment Survey and Interviews Among Farmers

First author(s): Laqiqige Zhu

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Ireland's forest cover, markedly lower than the European average, presents a significant environmental challenge. With only 11.6% of land under forestation compared to Europe's 38.6%, Ireland struggles to meet its afforestation goals despite substantial government incentives. This study seeks to understand the reluctance of Irish farmers towards afforestation and to quantify the effectiveness of financial incentives required for increasing forest coverage. Utilizing a Choice Experiment, we explored the willingness-to-accept (WTA) of Irish farmers for participating in afforestation programs.

Our research employed a mixed-methods approach, combining a Choice Experiment survey with in-depth interviews. The survey presented farmers with a series of choice cards depicting various afforestation scenarios differentiated by attributes such as tree species, land replanting requirements, subsidy payment duration, and annual premium payment amounts. Concurrently, interviews were conducted to gather qualitative insights that explore the nuances of farmers' perceptions and decision-making processes regarding these scenarios. The integration of quantitative data from the surveys and qualitative feedback from the interviews allows for a comprehensive exploration of the trade-offs and incentives that significantly influence farmers' participation in afforestation.

The study's findings play a critical role in reassessing and refining Ireland's forest policy. The insights gained from this research are expected to guide policymakers in developing more effective and farmer-aligned strategies to increase forest coverage. By pinpointing the key financial and decision-making factors in afforestation, this study contributes significantly to Ireland's efforts in enhancing forest cover, which is pivotal for ecological sustainability and climate change mitigation.

Keywords: Choice experiment, Afforestation, Financial Incentives, Forest Policy



4. FSC Verified Impact on Ecosystem Services: an added value for forest managers and companies

First author(s): Sofia Ferreira

Presenting author: Annerieke Sleurnik

Affiliation: FSC Portugal

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Forests provide essential ecosystem services and the management of those areas has a significant impact on their regulation. FSC certification allows forest managers to demonstrate their commitment to responsible forest management and the preservation of the services it provides.


However, forest managers are not always adequately rewarded for implementing good practices that contribute to the maintenance, improvement or restoration of ecosystem services. FSC has developed the Ecosystem Services Procedure as a tool for forest managers being recognized for the implementation of responsible practices, allowing them to communicate how they are making a measurable and verified difference on the forest.

This procedure provides a framework for impact verification in five ecosystem services – Biodiversity, Carbon, Water, Soil and Recreation – allowing the forest manager to relate activities implemented on the ground with the result being verified. This allows the manager to have a credible and verified basis (by an external and independent entity) based on high integrity data, for the communication of positive impacts on the ecosystem services provided by its forest and gives them the opportunity to attract businesses to sponsor their responsible forestry projects.

In addition to self-communication, the forest manager can also use verified impacts to attract companies and organizations that are interested in demonstrating their commitment to sustainability by supporting ecosystem services projects. Companies can communicate about this support and have access to quantifiable data that can be integrated into their sustainability and social reports.

FSC verified impact is an instrument that enables remuneration for ecosystem services, allowing effective support to forest managers in the monitoring, maintenance, and improvement of forests.

Presently there are 87 FSC ES projects implemented on the ground in 24 different countries.



Keywords: FSC certification, Ecosystem Services, Sponsorship

5. From nature-based solutions to nature-based governance: behavioural approach to understand human and non-human interactions

First author(s): Tatiana Kluvánková

Presenting author: Jiri Louda

Other author(s): Martin Špaček, Jiří Louda, Stanislava Brnkaláková, Julius Janáček, Tomáš Szabo; Dominik Horváth, Simo Sarkki, Juha Hiedanpää,

Affiliation: SlovakGlobe, Slovak academy of sciences and Slovak University of Technology, Slovakia

Contact: louda@ieep.cz

Nature-based solutions (NBS) are socio-ecological arrangements that benefit both humans and non-humans. Traditionally NBS builds upon natural dynamics but little attention has been given to how nature can inspire governance. Nature-based governance (NBG) integrates co-evolutionary potential through co-creative approaches, hence including more-than-human perspective into environmental decision-making. By responding to human and non-human needs nature-based governance cultivates collective action and transformation pathways towards more inclusive and resilient communities.

In this paper, we present a behavioural approach as a method to simulate multi-species involvement in nature-based governance. The method applies an algorithm of common pool resource game, originally developed by Elinor Ostrom, to solve social-ecological dilemmas in diverse cultural, ecological and geopolitical settings. The behavioural game uses role-playing as a tool for enhancing multispecies collaboration and learning. Role-board game (RBG), as an interactive agent-based model, enables to simulate resource dynamics, enable mutual learning and fair collective decision-making by human players stepping into the roles of diverse human and non-human actors.

The RBG reveals for discussion and deliberation: How non-human and human actors behave strategically in different situations and what can be the relevance of game playing to understand complex social-ecological dilemmas? By answering these questions, we build ideas on the often-hidden perspectives of non-human and human actors that can underpin emerging nature-based governance approaches in the real world. More-than-human perspectives



integrated in the RBG are tested in 7 communities across Europe as part of the Horizon Europe project COEVOLVERS (2022–2026).

In particular, we compare decision situations where i) NBS implementation is seen as environmental fixes, ii) organic co-design of full diversity of adaptive actions responds to the NBS by human and non-human actors, and iii) institutional co-design of human decisions is inspired by organic co-designs.

We believe that through game-based learning we can help to understand and navigate purposeful behavioural change for long-term sustainability and community well-being as a target of coevolutionary nature-based governance.

Keywords: Role board game; nature-based governance; co-creative approaches; multi-species involvement; co-evolution

BOOK OF ABSTRACTS

- I. SESSION DESCRIPTION
- II. SESSION PROGRAM

I. SESSION DESCRIPTION

ID: S6a

Transforming business conduct: Integrating the value provided by nature and people in private section decision-making

Hosts:

	Name	Organisation	E-mail
Host:	Martine Van Weelden	Capitals Coalition	martine.vanweelden@capitalscoalition.org
Co-host(s):	Erika Winquist	Natural Resources Institute Finland	

Abstract:

This session will focus on advancements that are being made to transform business models on the path towards nature positive. The session will bring together concrete private sector examples from several EU projects that incorporate ecosystem services, natural capital and biodiversity in their decision-making. The EU projects that will feature their advancements are SELINA, CircHive, SUSTAIN, GoNaturePositive! and A-Track. Business representatives that are working on the integrating of ecosystem services and natural capital information in their decision-making will present what they are working on, the challenge and the advancements made.

Planned output / Deliverables:

Improved collaboration across EU projects that aim to transform business action

Session format:

Discussion forum



II. SESSION PROGRAM

Room: Expert Street 5

Date of session: 18th of November 2024

Time of session: 11:00 – 12:30

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: S6b

Setting standards for biodiversity and ecosystem services for the corporate sector

Hosts:

	Name	Organisation	E-mail
Host:	Bettina Matzdorf	ZALF	matzdorf@zalf.de
Co-host(s):	Masahiro Ryo	ZALF	Masahiro.Ryo@zalf.de
	Cheng Chen	ZALF	cheng.chen@zalf.de

Abstract:

The requirements for companies to monitor their impacts on biodiversity and ecosystem services are increasing in Europe. The EU Corporate Sustainability Reporting Directive (CSRD) requires companies to undertake a double materiality analysis of their impact on and dependence on biodiversity and aims to increase transparency and accountability. In the agri-food sector, compliance with the directive means that the environmental impact, social responsibility and management practices for the management measures applied must be disclosed. So far, quantifying impact factors and setting reduction targets on the production side (measure level) is still popular, but sustainability reporting will have to shift to monitoring results or impacts, as well as rewarding the measures. Appropriate standards and monitoring methodologies are therefore required to enable both reporting and business models e.g. through to product labelling or ecosystem service provision. This session will focus on the current framework conditions for companies and the possibilities for standard setting. We will present and discuss standard setting in the context of reporting but also in the context of labelling-based approaches and business models and give examples of how to approach monitoring challenges with digital tools and artificial intelligence.



Goals and objectives of the session:

Improving the exchange on standard setting for the corporate sector

Planned output / Deliverables:

joint paper, in case of interest and input

Session format:

The session hosts will give an introductory presentation focusing on the current framework conditions and challenges. In addition, current use cases (e.g. CSRD monitoring, certificates) for standardisation will be presented. This overview will be sent to the session presenters before the conference so that the contributions within the session can refer to it. This will be followed by presentations on various research in the field of standard setting and a final discussion. Depending on the number of contributions, a length of 60 to 90 minutes is planned for the session.

II. SESSION PROGRAM

Room: Expert Street 3

Date of session: 18th of November 2024

Time of session: 11:00–12:30

Timetable Speakers

Time in min	Format	Presenter Surname	Title of presentation
6	Introduction	Matzdorf	Introduction into the session
12	Presentation +answer common questions +discussion	Wildner	Corporate biodiversity reporting in transition – Opportunities, Challenges and the importance of the Corporate Sustainability Reporting Directive of the European Union
12	Presentation +answer common questions +discussion	Evans	Biodiversity information pathways: a unified data structure to facilitate corporate sustainability reporting
12	Presentation +answer common questions +discussion	Reichenspurner	A trusted biodiversity standard: Foundation for corporate conservation engagement



12	Presentation +answer common questions +discussion	Garrido–Mateos	Bridging the Gap: Aligning Business and Biodiversity Metrics for Effective Conservation
12	Presentation +answer common questions +discussion	Kronenbitter	Basic Set of Biodiversity Criteria, a Blueprint to help Implementing and Measuring Biodiversity Governance and Performance in the Food Sector
12	Presentation +answer common questions +discussion	Ryo	Artificial Intelligence and Citizen Science for scalable monitoring and assessment of biodiversity and ecosystems
12	Discussion, common questions	all	Final moderated discussion/ potential joint publication?
90			

III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Biodiversity information pathways: a unified data structure to facilitate corporate sustainability reporting


First author(s): Alexandra Evans

Other author(s): Bruno Smets, Daniel Whitaker, Catarina Braga, Jacob Bedford

Affiliation: VITO (Vlaamse Instelling voor Technologisch Onderzoek)

Contact: alexandra.evans@vito.be

With the recent adoption of the EU Corporate Sustainability Reporting Directive (CSRD), companies will be required to report on their environmental and social impacts according to the European Sustainability Reporting Standards (ESRS). The significant risk that biodiversity loss poses to business and societal functioning is reflected in the ESRS as an increased focus on biodiversity impact reporting requirements. Concerns have been raised regarding the increased



reporting load for businesses and ambitious double materiality reporting target, as the complexity of the topic of biodiversity loss makes it difficult to identify, quantify and communicate relevant impacts. The need to meet the requirements of reporting directives has resulted in the development of a plethora of databases and tools, but a holistic method to manage biodiversity data, calculate indices and report impacts to comply with the CSRD remains lacking. As a co-lead in the Horizon Europe project A-TRACK, Vito is developing a common data structure to facilitate and harmonise biodiversity impact reporting for businesses. With the use of remote sensing and Natural Capital Accounting, Vito aims to accelerate the transition to green business by compiling a core set of biodiversity pathway data, accompanied by practical guidelines on applications in different business sectors.

Keywords: Corporate Sustainability Reporting Directive, biodiversity, Natural Capital Accounting, OpenEO, A-TRACK

2. Basic Set of Biodiversity Criteria, a Blueprint to help Implementing and Measuring Biodiversity Governance and Performance in the Food Sector


First author(s): Jenja Kronenbitter

Affiliation: Global Nature Fund

Contact: kronenbitter@globalnature.org

The Basic Set of Biodiversity Criteria, developed by Food for Biodiversity in 2022, is a comprehensive compilation of relevant biodiversity guidelines for agricultural and food production. This initiative involves collaboration among food companies, food standards, scientific institutions, and environmental organizations. While not a standalone "Biodiversity Standard," it serves as a blueprint for food companies and standards to update their criteria for agricultural production.

In September 2024, the EU-LIFE project "Biodiversity Governance and Performance in the Food Sector" will commence, aiming to revise and expand the Basic Set. This revision will incorporate feedback from member organizations' testing and align with new legal requirements. The project will tailor the general criteria to six high-risk, high-relevance commodities for the European market, with the goal of implementing these updated criteria across various supply chains involving Food for Biodiversity members.



A critical aspect of the project is the evaluation of suitable tools to measure the impact of these biodiversity criteria. The focus will be on different decision-making levels and the supportive tools required, specifically:

1. Tools for assessing potential risks to biodiversity,
2. Tools for evaluating the current state of biodiversity performance,
3. Tools for monitoring the progress of biodiversity performance over time.

By addressing these needs, the project aims to enhance biodiversity governance and performance in the food sector.

Keywords: Biodiversity criteria, standard setting, agricultural production, supply chain, biodiversity tools

3. Bridging the Gap: Aligning Business and Biodiversity Metrics for Effective Conservation


First author(s): Luis Garrido-Mateos

Other author(s): Fernando Rodríguez-López, José Ignacio Sánchez-Macías

Affiliation: University of Salamanca

Contact: luisgarrimateos@usal.es

Biodiversity has declined at an unprecedented rate in the last decades. In order to halt this process, public funds might not be sufficient, making it necessary to unlock private financing. At the same time, there is a growing social demand for more transparency on the effects of economic activity on nature. As a result, new legislation is being passed requiring companies to disclose information that identifies their impacts and dependencies on nature. The demand for biodiversity metrics and measurement tools has increased consequently, with a growing number of voluntary approaches and initiatives trying to meet those demands and set a benchmark. However, as biodiversity is a multidimensional concept, not all metrics refer to the same attributes, making it a fuzzy term to measure. To this end, we propose, on the one hand, a typology that contributes to a clearer understanding of the concept of biodiversity, and, on the other, we check the degree of alignment between the notion of biodiversity held by different stakeholders and the metrics available for its measurement, following the approach of



Balmford et al. (2022). This allows us to observe whether business preferences for biodiversity are reflected in the standard instruments to measure it. Furthermore, we also examine what role such potential dissonance may play in the efficient allocation of resources for biodiversity by firms, both in target-setting and in the channeling of financial flows to conservation policies.

Keywords: Biodiversity, firms, decision-making.

4. A trusted biodiversity standard: Foundation for corporate conservation engagement


First author(s): Margarethe Reichenspurner

Affiliation: Leibniz Centre for Agricultural Landscape Research

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Economic activities have a profound negative impact on biodiversity and related ecosystem services. At the same time, 50 % of the global economy is at risk due to biodiversity loss. In Europe, the decline is particularly pronounced in agriculture landscapes. To halt or reverse this trend, agricultural production methods must become more nature-friendly, and a larger share of land must be converted into non-crop habitats dedicated to biodiversity protection. Despite public funding supporting these efforts, the results are insufficient, partly due to limited budgets. To explore how corporate investments could complement public funding for agricultural conservation projects, 33 semi-structured interviews were conducted with companies outside the agri-food sector in Belgium, The Netherlands, France, UK and Germany between 2021 and 2022. The findings highlight that the development of a common standard and a trusted certification system are a necessary, even if not sufficient, basis for companies to engage in conservation. Both are needed for companies to set specific targets, report and communicate their actions effectively, and avoid accusations of greenwashing. In Germany, the Naturplus standard represents an initial effort to establish a high-qualitative standard for conservation. However, many challenges remain to improve and mainstream this standard as a basis for increasing corporate spending for biodiversity and ecosystem services.

Keywords: biodiversity standard, certification, reporting, communication, greenwashing



5. Artificial Intelligence and Citizen Science for scalable monitoring and assessment of biodiversity and ecosystems

First author(s): Masahiro Ryo

Other author(s): Yutong Zhou, Josepha Schiller

Affiliation: Leibniz-Zentrum für Agrarlandschaftsforschung (ZALF) e. V. Müncheberg

Contact: masahiro.ryo@zalf.de

Protecting biodiversity and ecosystem services (BES) is crucial for the agri-food sector, requiring an efficient monitoring tool, stakeholder engagement, and innovative tools beyond state support. In this talk, we will present an overview of a research framework that develops a scalable, user-friendly AI tool for monitoring biodiversity and ecosystem structure status in agroecosystems using smartphones. We will train a state-of-the-art multimodal large language-vision model with one of Germany's largest citizen-collected biodiversity datasets. The model should be able to predict ecosystem structural complexity, identify species across multiple taxonomic groups, and estimate land use intensity. After validation in experimental fields across Germany, the tool will be integrated into an online marketplace for certified nature conservation projects. The online marketplace assesses how well biodiversity conservation action is conducted in fields, and the AI is used for assisting the assessment. Additionally, we will evaluate the AI's potential and limitations for BES monitoring in terms of the institutional framework and social acceptance through standards review and stakeholder interviews. Our transdisciplinary consortium includes social management, AI, agronomy, biodiversity assessment, business consulting and NPOs. Typically handled by experts, biodiversity visual assessments can now be enhanced or replaced by our AI model and citizen science. Our project suggests a new business model that supports extensive local biodiversity assessments and conservation efforts with AI in practical, real-world applications.

Keywords: Biodiversity and ecosystem services assessment, Agroecosystems, User-friendly AI monitoring, Citizen Science, Large-Language Model

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: T1a

Operationalizing the IPBES framework in place based socio-ecological systems research

Hosts:

	Name	Organisation	E-mail
Host:	Neema Robert Kinabo	Senckenberg Biodiversity and Climate Research Center	neema-robert.kinabo@senckenberg.de
Co-host(s):	Peter Manning	University of Bergen	peter.manning@uib.no

Abstract:

Addressing global challenges of sustainable land use and biodiversity loss requires a knowledge base that integrates the major components of social-ecological systems, as attempted in the Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES) conceptual framework. This framework describes links between direct drivers of biodiversity change (e.g., land use and management), Nature's Contributions to People (NCP) provision (broadly equivalent to ecosystem services), stakeholder demand for NCPs, the link between NCPs and human well-being, and the governance and societal factors influencing biodiversity change and NCPs. However, the IPBES framework was developed for the science-policy interface, and operationalizing it in research projects presents numerous challenges that necessitate new research approaches. This posits an opportunity for interdisciplinary social-ecological research, which is of significant fundamental research interest and also an essential basis for transformation towards a sustainable relationship between nature and people.

Goals and objectives of the session:



This proposed session will showcase place-based social-ecological systems research that aims to operationalize the IPBES framework in a detailed but integrated fashion. Such detailed characterization of social-ecological systems is a crucial first step to identifying the many leverage points for transformation that may exist within them. The objectives for this session are to demonstrate approaches and share findings from interdisciplinary research studies that characterize the many components of the IPBES framework, and that generate knowledge that bridges the natural and social sciences interface. By doing this, we will show how such work can help identify potential leverage points within social-ecological systems for achieving transformative change. The focus of our session will be on the large-scale Kilimanjaro Social-Ecological Systems-KiliSES project (<https://kili-ses.senckenberg.de/>), which explicitly aims to operationalize the IPBES framework, and we will also welcome contributions from other projects with similar aims.

Planned output / Deliverables:

Characterization and mapping of social-ecological systems for identifying levers of transformative change.

II. SESSION PROGRAM

Room: Expert Street 2

Date of session: 19th of November 2024

Time of session: 11:00–15:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
11:00–11:13	Peter	Manning	University of Bergen, Norway	Operationalizing the entire IPBES framework on Mount Kilimanjaro
11:13–11:26	Dickson	Mauki	Senckenberg Biodiversity and Climate Research Center, Germany	Plant functional composition drives climate regulation across a tropical climatic gradient
11:26–11:39	Fabia	Codalli	Justus Liebig University Giessen, Germany	Water quality indices for drinking and irrigation water on the southern slopes of Mt. Kilimanjaro
11:39–11:52	Frank Paul	Shagega	Justus Liebig University Giessen, Germany	Influence of land cover types on preferential flow dynamics on southern slopes of Mt. Kilimanjaro, Tanzania



Time	First name	Surname	Organization	Title of presentation
11:52– 12:05	Koggani	D. Koggani	Senckenberg Biodiversity and Climate Research Center, Germany	The importance of biodiversity facets differs among wood supply products across tropical montane ecosystems
12:05– 12:18	Maria Eugenia	Degano	Senckenberg Biodiversity and Climate Research Center, Germany	Using soundscapes to reveal the role of biodiversity in non-material Natures' Contributions to People at Mount Kilimanjaro., Tanzania
12:18– 12:31	John	Sanya	Leuphana University of Lüneburg, Lüneburg, Germany	Heterogeneity of demands for Nature's Contributions to People and Nature's values by farmers: insights from the Kilimanjaro social-ecological System
14:01– 14:14	Neema Robert	Kinabo	Senckenberg Biodiversity and Climate Research Center, Germany	Land use and elevation shape NCP multifunctionality for diverse stakeholder groups in the Kilimanjaro Social-Ecological System
14:14– 14:27	Netra	Bhandari	University of Marburg, Germany	Exploring synergies and trade-offs between the potential supply of Nature's contributions to people in the southern slopes of Mt. Kilimanjaro, Tanzania
14:40– 14:53	Agnes	Vari	McGill University, Montreal, Canada	How is the IPBES conceptual framework useful for place-based research? Analyzing case studies across Canada
14:53– 15:06	Sophie	Peter	Institute for Social-Ecological Research, Germany	Transformative Change in Social-Ecological Systems: Analyzing Indirect Societal Drivers and Shaping Future Cultural Landscapes in Germany
15:06– 15:19	Victoria	Grießmeier	Senckenberg Biodiversity and Climate Research Center, Frankfurt am Main, Germany	Insights on place based on the causes and consequences of biodiversity change from the from the Biodiversity Exploratories Project
15:19– 15:30	Peter	Manning	University of Bergen, Norway	Open discussion and closing remarks

The first author is the presenting author unless indicated otherwise.

1. Exploring synergies and trade-offs between the potential supply of Nature's contributions to people in the southern slopes of Mt. Kilimanjaro, Tanzania


First author(s): Netra Bhandari

Other author(s): Neema Robert Kinabo, Dominic A. Martin, Andrea Larissa Boesing, Margot Neyret, Markus Fischer, Peter Manning, Dirk Zeuss

Affiliation: University of Marburg, Germany

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Mountain socio-ecological systems are biodiversity hotspots and provide various nature's contributions to people (NCP), which can vary with elevation and land use. Furthermore, diverse demands from stakeholders make it crucial to assess synergies and trade-offs in NCP supply at management-relevant scales. In this study, we reviewed literature and consulted experts from natural and social sciences to identify suitable indicators for NCP specific to the Kilimanjaro socio-ecological system. We underpinned each indicator with data from across a large interdisciplinary project, covering 65 plots belonging to 13 ecosystems along Mount Kilimanjaro's elevational gradient and collected between 2010 and 2023. Complementing these locally measured indicators, we compiled remote sensing data covering indicators best assessed at landscape scales. We trained a random forest model to upscale indicators collected from plots using suitable remote sensing proxy data, while some indicators were downscaled from pre-existing remote sensing data. Overall, the 49 indicators represent the potential supply of 18 NCP. We also addressed the problem of spatial autocorrelation using a 10-fold spatial cross-validation method. We then conducted an area of applicability assessment to define where the predictions are valid and invalid. We further standardized the scaled-up maps of landscape-level potential NCP supply to calculate synergies and trade-offs across the landscape. Results indicate that high supply of material NCP is associated with lower biodiversity and a trade-off with regulating and non-material NCP, which correlate with higher biodiversity. Regulating NCP are primarily governed by Kilimanjaro's climatic gradient, with land use and biodiversity explaining significant variation within climatic zones. Areas at higher elevation and conserved by the national park show higher supply of regulating and non-material NCP and low material NCP. These comprehensive results, especially when combined with stakeholder demand, will provide a holistic understanding of the socio-ecological system



and identify governance and management options to mitigate trade-offs and improve NCP supply.

Keywords: NCP indicators, Kilimanjaro, social-ecological system, upscaling, remote sensing

2. Water quality indices for drinking and irrigation water on the southern slope of Mt. Kilimanjaro

First author(s): Fabia Codalli

Other author(s): Frank Shagega, Lutz Breuer, Subira Munishi, Suzanne Jacobs

Affiliation: JLU Giessen, Germany

Contact: fabia.codalli@umwelt.uni-giessen.de

The southern slopes of Mount Kilimanjaro in Tanzania act as a water tower, providing the Nature's Contributions to People (NCP) regulation of water supply and quality for the densely populated slopes, the adjacent lowlands and the Pangani River Basin. The fertile soils have been home to the indigenous Chagga people, who have shaped the slopes with their small-scale "homegardens" and locally managed canal systems. Further down, the lowlands are characterised by intensive agriculture and settlements, particularly around the town of Moshi. Given the high water demand for drinking and agricultural use in the study area, this study aims to evaluate the NCP of regulation of water quality by assessing the suitability of eight different water types (streams in natural condition, streams, irrigation canals, domestic water, springs, lake, groundwater and rainfall) for drinking and irrigation. Fifty-one samples were collected in a snapshot sampling campaign over 10 days in February 2023 during the dry season. Initially, four physical water quality parameters, thirteen chemical and one microbiological parameter were analysed and compared with Tanzanian and international water quality guidelines. All parameters were within the guidelines except for faecal contamination and turbidity for drinking water and pH for irrigation water. Then, the same parameters were used to calculate the drinking (DWQI) and irrigation water quality indices (IWQI, Kelley's Index, Soluble Sodium Percentage, Permeability Index, Residual Sodium Bicarbonate and Magnesium Ratio). The DWQI classified 77% of the samples as unsuitable, 4% as poor or very poor and 19% as good or excellent for drinking. The poor drinking water quality was exclusively due to faecal contamination, highlighting the need to identify the sources and remediate them before distribution. The IWQI showed no restrictions in use. However, three of the other five suitability indicators revealed that high concentrations of sodium and magnesium made 20–30% of water sources unsuitable for irrigation.



Keywords: water quality, irrigation, drinking, water quality index, Kilimanjaro

3. Using soundscapes to reveal the role of biodiversity in non-material Nature's Contributions to People at Mount Kilimanjaro, Tanzania

First author(s): M. Eugenia Degano

Other author(s): Thomas Mueller, Ugo Arbieu

Affiliation: Senckenberg Biodiversity and Climate Research Center, Frankfurt am Main, Germany

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Soundscapes, comprising biological, biophysical, and anthropogenic sounds, hold significant cultural and emotional value for people. However, the differences and drivers of soundscape preferences and associated non-material Nature's Contributions to People (NCPs) across diverse cultural backgrounds and natural areas are relatively unknown. To address this gap, we collected acoustic recordings from seven habitat types across Mount Kilimanjaro (Tanzania) during dusk and dawn, and characterized them using eight acoustic indices. In a comparative approach, we played recordings to international tourists and local residents to assess their soundscape preferences and associated non-material NCPs. We ranked the recordings based on stakeholder group preferences and used generalized linear mixed models to identify drivers of non-material NCP association. We found a general preference for dawn recordings over dusk recordings, given the dominance and variability of birds' vocalizations over the louder, insect-dominated soundscapes of dusk. Local residents preferred and attributed more NCPs to natural sounds from montane habitats, followed by those from human-dominated areas such as coffee plantations and maize fields. In contrast, international tourists valued soundscapes from natural habitats such as grassland and subalpine habitats more highly. Furthermore, local residents and international tourists attributed different non-material NCPs to soundscapes. International tourists experienced greater restorative effects, particularly from natural sounds free of anthropogenic interference and with stable sound intensity, whereas local residents attributed cultural heritage to soundscapes associated with a high diversity of sounds, including both natural and human-generated sounds. This analysis highlights the differing perceptions of soundscapes and suggests pathways to link social perceptions with ecological data. Integrating these insights into management decisions could foster conservation strategies that consider the pluralistic perspectives of nature.

Keywords: non-material Nature's Contributions to People, cultural ecosystem services, soundscapes, pluralistic perspectives, acoustic indices



4. Insights on place-based research on the causes and consequences of biodiversity change from the Biodiversity Exploratories

First author(s): Markus Fischer

Other author(s): Victoria Griebmeier

Affiliation: University of Bern, Institute of Plant Sciences, Bern, Switzerland

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Since 2006, the Biodiversity Exploratories program (BE; www.biodiversity-exploratories.de) is focusing on long-term, large-scale investigations of the relations between land-use, biodiversity and ecosystem processes and services, using 150 grassland and 150 forest sites as model systems. More recently, the program is also addressing the indirect drivers of land-use change and the consequences of changing ecosystem service supply for various stakeholders.

To study these issues, three study regions, the so-called “Exploratories” were established along the North–East South–West axis of Germany, encompassing the following areas: Schorfheide–Chorin, Hainich–Dün, and Schwäbische Alb. In the current funding phase (2023–2026), 41 projects are involved, including several social–ecological ones.

We present results on land–use effects on various facets of biodiversity, on how biodiversity change affects ecosystem service supply, on how far this supply meets stakeholder demands, and on underlying cultural, socio–cultural, and socio–demographic factors. In addition, we highlight important lessons learned from place–based research into the ecological and socio–ecological causes and consequences of biodiversity change.

Keywords: Biodiversity, Interdisciplinarity, Research Platform, Ecosystem Services, Social–ecological Research



5. Heterogeneity of demands for Nature's Contributions to People and Nature's values by farmers: insights from the Kilimanjaro social-ecological System

First author(s): John Sanya Julius

Other author(s): Milena Gross, Tuyeni H. Mwampamba, Jasmine Pearson, Jennifer K. Sesabo, Maraja Riechers, Neema R. Kinabo, Viviane Krail, Berta Martín-López

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Farmers are not a homogeneous stakeholder group, particularly regarding their demands for Nature's Contributions to People (NCP) and how they value nature. Overlooking the inherent heterogeneity of farmers may prevent the implementation of inclusive nature conservation and agricultural policy that aligns with their needs and interests. We aimed to explore the inherent heterogeneity of the NCP demands and values of nature expressed by farmers, considering their socio-demographic characteristics, pro-environmental behavior, and geographical context. Additionally, we sought to understand how perceptions of NCP supply trends over the last decade affect demand for NCP. Using a socio-cultural valuation approach, we applied 364 face-to-face surveys in 14 villages residing on the southern slope of Mount Kilimanjaro, Tanzania. Based on the descriptive and redundancy analyses (RDA), we found that farmers primarily preferred material and regulating NCP: food, feed, and regulation of freshwater quality, whose supply is perceived as decreasing –i.e., 'critical' NCP–. Regarding values of nature, we found the highest share of agreement for statements representing intrinsic value (97.1% of respondents who agreed or strongly agreed), relational values (94.8%), and instrumental values (94.1%), although the pattern for individual value statements varied slightly. The RDA findings indicated that while altitudinal and latitudinal gradient, the number of generations living at Kilimanjaro and engagement in conservation activities strongly influenced NCP demand and nature's values. Values of nature were also influenced by age, education, and being a member of any association. Moreover, we found seven bundles of NCP demand that represent distinct ways farmers use and appreciate nature. These findings deepen the understanding of the interlinkages between NCP demands, perceived NCP supply trends, and the valuation of nature according to the inherent heterogeneity of farmers, which is essential to elaborate evidence-based strategies for nature conservation that align with their interests and needs.

Keywords: ecosystem services, interwoven NCP approach, mountain ecosystem, plural valuation, social preferences.



6. Land use and elevation shape NCP multifunctionality for diverse stakeholder groups in the Kilimanjaro Social-Ecological System

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Environmental changes can affect the balance between the supply of Nature's Contributions to People (NCP) and the demands of diverse stakeholders, especially in mountain social-ecological systems (SES). Balancing supply and demand require understanding how SES can provide the NCP demanded by diverse stakeholder groups. Here, we aimed to assess how multiple habitat types within the Kilimanjaro SES can provide multiple NCP simultaneously and how well this supply meets the demands of five stakeholder groups—farmers, conservationists, tourists, tour operators, and industry. Using the Ecosystem service multifunctionality (ESM) approach and data from across the Kili-SES project, we combined data on the supply of 25 context-specific NCP at the plot level with NCP demand social survey data of the five stakeholder groups. We found a significant difference ($p < 0.001$) between the demands of stakeholders, where tourists demanded non-material NCP, e.g., new and unique experiences, while others demanded material NCP like food. We also found that the supply of material NCP decreased while non-material and regulating NCP increased with increasing elevation and decreasing disturbance. Stakeholder groups with the highest average multifunctionality values were conservationists and tourists, suggesting favorable ecological conditions of the Kilimanjaro SES, as these groups prioritized regulating and non-material NCP, respectively. Furthermore, results showed that the smallholder agriculture system of homegardens had a high potential to provide both non-material NCP, e.g., aesthetic enjoyment, for tourists, and specific material NCP, e.g., provision of building materials, similar to the habitats under protection where these NCP are high. Our study identifies the ecosystems that best meet the demands of different stakeholder groups and why while highlighting those with potential for NCP provision beyond what is currently utilized. These results can form the basis for landscape multifunctionality measures to provide a landscape-level synthesis for conservation in the Kilimanjaro social-ecological system.

Keywords: Ecosystem Service Multifunctionality, stakeholder demand, NCP indicators, Kilimanjaro, social-ecological system



7. The importance of biodiversity facets differs among wood supply products across tropical montane ecosystems

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Biodiversity can strongly influence forest productivity, yet this does not necessarily translate to a higher supply of wood-based Nature's Contributions to People (NCP), as only selected fractions of tree biomass are used. This study utilized forest survey data from Mt. Kilimanjaro, plant trait databases, and information from the local socio-economic system to investigate how the role of functional biodiversity in driving NCP supply varied among several wood-based NCP: timber, charcoal, fuelwood, and for comparison, total tree above-ground biomass (AGB), while also incorporating climate and land use intensity (LUI) as direct drivers within a structural equation framework. The highest supplies of tree biomass, timber, charcoal, and firewood were at intermediate elevations and moderate LUI, specifically in lower montane, Ocotea, and Podocarpus forests, while supplies were zero at the highest and lowest elevations dominated by Helichrysum, Erica, grass, and maize fields. The role of biodiversity varied significantly among biomass and different NCP. Timber supply was greatest in areas with high species richness, whereas charcoal and fuelwood supplies were unaffected by species richness but were influenced by the community abundance-weighted mean (CWM) of tree height. Elevation did not directly impact the supply of timber, charcoal, or firewood; its effect was mediated through LUI, CWM tree height, and species richness. LUI negatively impacted tree AGB both directly and indirectly by reducing species richness and CWM tree height, which positively influenced AGB. Timber supply was indirectly affected by elevation and LUI via their negative effects on species richness, while fuelwood supply was directly and indirectly negatively affected by LUI through its reduction of CWM tree height. Our results indicate that the relationships between biodiversity and NCP differ from that linking biodiversity to ecosystem functioning because of selective human use. This has implications for the transferability of biodiversity-ecosystem functioning research, management of biodiversity and NCP.

Keywords: material Nature's Contributions to People, Kilimanjaro, Social-Ecological System, selective human use, functional biodiversity



8. Operationalizing the entire IPBES framework on Mount Kilimanjaro

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Addressing interlinked societal and ecological challenges requires interdisciplinary approaches, such as those promoted by the Intergovernmental Panel for Biodiversity and Ecosystem Services (IPBES) framework. Yet, because of the conceptual and methodological challenges posed by interdisciplinary work, applications of the framework have been mostly qualitative, or conducted in fragmented studies of sub-components of it. In this talk I will give an overview of the IPBES framework, describe the need to operationalize it and discuss the present challenges in doing so. I will then describe an approach taken to overcoming these challenges, and how it has been applied within the Kilimanjaro Social Ecological System (Kili–SES) project. The Kili–SES project is a large research consortium in which all major components of the IPBES framework are measured within multiple sub-projects in a single study region. The linked nature of these projects allows for detailed synthesis and whole systems level understanding. In turn this will enable identification of pathways to transformation. This talk will lay the foundation for later talks in this session which focus on conceptually linked sub-sections and synthesis of the system, and broader discussion of how we operationalize the IPBES framework in place-based social-ecological systems research.

Keywords: IPBES framework, social-ecological system, Kilimanjaro

9. Plant functional composition drive climate regulation across a tropical climatic gradient

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Plant functional composition play an important role in shaping plant ecological responses to environmental conditions and influencing ecosystem functioning. However, how whole-plant functional strategies aggregate at the whole community level to influence carbon storage across climatic gradients remains poorly understood. Across the broad climatic gradient of Mt



Kilimanjaro, Tanzania, we measured the variation in whole-plant strategies at the community level using both aboveground and belowground plant traits. With Structural Equation Models, we further assessed the joint effects of climate and plant functional strategies on carbon storage in trees and soil. Our results revealed two main axes of functional composition variation at the community level; namely slow-fast and woody-grassy axes, driven by climatic variability. Both axes of functional composition strongly drive variation in carbon storage, which was highest in "fast" and "woody" communities. Climate influenced carbon storage both directly and indirectly through variations in plant community strategies. There is an overall positive correlation between annual precipitation and carbon storage, while mean annual temperature tends to be negatively correlated with carbon storage. We demonstrated that major plant strategy axes manifest at the community level along climatic gradients and explain variation in carbon storage. Also, we show the climate can directly and indirectly influence carbon storage via plant functional strategies. In particular, communities with fast-growing woody plants show greater carbon storage potential.

Keywords: climatic gradient, plant functional composition, above-ground carbon, soil carbon storage

10. Transformative Change in Social-Ecological Systems: Analyzing Indirect Societal Drivers and Shaping Future Cultural Landscapes in Germany

First author(s): Sophie Peter

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Global biodiversity continues to decline, with unsustainable land use identified as a major direct driver, according to IPBES. To better understand this driving force, it is crucial to gain insights into indirect societal trends and their influence on the relationship between society and nature.

The DFG-funded project 'Socio-cultural Dynamics of German Cultural Landscapes – A Future-oriented Perspective' (SoCuLa) is part of the infrastructure priority program Biodiversity Exploratories and gain deeper insights into the social-ecological system of three German study regions. Therefore, our research takes a holistic perspective, focusing on indirect societal drivers of transformative change. By analyzing trends such as demographic change, health,



mobility, digitalization, societal transformation and changing values, we aim to understand their impact on biodiversity and ecosystem services. Our research focuses on identifying these indirect drivers and exploring sustainable approaches to shaping future cultural landscapes in Germany.

In my presentation, I will highlight three specific objectives of the project: (1) to investigate indirect societal drivers in Germany and more specifically in the study regions, (2) to participatively develop future social-ecological scenarios, and (3) to combine social science data with natural science research to create an interdisciplinary understanding of nature and society.

With the interdisciplinary approach of the SoCuLa project, we aim to combine social and natural science research to contribute to sustainable land use practices and the management of our cultural landscape in the future.

Keywords: Cultural Landscape, Indirect Societal Drivers, Participatory Scenario Development, Sustainable Land Use, Social-Ecological Research

11. Influence of land cover types on preferential flow dynamics on southern slopes of Mt. Kilimanjaro, Tanzania

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The southern slopes of Mount Kilimanjaro, Tanzania, feature a diverse range of land covers, from natural forests to agricultural lands. This diversity significantly impacts soil hydrological processes, particularly preferential flow (PF), and plays an important role in the provisioning of Nature's Contribution to People regulation of water supply. PF refers to the rapid movement of water through macropores, root channels, or fractures, bypassing the general vertical flow through the soil matrix. Understanding the influence of land cover on PF is essential for effective water resource management (e.g., groundwater recharge) and soil conservation (e.g., reduction of surface runoff) in this ecologically sensitive region. However, despite its importance, the quantification of PF in tropical regions, particularly in Sub-Saharan Africa, remains scarce. In this study, we assessed the influence of land cover on PF occurrence across



eight ecosystem types on Mount Kilimanjaro's southern slopes. We analyzed continuous soil moisture data measured in three soil depths and rainfall data at 1-h resolution from January 2022 to August 2023. After separating and clustering rainfall events, we assessed the dynamics of soil moisture responses. The order of soil moisture changes and response times in different soil depths informed us about the occurrence of PF versus sequential (matrix) flow. Our results also indicated frequent PF occurrence in upper mountain ecosystem types: Erica forest (81.6%), Ocotea forest (30.1%), and montane forest (26.4%), suggesting rapid subsurface water movement and potential groundwater recharge. Conversely, disturbed Ocotea forest, grassland, and maize fields indicated more uniform flow dynamics, which may lead to increased surface runoff and soil erosion. We also found that rainfall depth, duration, intensity, and initial soil moisture levels (optimal between 35 to 45%) significantly influenced PF occurrence. These findings are crucial for understanding subsurface water movements, soil conservation strategies, and managing the vital water resources of both the natural and disturbed ecosystems of Mount Kilimanjaro.

Keywords: rainfall events, soil moisture, soil moisture metrics, preferential flow, Mount Kilimanjaro

12. How is the IPBES conceptual framework useful for place-based research? Analyzing case studies across Canada.

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Conceptual frameworks in general are deemed to be important for multiple reasons: for synthesizing knowledge, for stepping from the specific to the general, for serving communication. The IPBES conceptual framework is one of the most acknowledged frameworks for social-ecological research. However, experience from place-based research points at a mixed engagement with this framework. In our comparative study, we wanted to know how far and for what the IPBES conceptual framework can be useful to place-based research. We analyzed six different landscape level case studies across Canada participating in the NSERC ResNet project. In our analysis we tested where the visual and textual representations of these case studies deviate or differ from the IPBES conceptual framework, and how these reflect their regional land management issues. We found that big-picture conceptual frameworks like the IPBES one are actually less used to guide local research than expected. The land-use management issues targeted by our case-studies could be often seen as conflicts within some



components of the IPBES conceptual framework (e.g. between different institutions, or as trade-offs between different ecosystem services). The process of developing own frameworks to represent more specific (local) social-ecological issues was often seen as more beneficial than the use of any pre-existing framework. Nevertheless, the use of well-known frameworks can help to translate between local actors (as a boundary object) or point out biases in stakeholders perceptions. They are also essential for communicating local processes and structures to external viewers.

Keywords: conceptual frameworks, place-based research, social-ecological systems, IPBES

BOOK OF ABSTRACTS

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- III. ABSTRACTS

I. SESSION DESCRIPTION

ID: T1b

The ES concept in science, policy and practice – a constructive reflection on its use, potential and challenges

Hosts:

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Abstract:

The concept of ecosystem services (ES) made its way from an initial communication concept with the intention to reconnect society with nature towards a widely accepted– yet contested – and applied concept in science, policy and practice in the past decades. Dedicated exchange platforms such as the ESP conference series as well as its mounting uptake into scientific publications, books and policy reports are just some signs of its successful development from niche into mainstream debate. In this session, we take the 5th ESP Europe conference as an occasion to



constructively reflect on the current status of the ES concept and the potential and challenges it bears for science, policy and practice now and in the future.

In this session, we seek to stimulate reflections, learnings and debate around the application of the ES concept in policy and practice and to elaborate pathways for bridging the gap between theory and practice. We start by looking back into the early times of the emergence of the ES concepts, its rationale, and the chances it brought to conceptualize social–ecological systems and their interdependencies with ecosystem goods and services. This view begins with a reconstruction of the ES development history and ends with its successors such as the IPBES work on NBP, NCPs and the latest values assessment. From there, we continue with a reflection on the integration of the ES concept into environmental governance and policy. Based on input presentations, we illustrate how the ES concept is used in policy strategies and instruments, its impact on institutional landscapes and governance, and assess respective policy performance and outcomes. In addition, we will focus on particular issues of uncertainties and underrepresentation. Finally, building on the conceptual and application–oriented perspectives, we enter into a moderated dialogue. We discuss the concept’s chances and challenges, and, moreover, to identify its ongoing relevance and pathways for bridging the gap between theory and practice for its future use.

Perspectives and questions we seek to cover in our session are:

- Insights into the ES concepts, rationales and further adjustment needs
- Translation of the ES concept into environmental governance and policy objectives across governance levels
- Performance of ES–oriented policy design and policy mixes
- Debating the ES use potentials, achievements and challenges for its future use, conceptualization and integration into practice

Throughout the session, an overview of perspectives on the ES concepts and its use shall be gained. Based on conceptual ideas, empirical findings and experiences on governance, policy and management practice, current and future chances and challenges of the ES concept shall become visible for debate.

Inputs by invited speakers and the mosaic of papers from an open call thus stimulate a constructive debate across disciplines and stakeholder groups on the ES concept in Europe and beyond. These insights serve as the basis for further conceptual development and practical applications to address the societal needs to ensure a healthy environment and more sustainable ecosystem uses.



Goals and objectives of the session:

The goal of the session is to stimulate reflections, learnings and a constructive debate around the current and future use of the ES concept. We seek to provide an insightful view of past to present conceptual developments, the uptake and integration of the ES into governance and policy, and a debate to derive implications for future use of the ES concept.

Planned output / Deliverables:

The outcome might be a Special Issue on perspectives and insights into ES concept, uptake and ways ahead based on the presentations and discussions

Session format:

This three-hour session is structured into two interlinked sub-sessions:

Part I: The ES concept in science, policy and practice (90 min)

In the first sub-session, we start with an input from invited speakers from science and policy to remind us on the early days of the ES concept, the underlying ideas and its successful mainstreaming, up to recent conceptual developments and uses.

This is followed by presentations of empirical findings on the integration of the ES concept in environmental governance and policy in different contexts. Central questions are (i) how is the ES concept used/integrated in policy instrument and strategy design, (ii) how did this integration lead to institutional and governance shifts, (iii) how do these policies perform in distinct contexts of natural resources management, and (iv) how are policy outcomes assessed.

Part II: Uncertainty and underrepresentation: Bridging the gap between theory and practice (90 min)

The second sub-session focuses on issues of uncertainty and underrepresentation as particular governance challenges and potential pathways for bridging the gap between theory and practice, based on few empirical findings.

Afterwards, we will have a final moderated science-policy-practice dialogue with participants from both sub-sessions to discuss their perception on the practicability, current relevance, chances and challenges of the ES concept in use. In combination of these perspectives, we hope for indications of future ES concept use in science, policy and practices and pathways ahead.

II. SESSION PROGRAM

Room: Expert Street 7


Date of session: 19th of November 2024

Time of session: 11:00 – 12:30 & 14:00 – 15:30

Timetable Speakers

Part I: The ES concept in science, policy and practice

Time	First name	Surname	Organization	Title of presentation
11:00 – 11:15	Alexander Jelle	Oudenhoven Vandenberg he		Introduction to the topic: a critical reflection on use and usability of ES from different angles.
11:15 – 11:25	Luis	Inostroza	Mendel University Brno, Czech Republic	The philosophical and conceptual ground of ecosystem services. A conversation about paradigms, analytical distinctions, pitfalls and misunderstandings in ecosystem services science.
11:25 – 11:35	Ewert	Aukes	Governance and Technology for Sustainability, Faculty of Behavioural, Management, and Social Sciences, University of Twente	The science diplomatic character of the ES concept
11:35 – 11:45	Simone	Martino	Social, Economic and Geographical Sciences Department, the James Hutton Institute, Aberdeen	Where is Natural Capital being used in Policy-Making? Results from an international review
11:45 – 11:55	Roxanne Suzette	Lorilla	Department of Geography, Harokopio University of Athens	ES as a cross-sectoral approach to account for pluricentric values of nature within the new EU Green Deal
11:55 – 12:05	Jan	Daněk	Global Change Research Institute of the Czech Academy of Sciences	National platform for ES and its role in facilitating implementation of the ES framework in the Czech Republic



Time	First name	Surname	Organization	Title of presentation
12:05 – 12:15	Michael	Leon	Research Institute for Nature and Forest (INBO)	Ecosystem Services as (Co-)performative Practice: Experiences from Integrated Water Management in Flanders
12:15 – 12:25	Connie	López-Gómez	Department of Geosciences and Environment. National University of Colombia, Medellín–Colombia	Rural and afro–descendant women narratives on ES in conservation planning and policy: a Colombian case study.
12:25 – 12:30	Q&A			Remaining q&a

Coffee Break: 12:30 – 14:00

Part II: Uncertainty and underrepresentation: Bridging the gap between theory and practice

Time	First name	Surname	Organization	Title of presentation
14:00 – 14:05	Roberto	Pastén	Universidad San Sebastián	Introduction to sub session on challenges
14:05 – 14:15	Chantal	Blom	Statistics Netherlands	well-being, SDGs and Natural Capital
14:15 – 14:25	Ilse	Nijenstein	Vrije Universiteit Amsterdam	The concept of novel lans uses in Europe: data collection and linkages with ecosystem services well-being and biodiversity
14:25 – 14:35	Roberto	Pastén		Economic valuation of sediment retention and the impact of forest conservation
14:35 – 15:30	all			<p>Final and joint debate:</p> <p>A constructive reflection on the use, potentials and challenges of the ES concept in science, policy and practice</p> <p>Session conclusion</p>

The first author is the presenting author unless indicated otherwise.

1. The science diplomatic character of the ecosystem services concept

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The notion of ecosystem services and ecosystem knowledge in general have gained a foothold in environmental governance in the past few decades. Although various domestic policy levels apply (eco-)systems thinking sometimes explicitly, sometimes more implicitly, the pervasiveness of ecosystem knowledge in and its value for international relations and transboundary governance processes and an ecosystem service perspective is not well-explored. Other than for single-issue treaties existing for water, energy or agriculture, ecosystem services are harder to address with international legal treaties due to their holistic nature. Thus, this contribution intends to explore the question: What role does ecosystem knowledge and an ecosystem service perspective play in transboundary environmental governance? We approach this issue with a perspective of science diplomacy. On the one hand, the science diplomacy perspective allows us to conceptualize ecosystem services as a specific form of knowledge that can mediate in understanding transboundary ecological contexts, requiring specific experts in corresponding governance contexts. On the other hand, ecosystem services may support diplomatic interactions relating to transboundary environmental issues. Thus, we do not take a vertical multi-level governance approach, but rather focus on a horizontal, cross-jurisdictional perspective, in which ecosystem services may play a role in escalation or de-escalation of conflict. This includes implications for what could be called an ecosystem justice approach. We address the research question by exploring two cases of transboundary environmental governance collaboration in which we focus on the implicit or explicit role of ecosystem services. These cases involve (a) a transboundary research project involving various lower-level governmental organizations on the border between the Netherlands and Germany, as well as (b) the transboundary water resources shared between Central Asian countries based on the Almaty treaty and other agreements.

Keywords: Ecosystem services, science diplomacy, international relations, cross-jurisdictional perspective, Exploratory comparative case study



2. Well-being, Sustainable Development Goals and Natural Capital

First author(s): Chantal Blom

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The availability of Natural Capital (NC) resources is an important component of both well-being and Sustainable Development Goals (SDGs) indicator frameworks. Statistics Netherlands compiles Ecosystem Accounts using the SEEA standard, and analyzed the suitability of the resulting data to inform the well-being and SDG frameworks. This resulted in five NC indicators to be used in this context.


There are however differences between the frameworks which bring some challenges.

First: directionality. The SDG indicators puts humans at the center. It is therefore important that the interpretation of indicators in terms of positive or negative effects on well-being is straightforward and unambiguous. For the case of Ecosystem services this is not always the case. For example, the annual flow of ecosystem services may decline because supply decreases (e.g. less capacity of ecosystems for air filtration) or because demand decreases (e.g. cleaner air). Subsequently, changes in the flow of ecosystem services cannot be unambiguously related to changes in well-being, and are therefore less suitable for monitoring well-being following the current framework of the SDGs.

Second, the valuation of ecosystem services is less suitable within our monitoring framework, because an increased use of an ecosystem service does not necessarily improve well-being. In contrast, ecosystem condition indicators are better suitable to measure well-being, because of their clear directionality.

Intertwining different frameworks is important but challenging.

For example: different definitions used by different frameworks and multiple organizations deliver data for the SDG indicators. As an example, for monitoring 'forest', the EU Green Deal Dashboard (LUCAS), SDG Portal (UNSTATS), NC, FAO-FRA and others all use different methods and definitions. In our experience, even after following the standardized method and definitions of the System of Environmental Economic Accounting (SEEA) framework and Eurostat as much as possible, maintaining consistency remains challenging. Therefore, staying in contact with other stakeholders is of most importance.



Keywords: Natural Capital, Sustainable Development Goals, Well-being, Ecosystem services, System of Environmental Economic Accounting

3. National Platform for Ecosystem Services and its role in facilitating implementation of the ecosystem services framework in the Czech Republic

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Although the ecosystem services (ES) framework is already implemented in key national environmental policies in the Czech Republic, its application in decision-making has so far been rather scarce. In this contribution, we reflect on the role of the existing national science-policy interface which was formed through participatory approaches and how it supports the implementation of ES in policy and decision-making in the Czech Republic.

The National Platform for Ecosystem Services (NPES) was established in 2022 as a result of a stakeholder consultation process with a broad range of actors. The platform aims to enable the effective integration of scientific knowledge in the policy-making and decision-making process, in order to minimise the existing gap between science and practice and to further develop the science-policy interface in and beyond the nature protection sector. After three successful meetings during the last three years (and the next one being planned in 2025), we suggest that the NPES has created an important and unique space for the ES agenda on the national level. Participatory elements are part of the meetings of NPES, e.g. in the form of round table discussions, presentations of platform members and evaluation surveys. Stakeholder engagement also provides further insights into implementation of the ES framework, reflecting pertaining barriers and challenges, but also positive visions for the future use of ES.

Continuous involvement of a wide range of actors confirms the need for a well-functioning science-policy interface to facilitate knowledge exchange and implementation of ES across various policies, sectors and institutions (and to overcome traditional “silo” boundaries). We conclude by suggesting the future role of NPES within upcoming national environmental policies.



Keywords: ecosystem services, implementation, science–policy interface, national platform, stakeholder participation


4. The philosophical and conceptual ground of ecosystem services. A conversation about paradigms, analytical distinctions, pitfalls and misunderstandings in ecosystem services science.

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The ecosystem services (ES) concept has become a consolidated research field with a consistent knowledge structure. ES was first used as such in 1984 by Ellis and Ellis, however, the conceptual ground is to be found in systems ecology, the discipline that shaped the foundational ground of what we know today as ES science. From early uses of related concepts such as landscape and ecosystem functions, nature services, and the like, ES has become a powerful tool for understanding the extent to which humans depend on nature. The ES community iterates around two predominant paradigms that possesses clear differences in the conceptualisation of the benefits humans receive from ecosystems and how these benefits are produced. The concept is also crossed by the transdisciplinary contradictions emerging from the interbreeding of economics – i.e. demand & supply – with conservation biology – intrinsic values, etc. resulting in unclear operationalizations of the concept on the ground. Being an intuitive concept that seems to be understood at first sight, it also shows the signs of buzzwords, where pitfalls and misunderstandings of the ecological foundations are frequent, inside and outside the ES research community. In recent years, several articulations with societal problems like climate change have broadened the horizon of ES science, reaching an undeniable global relevance crossed with regional and local meanings and flavours. As with any science, ES is an evolving field that remains compromised with the core mission set in the early days. This spirit of ES science keeps the capacity to inspire new generations in the pursuit of not only solving our striking societal problems led by the current socioecological crises but mostly to provide the conceptual apparatus to advance towards a profound change in the philosophical ground of our daily assumptions. Mostly by reallocating humans inside ecosystems, as co-producers of the ES we benefit from, a kind of awareness exercise that can reveal our place in the web of life including the myriad of intricate connections, we have with every living form and environmental compartment on this planet. Humans are nature and this is mostly a philosophical proposition that calls for a humble recognition of our limited capacity for



stewardship (rejection of moral tuition) and understanding of non-human-person needs. Nature does not need humans.

Keywords: human-nature, ecosystem services science, knowledge production

5. Ecosystem Services as (Co-)performative Practice: Experiences from Integrated Water Management in Flanders

First authors(s): Ann van Herzele

Presenting author: Michael Leone

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Environmental concepts are performative in that they help create the environment they describe. We explore the performativity of the ecosystem services concept in the field of integrated water management in Flanders (northern Belgium). The data was collected from 23 in-depth interviews with professionals in the field, conducted in two rounds with a five-year interval (2013 and 2018) and complemented with on-site observations of practices applying the concept. Results indicate that ecosystem services was only marginally performative on its own, and rather was seen as a ‘co-performative concept’ that – in conjunction with existing concepts – could accelerate the envisioned integration process through promoting initiatives, mobilising stakeholders, shaping orientation, creating win-win situations, and more. Yet, despite these aspirations, the concept has in general failed to perform as expected. Many perceived ecosystem services as an academic concept, too complex for practical application. Common strategies were either to adapt the concept to fit one’s professional context or to create a new practical context (a stakeholder workshop, for example) where the concept could function. We end with a discussion on the more general implications of the (pseudo-)malleability and context-dependence of the ecosystem services concept.

Keywords: Performativity, ecosystem services, integrated water policy and management, environmental concepts, malleability



6. Rural and Afro-Descendant Women narratives on ecosystem services in Conservation Planning and Policy: A Colombian Case Study.

First authors(s): Connie López-Gómez

Affiliation: Assistant professor. Department of Geosciences and Environment. National University of Colombia, Medellín-Colombia

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This study explores the divergences and convergences between the perceptions and narratives of women leaders from peasant organizations and Afro-descendant community councils regarding the concept of ecosystem services and processes of conservation in their territories through planning instruments and payment for ecosystem services schemes. The central research question of the ESP conference is: What visions do women leaders express in response to the dominant discourses of planning – conservation versus production-deforestation-economic growth in implementing the ecosystem services approach? Using a qualitative methodology, the study involved 42 interviews, of which 66.7% were with female leaders and 33.3% with male leaders. The interviewees are representative of cultural groups, including farmers (31%), Afro-descendants (38%) and individuals not belonging to any particular cultural group (31%). This research identifies how ethnic self-identification, age and territorial political roles influence acceptance or opposition to institutional conservation processes and understanding of the ecosystem services approach. This approach challenges the dominant narrative that portrays women as naturally aligned with environmental interests due to perceived feminine and altruistic principles. The results show that cultural background and political roles significantly shape leaders' perspectives on conservation and ecosystem services, highlighting that women's environmental engagement cannot be attributed solely to inherent altruism, but is influenced by complex socio-cultural dynamics. This study provides insights into how gender, ethnicity and political identity intersect with environmental conservation efforts and offers a more informed understanding of the role of women leaders in these processes.

Keywords: Ecosystem services, conservation planning, gender perspective, latin america, qualitative research



7. Ecosystem Services as a cross-sectoral approach to account for pluricentric values of nature within the new EU Green Deal

First author(s): Roxanne Suzette Lorilla

Other author(s): Evangelia G., Drakou

Affiliation: Department of Geography, Harokopio University of Athens, Greece

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The new EU Green Deal (EGD) outlines a multifaceted strategy encompassing, among others, climate neutrality, clean energy, circular economy, biodiversity preservation, and pollution mitigation. Due to the EGD's diverse goals policymakers and stakeholders need to follow a multidisciplinary approach to address all policy priorities, and minimise cross-sectoral challenges while ensuring that biodiversity remains at its best state. Within the GUARDEN project, we develop an operational framework that integrates the Ecosystem Services (ES) and Nature's Contributions to People (NCPs) frameworks into policy formulation and decision-making. The ultimate goal is to reveal alternative pathways for harmonized actions within the EGD's broader context of a more sustainable future. Through a text-mining approach, we identified the key topics and ES within the EGD policy documents and revealed potential synergies and trade-offs among them. Through an analysis of co-occurrence matrices, we identified the direct and indirect links between policy areas, suggesting that addressing specific policy targets can either fulfil or inhibit another target. We further assessed the relationships among EGD objectives considering the values that each policy integrates in their specific targets. We assigned IPBES' values types to each target and identified the distribution of intrinsic, instrumental and relational values across the EGD objectives. We then carried out the analysis at a local level, through focus group discussions with established multi-stakeholder partnerships. These allowed us to identify the diverse values, views and priorities that stakeholders attribute to these policies in France, Greece, Spain and Cyprus. Then the outcomes from the EU to the local level were qualitatively analyzed to highlight the ES applicability to provide decision support. The concept of ES/NCPs served as a bridging concept which allowed us to integrate different local/regional management and governance priorities while demonstrating the cross-scale challenges when applying European-wide policy agendas. We conclude that in order to achieve socially equitable, pluricentric and environmentally sustainable outcomes, one has to consider nature's multiple values.

Keywords: European Green Deal, IPBES, plural values, stakeholder partnerships, text-mining



8. Where is Natural Capital being used in Policy-Making? Results from an international review

First author(s): Simone Martino

Other author(s): Ishaan Patil, Stanislav Martinat, Antonio Ballesteros, Kerry Waylen, , , ,

Affiliation: The James Hutton Institute

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The term ‘Natural Capital’ (NC) is attracting interest both within and beyond academia. One area where NC may be useful is in public policymaking. Although efforts have been made to track the influence or use of these initiatives (for example by the WAVES programme of the World Bank in the Global South or the INCA project in Europe) there is still limited knowledge of how NC is influencing policymaking.

We searched for case studies of NC being linked to policy development anywhere in world, at a national and subnational level, based on both academic and grey (non-peer-reviewed) literature. We found that 30 countries (half were in the Global South) had implemented one or more initiatives by or for the public sector, mainly based on NC accounting at national level, while approaches using the concept of Ecosystem Services (ES) were more dominant in the Global North. The most common types of NC accounts reported as achieving use or influence are focused on water, forestry, timber, minerals, energy, and biodiversity. These accounts were used to inform the corresponding policy areas and plans. We have also found that 30% of the database (168 case studies) reports cases claiming “instrumental” impact, such as making tangible changes to the design of economic and regulatory approaches such as changing resource use permits, refining fiscal regimes, or reviewing conservation easement.

These results suggest that there have been considerable efforts worldwide to develop NC approaches within national or regional level policymaking. However, it was often hard to discern specific changes in policy or its outcomes. Challenges to mainstreaming NC approaches remain, including the lack of national and regional policy drivers, the presence of sectoral divisions within environmental governance, and insufficient resources and a lack of skilled intermediaries at the science and policy interface.

Keywords: natural capital, ecosystem services, policymaking, policy impact, science-policy interface



9. Land and Property Valuation Informed by Ecosystem Services

First author(s): Ernesto López–Morales

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The monetary valuation of ecosystem services (ES) can help improve fairness in land price distribution. Land appreciation is widely acknowledged as unearned because external factors influence it, including natural goods and benefits. However, property tax regimes barely consider these factors, as there is a limited understanding of how different types of ES, primarily regulating and cultural ES, impact property prices during urbanization. This study aims to address this knowledge gap.

This study is particularly relevant as it centers on the Northern Patagonia region in southern Chile. This ecologically sensitive area, experiencing an increase in population from urban to rural areas with low-density residential development and significant rises in land and property values, is an ideal location to study the impact of urbanization on property prices.

The research involves several steps. First, it conducts identification, mapping, and matrix-based ES valuation. Free-source land use and satellite-assisted land cover maps create a map of urban structural types (UST). Ecosystem services are then assessed using Burkhard's matrix land cover-based approach and a Delphi panel, with input from a 12-local expert pool from diverse environmentally related disciplines.

Second, a GIS creates a geodatabase for analyzing property factors such as price, size, and materiality. Around 400,000 observations are available from 2000 to 2023. To measure accessibility to ES, the study uses distances based on Euclidean, Manhattan, and network methods criteria to ascertain real versus virtual accessibility. We aim to show that accessibility to specific ES affects property value. Hedonic pricing analysis estimates the marginal willingness to pay for proximity to every ES in every UST.

This study's method and expected results have the potential to significantly impact property tax appraisal mechanisms in southern Chile and elsewhere, providing valuable insights that could lead to improvements in these systems.

Keywords: Property valuation, Ecosystem services, Urbanization, Northern Patagonia





10. The concept of novel land uses in Europe: data collection and linkages with ecosystem services, well-being and biodiversity

First author(s): Ilse Nijensteen

Other author(s): Nynke Schulp

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Research on land use change traditionally emphasizes spatial patterns of land use type conversions and shifts in management intensity and their drivers. Current methodologies often generalize these changes, overlooking novel land uses—unprecedented or emerging types within a region. Novel land uses involve transformations resulting in different ecosystem services or fundamentally altered operations, with significant ecological and emotional impacts. Categories include recreation, energy, new dietary trends, climate adaptation and rewilding. This study examines synergies and differences among novel land uses and their impacts on ecosystem services, biodiversity and human wellbeing.

Novel land uses such as holiday villages, golf courses and recreational horse keeping reflect shifting lifestyle preferences and economic developments, yet they present environmental challenges like habitat fragmentation and resource overuse. Renewable energy projects, also an example of novel land uses, introduce visual and ecological disruptions, necessitating a balance between development and conservation. Another example of novel land use is the rapid expansion of greenhouses, particularly in the region Almería, Spain.

Social acceptance and temporal impacts of novel land uses vary, with immediate economic benefits often juxtaposed against long-term ecological changes.

This study emphasizes the need for a comprehensive understanding of the mechanisms driving novel land uses, their spatial and temporal patterns, and their impacts on ecosystem services and human well-being. It discusses the synergies and differences among various novel land uses, from enhancing recreational opportunities and local economies to creating environmental pressures.

Lastly, integrated landscape planning, sustainable resource management and community engagement are promoted. Encouraging multifunctional land use and balancing economic development with environmental conservation are crucial to optimizing land resources for biodiversity, ecosystem services and human well-being. This research contributes to filling the



gap in knowledge about novel land uses, offering insights into their potential benefits and challenges for sustainable land use management.

Keywords: land use, ecosystem services, human well-being, biodiversity, novel

11. Economic Valuation of Sediment Retention and the Impact of Forest Conservation Policies

First authors(s): Ana Araos

Presenting author: Roberto Pastén

Other author(s): Roberto Pastén

Affiliation: CEDES, Universidad San Sebastián

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This study examines the economic valuation of sediment retention as an ecosystem service, its relationship to forest coverage, and the impact of public policies aimed at increasing conservation. We analyze how forests contribute to soil stability and reduce erosion, quantifying the economic benefits of avoided sedimentation in waterways and reservoirs. Using a combination of remote sensing data, hydrological modeling, and economic analysis, we demonstrate a positive correlation between forest cover and sediment retention value. Furthermore, we evaluate the effectiveness of various public policies designed to promote forest conservation, including payment for ecosystem services programs and regulatory measures. Our findings suggest that targeted conservation policies can significantly enhance sediment retention services, yielding substantial economic benefits while contributing to broader environmental goals.

Keywords: sediments retention, forest conservation, ecosystem services, economic valuation, public policy

BOOK OF ABSTRACTS

- I. SESSION DESCRIPTION
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I. SESSION DESCRIPTION

ID: T1c

Conceptual mismatch: how to reconcile ecosystem services, One Health, and other buzzwords to achieve real transformative impact?

Hosts:

	Name	Organisation	E-mail
Host:	Simon Lhoest	ULiège	simon.lhoest@uliege.be
Co-host(s):	Nicolas Antoine-Moussiaux	ULiège	nantoine@uliege.be
	Sophie Vanwambeke	UCLouvain	sophie.vanwambeke@uclouvain.be
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	Sander Jacobs	INBO	sander.jacobs@inbo.be

Abstract:

In recent years, a plethora of conceptual frameworks have emerged in environmental and public health discourse, including ecosystem services, Nature's contributions to people, One Health, Planetary Health, Resilience, and Sustainable Development. While these concepts aim to address complex issues at the intersection of ecology, human health, and sustainability, their proliferation has led to questions about their efficacy and practical application. Are these frameworks truly advancing nature preservation and enhancing human well-being, or are they merely buzzwords that dilute focus and impede progress?

The session seeks to critically examine these concepts and explore opportunities for integration into a unified vision that can drive transformative impact. Through a combination of presentations and interactive discussions, participants will delve into the purposes and implications of these frameworks, identifying synergies, conflicts, and potential pathways for effective implementation.



The transformation of our research approaches themselves, emphasizing more actionable science and avoiding overly rigid conceptual frameworks will be discussed.

Goals and objectives of the session:

We are looking for conceptual contributions, and case studies that clearly employ a conceptual framework (thus rendered operational). The desired aim of this session is to integrate these multiple concepts into a unified vision of how to navigate through all the existing frameworks and mobilize them to achieve real transformative impact.

Planned output / Deliverables:

We will provide a discussion forum on the transformative potential of conceptual frameworks in general, and of conceptual frameworks presented in this session in particular. Following the session, we will propose to write a paper that synthesizes the collective insights and recommendations generated during the discussions. All participants will have the opportunity to contribute as co-authors, ensuring diverse perspectives and expertise are represented. The draft manuscript will be submitted to a peer-reviewed journal for publication, thereby extending the impact of the session beyond the conference.

II. SESSION PROGRAM


Room: Expert Street 6

Date of session: 18th of November 2024

Time of session: 11:00–12:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
11:00	Olgalu	Hernandez–Manrique	Basque Centre for Climate Change	Beyond "One Health" in Socio–ecological Systems: eliciting interdependencies with researchers
11:15	Kati Susanna	Kiiski	South–Eastern Finland University of Applied Sciences / University of Eastern Finland	Nature–based methods and structures in the Finnish social and health service system: One solution in the life of a person living in the midst of global challenges
11:30	Enrico	Lucca	University of Florence	Integrating “Nature” in the Water–Energy–Food Nexus: Current Perspectives and Future Directions



Time	First name	Surname	Organization	Title of presentation
11:45	Fadzai	Matsvimbo	BirdLife International	Vulture conservation, a practical demonstration of the One Health concept.
12:00	Joséphine	Piette	University of Namur	Linking Nature Perception to Dengue Epidemics: A systemic implementation of One Health framework in Argentina
12:15	Bep	Schrammeijer	Vrije Universiteit Amsterdam	Socio-technical-ecological metabolisms

III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Beyond "One Health" in Socio-ecological Systems: eliciting interdependencies with researchers

First author(s): Olgalu Hernandez-Manrique


Other author(s): Andrea Albert Fonseca, Aline Chiabai, Marc Neumann

Affiliation: BC3 – Basque Centre for Climate Change

Contact: olga.hernandez@bc3research.org

The One Health approach is traditionally centred around human and animal health. This research investigates the full integration of human, animal, and ecosystem health within socio-ecological systems. The study addresses the complexity of employing a systems approach to the recent holistic One Health High-Level Expert Panel definition of One Health.

A set of initial categories and components was obtained from the “determinants of human health” and “nature’s contributions to people” frameworks. To identify the components of animal health, we included elements from various perspectives, including social determinants of animal health and health inequalities, fish and wildlife health, and companion animals’ health. We also separated the socioeconomic components proposed for human and animal health into a new category.



This experiment involved 12 researchers who conducted a cognitive mapping exercise with 51 components. These maps were analysed for network characteristics, and the cognitive maps (CM) were aggregated into a collective CM. This collective map provides a preliminary holistic view of One Health within SES.

Our research explored the complex interdependencies within the network. The findings indicate that habitat maintenance, food and feed, pollution, body function, and the microbiome are the most influential components. The collective CM revealed significant interconnections, emphasising the importance of political governance, habitat maintenance, and pollution in influencing the network. The analysis identified critical pathways and feedback loops, highlighting the need for analysis beyond the traditional One Health framework.

This study demonstrates the utility of CM in visualising and analysing the intricate relationships between various health domains in SES. The findings offer a preliminary yet valuable perspective on enhancing the One Health approach despite assets such as methodological constraints. To refine this integrative health model in socio-ecological systems, future research should continue to expand our general model, incorporating broader environment-related components, including soil and pollinators.

Keywords: One Health, socio-ecological systems, cognitive mapping, knowledge co-production

2. Nature-based methods and structures in the Finnish social and health service system. One solution in the life of a person living in the midst of global challenges

First author(s): Kati Susanna Kiiski

Affiliation: Kati Susanna Kiiski

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Many of the human physical and mental health challenges probably stem from our alienation from our natural environment. Alienation from nature and health challenges are part of the wicked problems we live in the midst of. At the same time, our social and healthcare system is in crisis. There is some national and international research on the health and well-being effects of nature. The effects have been shown to be mostly positive. Harnessing the health and well-being effects of Finnish forest nature as part of the Finnish field of social and health services and increasing the well-being of the population has not yet been implemented on a large scale.



However, the concept of planetary well-being and planetary health has emerged in Finland recently. Intervention studies investigating the health and well-being effects of nature have been ongoing for ten years. With the help of these, the applicability of the services from the point of view of individuals (and certain customer groups) has been investigated, and the experiences of the target persons (customers) with nature-based services have also been studied. More research is still needed on this whole to assess how Finnish (forest) nature can be suitable as an effective part of the Finnish social and health service system. At the same time as nature-based methods are being studied in practice for different disease groups, both preventively and therapeutically, it is worth considering how they will be introduced into the service system. In my own research, I intend to use the delphoi method of future research to find out how those working in the field or those deciding on best practice recommendations see the issue.

Keywords: planetary well-being, planetary health, nature connectednes, social and health care system

3. Integrating “Nature” in the Water–Energy–Food Nexus: Current Perspectives and Future Directions


First authors(s): Enrico Lucca

Other author(s): Dimitris, Kofinas, Tamara, Avellán, Hasan Volkan, Oral

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Integrated approaches for managing natural resources are said to meet the increasing demand for water, energy, and food while maintaining the integrity of ecosystems and ensuring equitable access to resources. The Water–Energy–Food (WEF) Nexus has been proposed as an approach to manage trade-offs and exploit synergies that arise among these sectors. Despite the WEF Nexus being focused on satisfying the anthropogenic needs for water, energy and food security, the role of nature in sustaining these securities and in regulating their interrelationships is increasingly recognised by the Nexus community. To converge existing approaches that integrate nature into the WEF Nexus and suggest a common framework, we – an interdisciplinary group of natural resources management researchers and systems thinkers from the research network NEXUSNET COST Action – followed a collaborative process of knowledge creation. We explain the disparity found in the roles attributed to nature through



two main paradigms: (1) ecosystems as a foundational layer to the Nexus and (2) ecosystems as the fourth component of an expanded Nexus. We complement such paradigms with a novel WEF–Ecosystems Nexus conceptualization that integrates the WEF Nexus with the interface of social–ecological systems (SES). The new paradigm expands the mutual interlinkages among water, energy, and food to the human–ecosystems overlap of SES, thus acknowledging the social–ecological processes that determine and are determined by the WEF Nexus. Simultaneously, the WEF Nexus emphasises the complex interplay of SES through the web of interlinkages between key sectors of human activities. The paradigm promotes a shift in Nexus practice towards governing nature and the Nexus in line with everyone’s needs – including those of nature itself – and addressing both the supply side of resources and the demand side of societies. We will contribute to the discussion forum by presenting the conceptual framework and its preliminary deployment in Italy, Greece, and Turkey.

Keywords: ecosystem services, interdisciplinarity, WEF Nexus, natural resources management, social–ecological systems

4. Vulture conservation, a practical demonstration of the One Health concept.

First author(s): Fadzai Matsvimbo

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One health brings together the powerful interrelationship and interdependence of the health of humans, livestock, wildlife and the environment. The loss of biodiversity is an indicator of ecosystem stress often visualised by effects on wildlife populations. Vulture conservation exemplifies many contemporary tenets of the One Health approach. Vultures are critical to a sustainable and resilient ecosystem, which in turn is essential for the socio–ecological health of human communities and can be used as a reflection of the health of the ecosystem. The ecosystem services provided by vultures include rapid removal of carcasses from the environment, sentinel value, nutrient cycling and tourism value. While the removal of carcasses promotes the aesthetic value of the environment by getting rid of the carcasses and the smells that would result from in the reduction of the spread of diseases. Eliminating carcasses reduces the amount of time spent by carnivores and other scavengers at carcasses, reducing opportunities for the spread of diseases in these areas. The sentinel value of vultures also allows them to be used as early warning systems which helps to identify sites where mortalities



have taken place and appropriate responses can be put in place to save both wildlife and livestock from further losses. This is usually appropriate in wildlife poisoning cases. In the African landscape, this also protects communities from feeding from identified poisoned carcasses. Buffer zones and in some cases protected areas as well are a zone of interaction between wildlife and livestock, with carcasses on either side being potential disease transfer sites. Understanding the role played by vultures in reducing zoonotic disease transmission is key to fully understand their role in reducing disease transfer and burden. This can only be done through understanding the contribution of vultures to the economics of human health and veterinary care.

Keywords: vultures, ecosystem services, diseases

5. Linking Nature Perception to Dengue Epidemics: A systemic implementation of One Health framework in Argentina

First author(s): Joséphine Piette

Other author(s): Catherine Linard

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In recent decades, with Climate Change, dengue has become a major public health concern, especially in tropical and subtropical regions but also in non-endemic areas. In Argentina, since 2009, epidemics of this mosquito-borne disease are more frequent and significant. Here we evaluate how the local population perceives the concept of Nature influences dengue outbreaks and their management using the One Health conceptual framework. According to this framework, the health of the environment, the animals and the humans are interdependent.

Based on the case study of the city of Tartagal (North of Argentina), our aim is to understand how Nature perception shapes the social structure and its dynamics, the surrounding environment, and the concrete actions that are implemented to cope with dengue, but also the synergies between these dimensions. We assume that Nature perception can lead to different behaviours (disconnection or connection, destruction or protection, etc.) which have various impacts on Nature (i.e. environment, animals and humans) and consequently on its health, our health. Hence, we hypothesize that how people feel connected to Nature influences the significance of dengue epidemics and their management through different parameters.



We embrace the problematic with a systemic approach, using mixed methods. First, we will analyse national cases data for several epidemic years, to assess the situation and the main driving factors within the whole dengue endemic region, in Northern Argentina. Then we will focus on a city scale, conducting interviews with local stakeholders, doing fieldwork, including participant observation in the implementation of protection measures and characterizing the local situation.

Our results will allow a better and systemic understanding of the studied problematic and will be an important step to implementing One Health conceptual framework for transformative change.

Keywords: Dengue Epidemic, Nature Perception, One Health, Systemic Approach, Transformative Change

6. Socio–technical–ecological metabolisms

First author(s): Bep Schrammeijer

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Understanding and addressing wicked problems, such as the crises in biodiversity, climate and water as well as environmental justice and human health, requires knowledge of (at least) both the social and ecological subsystems and their interaction. While many attempts have been made to integrate social and ecological subsystems in scientific research their conceptualisation, operationalisation and application tends to still focus on either the social or the ecological system, or superficially embed one in the other.

Integration of subjective and cultural interactions with biophysical processes and the consideration of relational vs instrumental evaluation are often overlooked in conceptual approaches that attempt to integrate social (–technical) and ecological aspects. I propose the concept of socio–technical–ecological metabolisms (STEMs) to account for some of these shortcomings. The STEMs framework aims to account for the way that relational and instrumental values in socio–technical systems interact with the ecological system to influence land use management decisions and resource flows.

Alongside a scoping literature review, several case studies are being used to inform the further development of this conceptual framework. Firstly, an interdisciplinary investigation of socio–



technical and ecological diversities in (agri-food) cropping systems and their interactions across scales provides an overview of functional variables and categories that enable operationalisation of socio-technical-ecological metabolisms. Secondly, research into cultural values and ecological and socio-economic outcomes of land use change in peat meadows shows how cultural values interact with ecological and economic potential. Finally, transdisciplinary exploration of co-design processes that incorporate the needs and perceptions of vulnerable residents in climate sensitive planning of urban areas enable the development of methods that integrate quantitative and qualitative approaches and enable inclusion of environmental justice and well-being measures in socio-technical-ecological metabolisms.

Keywords: socio-technical and ecological systems, relational and instrumental valuation, inter- and transdisciplinary research

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- I. SESSION DESCRIPTION
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I. SESSION DESCRIPTION

ID: T1d

Human–Nature Relations for transformative change: a holistic perspective

Hosts:

	Name	Organisation	E-mail
Host:	André Mascarenhas	ILPÖ – Institute of Landscape Planning and Ecology (Univ. Stuttgart)	andre.mascarenhas@ilpoe.uni-stuttgart.de
Co-host(s):	Nicolas Dendoncker Carla Washbourne	University of Namur University College London	nicolas.dendoncker@unamur.be c.washbourne@ucl.ac.uk

Abstract:

To assess the root causes of ecological degradation, it is important to consider different dimensions of human–nature relations. Those include, among others, worldviews, broad and specific values people hold towards nature (Pascual et al., 2023), direct and indirect interactions between people and nature (like visiting a park; Soga & Gaston, 2021), or the material and immaterial outcomes of such interactions (e.g. for physical and mental health, or sense of place; Díaz et al., 2018). However, considering the multiple dimensions of human–nature relations in a holistic way poses a major scientific challenge. Different dimensions have often been studied by different disciplines or research communities, using different concepts and frameworks. These concepts and frameworks – including ecosystem services (Daily, 1997), nature’s contributions to people (Díaz et al., 2018) multiple values of nature (Pascual et al., 2023), human–nature connection (Ives et al., 2017), nature connectedness (Zylstra et al., 2014) human–nature interactions (Soga & Gaston, 2021), among others – have varying levels of overlap. This creates issues with intangibility and incommensurability across and between frameworks (Chan et al., 2012). Relevant knowledge gaps persist in terms of how the different dimensions of human–nature relations and their interrelations are understood and recorded (for example how are



multiple values of nature related with human–nature interactions). Researchers are still devising strategies and gathering empirical data to deal with these challenges. For example, some have shown how embracing incommensurability can be beneficial for participatory sustainable landscape management (Allain & Salliou, 2022).

We argue that broadening ecosystem services research towards a more holistic human–nature relations perspective is an important condition for transformative change. Even though this comes with major scientific challenges, such a shift could contribute to the guiding vision of “One Planet, One Health”, as it promotes a relational notion of people and nature that goes beyond focusing on the benefits nature provides to humans. In this context, we welcome and encourage submissions interested in:

- new ways of conceptualising and analysing human–nature relations;
- how human–nature relations are (or have been) represented in policies;
- the multiple dimensions of human–nature relations;
- exploring relationships between those dimensions (even if submissions focus on more specific aspects of human–nature relations, e.g. different types of values);
- visions and scenarios of the future focussing on human–nature relations;
- and how those aspects are related to transformative change and sustainability.

Goals and objectives of the session:

We want to stimulate discussion and dialogue around the different dimensions of human–nature relations and how we can consider them holistically, in order to devise research approaches that can help advancing our knowledge on this topic.

Planned output / Deliverables:

Depending on the quality of the submissions received and the discussion during the session, a joint discussion paper or a special issue on the topic, as well as non–scientific outputs (e.g. blog entry) can be envisioned.



II. SESSION PROGRAM

Room: Expert Street 5

Date of session: 18th of November 2024

Time of session: 14:00–17:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
16.10	Carla	Washbourne	University College London	Human–nature relations in the nitrogen cycle: insights from an overview of scientific literature
16.20	Julia	Diekämper	Museum für Naturkunde, Berlin.	Network Nature Knowledge: a more holistic human–nature relations perspective
16.30	Anastasia	Van Der Meer	Lund University and IUCN Commission on Ecosystem Management	Just Green Urban Transitions: Analysing Multispecies Justice in Mexico City in Urban Greening and Urban Nature Governance
17.00	Dominique	Ghijselinck	University of Antwerp	Relational values of nature: Outgrowing anthropocentrism by enriching human–nature relationships?
17.10	Silvia	Rova	Ca' Foscari University of Venice	Exploring plural values and ecosystem services perceptions to enable transformative change in the Venice lagoon, Italy.
17.20	Jana	Schluenss	Université du Québec en Outaouais (UQO)	About fish, farms, and fragility – a case study to enlighten human–nature relationships through a plural values assessment
17.30	Sarah	Nieß	ISOE – Institute for Social–Ecological Research; SBiK–F Senckenberg Biodiversity and Climate Research Center	Seeds of Change in Human–Insects Relations: Unfolding the Transformative Potential of a Gardening Intervention.



III.ABSTRACTS

first author is the presenting author unless indicated otherwise.

1. Relational values of nature: Outgrowing anthropocentrism by enriching human–nature relationships?

First authors(s): Dominique Ghijssels

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Increasingly, science–policy–oriented publications discuss the potential of ‘relational values of nature’ to bolster future conservation related decision–making. This paper unravels two meanings of relational values and elaborates on how these may add to the toolkit of conservation. Firstly, it is explained how relational values are a third axiological category and compare to instrumental and intrinsic values assigned to nature. Secondly, it is clarified how relational values appear part of a shift that seeks to improve conservation decision–making processes by mapping and recognising the multiple ways of valuing nature people have developed over time. This would allow to more comprehensively capture the context–specific perspectives on human–nature relations. It is argued that these two meanings of relational values underscore the need not to conflate the questions of how to make valuation methods more socially inclusive with prescriptive questions of why we should protect nature. To illustrate this, this paper focuses on New Zealand conservation legislation that demonstrates how relational values, rooted in place–based indigenous knowledge and traditions, are coded into rights of nature law. Partially based on this it is argued that while social inclusiveness in conservation is important, this may still allow for anthropocentrically inspired thinking. Ultimately, it is concluded that the potential of relational values can be more fully realised by using them to offer prescriptive guidance to conservation decision–making and practice. However, to facilitate this, their embeddedness in a meaningful relationship with, and care and respect towards, nature needs to be emphasized and mainstreamed.

Keywords: Relational values, Intrinsic values, Anthropocentrism, Ecocentrism, Rights for nature



2. Network Nature Knowledge: a more holistic human–nature relations perspective

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Today more than ever, ecological, political and social changes require us to rethink cooperation. Necessary cultural change therefore undoubtedly needs trusting alliances. The production of this natural knowledge requires concepts that capture the ambivalence of the intrinsic openness of the sciences and offer them a structure. There is no lack of corresponding programmatic demands (European Commission, 2016). However, it is not enough to simply focus on academic research (e.g. replicability) or scientific communication (e.g. open access). Rather, it is crucial for the transfer and exchange of this natural knowledge to experiment with new forms of collaboration in a transparent and sustainable manner.

In order to venture thinking and testing new ways of acting, the Nature Knowledge Network at the Museum für Naturkunde Berlin is therefore being set up as an agile and innovative contact zone for various partners from the Berlin/Brandenburg (Germany) region. The aim of the network is to acquire and reflect on contemporary nature knowledge as a basis for shaping the world by taking up the challenge of science and research. This succeeds when innovative and flexible social practices and patterns of interpretation bring together different bodies of knowledge in a resonance space.

The talk will take place against the background of first experience of a new way of conceptualizing and analyzing human–nature relations in this network. In this context, the digital “Atlas of Natural Knowledge” will be presented as a way to sustainably collect different sources of knowledge. The Atlas of Natural Knowledge offers a digital infrastructure for methodological and content–related reflection processes. It documents, visualizes, analyses and makes accessible a collaboratively created common digital knowledge map as an imprint of social relations, discourses and practices. The atlas is therefore not a geographical compendium, but a cultural artefact that reflects the political, social and cultural relationships between the projects and their structures.

Keywords: transdisciplinarity, new work; nature knowledge; transfer



3. Seeds of Change in Human–Insects Relations: Unfolding the Transformative Potential of a Gardening Intervention.

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The alarming decline in insect populations is still greatly underestimated by the public and their vital ecosystem services are largely taken for granted. Declining nature experiences have been associated with negative attitudes towards nature, potentially resulting in ‘biophobia,’ with this antipathy particularly pronounced towards invertebrates and insects. Consequently, negative attitudes and relations with insects have been associated with a reduced willingness to engage in conservation. Gardens, beyond their ecological benefits, can serve as spaces for direct interaction with nature, fostering people’s connection with and valuation of nature, and a sense of stewardship and responsibility towards nature.

Addressing the persistent challenge of unfavorable attitudes towards insects and consequent low conservation efforts, in this contribution, we explore the potential and effectiveness of a large–scale gardening intervention as a leverage point for transformative change in the relationship between humans and insects. In an interdisciplinary social–ecological collaboration involving entomologists and social scientists, and together with a renowned weekly newspaper, we conducted a Germany–wide intervention. The multifaceted intervention combined education, citizen–science engagement, and practical conservation actions. Using a quasi–experimental design with 1124 participants, we employed a difference–in–differences analysis to assess the intervention’s impact on a holistic set of human–nature relations and behaviors.

Our findings demonstrate positive effects on insect–related attitudes, problem awareness, knowledge levels, and conservation behaviors, particularly among individuals with initially low engagement. We conclude that the topic of gardening can function as a lever to shape the relationship between people and nature and to change people’s behavior in relation to insect conservation. This approach aligns with a relational notion of people and nature that goes beyond focusing on the benefits nature provides to humans, fostering a holistic perspective on human–nature interactions.

Keywords: Human–nature relations, Behavioral interventions, Insect conservation, Nature Connectedness



4. Exploring plural values and ecosystem services perceptions to enable transformative change in the Venice lagoon, Italy.

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Climate change and biodiversity crises are rooted in the narrow set of utilitarian values that are prioritized in current policymaking processes. Therefore, recognizing the plurality of nature's values is a key step to enable a transformative change towards sustainability. In this work, we aim to explore the diversity of nature's values and ecosystem services (ES) perceptions expressed by the citizens of the Venice lagoon, Italy. The 965 complete responses obtained from our survey revealed a diversity of values, with almost half of the respondents mentioning a combination of two or more values of nature, including intrinsic, relational and instrumental ones. The perceptions expressed on ES allowed to divide the sample into four clusters, which recognize the importance of the lagoon's ES to different extents. Interestingly, these distinct ES perceptions are associated with different priorities in terms of nature's values. By considering ES perceptions and nature's values together, these clusters can be positioned along a gradient ranging from high to low alignment with sustainability principles. These results convey two key messages. First, part of the local community already recognizes the high importance of the lagoon's ecological structures, processes and ES, and holds values aligned with sustainability principles. These perspectives and values should thus be recognized and embedded in the local decision making processes. Second, the citizens that currently fail to recognize the importance of ES are those to which the greatest efforts should be directed, to promote a shift towards sustainability-aligned values and behaviours. From a leverage points perspective, working in these directions means to act upon crucial value-centred leverage points that can enable a transformative change towards a sustainable use of natural resources.

Keywords: Human–nature relationships, ecosystem services, plural values, transformative change, sustainability



5. About fish, farms, and fragility – a case study to enlighten human–nature relationships through a plural values assessment

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Freshwater ecosystems are under increasing pressure. From a value perspective, this pressure is closely related to a too narrow definition of nature's values in decision-making. Assessing plural values that encompass not only economic factors, but a variety of different value dimensions, such as socio-cultural and intrinsic values, is imperative to achieve transformative change. Nevertheless, assessment and consideration of multiple values is still scarce.

To promote a perspective of plural values in environmental decision-making, we assessed multiple values that people attribute to ecosystem services (ES), and how these values are affected by ES loss. We conducted semi-structured interviews with local stakeholders in a case study in the St.-Lawrence River in Southern Quebec, Canada.

We orient our analysis along the conceptual framework of multiple value dimensions of the IPBES (Intergovernmental Panel on Biodiversity and Ecosystem Services), which differentiates between intrinsic, instrumental, and relational values. Based on the value assessment, we identified narratives about human–nature relationships, and implications for decision-making that come along with these prevailing worldviews.

Our results show a strong discourse of human–nature dichotomy, accentuating the perceived opposition of instrumental and intrinsic values. This opposition comes along with narratives of fragility and wilderness that has to be protected from human influence. Relational values were strong in participants discourses, but not represented in actual decision-making processes. Our findings suggest that the identified relational values and related concepts, such as environmental justice and equity concerns, need to be emphasized in policy-making to ensure an inclusive and sustainable management of aquatic ecosystems.

Keywords: plural values, human–nature relationships, ecosystem services, decision-making, freshwater ecosystems



6. Human–nature relations in the nitrogen cycle: insights from an overview of scientific literature

First author(s): Bede West

Presenting author: Carla Washbourne

Other author(s): Maximilian Bauer, Charis Chalkiadakis, Nicolas Dendoncker, Tanya M. González–Martínez, André Mascarenhas, Francesca Leucci, Benjamin B. Phillips, Konstantina Tania Ploumi

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The nitrogen (N) cycle is a familiar concept. As is the much simplified, often diagrammatic, representation commonly used to illustrate the scale, importance and interconnectedness of this global cycle that links air, water, rocks and living beings. However, in this representation, humans are often presented as a seemingly minor entity or not explicitly shown at all. This can obscure the idea that humanity is both a direct beneficiary of the nitrogen cycle (through food and resources) and an increasingly significant influence on its function. In this presentation, we highlight how diverse Human–Nature relationships (HNR) are expressed in recent academic literature on the nitrogen cycle. A sample of peer reviewed literature, containing explicit and inferred examples of HNR and the nitrogen cycle, was analysed using two approaches: 1) network analysis, to identify and illustrate quantified links made between components of the nitrogen cycle and 2) content analysis to understand how different kinds of terminology were being used to describe relationships between components in the cycle. The network analysis revealed diverse links between ‘human’ and ‘non-human nature’. The content analysis found some explicit use of relational terms, most commonly ‘depend*’. Both approaches highlighted strongly reciprocal links within the ‘human’ realm and the explicit centrality in which this is held across the corpus. We demonstrate the utility of combining quantitative and qualitative analysis to understand nuanced relationships in the nitrogen cycle and explore the utility this has to increase the acknowledgement of HNR in science communication and science–policy interface work. In this sense, we address several of the session’s topics, such as new ways of conceptualising and analyzing HNR, considering its multiple dimensions.

Keywords: Nitrogen Cycle, Human–Nature Relationships, Dependence, Network



7. Just Green Urban Transitions: Analysing Multispecies Justice in Mexico City in Urban Greening and Urban Nature Governance

First author(s): Anastasia Van Der Meer

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This paper investigates the intersection of urban greening and multispecies justice from a more-than-human (MTH) perspective in Mexico City (CDMX). The study addresses a critical gap in existing research, which predominantly focuses on the human-centric implications of urban greening, such as gentrification and human well-being, while neglecting the needs and well-being of non-human life forms. By exploring notions of multispecies justice (MSJ), this research highlights the interconnectedness of human and non-human life within urban environments and advocates for a more inclusive approach to urban greening initiatives.

The research employs an exploratory qualitative case-study methodology, incorporating 4 site visits, 2 events, and 15 interviews with urban planners, landscape architects, nature conservationists, local communities, traditional agriculturalists, lawyers, policy makers, activists, and NGOs in CDMX. Data collection also includes a systematic review of literature of 140 articles, historical accounts, and urban ecosystem mapping. The findings reveal that although initiatives like the Plan Verde (Green Plan) show promise in promoting ecological justice, their implementation is often inconsistent and fragmented. Moreover, there is a disparity in recognizing various forms of nature, emphasizing the need for a more coordinated and decolonial governance approach.

Key findings suggest that effective urban greening initiatives should integrate traditional knowledge with scientific understanding to promote a holistic and inclusive approach to ecological justice. This study underscores the importance of community involvement and interdisciplinary collaboration in advancing MSJ. Local communities are identified as crucial stakeholders in environmental governance, ensuring continuity and fostering a sense of identity and belonging.

The research also highlights the potential of the Rights of Nature legislation as a framework for promoting MSJ in urban environments, though its success depends on coordinated societal efforts. A hybrid governance approach, emphasizing community participation and interdisciplinary collaboration, emerges as a viable solution for bridging policy intent and practical realities.



Ultimately, the research calls for a paradigm shift in urban governance towards a more holistic and inclusive approach that acknowledges the interconnectedness of human and more-than-human worlds. By prioritizing the voices and needs of both human and non-human inhabitants, urban greening initiatives can foster a more equitable and sustainable coexistence in urban environments. The findings advocate for tangible actions and collaborative efforts across diverse sectors to address socio-ecological injustices and promote a pluriversal approach to MSJ in urban settings.

Keywords: Multispecies Justice, Urban Greening, Urban Nature Governance, Environmental Justice

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: T1f

Challenges and opportunities of ecosystem services assessments on small and medium islands

Hosts:

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II. SESSION PROGRAM


Room: Expert Street 6

Date of session: 21st of November 2024

Time of session: 13:30–15:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
13:30–13:40	Evangelia	Drakou	Harokopio University of Athens	Small and medium islands and their contributions to people: a literature review within the European context



Time	First name	Surname	Organization	Title of presentation
13:40– 13:50	Ioannis	Vogiatzakis	Open University of Cyprus	The natural capital of European islands: towards common protocols of assessment
13:50– 14:00	Miriam	Montero–Hidalgo	Rey Juan Carlos University	Assessment of nature recreation associated with coastal ecosystems in the Canary Islands through maps, indicators, and stakeholders' perceptions.
14:00– 14:10	Christos	Zoumides	The Cyprus Institute	Tourism–induced impacts and transformations on small and medium islands: Implications for Ecosystem Services from Tourists' Food Consumption in Cyprus
14:10– 14:20	Savvas	Zotos	Open University of Cyprus	The contribution of the N2K network to ecosystem services in an island state: The case study of Cyprus
14:20– 14:40	Alistair	McVittie	Scotland's Rural College	Developing a natural capital assessment and land use decision tool for Montserrat
14:40– 14:50	Rex	Steward	Vrije Universiteit Amsterdam	Navigating the spatial trade-offs between ecosystem services in Curacao: Land use modeling for scenario assessment
14:50– 15:00	Pierre	Chopin		"Navigating the Tides of Change: Challenges and Opportunities in Ecosystem Services Assessments on Small and Medium Islands"
15:00 – 15:30		Group discussion		



III. ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Navigating the spatial trade-offs between ecosystem services in Curacao: Land use modeling for scenario assessment

First author(s): Rex Steward

Other author(s): Pierre Chopin, Peter Verburg

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The sustainable development of small island states faces complex challenges exacerbated by their unique vulnerabilities and limited resource bases. Global change and pressures can locally affect ecosystem functions and benefits to society. High resolution spatial planning is key in such inherently bounded contexts to minimize trade-offs associated with land development amidst scarce land resources.

In this study, we propose an integrated approach combining participatory Bayesian networks, land use modelling, and ecosystem services impact analysis to explore three development pathways to 2050 (business as usual, tourism development, and agricultural development) constrained by three alternative spatial planning options (no zoning, current zoning, and alternative zoning) in Curaçao, a Caribbean Small Island Developing State (SIDS).

Our results show that, while sectoral expansion plays the most significant role in determining the scale of potential impacts, spatial planning steers future land use considerably, yielding distinct outcomes for nutrient cycling, habitat for biodiversity and well being for society. Zoning regulations limited sprawling built-up patterns and confined development to specific segments of the coast, reducing loss of rare vegetation by an average of 32% and reducing added nutrient fluxes to the coastline by up to 22%. Outcomes arising from unregulated development typically perform worst in terms of delivery of ecosystem services – as land use change occurs in areas of high hydrological connectivity relative to the coast or bays, often coincident with patches of rare vegetation. Ultimately, this research contributes practical insights for decision makers –such as land planners in Curaçao – grappling with the intricate challenges of spatial development in small island contexts, fostering planning debates and aiding in navigating trade offs across various ecosystem services and benefits to society. By elucidating the relationships between zoning regulations, socio-economic drivers, ecosystem



services, the study supports informed decision-making towards achieving sustainable development goals amidst uncertainty and resource constraints.

Keywords: ecosystem function, habitat for biodiversity, land system science, nutrient cycling, provisioning services

2. The support of the Global Environment Facility (GEF) for the effective integration of the value of nature into coherent nature positive policy and planning reforms in Micronesia

First authors(s): Giacomo Cozzolino


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Micronesia, an archipelago in the Western Pacific Ocean, faces significant environmental challenges. These problems, driven by geographic and climatic conditions and human activities, include coral reef degradation, deforestation and habitat loss, land degradation, unsustainable fishing practices, and climate change effects such as rising sea levels, droughts, and extreme weather events.

Addressing these issues requires concerted efforts at local, national, and international levels, including designing and implementing sustainable practices and enhancing environmental policies. Often, policies and regulations fail to sufficiently consider the value of natural capital and ecosystem services in decision-making processes. This leads to undervaluing or overlooking natural capital in policy decisions, and the short- and long-term negative impacts of human activities on ecosystems and biodiversity are not properly accounted for. Furthermore, the lack of clear policies and regulations creates uncertainty for investors and businesses looking to make nature-positive investments, making it difficult for such investments to compete with traditional ones that do not consider environmental impacts.

The Global Environment Facility (GEF) is funding the Blue and Green Island Integrated Programme, which finances nature-positive interventions in 15 Small Island Development States (SIDS) around the globe, including Palau and the Federated States of Micronesia. This Programme provides technical and financial support to strengthen capacities for Natural Capital Accounting (NCA) and Ecosystem Services Valuation (ESV), covering key sectors and ecosystems to effectively mainstream environmental considerations into sectoral decision-making.



Supported by outputs of a strategic social and political economy assessment, this will promote greater policy coherence through more integrated and comprehensive planning.

The presentation will showcase examples of these actions in Palau and the Federated States of Micronesia.

Keywords: Small Island Development States, Natural Capital Accounting, Ecosystem Services Valuation, policy, planning

3. Small and medium islands and their contributions to people: a literature review within the European context

First author(s): Evangelia Drakou

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Small and medium islands are characterized by unique biodiversity, cultural legacy, landscapes, and are places where human societies have historically developed iconic relations with the natural environment. The value of these spaces has been widely recognized yet neglected in national and regional policy agendas. Within the SMILES COST action, we aim to capture the different values attributed to these spaces within the scientific literature across Europe. We conducted a systematic literature review and distilled information about the core ecosystem services (ES) and nature's contributions to people (NCPs) that were assessed, the size-related challenges reflected in the conceptualization of ES/NCPs, the methods used, data availability, the main realms assessed, as well as the extent to which island "dependencies" in relation to their counterpart mainland are considered.

Within the 443 reviewed papers, most targeted terrestrial realms within small and medium islands. Those assessing marine and coastal realms were limited and mainly targeted food from fisheries and coastal protection. We detected a strong focus on cultural NCPs, particularly on recreational NCPs. Overall, we identified a very limited manifested applicability of existing ES or NCP frameworks and in most cases, the reviewed studies developed tailor-made approaches for defining and quantifying island related ES/NCPs. The main detected conceptual and methodological gaps in island ES studies were in most cases related to space and data scarcity issues. Three points of improvement for future research are discussed that can contribute to a



better recognition of the values and contributions of these spaces to society: i) recognition of unique nature's contributions which are specific to islands (e.g., dialects, dietary habits); ii) improvement of data quality and resolution through enhanced monitoring ; and iii) enhanced methodologies and conceptualizations that better account for the telecoupled nature of the contributions these islands provide to society at the local, national and regional levels.

Keywords: telecoupled systems, social–ecological systems, isolation, human–nature relations

4. The contribution of the N2K network to ecosystem services in an island state: The case study of Cyprus

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Presenting authors(s): Savvas Zotos

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A wide range of ecosystem services (ES) are based on habitat and species protection and on biodiversity conservation. The Natura 2000 ecological network, which aims to safeguard Europe's biodiversity, increases the recognition of the socio–economic benefits of protected areas. However, significant challenges remain in the integration of ES in the conservation efforts of the protected areas, especially at a national level. The aim of the study is to provide a methodological approach and the first qualitative results from ES assessment in Natura 2000 areas in Cyprus.

Following the completion of the first national ES assessment in Cyprus, we quantified and mapped the potential of ES provisions in the network of protected areas. We applied a rapid method, using the assessment matrix approach, to quantify the potential ES provided by each habitat type. Summing up individual ES, we obtained a total ES supply map per N2K site in Cyprus. ES indices were then calculated for those ES having the highest score in the assessment matrix.

Significant differences were found in the supply of ES among ecosystem types. Inland aquatic ecosystems have the highest potential for regulating ES services, while forests and shrublands provide a high level of cultural ES. Agroecosystems have the highest potential for provisioning ES. We present ES hotspots and cold spots, discuss the differences between N2K sites and show



why ES hotspots should be considered in spatial planning, focusing on the specificities of small island states.

Keywords: Ecosystem Services Assessment, Natura 2000 network, Island state, ES hotspots, habitat types, spatial planning

5. Developing a natural capital assessment and land use decision tool for Montserrat

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Montserrat is a British Overseas Territory, part of the leeward islands in the Caribbean. Like many small, isolated islands its biodiversity is characterised by rare and endemic species. Mountainous terrain means there is limited agricultural land (resulting in import dependence and reducing food security), and it is vulnerable to extreme weather events. These common issues were exacerbated by eruptions of the Soufriere Hills volcano since 1995 which rendered much of the island uninhabitable and increased sedimentation loads. The latter is a key issue for the health of the island's coral reefs which underpin their fishing and tourism sectors.

Understanding Montserrat's natural capital constraints and opportunities provides the potential to increase resilience and inform land use decisions. However, the available data to assess natural capital are often outdated (the Montserrat soils map dates from 1967) or limited in scope. Consequently, a flexible approach is needed to model and evaluate natural capital. We developed a model using a spatial Bayesian Belief Network (BBN). This approach incorporates the limited available data into a model of ecosystem processes and resulting ecosystem services. The model identifies key areas for ecosystem services such as water supply, flood risk reduction and sedimentation loads. We also identify opportunities for expanding agricultural production taking into account the hydrological and sedimentation risks.

We explored the extension of the spatial BBN to model the impacts of land use on the marine environment. This was supplemented by citizen science-based ground sampling of in-stream sediments, habitats and soil properties to develop catchment level sediment transport models. However, the project research and further impact were constrained by limited capacity on island and respondent fatigue amongst important stakeholders. Many day-to-day planning decisions also remain at small scale rather than accounting for wider impacts.



Keywords: Ecosystem services, natural capital, Bayesian Belief Networks, Small islands



6. Assessment of nature recreation associated with coastal ecosystems in the Canary Islands through maps, indicators, and stakeholders' perceptions.

First authors(s): Miriam Montero–Hidalgo

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Although the Canary Islands represent one of the richest biodiversity hotspots in Europe, assessments of the non-material benefits people obtain from ecosystems (cultural ecosystem services) are scarce, and evaluations of the recreational services provided by marine and coastal ecosystems are even rarer. These services are crucial for managing the use of coastal areas, supporting the socio-economic activities of the archipelago, and considering the identity of the local population. To fill that knowledge gap, this is the first study that evaluates the recreational ecosystem service provided by coastal ecosystems spatially explicitly, covering the entire archipelago and using local information. Local and official information sources were used to identify, select, and zone the most relevant recreational activities practiced in coastal areas. Simultaneously, a participatory approach comprising online and phone surveys and the organization of a workshop including a participatory mapping exercise with relevant actors from the recreational sector was employed to localize areas where water sports occur and gather social perceptions about their management in coastal areas. The main outputs obtained included detailed maps of maritime recreational activity hotspots and the sector's perception of both the synergies and conflicts among the activities, as well as the primary issues regarding their management. In conclusion, this study provides science-based evidence and local perceptions, filling an important knowledge gap for decision-making in marine spatial planning.

Keywords: Cultural Ecosystem Services, Coastal ecosystems management, Participatory Approach, Canary Islands, Recreational Activities



7. The natural capital of European islands: towards common protocols of assessment

First authors(s): Emilio Padoa-Schioppa

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Natural capital includes certain stocks of the elements of nature that have value to society and includes both the living and non-living aspects of ecosystems. On islands, the terrestrial and marine natural capital are equally important but assessments rarely include the latter. The marine natural capital become perhaps more important as the island's size decreases and isolation increases. An island's limited space and isolation means that natural capital is constrained influenced more by externalities but at the same time precious for island societies and beyond.

Based on two workshops, as part of the COST action SMILES we brought together a team of terrestrial and marine ecologists reviewed main "variables" which conform to the natural capital definition and the relevant datasets which can support their assessment. We put together a metadatabase which includes a parsimonious set of attributes for natural capital elements and main pressures related to the components of the natural capital of small-medium islands of Europe (about 6.000 islands).

With the help of such a database and by following established Natural Capital Protocols, we demonstrate for 3 case studies which reflect different island profiles (in terms of capital, pressures and geography) how can other European islands with similar characteristics use this decision-making framework to identify, measure and value the direct and indirect impacts and dependencies on natural capital.

Keywords: Decision making, Natural Capital Protocols, pressures, small-medium islands



8. Tourism-induced impacts and transformations on small and medium islands: Implications for Ecosystem Services from Tourists' Food Consumption in Cyprus

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Tourism is a major economic sector and source of income for many small and medium islands. Apart from job and income generation, tourism brings significant pressure on local ecosystems, particularly through food consumption patterns that influence land use and biodiversity. Tourist food experiences significantly enhance cultural immersion and satisfaction, especially in island destinations where unique agricultural systems reflect the rich local heritage. However, on islands such as Cyprus, Malta, Phuket, and Fiji, the influx of tourists often surpasses the local population, particularly during peak seasons. This surge in demand exerts substantial pressure on local ecosystems and biodiversity, leading to notable adverse impacts and land use transformations for food production and tourist establishments. Additionally, tourism food demand is associated with increased reliance on imported food, affecting ecosystem services and causing environmental degradation beyond the boundaries of island destinations.

This study investigates the pathways through which tourist food consumption affects provisioning ecosystem services, land use, and biodiversity on islands with high tourist influx, using Cyprus as a case study. By employing primary data collected from hotel establishments and tourists visiting Cyprus, as well as secondary data on food consumption, the study quantifies land use requirements and environmental impacts associated with tourism food demand. The results reveal a direct relationship between tourist food preferences and environmental impacts, providing a better understanding of how tourism-driven demand in one location can affect production systems and ecosystem services in distant regions. The research highlights the importance of promoting seasonal and local foods, introducing meat-free days, implementing sustainable land-use planning and food management frameworks, and raising awareness about the environmental implications of tourism. The study concludes by discussing several recommendations for effective practices and tourists' behavior that can potentially minimize the environmental impacts on small and medium island destinations.

This study is part of RAINFOREST project (Grant agreement 101081744), funded by the European Union



Keywords: Food Consumption, Food Production, Land Use, Food Trade, Tourism, Ecosystem Services

BOOK OF ABSTRACTS

- I. SESSION DESCRIPTION
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- III. ABSTRACTS

I. SESSION DESCRIPTION

ID: T2

Assessing Ecosystem Condition: Integrating Science, Policy and Practice

Hosts:

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Abstract:

Ecosystems form the bedrock of biodiversity and provide vital services that sustain human society and economics. However, understanding ecosystem condition and assessing spatial variations remain complex challenges, particularly when covering a broad range of ecosystems in different biomes. This session seeks to explore the multiple dimensions of assessing ecosystem condition, emphasizing the integration of scientific methodologies, policy frameworks, and practical applications. Presentations are invited to explore the frameworks, methodologies, metrics, and applications used to evaluate ecosystem condition, with a particular focus on spatial assessments. We also aim to explore techniques for calibration, the relationship between ecosystem condition and restoration needs, and the capacity of ecosystems to provide essential services. We will also investigate how these assessments vary across different ecosystem types and biomes, providing valuable insights for informed decision-making and effective management strategies.



The session will delve into various approaches and tools utilized in assessing ecosystem condition, encompassing both biophysical and socio-economic indicators. We aim to highlight innovative methodologies, case studies, and interdisciplinary perspectives that contribute to a comprehensive understanding of ecosystem condition across different spatial and temporal scales.

Key topics addressed:

- Metrics that Matter: What are the most effective and informative metrics to evaluate ecosystem condition across diverse ecosystems?
- Spatial Smarts: How can we leverage spatial assessment tools to map and monitor ecosystem condition at various scales?
- Calibrating for Clarity: What methods are available to calibrate ecosystem condition assessments and ensure consistency?
- Condition to Capacity: How does ecosystem condition translate into its ability to deliver vital services?
- Restoration Roadmaps: Can ecosystem condition assessments inform targeted restoration efforts and prioritize areas of greatest need?
- Ecosystem Diversity: How do the ideal metrics and assessment approaches differ between various ecosystem types and biomes?

II. SESSION PROGRAM

Room: Expert Street 3

Part I

Date of session: 19th of November 2024

Time of session: 11:00–12:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
11:00	Fernando	Santos	URJC	Session introduction



Time	First name	Surname	Organization	Title of presentation
11:05	Xavier	Lecomte	INRAE	Advancing Ecosystem Condition Assessment: Refining the SEEA EA Framework
11:15	Joshua	Berger	EC-protocol	The Ecosystem Condition Protocol: a new major tool for corporates to measure and account for their impacts on ecosystem condition
11:25	Alessio	Bulckaen	BC3	EO-based forest condition assessment for Europe
11:40	Mariou	Bellingen	Destatis	A deep dive into German condition account: systematic approach and the link to ecosystem capacity
11:55	Emily	Bank	LHU	Selecting and testing agroecosystem condition indicators
12:05	Eszter	Tanács	Colres	Validating a national-scale pressure-based cropland condition map using bird census data
12:15	Balint	Czúcz	NINA	References for ecosystem condition in major European biodiversity policies
12:30	–	–	–	Q&A discussions


Part II

Date of session: 19th of November 2024

Time of session: 14:00–15:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
14:00	Philippe	Roche	INRAE	Session introduction
14:05	Megan	Critchley	unep-wcm	Applying ecosystem conditions metrics to predict the provision of ecosystem services: a case study on supporting transformative policy and practice.
14:15	Fernando	Rodriguez	USAL	Enhanced logic chains based on value parameters. An application to the



Time	First name	Surname	Organization	Title of presentation
				economic valuation of ecosystem services at mediterranean forests
14:25	Ariadna	Álvarez	URJC	Methodology and application of the natural capital condition account: case study in Madrid (Spain)
14:35	Beñat	Egidazu-de la Parte	BC3	Integrated methodological approach to develop marine physical accounts
14:45	Anna Lilian	Gardossi	UNIUD	High Nature Value Farmlands: Preserving Biodiversity and Ecosystem Services
15:05	Grazia	Zulia	LHU	A multiple steps procedure for the analysis of intra- and inter-patches connectivity: an application in Lower Saxony, Germany
15:15	–	–	–	Q&A discussions

III. ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Methodology and application of the natural capital condition account: case study in Madrid (Spain)

First author(s): Ariadna Álvarez Ripado

Other author(s): Adrián García Bruzón, Patricia Arrogante Funes, David Álvarez García

Affiliation: Rey Juan Carlos University

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We presented a methodology based on the SEEA-EA statistical framework to develop condition accounts for urban ecosystems. This methodology, which employs Euclidean distance in condition calculation, allows the condition accounts of urban ecosystems to be spatially and explicitly evaluated at a very detailed scale. The urban condition is calculated for each pixel. Still, the reference area is obtained through object-based evaluation, as the reference value for each variable is considered within a real territory rather than individual pixels.

This methodology involves achieving the following steps: 1. Delimitation of the urban categories to be evaluated; 2. Selection of the variables that characterise the abiotic and biotic



environment; 3. Establishment of the reference polygon with which to compare the condition values; 4. Calculation of weighted condition indicators; 5. Generation of a single condition index from the aggregation of the indicators.

In the city of Madrid, it has been observed that the areas with the highest condition are areas that host a significant tree density and are close to the reference area and those with the lowest condition are located far from the reference polygon, with high levels of contamination and are impervious zones, built-up areas and communication routes.

This novel approach to calculating urban condition accounts allows the natural capital accounting approach to be included in decision making and can serve as support in all phases of urban policy, from the identification of an urban problem to the review of the effectiveness of a plan already implemented. This condition account can be applied in almost all areas, from water, energy, climate, biodiversity and economic issues. Being an essential tool to detect urban problems, identify the variables that most influence the change in condition and act effectively and efficiently, identifying priority areas of action and obtaining the greatest benefits with the least expense.

Keywords: Urban ecosystem accounting, natural capital, condition account, SEEA-EA, Spain

2. Selecting and testing agroecosystem condition indicators for pollination ecosystem services modelling on a regional scale

First author(s): Emily Bank

Other author(s): Malte, Hinsch, Benjamin, Burkhard

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Ecosystems' capacity to provide services and to support human well-being strongly depends on their condition, comprising the composition, structures and functions promoting the systems integrity and resilience. Therefore, efforts are increasing to integrate ecosystem condition indicators in addition to land use/land cover information in ecosystem service models, for instance the adapted ESTIMAP model for pollination. To include ecosystem condition meaningfully, indicators are required that are conceptually and practically suitable and as comprehensive as possible.



In this research, a set of suitable agroecosystem condition indicators was identified and mapped to be applied in a series of ESTIMAP pollination models in the region of Hanover, Germany. The method is structured as follows: 1) a literature review was conducted to identify the most relevant agroecosystem characteristics to be considered, 2) the UN SEEA EA Ecosystem Condition Typology and selection criteria were applied on the characteristics to select a comprehensive set of indicators with respective datasets, 3) different indicator combinations were tested in the ESTIMAP model to gain insights into the influence of the selected indicators on the model results. In particular, the influence of the comprehensive indicator set, describing the entire ecosystem's condition, was compared with the influence of single indicators with special relevance for pollinators.

The preliminary results show that only a small proportion of important agroecosystem characteristics and indicators is suitable as SEEA EA-aligned condition indicator. Based on initial trials, we expect the incorporation of the comprehensive indicator set to result in a similar, but more differentiated pattern than the original model. Additionally, we anticipate the application of single indicators with special pollinator relevance to reveal divergent results, underlining the importance of a transparent indicator selection.

In conclusion, this research provides a) a comprehensive set of agroecosystem condition indicators and b) contributes to the challenge of selecting ES-specific condition indicators.

Keywords: Ecosystem characteristics, Review, UN SEEA EA, Selection criteria, ESTIMAP

3. A deep dive into German condition account: systematic approach and the link to ecosystem capacity

First author(s): Marius Bellinghen

Other author(s): Dr. Simon Felgendreher, Dr. Johannes Oehrlein, Jonathan Reith, Dr. Simon Schürz

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As part of the environmental-economic accounts, the German ecosystem accounts record the interactions between humans and the environment following a systematic approach. The condition account is based on the extent account, which covers 74 ecosystem classes over six different ecosystem divisions. For each ecosystem division, an ecosystem condition typology,



describing the most important components of an ecosystem in terms of abiotic, biotic and landscape characteristics as well as information on pressure, management and ancillary data has been established. The data used for the condition account are derived from remote sensing, modelling approaches and existing monitoring systems. All these data have different properties according to spatial and temporal resolution, update frequency and data format. To overcome the challenge of technical implementation to account for ecosystem condition across different spatial and temporal scales, a metadata base was created. This metadata base enables the automatic production of condition accounts and is flexible enough to add or adjust new condition variables, new data or changes in methods. Accounting for condition in this way ensures consistency and allows for transparent tracking of changes. In addition to the condition variables, a methodology to set ecosystem specific reference levels was developed. Changes in extent and condition of an ecosystem can explain changes in a specific ecosystem service. Such observations in a timely fashion can provide information on the capacity of an ecosystem to deliver services.

The presentation will briefly introduce the extent account as it is the basis for the compilation of the condition account and then focus on its technical implementation, as well as different publication formats to satisfy interests of different user groups. Finally, a concept for obtaining information on the capacity of ecosystems will be presented using an example in an urban context.

Keywords: Ecosystem Accounting, Condition Account, Ecosystem Capacity, Environmental Economic Accounting, SEEA EA

4. The Ecosystem Condition Protocol: a new major tool for corporates to measure and account for their impacts on ecosystem condition

First author(s): Joshua Berger

Affiliation: Ecosystem Condition Protocol

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The session will introduce the Ecosystem Condition Protocol (EC Protocol) and the works undertaken in this context.



Measuring and disclosing impacts on ecosystem condition is required from companies by major frameworks, but the concept lacks clear definitions and guidelines. Similar to the GHG Protocol but for ecosystem condition, the EC Protocol aims to provide guidance to non-financial corporates to accurately measure and account for their impacts on ecosystem condition. It will thereby enable them to report against key frameworks and standards (such as the ones from TNFD, GRI, EU standard ESRS E-4, or the SBTN methodology).

The session will introduce the EC Protocol overall context: how the protocol will bring the missing piece to the nature disclosure landscape and its collaborative approach and governance scheme, with the involvement of key organisations.

It will then focus on the current thinking of the EC Protocol and delve into the questions it would answer, based on a first mapping of needs and resources open for consultation, and on the consultation results. More specifically, those key questions include:

- Defining ecosystem condition: what are its components, the reference conditions against which it should be measured?
- What kinds of impacts should be considered (negative and positive impacts, reduced and avoided impacts, potential and actual impacts, future impacts, or the remaining ecosystem condition)?
- Methods and metrics: How to reconcile direct measurement methods at site level with top-down approaches at corporate level? What are the criteria a good ecosystem condition metric should meet? How do realm-agnostic and ecosystem-specific metrics relate to each other?
- How to track impacts over time?
- How to allocate responsibility to companies in the case of co-products (e.g. leather vs milk vs meat) or for sites where ecosystem condition is impacted by what happens at the landscape level?

Keywords: Impact, Corporates, Accounting, Measurement, Disclosure

5. EO-based forest condition assessment for Europe

First author(s): Alessio Bulckaen

Other author(s): Stefano Balbi, Marcel Buchhorn, Caterina Gilli, Bruno Smets, Ferdinando Villa

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We present a state-of-the-art, open and free forest ecosystem condition assessment and accounting system for Europe, based on the publication “Accounting for forest condition in Europe based on an international statistical standard”, enhanced by the use of EO data, based on the datasets quality, relevance and scale (time and spatial resolution). This enables the



production of ecosystem condition accounts under the System of Environmental–Economic Accounting (SEEA), with higher temporal and spatial resolution and reduced latency compared to previously published results.

This work highlights the benefits of integrating Earth Observation (EO) for SEEA ecosystem accounting, to regularly generate environmental–economic accounts in a faster yet customizable fashion. While the current implementation aligns closely with the original methodology, the capacity to support tailored applications of forest ecosystem condition accounting, which incorporates country and locally-specific needs, is an important part of this work going forward. The combination of semantic modelling, coupled with on-the-fly generated remote sensing data, offers increased frequency, easier data access and faster computation of the accounts for the final user, reducing startup costs, as one can (re)use models and data already integrated into the system.

Moreover, the platform provides an efficient modelling environment for experts to quickly test different methodologies and scenarios (by producing digital twins), as well as to more easily verify the effectiveness of the combinations of data and models for their region of interest.

New information can be integrated in several ways: ecological experts and statisticians can calibrate or change the parameters of a model with fewer complications, substitute a dataset, or add new data or entire models or computational workflows made accessible online. This allows the generic European approach to be improved by applying local knowledge whenever available.

The results are useful for multiple user groups, from practitioners who generate accounts more easily and regularly but using expert-revised models, to scientists who contribute their expertise to improve current models, which can be (re)used by the wider community.

"The research and the development of the system was supported by the PEOPLE EA project, funded by the European Space Agency (ESA)"

Keywords: EO-based Forest Condition Accounts, Forest condition mapping, Integrated Natural Capital Accounting, Ecosystem Condition Accounting



6. Applying ecosystem condition metrics to predict the provision of ecosystem services: a case study on supporting transformative policy and practice

First author(s): Megan Critchley

Other author(s): Arnout van Soesbergen, Calum Maney, Tom Mason, Samantha Hill

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Identifying robust and efficient metrics to rapidly inform policy and practice across multiple scales is crucial to advancing and monitoring global targets within the Kunming–Montreal Global Biodiversity Framework. One such metric is the Ecosystem Integrity Index (EII), which provides a simple and robust way of measuring, monitoring and reporting on terrestrial ecosystem condition. Ecosystem integrity encompasses the full complexity of an ecosystem, including the physical, biological and functional components.

Ecuador is home to a rich diversity of high-biodiversity ecosystems, depended on by millions. We adapted the global EII by including national or regional data and models to develop Ecuador-specific models and produce maps of EII. Additionally, projections of four ecosystem services were produced using the Co\$tingNature model. This study aimed to assess whether EII can be used to predict ecosystem service provision spatially.

Results indicated that 32% of the Ecuador's ecosystem integrity has been lost, with a mean EII of 0.68. EII was highest in the Amazon region (mean, 0.86; SD, 0.15) and lowest across most of the Pacific coastal region (mean, 0.48; SD, 0.20) of western Ecuador. We found that EII correlates moderately well with the provision of three ecosystem services: sustainable fuelwood availability to local people, fraction of area with potential to supply non-wood forest products, and the occurrence of wild pollinators/pest controllers (Pearson's r , 0.65–0.69).

These results indicate that there is strong potential to use the EII as a proxy for a range of ecosystem services, but that some ecosystem services may not be represented well by ecosystem integrity. Further investigation into these relationships is needed to understand how ecosystem condition correlates with the capacity to deliver a broad range of services, and whether these spatial approaches can support transformative policy and practice for people and nature.

Keywords: Ecosystem integrity, Indices, Ecosystem services, Modelling, Policy



7. References for ecosystem condition in major European biodiversity policies

First author(s): Bálint Czucz

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The recent Ecosystem Accounting standards of the System of Economic Environmental Accounts (SEEA EA) constitute a major step towards standardising and operationalising the concept of ecosystem condition. Similar concepts can be discovered in several EU-level and national policy frameworks, which predate SEEA EA. Nevertheless, these frameworks apply highly different terminologies which conceals both similarities and differences, hindering mutual learning and collaboration. In this study we looked at major European biodiversity policies (e.g. Water Framework Directive, Marine Strategy Framework Directive) and national frameworks (e.g. the Index-Based Ecological Condition Assessment framework in Norway) that apply dimensionless condition indicators measured on a harmonised 0–1 scale to characterise the condition of ecosystems. Similarly to SEEA EA, these frameworks use references (reference levels and reference conditions) for rescaling raw variables to the common dimensionless scale. These references have a central role in establishing the salience, credibility, and legitimacy of the rescaled values as meaningful metrics of ecosystem condition. Here we present the main commonalities in the EU approaches using a simple harmonised terminology building on SEEA EA, with a particular focus on the use of references in these frameworks.

Keywords: Conservation status, environmental status, ecological status, ecological integrity, reference condition



8. Integrated methodological approach to develop marine physical accounts

First author(s): Beñat Egidazu–de la Parte

Other author(s): Marta, Pascual, Stefano, Balbi, Ferdinando, Villa, Tiziana, Luisetti, Anita, Franco, Daryl, Burdon

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Ocean Physical Natural Capital and Ecosystem Accounts are still under development worldwide. The System of Environmental Economic Accounting – Ecosystem Accounting sets the international standard to fill in the quantity and their related condition of the accounting areas. Although there is now agreement on how to calculate the extent, the investigation of the condition of the accounting areas is still undertaken with different methods. Our ongoing Horizon Europe MARBEFES (Marine Biodiversity and Ecosystem Functioning leading to Ecosystem Services) project uses a mixed approach to report condition of the considered study areas. Our approach includes the use of the Marine Strategy Framework Directive indicators and the Ecological Value Assessment of the marine biodiversity in those specific areas. We aim to incorporate this methodology in the ARIES (Artificial Intelligence for Environment & Sustainability) platform, a cutting-edge integrated modeling technology in development since 2007, which allows to integrate natural science, human behavior and economic data. The methodology proposed here is aligned with ARIES for SEEA efforts to test these approaches in marine environments.

We envisage our method to make it faster for policy makers to visualize in a simpler form complex physical natural capital and ecosystem accounting information. We anticipate our contribution to inform the ongoing international development of physical natural capital and ecosystem accounting which includes specific marine biodiversity data and can be comparable worldwide. Our contribution will help improve monitoring over time of coastal and marine areas providing the necessary information to evaluate past and future policies and projects aimed at the sustainable management of the Ocean.

Keywords: spatial integration, marine physical accounts, ecosystem condition, ARIES, SEEA



9. High Nature Value Farmlands: Preserving Biodiversity and Ecosystem Services

First author(s): Anna Lilian Gardossi

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Agroecosystems are often perceived as incompatible with natural resource conservation. However, High Nature Value Farmlands (HNVFs) challenge this notion by recognizing the crucial role of low-intensity agriculture in biodiversity preservation. The EU's integration of HNVFs into policy frameworks underscores their importance.

This study is part of the project "SICANSE–Development of an information system on the natural capital and ecosystem services of the agricultural and forestry sector" (Action 2.1.3). Our aim is to estimate the total extent of HNV farmland and monitor trends in its extent and condition at the regional scale. HNVFs are cultivated landscapes rich in biodiversity or supporting endangered species and habitats. They are categorized based on semi-natural vegetation, landscape diversity, and presence of protected species.

To map HNVFs, we combined available datasets, identified potential HNVF types, integrated weighted indices, and characterized the results. This process involved scaling data to match the desired level of detail. First analysis suggests that a significant portion (84%) of the studied area with over 20% agricultural land is likely to be classified as HNVF.

HNVFs are important for ecosystem services: By preserving biodiversity and traditional farming practices, they contribute to essential functions like pollination, water regulation, and soil health. Understanding their spatial distribution and evolution is crucial for effective conservation strategies and sustainable land management.

This study contributes to the growing body of knowledge on HNVFs. By quantifying their extent and monitoring their changes, we can inform policies and practices that safeguard these vital landscapes and the ecosystem services they provide. As we strive for a more sustainable future, HNVFs emerge as key players in ensuring the balance between agricultural production and environmental conservation.

Keywords: Agroecosystems, High Nature Value Farmlands, Mapping techniques, Biodiversity conservation.



10. Advancing Ecosystem Condition Assessment: Refining the SEEA EA Framework

First author(s): Xavier Lecomte

Other author(s): Philip Roche

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The European Biodiversity Strategy for 2030 emphasizes the importance of maintaining ecosystems in good condition to combat biodiversity loss and provide ecosystem services. However, ecosystems face relentless pressures from human activities, climate change, and invasive species, adversely affecting biodiversity. A standardized framework for assessing ecosystem condition (EC) and trends is crucial in this context. The UN System of Environmental–Economic Accounting Ecosystem Accounting (SEEA EA) offers a comprehensive protocol for evaluating EC, based on abiotic and biotic characteristics. Nevertheless, it falls short in addressing ecosystem responses to disturbances, which are vital for analysing environmental issues and formulating effective interventions.

The concept of EC aligns closely with ecological health and ecosystem integrity, encompassing the ecosystem's state in response to human pressures and its ability to provide services and ensure species conservation. EC can be succinctly defined as the sum of biophysical properties underpinning ecosystem diversity and functioning.

We introduce new insights into the SEEA EA framework by proposing a clear separation between pressure indicators and ecosystem state indicators, aiming to develop a Human Pressure Index, directly related to EC. By distinguishing the causes affecting biodiversity and ecosystem functioning, and characterizing EC, this approach facilitates the identification of a minimal set of readily available indicators. Additionally, this refined framework seeks to bridge data gaps and leverage new scientific and technological advancements to support the European biodiversity strategy.

Given the complexity of EC, which involves various conditions supporting ecosystem services, defining a universal set of ecological features and functions is unfeasible. Therefore, it is essential to investigate individual services to identify critical determinants and establish criteria for EC. We highlight the importance of this nuanced approach in enhancing the robustness of EC assessments within the SEEA EA framework. We will also present a practical example of implementing this framework, demonstrating its potential to contribute to effective biodiversity conservation efforts.



Keywords: Ecosystem accounting, Human Pressure Index, Ecosystem condition indicators, Ecosystem functioning, Biodiversity conservation

11. Validating a national-scale pressure-based cropland condition map using bird census data

First author(s): Eszter Tanács

Other author(s): Ákos, Bede-Fazekas, András, Báldi


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The assessment and mapping of ecosystem condition is getting ever increasing attention. Croplands are artificial ecosystems but they occupy a large portion of the land, and thus it is important to study their suitability to support wildlife on a large scale. Due to the lack of suitable biodiversity data, mostly pressure-related proxies are used for this purpose, which increases the uncertainty of the resulting map. In this study, we aim to test the pressure-based cropland condition map of Hungary using bird census data. Besides validating the composite condition indicator, we also tested some key elements of the mapping process, such as the choice of variables and thresholds.

Using multiple comparisons of means by Tukey's contrast and Random Forest modelling, we examined the relationship of (1) the continuous cropland condition variables, (2) their rescaled, ordinal version (sub-indicators), and (3) sum of the sub-indicators (the final, composite cropland condition indicator) with a biodiversity measure, the standardised relative richness of characteristic farmland bird species (rRRCS). To get a picture of the spatial patterns of the examined relationships across Hungary, individual Random Forest models were constructed for all the spatial units of the bird census database, using focal analysis with a 30 km radius moving window.

We found significant differences in the rRRCS for nearly all sub-indicator categories, signifying that the literature-derived thresholds were mostly sound. Categories with higher (better) composite condition scores had higher rRRCS; the differences were significant in the mid-range but not in the extreme categories. The goodness-of-fit (R^2) of the Random Forest models is spatially heterogeneous, similarly to the variable importance. The proportion of semi-natural areas proved to be the most important condition variable. Our results highlight the spatial context dependence of the uncertainty of condition maps.



Keywords: ecosystem condition, ecosystem integrity, spatial context dependence, Hungary, EU Biodiversity Strategy

12. A multiple steps procedure for the analysis of intra- and inter-patches connectivity: an application in Lower Saxony, Germany

First author(s): Grazia Zulian

Other author(s): Malte Hinsch, M. Sc., Dr. Peter Vogt, Prof. Dr. Benjamin Burkhard

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The current environmental policies of the EU recognize the importance of transnational Green Infrastructure (GI) to improve ecosystem condition. Ecosystem restoration and sustainable land use planning complement the efforts to protect nature made with the establishment of Natural Protected Areas.

This study proposes the implementation of a multiple steps procedure for the analysis of intra and inter-patches connectivity to identify areas for mitigation measures, using the example of Lower Saxony, Germany. Specific attention is given to the role of transportation networks, to quantify their impact on connectivity; the presence of highly modified ecosystems, to quantify to what extent they can support the deployment of GI; the location of Protected Areas, to detect sites, and surrounding areas, that need restoration actions.

Connectivity is measured using three landscape metrics included in the Guidos Toolbox: a modified version of Accounting (classifies green patches according to the sizes), the Foreground Edge Density (measures the intra-patches connectivity using a new procedure based on continuous data, in this case a NDVI) and the Morphological Spatial Pattern Analysis (classifies the GI in morphological components). The identification of areas for mitigation measures is based on two Cluster analyses, respectively done at the Settlement and Protected Area level.

Transportation network acting as a fragmenting element reduced the size of the biggest patches by 28.9%. Respectively 6 and 4 connectivity profiles were identified for settlements and Natura 2000 sites. Among the Natura 2000 sites in Lower Saxony, 45.7% terrestrial sites are impacted by a threat linked to connectivity. The clustering method coupled with more specific filters allows to select areas where tailored mitigation actions could be implemented. Mitigation actions were identified according to the IUCN mitigation hierarchy. This methodology allows for



status, trend, and scenario-based analyses. It can be implemented in a multi-scale perspective and can be part of restoration plans or protected areas management effectiveness assessments.

Keywords: Sustainable landscape management, protected areas effectiveness management , connectivity measures, spatial modelling

13. Enhanced logic chains based on value parameters. An application to the economic valuation of ecosystem services at mediterranean forests

First authors(s): Fernando Rodriguez

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Even though SEEA-EA generic logic chains may be considered an important step forward, connecting ecosystems with well-being, they may fall short for operative goals, especially for the systematic collection of data, decision making, or benefit transfer. Instead, we advocate the use of enhanced value chains that conduct from Nature to net benefits and net economic value focusing on value connections, based on value parameters that are observable, can be measured, and whose effects can be assessed by way of the statistical estimation of a suitable value function. This establishes a common procedure that allows to focus on the set of building blocks of value, including attributes such as productivity, uniqueness, resilience, and condition.

The application of this procedure is eased by the adoption of a structured data collection model in which value parameters are collected for each combination ecosystem service – ecosystem, proxy variables are collected for each value parameter, and reported effects are collected for each proxy variable. Condition variables are considered as value parameters, with an upstream reference to ecosystems to account for possible diversities and downstream to proxy variables and their effects. The consideration of proxy variables separated from value parameters as the general case is very convenient for condition indicators and allows to keep a common structure for all sort of approaches, including benefit transfer. The model is presented from a theoretical standpoint, and then applied to the economic valuation of ecosystem services at five sites of mediterranean forest located in Spain.

Keywords: SEEA-EA logic chains, enhanced logic chains, value parameters, mediterranean forest

BOOK OF ABSTRACTS

- I. SESSION DESCRIPTION
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I. SESSION DESCRIPTION

ID: T3

Indicators for monitoring Ecosystem Services and Nature-Based Solutions in relation to the Global Biodiversity Framework

Hosts:

	Name	Organisation	E-mail
Host:	Alexander Van Oudenhoven	Institute of Environmental Sciences, Leiden University	a.p.e.van.oudenhoven@cml.leidenuniv.nl
Co-host(s):	Roxanne Lorilla Agnes Vari	Harokopio University of Athens HUN-REN Centre for Ecological Research	

Abstract:

The adoption of the Kunming–Montreal Global Biodiversity Framework (GBF) marks one of the most ambitious environmental agendas of the 21st century, and features both ecosystem services (ES) and nature-based solutions (NbS) prominently. For instance, Goal B deals with ecosystem services and Target 11 focuses on restoring and enhancing ecosystem services and nature's contributions to people, but also suggests NbS as key to doing so. Eight other targets refer to ES. Also, Target 8 suggests NbS as key to minimising the impact of climate change. Other targets might not explicitly mention NbS, but can be interpreted as depending on the effectiveness of NbS. Hence, although biodiversity is key in the GBF, attention needs to be (re)directed towards monitoring well beyond biodiversity, taking the whole socio-ecological system into account.

This calls for clear measures to monitor ecosystem services and nature-based solutions, as well as indicators that address and link biodiversity, ecosystem services and multiple value types. The current lack of clear measures and indicators makes it challenging to implement the GBF in practice. Adding to the challenge is the absence of a clear definition of what ES are included



within the target, how inclusively they have been framed, and how the effectiveness of NbS can be assessed.

In this session of Thematic Working Group 3 (on Indicators), we want to explore how indicators for ecosystem services as well as nature-based solutions can support monitoring of the GBF targets. This session will compile insights from researchers' projects, perspectives by researchers, practitioners and decision makers. Note that indicators and monitoring should be central in your submission and presentation, rather than (general) information on assessments and projects. We also welcome work on indicators within existing frameworks that can be related linked to GBF monitoring, such as the GEO BON Essential Ecosystem Service Variables, IPBES assessments, or the One Health framework. Studies and perspectives can be regional, national or even local, but ultimately we expect the indicators suggested and discussed to be compatible with GBF targets.

This session invites contributions on how to advance ES and NbS monitoring, including the definition of indicators, and the integration of ES into wider sustainability reporting frameworks and agendas, among others.

Goals and objectives of the session:

Identify and discuss indicators for ecosystem services and nature-based solutions that are suitable to monitor the Kunming–Montreal Global Biodiversity Framework (GBF) targets.

- Discuss how to advance ES and NbS effectiveness monitoring, e.g. through the definition of indicators, standardisation and harmonisation of data and concepts, and integration into wider policy and sustainability frameworks.
- Explore the biodiversity and human wellbeing outcome dimensions of NbS and how to monitor them, in the light of assessing NbS effectiveness. This can include but is not limited to ES that are provided by NbS.
- Discuss the future of the ESP Thematic working group on indicators, especially in relation to global targets, GEOBON and Nature-Based Solutions.

Planned output / Deliverables:

Each presenter will be provided with predefined questions, to guide the presentation. Informed by the answers of each presenter, we will host a closing discussion / workshop, aiming towards establishing indicators and criteria / reasons for doing so.



II. SESSION PROGRAM

Room: Expert Street 4

Date of session: 18th of November 2024

Time of session: 11:00–12:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
11:00	Alexander	van Oudenhoven	Leiden University	Introduction to the session and its expected outcomes
11:10	Stefanie	Broszeit	Plymouth Marine Laboratory	Indicator selection – key to effective ecosystem services and biodiversity monitoring
11:20	Joana	Seguin	Leibniz University Hannover	Unravel the ball of interwoven ecosystem services and condition indicators: a systematic literature review
11:30	Ralf-Uwe	Syrbe	Leibniz Institute of Ecological Urban and Regional Development (IOER)	Nation-wide indicators on ecosystems and their services in the new IOER research data centre
11:40	Agnes	Vari	HUN-REN Centre for Ecological Research	Social-ecological indicators for global monitoring and locally relevant implementations
11:50	Meng	Li	Leiden University	Global assessment of nature-based solutions, urban challenges and outcomes
12:00	Lori	Giagnacovo	VITO – Flemish Institute for Technological Research	Nature-based solutions through the use of Essential Biodiversity Variables in Land Dynamics predictions.
12:10	Panel discussion			



III. ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Indicator selection – key to effective ecosystem services and biodiversity monitoring

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Anthropogenic drivers are a main cause of biodiversity loss and degradation of natural environments, with negative consequences for humanity and the natural world. To counter this trend, international organisations of the United Nations such as the Convention on Biodiversity and the Intergovernmental Platform on Biodiversity and Ecosystem Services are proposing goals and targets to reverse the decline. A key step in achieving a reduction in biodiversity loss is regular monitoring that allows us to understand not only if biodiversity recovers but also which pressures cause loss of biodiversity, and if goals are being achieved. The new Global Biodiversity Framework sets out a number of indicators that can help with this purpose.

To assess if these indicators can help at a local and regional level, indicators need to fulfil several criteria, such as showing a change in value in response to a change in the biodiversity aspect measured. Indicators also need to be fit for purpose to measure the correct habitat or species or community. This means that a selection process is critical in finding appropriate indicators to provide data reflective of what happens in the environment.

To assess if they are useful at small/local scale, we created a framework to test this purpose on a set of indicators from the GBF and other sources. This framework was tested, then the indicators were prioritised to a number of test case studies, including both terrestrial and coastal biomes.

To check the usefulness of the indicators for each case study site, we then contacted local stakeholder organisations to gain feedback on the indicator choices we had created for their case study. Overall, stakeholders in the respective case study sites are interested in many of the indicators that we suggested for them, while they only use few of them at this stage.



Keywords: Biodiversity loss, monitoring, indicator selection, scale

2. Global assessment of nature-based solutions, urban challenges and outcomes

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In response to multiple societal challenges faced by urban areas, nature-based solutions (NbS) are gaining prominence as means to support sustainable and resilient urban planning. Despite their potential, widespread adoption of NbS can be enhanced by studying their effectiveness and multifunctionality. Here, we present findings from a systematic evidence mapping study. We synthesized 547 empirical cases of NbS in 197 cities globally, involving 799 outcomes (benefits) related to biodiversity, health and well-being, and regulating ecosystem services. We assessed the effectiveness of NbS by examining which urban challenges are addressed by NbS, how outcomes of NbS perform compared to alternative solutions and how multiple outcomes are provided and related to each other. Our findings reveal that forests & trees and parks commonly address health and well-being issues, while grasslands and gardens often address biodiversity loss. Our study also reveals that urban NbS generally yield positive effects compared to non-NbS, particularly in microclimate mitigation and mental health. Notably, NbS largely contribute to urban biodiversity, primarily enhancing the diversity and abundance of invertebrates and plants. We identified win-win solutions where biodiversity conservation aligns with other sustainability goals, showcasing the potential for multifunctional NbS. Nevertheless, evidence is scarce on NbS providing multiple outcomes related to biodiversity and well-being simultaneously. Furthermore, we address issues related to the indicators to measure different dimensions of urban NbS, and the role they play in assessing the effectiveness of NbS. Our study provides a foundation for further understanding NbS effectiveness and can inform urban planners and policymakers with evidenced-based targets for the application of NbS.

Keywords: Cities, Biodiversity, Ecosystem services, Effectiveness, Well-being, Systematic map



3. Unravel the ball of interwoven ecosystem services' and condition indicators: a systematic literature review

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The integrated assessment of Ecosystem Services (ES) is a powerful approach to raise awareness on human dependence on a functioning, biodiverse environment. Since related initiatives such as the Mapping and Assessment of Ecosystems and their Services (MAES) initiative of the EU, it has become common practice that the consideration of Ecosystem Condition (EC) and the respective application of EC indicators are or should be an integral part of an ES assessment. For the implementation of the Kunming–Montreal Global Biodiversity Framework (GBF) as well as the System of Environmental Economic Accounting (SEEA), there is a clear need for robust indicators that allow for an integrated assessment and monitoring to regularly inform EU as well as national policies about the current state and temporal changes in ecosystem assets and related services.

In the scope of the EU Horizon project SELINA (Science for evidence-based and Sustainable decisions about natural capital), we have conducted a systematic literature review to analyze the integration of EC and ES information and indicators in the most recent scientific literature. The review focused on the identification of applied indicators, variables, and proxies and their features linking EC and ES. Questions guiding our work were among others: For which ecosystem types or services did we identify a clear lack of indicators? What can we learn for future integrated ecosystem services assessments?

In this talk, the main findings from this literature review will be presented. The focus of the presentation will be on the indicators and indicator types that have been identified as well as on the gaps that have been detected in the scientific studies.

Keywords: indicators, proxies, variables, linkages, integration



4. Nation-wide indicators on ecosystems and their services in the new IOER research data centre

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Research data represents an important part of the human's knowledge base, thus a free access to it should be one of the cornerstones of our future society. The Leibniz Institute of Ecological Urban and Regional Development (IOER) is developing a special kind of research data centre (RDC), as this service primarily comprises high-resolution object and spatial data with information on land use, settlements, buildings and ecosystems. The IOER RDC is aimed to support researchers, policy makers, NGOs, and the public interested in sustainable development. An important component of the RDC is the information on Germany's ecosystems. This part makes indicators on the extent, conditions and services of ecosystems available following the FAIR principles. Based on regular analyses of landscape-related data, figures of biodiversity, ecosystem services, quality of life, and environmental justice are calculated, evaluated and made available.

Examples that will be presented address indicators on biodiversity, climate protection by ecosystems, and cooling the local climate in cities by green infrastructure. These results serve as a basis for debates on strategies to conserve or redesign landscapes of a high live quality. Since the beginning of 2023, data on landscapes and ecosystems from our previous projects (in the MAES framework) and most recent research has step by step been included into the IOER RDC. The indicators are geodata, available for download, visualized in interactive maps and will regularly recalculated for monitoring the environmental development.

Keywords: Geodata, land use, FAIR data, monitoring, MAES



5. Social-ecological indicators for global monitoring and locally relevant implementations

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At COP 15 in December 2022 nations committing to the Kunming Montreal–Global Biodiversity Framework signed up to target the maintenance and restoration of both biodiversity and ecosystem services (ES), and to monitor their progress towards the goals. Monitoring is essential in order to track progress towards these targets, and to detect shortcomings. The development of indicators for this global monitoring of ecosystem services is under rapid development. Implementing the monitoring of ES would be a great step towards the sustainable use of resources and conservation measures in a way that acknowledges the role of people in complex social–ecological systems. However, it has proven hard to design global monitoring in a way that is suitable for nationwide reporting, but also effective and meaningful locally. Working with the GEOBON Ecosystem Services Working Group and drawing from insights from the NSREC ResNet project’s Landscapes across Canada, we developed a set of indicators that can be used at global scales and interpreted at different local scales. While there are many possible interpretations of the different aspects of ES in a social–ecological system, and there is no one “right way” to do it, this compilation provides some workable solutions and gives guidance on how to design variables for multi–level monitoring.

Keywords: monitoring, indicators, Global Biodiversity Framework, social–ecological systems

6. Nature-based solutions through the use of Essential Biodiversity Variables in Land Dynamics predictions.

First author(s): Lori Giagnacovo

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Target 8 and 11 of the Global Biodiversity Framework (GBF) aim to restore, maintain and enhance ecosystem services and evaluate policy and management that minimize negative impacts and stimulate positive impacts on biodiversity. However, there are still substantial data gaps for reliable estimates in services provided by ecosystems to people and how positive



climate action is incorporated by countries. To fill this gap, we need to evaluate essential ecosystem service variables (EESVs) and essential biodiversity variables (EBVs). The state of the biodiversity within an ecosystem is key in determining the ecosystem integrity and is therefore a very important indicator in assessing the capacity of an ecosystem to provide its potential ecosystem services. This is illustrated by the theory that a resilient and intact ecosystem will have a higher level of functional redundancy in comparison to a degraded ecosystem. EBVs can be designed to focus on ecosystem structure or ecosystem functioning. In the OBSGESSION project, we will create data cubes composed by a large number of different datasets (i.e. remote sensing data, in-situ data, citizen science, eDNA, etc.), from which an EBV can be derived by a specific metric. Time series analyses of EBVs may point out where and when biodiversity is declining. As an example, EUNIS habitat maps can serve as ecosystem distribution EBV. We plan to use this EBV in the SONATA project for Serbia. There we will evaluate alternative land use scenarios to spatially optimize nature-based solutions (NbS) in the area. This way, we aim to gain insights in how, where and which NbS can best be implemented in targeting conservation and/or restoration of biodiversity and ecosystem services.

Keywords: EBV, ecosystem structure, ecosystem function, land dynamics, scenario analysis

BOOK OF ABSTRACTS

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I. SESSION DESCRIPTION

ID: T4a

Integrating ecological and legal approaches to mapping and assessment of ecosystem services vulnerability, resilience, and restoration


Hosts:

	Name	Organisation	E-mail
Host:	Francesca Leucci Philip Roche	Wageningen University & Research INRAE	francesca.leucci@wur.nl philip.roche@inrae.fr
Co-host(s):	Alexandra Aragão Sylvie Campagne	University of Coimbra Biological Research Station Roscoff	aaragao@fd.uc.pt scampagne@sb-roscoff.fr

Abstract:

‘Environmental damage’ may be either the direct and imminent result of polluting activities or the long-term effect of multiple and diffuse anthropogenic sources cumulating and commingling. Whatever the cause is, environmental damages are disturbances of ecosystems that could lead to a strong loss of ecosystem services. This raises the question of how to bring the environment back to the state of nature before the disturbance while taking into consideration the notion of ecosystem vulnerability as assessment of exposition and sensitivity of ecosystem services as well as ecosystem resilience dynamics.

According to the EU Commission (SWD EU guidance on integrating ecosystems and their services into decision-making, 2019), the ecosystem service framework can be a useful instrument and could be used in two moments: first, to map and assess the extent and severity of the environmental damage at the local, national or global level; secondly, to envision the type of restoration activity needed to bring the environment back to the previous state and to improve its conservation status. In the first moment, the question is: which ecosystem services have been lost as imminent or long-term result of a degradation/deterioration/disturbing event? In the



second moment, the question is: which ecosystem services, where and how should they be restored?

Goals and objectives of the session:

This session aims to create a synergistic dialogue between ecological science and legal science to deepen our understanding and enhance methodologies in assessing and managing ecosystem service vulnerability and resilience. Scholars and practitioners either from the scientific or from the legal field are invited to explore and present a broad spectrum of studies and tools that aim to evaluate the vulnerability and resilience of ecosystem services in the face of environmental disturbances, with a strong emphasis on the implications for legal standards and restoration practices.

From an ecological viewpoint, this session aims to discuss methodologies ranging from quantitative models and spatial analysis to innovative approaches like dynamic modeling, GIS-based tools, remote sensing applications, systems dynamics, and machine learning. These methods provide critical insights into the ecological pressures such as climate change, habitat degradation, and overexploitation, and how they can be systematically assessed and managed.

From a legal perspective, the session will focus on how environmental liability, as outlined in directives such as the EU Directive on Environmental Liability, interacts with ecosystem service frameworks. This includes understanding how laws enforce the assessment and restoration of environmental damage and how these practices are implemented on the ground following significant ecological events, such as oil spills or large-scale deforestation.

Key discussions will also revolve around the real-world applications and case studies, highlighting how various regions and biomes across the globe are applying these frameworks to assess damage and plan effective restoration strategies. Additionally, the session will tackle the intrinsic challenges such as dynamic environmental baselines, complex data requirements, the need for sophisticated ecosystem models, and the trade-offs among various restoration options.

Session format:

Here some examples of topics that could be covered:

1. Theoretical and Methodological Frameworks: Expanding on conceptual frameworks for assessing ecosystem service vulnerability, including discussions on exposure, sensitivity, adaptive capacity, resilience, and resistance metrics.
2. Technological Advances in Assessment: Showcasing the role of technological innovations in enhancing ecosystem service evaluations.

3. Legal and Social Dimensions: Exploring how legal requirements influence the assessment and restoration of ecosystem services, emphasizing the integration of ecosystem services into environmental legislation.
4. Case Studies and Practical Applications: Presenting detailed case studies from different global contexts that demonstrate the application of these assessments in real-world scenarios.
5. Challenges and Solutions in Ecosystem Assessments: Addressing the technical and legislative challenges in ecosystem service assessments, focusing on solutions that facilitate better decision-making for long-term environmental and societal benefits.

Building on common challenges, synergies and overlaps between the scientific and the legal domain, the final aim of this session is to come up with some guidelines for public authorities, regulators, judges and experts to systematically incorporate ES considerations in the assessment of environmental damages and the practice of ecological restoration in order to take into account the ecosystem services vulnerability.

II. SESSION PROGRAM

Room: Expert Street 8

Date of session: 21st of November 2024

Time of session: 11:00–12:30 & 13:30–15:30

Timetable speakers

Part1

Time	First name	Surname	Organization	Title of presentation
11:00 – 11:03	Introduction to the morning session “Measuring, mapping and assessing ES for resilience”			
11:03 – 11:15	Philip	Roche	French National Institute for Agriculture, Food, and Environment (INRAE)	Post-Fire Recovery and Resilience of Ecosystem Services in Mediterranean-Type Ecosystems
11:16 – 11:28	Pavel	Cudlín	Czech Academy of Sciences	Vulnerability and resilience of selected ecosystem services in Central European Uplands
11:29 – 11:41	Lori	Giagnacovo	VITO Remote Sensing, Belgium	Detecting early-warning signals of resilience loss in ecosystems to



Time	First name	Surname	Organization	Title of presentation
				avoid regime shifts and loss of ecosystem services
11:42 – 11:54	Elena	Todorova	Bulgarian Academy of Sciences	Using Driver–Pressures–State–Impacts–Responses framework to form forest management solutions that foster resilience
11:55 – 12:07	Anna Lilian	Gardossi	Udine University, Italy	Remote Sensing–Based Mapping of Hedgerows: Enhancing Ecosystem Services
12:08 – 12:20	Zahra	Asadolahi	Lorestan University, Iran	Monetary valuation of ecosystem services: As a way to protect Iran’s middle Zagros protected areas

12:21 – 12:30 Wrap-up of the morning session by the hosts

Part 2


Time	First name	Surname	Organization	Title of presentation
13:30 – 13:32	Introduction to the afternoon session “Measuring, mapping and assessing ES for restoration”			
13:33 – 13:45	Hendrik	Schoukens	Ghent University, Belgium	The Environmental Damage Directive and wetlands: What lessons can be learned from the CJEU’s 2020 German Drainage decision?
13:46 – 13:58	Giedrius	Dabasinskas	Vytautas Magnus University	Impact of peatland restoration on the value of ecosystem services provided by wetland ecosystems in Lithuania
13:59 – 14:11	Ifigenia	Kagalou	Democritus University of Thrace, Greece	Regulating Ecosystem Services (RES) impacted by hydro–morphological alterations in Mediterranean Lakes: a national assessment
14:12 – 14:24	Ioannis P.	Kokkoris	University of Patras, Greece	Geodiversity: steps towards the MAES implementation in Greece



Time	First name	Surname	Organization	Title of presentation
14:25 – 14:37	Vahid	Amini Parsa	University of Lodz, Poland	Which landscape metrics support soil retention ecosystem service? Identifying the thresholds of patch shape for sustainable soil retention in forests
14:38 – 14:50	Francesca	Leucci	Wageningen University, Netherlands	The ES approach to damage valuation: costs, benefits and improved deterrence
14:51 – 15:03	Alexandra	Aragão	Coimbra University, Portugal	Cultural ecosystem services and human rights laws: improving the Rosetta Stone effect
15:04 – 15:16	Ehsan	Pashanejad	University of British Columbia, Canada	Balancing Ecosystem Services and Agriculture in the Canadian Prairies: A Spatial Decision-Making Approach for Sustainable Policy Implementation
15:17 – 15:30	Wrap-up of the whole session by the hosts			

III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.



1. Which landscape metrics support soil retention ecosystem service? Identifying the thresholds of patch shape for sustainable soil retention in forests

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Forests play a crucial role in mitigating soil erosion by providing Soil Retention Ecosystem Services (SRES), which are increasingly threatened by modifications to forest landscape structure. Understanding the relationship between forest landscape structural shape and SRES is essential for managing forest landscapes effectively to sustain SRES. This research provides novel insights into how thresholds in forest patch shapes affect SRES across diverse forest types.

Our aim is to analyze the intricate relationship between forest landscape structure and SRES, emphasizing the critical role of identified thresholds for sustainable SRES provision. We analyzed the relationship between forest landscape shape and SRES across 401 catchments in Poland, focusing on three forest types: broad-leaved, coniferous, and mixed forests. In particular, we assessed forest landscape shape using diverse landscape metrics (e.g., shape index, fractal dimension, contiguity, perimeter–area ratio) computed via FRAGSTATS. Soil erosion rates were estimated using slope, rainfall, organic carbon, water content, and clay ratio. Generalized Additive Models (GAMs) were employed to quantify the influence of these metrics on SRES, identifying significant thresholds ($p < 0.05$) impacting SRES provision.

The results indicated that SRES provision by different forest types could be predicted using landscape shape metrics: coniferous forests ($80.5 \leq r^2 \leq 81.1$), broad-leaved forests ($79.1 \leq r^2 \leq 80.1$), and mixed forests ($80.9 \leq r^2 \leq 81.4$). Specifically, in broad-leaved forests, three thresholds in the shape index distinctly influenced soil erosion rates. Coniferous forests exhibited nonlinear relationships with soil erosion rates, influenced by thresholds in the perimeter–area ratio, related circumscribing circles, and contiguity indexes. Mixed forests demonstrated varying impacts on soil erosion rates, with two thresholds in related circumscribing circles and one in fractal dimension. These insights could be essential for forest managers to enhance sustainable forest management practices and ensure the continued supply of SRES.



Keywords: Threshold, Critical Point, Patch, Shape, Landscape, Ecosystem Service, Soil Retention ecosystem service

2. Impact of peatland restoration on the value of ecosystem services provided by wetland ecosystems in Lithuania

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The loss of most of the world's wetlands has highlighted the importance of the services they provide. The purpose of the study is to assess spatial and temporal changes in the economic values of ecosystem services (ES) provided by Lithuanian peatlands and to assess the benefits of restoring drained bogs in comparison to costs. Lithuania has lost about 75% of its peatlands, most of which are drained fens (74%), and most of which remain intact were raised bogs (65%). Forestry and agriculture were the main drivers of peatland loss. The main ecosystem services provided by undrained wetlands, compared to drained ones, were mainly related to climate and water flow regulation, waste management, biodiversity and recreation. Currently, the value of intact peat ecosystem services is \$1.336 million per year. The double-drained peatland area has even lower ESV than the undrained area. If these drained peatlands were restored by 2050, they would account for \$4006 million per year. A cost-benefit analysis has shown that the benefits outweigh the costs, making restoration efforts economically justifiable. More effective management measures could achieve a balance between the use of these ecosystems and the benefits they provide to human well-being.

Keywords: ESV; land use; peatland; benefit/cost ratio; restoration



3. Regulating Ecosystem Services (RES) impacted by hydro–morphological alterations in Mediterranean Lakes: a national assessment

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Under the term “water related ecosystem services” there is a plethora of valuable services provided by aquatic ecosystems that are strongly linked with their health/status. The deviation from natural hydro–morphological (HyMo) condition reflects the gap from ecosystem proper functioning, a fundamental pillar providing numerous ecosystem services and societal benefits. As acknowledged by the Directive 2000/60/EC (WFD), HyMo pressures influence Biological Quality Elements (BQEs) through processes that affect habitat quality and structure, with riparian vegetation typically playing a significant role.

Using an ecosystem service approach can further advance our understanding of the impacts of HyMo changes on aquatic ecosystems and how future changes might change the availability of aquatic ecosystem services. The Regulating Ecosystem Services (RES) mainly emerge from the ecosystem functioning which, in turn, is supported by “a healthy” condition. The WFD ecological status expresses the quality of the structure and functioning of the aquatic ecosystems directly contributing to the RES.

Our aim is: a) to explore the RES affected by HyMo changes in a conceptual model, across the natural Greek lakes and b) to support the implementation of the WFD and the associated River Basin Management Plans (RBMP) by opening the dialogue on the use of the ecosystem service approach in Integrated Water Resource Management (IWRM).

Having correlated HyMo parameters with major BQEs from 18 Natural lakes, reflecting specific human pressures and lakes’ functions, we attempt to link them with ecological functioning, affected ES and RES indicators from CICES (5.1). Findings suggest that natural lakes’ RES are interlinked and simultaneously affect, and are being affected by the HyMo alterations, recommending an integrated approach for their conservation. Yet, the complexity of the Mediterranean ecosystems, under the light of climate crisis, need adaptive water policy instruments based on the ES approach.

Keywords: Water policy, hydro–morphology, Ecosystem Services Approach



4. Enhancing our understanding of resilience and vulnerability to address global change in forests

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Resilience and vulnerability are not new concepts to address the recent disturbances that caused unprecedented high levels of forest damage, threatening the provision of ecosystem services. Both are important concepts to understand, anticipate, and manage global change impacts on forest ecosystems. However, they are often used confusingly and inconsistently, hampering a synthetic understanding of global change, and impeding communication with managers and policy-makers.

Here, we synthesize the similarities and differences of resilience and vulnerability in forest social–ecological systems, aiming to better define their scope in improving our understanding of forest responses to global change. In particular, we address the following questions: (i) What are the commonalities and differences between resilience and vulnerability, their respective contexts, and uses?; (ii) What are the particular strengths of each concept for addressing forest change?; and (iii) What can we learn from past studies on resilience and vulnerability for the next generation of global change assessments in forest social–ecological systems? Resilience and vulnerability are powerful concepts with complementary strengths, having different histories, methodological approaches, components, and spatiotemporal focus. Resilience assessments address the temporal response to disturbance and the mechanisms driving it. Vulnerability assessments focus on spatial patterns of exposure and susceptibility, and explicitly address adaptive capacity and stakeholder preferences. We suggest applying the distinct concepts of resilience and vulnerability where they provide particular leverage, and deduce some lessons learned to facilitate the next generation of global change assessments.

Keywords: resilience, vulnerability, forests



5. The ES approach to damage valuation: costs, benefits and improved deterrence

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The potential of liability laws of preventing environmental accidents is often underestimated due to various issues that might hinder both their efficiency and their effectiveness. Among them, the uncertain level of monetary damages to be paid in litigation is likely not to induce polluters to invest adequate money on prevention. The aim of this presentation is therefore threefold. First, it wishes to shed a light on the current legal system of environmental liability at the EU level (at regional and national level), based on the American model. Secondly, it highlights advantages and pitfalls of specific methods to calculate ecological damages in the courtroom (contingent valuation, HEA, travel cost method, etc.). While judges have been employing for decades stated-preferences and revealed-preferences methods, they seem more at ease with the restoration-cost method. Yet, this approach cannot pass the efficiency test due to many reasons (e.g., uncertainties regarding baseline conditions or the real remediation of impaired sites). From an economic standpoint, inaccuracy in the assessment of damages can provide polluters with efficient incentives to avoid accidents only in case of small accidents. But large accidents would need to be assessed through more accurate methods in order to make sure that future potential polluters will receive adequate incentives to avoid their occurrence. Apparently, the ecosystem services approach would provide a possible way forward to make liability laws more efficient and effective. Courts have discussed its application in some recent cases (e.g., the Deepwater Horizon or the Costa Rica case) and many issues of validity have been raised. After identifying the specific bottlenecks in the judicial decision-making, the last aim of the author is to investigate how the ES approach (e.g., what types of classifications) could enhance the likelihood of judges of introducing it in litigation, hence raising the deterrent effect of environmental liability laws.

Keywords: liability, accidents, courts, environmental damage assessment, ecosystem services approach



6. Post-Fire Recovery and Resilience of Ecosystem Services in Mediterranean-Type Ecosystems

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Forest fires are a significant disturbance in Mediterranean ecosystems, profoundly affecting the capacity of these landscapes to provide essential ecosystem services (ES). This study examines the post-fire recovery dynamics and resilience of ES, focusing on the differences between seeder and resprouter-dominated systems. Utilizing an integrated approach that combines ecosystem service capacity matrices with transition models, we explore the temporal recovery patterns of ES under varying fire intensities in southern France's Mediterranean-type ecosystems.

Our findings reveal distinct recovery trajectories between seeder and resprouter systems. Seeder-dominated environments exhibit a gradual recovery, with critical services such as carbon sequestration and soil quality taking up to 87 years to return to 90% of their pre-fire capacity after high-intensity fires. In contrast, resprouter-dominated systems show a faster recovery, with similar services rebounding within 23 years under the same conditions. Notably, pollination and wild plant services demonstrate high resilience, recovering within 2 years regardless of fire severity, while provisioning services such as game provision exhibit lower resilience, taking up to 67 years to recover.

Cultural services, which embody the symbolic and emblematic values of the landscape, show varied resilience, recovering over 3 to 51 years. This study underscores the importance of understanding vegetation types and succession patterns in predicting ES recovery post-fire, offering insights into ecosystem recovery and resilience in fire-prone Mediterranean landscapes. By employing a transition matrix approach to simulate two distinct post-fire vegetation dynamics, we assessed how different recovery rates affect the provision of crucial services. The integration of slow and rapid recovery models, combined with varying fire intensity scenarios, provides a comprehensive understanding of potential ecosystem recovery trajectories.

Keywords: vulnerability, forest, transition, dynamics



7. The Environmental Damage Directive and wetlands: What lessons can be learned from the CJEU's 2020 German Drainage decision?


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When adopted in 2004, the Environmental Damage Directive (ELD) was hailed as a very innovative piece of environmental legislation, with the potential of prompting more comprehensive ecological restoration efforts in the context of environmental accidents and massive degradation. These high hopes seem justified by the impressive set of compensation criteria included in its annexes, which appear to focus on the effective restoration of 'pure' ecological damage. However, after two decades of application, the ELD's track-record appears mixed, to say the least. Very few cases exist where the ELD was instrumental in achieving a proper and effective restoration in cases of ecological degradation. A potent illustration of its shortcomings appears to be offered by a 2020 ruling on the legality of the existing water level management and draining on the Eiderstedt Peninsula in Germany. Whereas the area was in 2006 designated as a protected area under the EU Birds Directive, the protection of the Black Tern requires relatively wet conditions, to be found in marshlands and extensively used pastures. A German NGO therefore challenged the continued drainage activities in light of the ELD, requesting the competent authorities to adopt measures to remedy the damage. However, as the requests were rejected by several local courts, the court case ended up in Luxembourg, where the Court of Justice of the EU was questioned on whether the existing drainage activities are set to constitute 'normal' management and could therefore be exempted from the scope of application of the ELD. In my paper, the CJEU's decision of 9 July 2020 is critically assessed, in light of the premises of the ELD and, more generally, the EU's Green Deal and recently adopted EU Nature Restoration Law.

Keywords: wetlands, drainage, restoration, Environmental Damage Directive, EU Nature Restoration Law



8. Cultural ecosystem services and human rights laws: improving the Rosetta Stone effect

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Ecosystem Services (ES) have been presented as “A Rosetta Stone for nature’s benefits to people” (1). However, decision makers are not using the Stone as much as it should. The European Court of Human Rights’ case *Kyrtatos v. Greece*, illustrates the judicial inability to consider immaterial benefits.

To overcome this, a direct correspondence between the classes of Cultural ES (CES) in the Common International Classification of ES (<https://cices.eu/>) and human rights catalogues is feasible. Using the CES as an interpretation key it is possible to establish a correspondence between CICES and the Charter of Fundamental Rights of the EU (CFREU).

- CICES scientific and educational services, can be protected via freedom of expression and information (art.11); freedom of arts and sciences (art.13); and right to education (art.14);
- CICES experimental and physical services, can be conserved through the prohibition of degrading treatment (art.4); the right to wellbeing of the child (art.24 n.1); the protection of the environment (art.37); the right to daily and weekly rest (art.31 n.2), the freedom of peaceful assembly (art.12), and the right to liberty and security (art.6);
- CICES heritage and existence services, can be secured through the respect for physical and mental integrity (art.3 n.1), prohibition of degrading treatment (art.4), respect of cultural diversity (art.22) and right to reconcile family and professional life (art.33);
- CICES sacred and symbolic services, can be defended while safeguarding cultural and religious diversity (art.22), the right to daily and weekly rest (art.31 n.2), and the right to reconcile family and professional life (art.33).

The reinterpretation of fundamental rights in the light of CES can be a sharp instrument for effective justice.

Reference:



Díaz, Sandra et al (2015) A Rosetta Stone for Nature's Benefits to People, PLoS Biology 13(1)
<https://doi.org/10.1371/journal.pbio.1002040>

Keywords: Cultural Ecosystem Services, immaterial benefits, human rights, Charter of Fundamental rights of EU.

9. Vulnerability and resilience of selected ecosystem services in Central European Uplands

First author(s): Pavel Cudlín

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The assessment of the vulnerability and resilience of selected ecosystem services (ESs) in the landscape increasingly requires information about the landscape vulnerability to land degradation, rate of ecosystem service provision and their resilience to climate change and land use change under contemporary preservation by nature protection laws.

We present a method for assessing the provision of ecosystem services (most important under climate change conditions) at the habitat level on a scale of 1:10,000 in the cadastral area of Černovice town, situated in the Czech–Moravian Upland. ESs are quantified by the indicator rate of key ecosystem functions, associated with habitat types using look-up-table method, indicating their ability to provide ESs (environmental cooling through evapotranspiration, climate change mitigation through carbon storage, regulation of extreme events through water retention and habitat provision through species and habitat diversity).

The next step consists in analysing and evaluating their resilience under climate change conditions. It is based on indicators related to resilience that represent (i) the degree of disturbance represented by the climate change future projection and future land use intensification estimation, (ii) the preconditions for resilience estimated by assessing biodiversity, habitat connectivity (distance to nature), and habitat heterogeneity, and (iii) the level of landscape protection due nature preservation laws.

This approach will be complemented by the computation of the Environmental Sensitive Area Index (ESAI), defining sensitivity level to land degradation, based on combinations of 16 drivers,



grouped into four environmental groups related to climate, soil, vegetation and land use quality, human pressure and land management.

On the basis of all mentioned parts, the main risk factors in the landscape on a local scale are identified and typical measures to minimize their potential negative impact (resilience support) are proposed.

Keywords: Provision and resilience of selected ecosystem services, Vulnerability to land degradation, Impacts of climate change, Mitigation and adaptation measures

10. Detecting early-warning signals of resilience loss in ecosystems to avoid regime shifts and loss of ecosystem services


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Ecosystems worldwide are under threat by anthropogenic impacts and climate change, and risk losing their ecosystem services and biodiversity. These intrinsic changes have a major impact on the ecosystem structure and functioning, and will lead to degradation of the initial state. When drivers of change become too intense and/or frequent, the resilience of the ecosystem decreases and may no longer be able to withstand the disturbances. Once a critical threshold in resilience loss is reached, the system may shift into an alternative stable state, better known as a regime shift. Research has shown that ecosystems exhibit early-warning signals of resilience loss when being pushed towards the tipping point, that can be detected by time series analyses. In a tropical dry woodland in Zambia, called Miombo, we recently investigated critical slowdown of the ecosystem's response to increased fire frequency as an early warning signal for a regime shift. Identifying a transition in ecosystem state and the actual driver(s) of change is crucial in planning effective interventions for conservation or restoration. In the OBSGESSION projects, we aim at setting up a standardized detection-attribution-modelling (DAM) framework to harmonize change detection and attribution in ecosystems and biodiversity in Europe. Our study in Zambia pointed out that the detection of an actual regime shift requires not only changes in ecosystem structure, but also ecosystem functioning. As biodiversity is a crucial element in supporting and maintaining the ecosystem functioning, we will create and analyze time series of essential biodiversity variables (EBVs) in relation to associated negative



disturbances in areas of interest. The goal of the DAM framework is to provide a useful reference guide for conservation and restoration practitioners on evaluating where, when and how to intervene in areas at risk for regime shifts and to support resilience in ecosystem services.

Keywords: regime shift, early-warning signals, resilience loss, ecosystem functioning, DAM framework

11. Geodiversity: steps towards the MAES implementation in Greece

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In the frame of the LIFE IP 4 NATURA Project, this study seeks to facilitate the implementation of the Mapping and Assessment of Ecosystems and their Services (MAES) in Greece, through the development of an indicator tailored for abiotic attribute assessments, specifically focusing on geodiversity. This indicator serves not only to fulfill reporting requirements outlined in EU initiatives but also to pinpoint areas of significance, known as "conservation hotspots". These areas, characterized by their diverse geology, play a crucial role in supporting biodiversity and various ecosystem services. Furthermore, the identification and mapping of threats, whether from natural or human-induced factors, can inform the establishment or revision of protective environmental policies. The geodiversity indicator has been developed by integrating geological, geomorphological, climatic, pedological, and hydrological datasets, while threats to geodiversity have been produced by combining sub-indicators related to erosion, protection status, land degradation, mineral extraction activities, and the distribution of wildfire ignition points. A thematic map has been produced to highlight geodiversity "hotspots" across Greece, which tend to align with areas of high geodiversity but insufficient protection against adverse natural or anthropogenic factors, largely due to inadequate protective measures. Study findings offer a baseline for making scientifically sound decisions regarding conservation, management, and spatial planning, all while adhering to EU and national regulations and strategies concerning nature conservation and sustainable development.



Keywords: ecosystem condition, geodiversity hotspots, land use management, natural capital

12. Using Driver–Pressures–State–Impacts–Responses framework to form forest management solutions that foster resilience

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Abstract text (maximum 300 words)

The dynamic two-way interactions between human and natural systems reveals in retrospection a series of trade offs and synergies that form both the landscape and the way of life of local people. The Scots pine forests in the west Rhodopi mountain were afforested in the period 1960–1970, after the oak forests that naturally inhabited the area were destroyed. These forest plantations are located below their natural altitude diapason which results in lower resilience to disturbances. Meanwhile, many drivers and pressures are affecting the health and conditions of these forests. The local population is strongly dependent on all ecosystem services these forests provide. The present research explores policy–economics–society interaction through analysis of local development plans, statistical data and results from feedback received by local stakeholders. The obtained information is integrated in a Driver–Pressures–State–Impacts–Responses framework to form comprehensive description of the interactions between society and environment. Based on the analyzed results the multiple values of forests in rural areas and forest management solutions that would enhance the resilience of the coupled human–environment system are identified.

Keywords: ecosystem services; forests; socio–ecological resilience; DPSIR; stakeholders



13. Remote Sensing–Based Mapping of Hedgerows: Enhancing Ecosystem Services

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Hedgerows are important linear features of landscape composed of trees and/or shrubs of various species. They perform ecosystem services, as well as cultural functions, such as control of soil erosion, microclimatic effect, wood production, and other ecosystem services. In particular dense hedgerow network plays a key role in habitat connectivity for some species and thus influences the degree of fragmentation of the landscape. Information on hedgerow networks is often retrieved in the field using accurate ground surveys, a very time-consuming process. Remotely sensed data offer the opportunity to map and characterize hedgerow networks at a landscape scale. Generally remote sensing images are widely used to characterize landscapes while less explored is the detection and characterization of this important linear features.

The aim of this study was to identify wooded hedgerows from remote sensing data using an object-oriented approach, in order to estimate the proportion of hedgerow network that can be automatically extracted. The investigated area is a rural–urban landscape located in the plain area of Friuli Venezia–Giulia region (North–East of Italy).

The image object-oriented classification approach was conducted with eCognition on Planet’s data. It consists of a two steps method: a segmentation and a classification. Respectively the segmentation generates image objects in different resolutions (fine to coarse) while the supervised classification allows classification of objects into different landscape element types to extract wooded hedgerows. For the segmentation procedure, three parameters as size (scale parameter), homogeneity of areas (NDVI) and shape (smoothness and compactness) were used. The multitemporal data made possible to identify the target class using the RGB and Infra–red bands.

The results highlight that agricultural landscape complexity influences the classification accuracy, as the detection performance increases with hedges density. The study was complemented by the design and use of a ground truth application, thus integrating the use of crowdsourcing.

Keywords: Remote sensing, hedgerows, eCognition, Planetscope data, object oriented

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
	Benjamin Burkhard	Leibniz Universität Hannover	burkhard@phygeo.uni-hannover.de
	Wieteke Willemen	University of Twente	I.I.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
			Leibniz Universität Hannover	
	Benjamin	Burkhard		
	Miguel	Villoslada	University of Eastern Finland	
13:30– 13:35	Solen	Le Clec'h	Wageningen University	Introduction to the session
	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
	Benjamin	Burkhard	Leibniz Universität Hannover	
15:25– 15:30	Miguel	Villoslada	University of Eastern Finland	Wrap-up
	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

First author(s): Andrea Larissa Boesing

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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.

Keywords: landscape structure, spatial configuration, landscape features, proxy models, spatial planning

2. Nature-based Landslide Mitigation Economic Assessment

First author(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 · ha⁻¹ · yr⁻¹) and the lowest in San Marino (35.24 EUR · ha⁻¹ · yr⁻¹). Furthermore, this mapping approach helps to identify potential restoration areas, thereby enhancing the natural capital of European mountainous regions.

Keywords: Economic value, Ecosystem services, Land Cover, Mapping, Pan-European



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

First author(s): Johannes Langemeyer

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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 author(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.

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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

First author(s): LUIS INOSTROZA

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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.

Keywords: urban planning and design; CICES; urban structural types; master plan

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

First author(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.

Keywords: apiculture, nectar flow, melliferous resource, bee pasture

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

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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.

Keywords: Willingness to care, Cultural Ecosystem Services, Participatory Mapping, Portugal
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.

Keywords: apiculture, nectar flow, melliferous resource, bee pasture

BOOK OF ABSTRACTS

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I. SESSION DESCRIPTION

ID: T5

Ecosystem Services Modelling for Nature-based solutions

Hosts:

	Name	Organisation	E-mail
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Co-host(s):	Kremena Burkhard Thomas Elliot Bart de Knecht Roy Remme Mario Balzan	Leibniz University Hannover, Aalborg University, Wageningen University & Research, Leiden University, Malta College of Arts	burkhard@umwelt.uni-hannover.de thomaselliot@plan.aau.dk bart.deknecht@wur.nl r.p.remme@cml.leidenuniv.nl mario.v.balzan@gmail.com

Abstract:

The interconnected and interdependent relation between human health and healthy environment is becoming increasingly clear and the concept of Nature-based Solutions (NbS) can act as a way to bridge the gaps between conservation and public health for holistic approaches (WTO-IUCN, 2023). NbS are tools for enhancement and operationalisation of specific Ecosystem Services (ES) for solving particular societal challenges. Therefore, applying NbS requires an integrated understanding of the environmental, economic and social systems and their interactions. The ES models can be appropriate tools to identify the most suitable NbS by quantifying the benefits and trade-offs they provide.

The session on ES models for NbS at the previous European ESP conference 2022 in Crete included various contributions covering different aspects from application of models in real world case studies to interactions between biophysical, economic and the social systems. The contributions in the session covered a range of ecosystems and their services in various environments and at




multiple scales. Group work during the session emphasized the essential components of ES modelling (frameworks) in assessing NbS. The most highly rated components were inclusion of multiple ES, validity of the models and uncertainty analyses. Incorporation of ecosystem structures, functions and services and use of high quality spatial and temporal data were also defined as important elements. The main gaps identified during the group work were: not taking into account feedback loops and interactions; monetary valuation; side effects of NbS; lack of accessible and understandable communication of multiple values. Stakeholders' involvement and synergies and trade-offs were identified as both essential elements and gaps.

The studies on synergies and trade-offs in ecosystem management can effectively reveal the effects of NbS on environmental health and the consequent relation to human health. Understanding such synergies and trade-offs requires effective modeling methods such as system dynamics, land use matrices, and participatory approaches. System dynamics models reveal complex ecosystem interactions, while land use matrices quantify the impacts of land use practices on biodiversity and ecosystem services. Participatory approaches engage stakeholders, ensuring diverse perspectives are considered. Integrating these methods informs sustainable land management and collaborative environmental governance. This session aims to build on the achievements of the previous session by further searching for best practice examples of model implementations for identifying NbS and quantifying benefits and trade-offs. The session is open to ES modelling for NbS in all environments, with specific space reserved for cases from small and medium islands.

We invite speakers to present advancements in modelling of NbS in relation to:

- Application of ES models for NbS in real world case studies with stakeholders and end-users
- Linking NbS to ES and Societal challenges, including human health, through models
- Modeling the interactions between the biophysical, economic and the social system
- Good and bad practices in the development and application of ES models for NbS
- Multiscale ES modeling for NbS (from single ecosystems to landscapes) – the impacts of local NbS on landscape scale ES
- ES modelling as decision-making support tool for robust policy-making and sustainable development
- Modeling impacts of NbS implementation on ES and trade-offs with other solution options

Given the collaboration with the COST Action SMILES, we would like to invite speakers working in small-medium islands to share their experiences with NBS uptake and implementation. Therefore, part of this session is dedicated to NbS in small and medium European islands, aiming



at showcasing the effectiveness and co-benefits arising from NbS. Such islands are hotspots of biological and cultural diversity, with high vulnerability and co-dependencies related to human and environmental health. Thus, small and medium islands can provide appropriate and challenging case studies in ES modeling for NbS, such as restoration projects, protection initiatives, and sustainable coastal management practices.

Goals and objectives of the session:

This session is organized by the ESP Thematic Working Group on Modelling ES (TWG5) in collaboration with the COST action SMILES (“Enhancing Small-Medium Islands resilience by securing the sustainability of Ecosystem Services). It has two main goals:

- to further develop the understanding on the applications of ES models for NbS;
- to demonstrate the effectiveness of implementation of NbS in diverse environments, with emphasis on small-medium islands.

Planned output / Deliverables:

This session will be used to further develop collaboration and a research agenda within the ESP Thematic Working Group on Modelling ES.

II. SESSION PROGRAM

Room: Expert Street 6

Date of session: 19th of November 2024

Time of session: 16:00–18:00

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
16:00–16:05	Stoyan	Nedkov	NIGGG-BAS	Welcome and introduction
16:05–16:17	João	David	Humboldt-Universität zu Berlin, Geography Department	Assessing Urban Ecosystem Services to Support the EU Climate-Neutral and Smart Cities Mission
16:17–16:29	Margot	Neyret	Alpine Ecology Laboratory, Grenoble, France	One cannot have it all: trading-off ecosystem services and biodiversity bundles in landscape connectivity restoration

Time	First name	Surname	Organization	Title of presentation
16:29– 16:41	Arnout	van Soesbergen	UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC)	Modelling and valuing agricultural NBS impacts on ES in the Pemba– Lichinga Integrated Development Corridor in Mozambique
16:41– 16:53	Nicolas	Grondard	Wageningen University	Assessing benefits of Nature-based Solutions for freshwater ecosystems restoration with a biophysical – economic modelling framework
16:53– 17:05	Davide	Stucchi	Dipartimento di Elettronica Informazione e Bioingegneria, Politecnico di Milano; National Biodiversity Future Center	Developing a Dynamical and Individual-based Urban Forest Model: how much Species diversity impact ES supply?
17:05– 17:17	Swantje	Gebhardt	Copernicus Institute of Sustainable Development, Utrecht University	Investigating the interactions of habitat configuration and pesticide toxicity for pollination to evaluate opportunities for natural landscape element restoration
17:17– 17:29	Aline	Pingarroni	Facultad de Estudios Superiores Iztacala, Universidad Nacional Autónoma de México; Instituto de Investigación en Ecosistemas y Sustentabilidad, Universidad Nacional Autónoma de México.	Synergies and trade-offs between biodiversity and ecosystem services in tropical landscapes
17:29– 17:41	Davide	Longato	University IUAV of Venice	Assessing ecosystem service demand in urban areas to support the spatial allocation and prioritization of nature-based solutions: an application in Valletta, Malta
17:41– 18:00	Stoyan	Nedkov	NIGGG-BAS	Discussion and wrap up



III. ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Investigating the interactions of habitat configuration and pesticide toxicity for pollination to evaluate opportunities for natural landscape element restoration

First author(s): Swantje Gebhardt

Other author(s): Jerry van Dijk, Marjolein E. Lof, Martin J. Wassen, Martha Bakker


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The restoration of natural landscape elements is a prominent pathway within Nature-based Solutions towards conservation, and it is also widely suggested to improve wild pollinator abundance, diversity, and their pollination services in intensively used agricultural landscapes. However, the intended natural refuges for pollinators can become exposed to agrochemicals applied on surrounding agricultural fields. In order to effectively plan habitat restoration for pollinators, the effect of land use configuration on pesticide exposure and pollination service has to be thoroughly investigated.

To address this knowledge gap, we created a mechanistic pollination model that simulates the spatial processes of pollinator exposure to toxic pesticides and the subsequently reduced pollination service. We calculated pollination for a set of artificial binary landscapes, which vary in habitat amount and aggregation, as well as in toxicity of pesticides applied on agriculture. Preliminary results suggest that in landscapes with limited habitat amount and highly toxic pesticides, pollination services in the landscape are mostly safeguarded by aggregated patches of habitat, as this configuration shelters habitat from pesticide exposure. With increasing habitat amount and/or less toxic pesticide application, more dispersed patches of habitat achieve a better pollination service for the landscape.

Our ongoing research, whose results will be presented at the conference, utilizes our findings on the interaction of landscape configuration and pesticide toxicity to design landscapes where strategic nature restoration enhances pollinator health and pollination services. This model application will contribute to evaluate implementations of Nature-based Solutions such as habitat restoration and reduced pesticide application for pollination services and biodiversity



conservation. The results will be discussed with regards to informing policies to include beneficial landscape configuration measures that target the tradeoff between providing refuges for pollinator and facilitating spillover into agricultural landscapes to improve productivity.

Keywords: Pollination service, Spatial configuration, Pesticide exposure, Habitat restoration

2. Assessing benefits of Nature-based Solutions for freshwater ecosystems restoration with a biophysical – economic modelling framework

First author(s): Nicolas Grondard


Other author(s): Xavier Garcia, Nikshep Bangalore Suresh, Sien Kok, Lars Hein

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Freshwater ecosystems are biodiversity hotspots that provide key services, but their degradation impacts species habitats and service delivery. Nature-based solutions (NBS) offer opportunities for ecosystem restoration. The MERLIN project (Mainstreaming Ecological Restoration of freshwater-related ecosystems in a Landscape context: INnovation, upscaling, and transformation) showcases NBS for freshwater ecosystem restoration in 18 European case studies. To implement and finance NBS on a large scale, benefits must be quantified in biophysical and monetary terms. However, this quantification is challenging due to complex ecosystem and social processes and the lack of accessible modelling tools and data. Consequently, cost-benefit analyses often fail to capture ecosystem services and benefits, disadvantaging NBS compared to grey infrastructure alternatives.

Within MERLIN, a framework that couples biophysical and economic models is being developed to provide an accessible solution for quantifying and monetarily valuing benefits of freshwater ecosystem restoration at the catchment level. This framework is designed for applicability across Europe, utilizing continent-wide datasets. It integrates the newest version of the Soil and Water Assessment Tool (SWAT+) with a set of ecosystem services valuation models based on ecohydrological model results. The current development stage allows for the quantification of flood risk mitigation and water purification economic benefits from different restoration measures (peatlands rewetting, rivers restoration, floodplains reconnection).



In this presentation, we introduce this modelling framework and demonstrate its applicability using a MERLIN case study: the rewetting of peatlands in the Forth catchment (Scotland, UK). First, a catchment-scale restoration scenario is built. A SWAT+ model is developed, the restoration measures are simulated, and resulting output variables are used to model economic benefits of flood risk mitigation and water purification. To test the framework robustness, the sensitivity of outputs to different data sources is quantified. The results highlight the economic benefits of restored peatlands, emphasizing the value of NBS in ecosystem restoration.

Keywords: Freshwater ecosystems, ecosystem services, Nature-based solutions, Cost Benefit Analysis, Natural Capital.

3. Assessing ecosystem service demand in urban areas to support the spatial allocation and prioritization of nature-based solutions: an application in Valletta, Malta

First author(s): Davide Longato

Other author(s): Chiara Cortinovis, Mario Balzan, Davide Geneletti

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Mapping and assessing the demand for ecosystem services (ES) in urban areas can support the allocation of nature-based solutions (NbS) to deliver the desired ES where they are most needed. This study presents a method that combines spatial assessments of the demand for selected ES in a city with ES supply scores reflecting the capacity of different typologies of NbS to potentially deliver the demanded ES. The method was applied to simulate the spatial allocation and prioritization of NbS in a number of potentially suitable sites across the urban area of Valletta, Malta, considering 11 NbS types and 5 priority ES (i.e., runoff regulation, microclimate mitigation, air purification, noise reduction, and nature-based recreation). The proposed approach supports both the prioritization of potentially suitable NbS sites and the allocation of the specific NbS types which maximize the benefits to residents by providing the best balance of multiple ES. Results show that urban forest is the most needed NbS type across the study area, being the one with the highest capacity to supply most of the ES selected as a priority for the study area. However, there are specific cases in which other typologies are more suitable, according to the existence of hotspots of demand for specific ES, such as noise reduction and nature-based recreation; as well as sites where size, shape, or land use



constraints hinder the implementation of urban forests. Our approach can be used and adapted to support a variety of planning decisions dealing with the prioritization and spatial allocation of NbS in urban development/transformation projects.

Keywords: Urban planning, Green infrastructure, Ecosystem service mapping, Ecosystem service assessment, Decision support tool

4. One cannot have it all: trading-off ecosystem services and biodiversity bundles in landscape connectivity restoration

First author(s): Margot Neyret

Other author(s): Daniel Richards, Marie-Caroline Prima, Thomas R Etherington, Sandra Lavorel

Affiliation: Alpine Ecology Laboratory, Grenoble, France

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Countering the impacts of habitat loss and fragmentation on ecosystems requires complementing conservation areas with Other Effective area-based Conservation Measures within landscapes as nature-based solutions to jointly promote biodiversity and multiple ecosystem services (ES). However, critical knowledge gaps persist in where and how natural elements should be restored to improve landscape connectivity to simultaneously support, and reduce trade-offs between biodiversity and ES. In virtual landscape experiments that allow exploring the effects of spatial pattern systematically, we generated alternative landscape restoration scenarios aimed at fostering ecological connectivity. Scenarios varied in the location and size of restored areas complementing existing natural areas. We analysed the impact of these scenarios on four bundles representing distinct priorities of target ES and biodiversity-related values. All bundles were favoured by increasing restored area in the landscape, but were promoted by different spatial configurations. Restoration scenarios that fostered high aggregation of natural habitats promoted biodiversity and cultural value-related bundles, while smaller natural elements dispersed throughout the landscape were more beneficial for the sustainable production and climate adaptation bundles. These contrasts were most pronounced at low restoration efforts, where landscape configuration had greatest impacts on biodiversity and ecosystem processes. Effective spatial planning of restoration initiatives within landscapes and landscape-level nature-based solutions should consider these trade-offs, along with context-specific constraints, when prioritizing areas for restoration or conservation. Our findings contribute to a more comprehensive understanding of how protected and restored



areas can be integrated within landscapes to jointly support connectivity for both biodiversity and people.

Keywords: Restoration, virtual landscape modelling, ecosystem services, spatial planning

5. Synergies and tradeoffs between biodiversity and ecosystem services in tropical landscapes


First authors(s): Aline Pingarroni

Other author(s): Patricia Balvanera, Antonio J. Castro

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Rapid changes in tropical agricultural frontiers pose significant challenges in balancing tradeoffs between ecosystem service (ES) supply, biodiversity conservation, and the livelihoods of local communities. This study aimed to analyze the spatial patterns of biodiversity and the potential supply of multiple ES in the transformed Marqués de Comillas region in Mexico, employing three spatial modeling tools: GLM, InVEST, and soil functions. We produced detailed maps for 18 ES categories (provisioning, regulating, and cultural) and two biodiversity types (species richness and functional diversity). We identified ES spatial patterns by calculating average pixel values within 1 km² grids. Linear models were used to evaluate the relationship between biodiversity and ES across three observation scales: plot, landscape (1 km²), and village. Our findings, which are pioneering in the field of ES and the study of transformed tropical forests, offered robust spatial models and detailed maps at a local scale (3,556 km²) with high spatial resolution (225 m²). Importantly, land cover type, the red band texture index, and proximity to rivers and towns were identified as key variables for map generation. Tradeoffs in ES spatial patterns were observed, particularly between agriculture-related services and those linked to forests and water bodies. The landscape scale was generally effective for establishing relationships between biodiversity and most ES, except for hydrological ES, where the village scale proved more relevant. We highlight the necessity of conserving adjacent reserves to sustain the provision of services and biodiversity in the region. These results offer valuable tools for a comprehensive understanding of tropical forests and support collaborative landscape planning in the region.



Keywords: Spatial modelling, biophysical supply, rainforest, spatial trade-offs, transformed landscape

6. Developing a Dynamical and Individual-based Urban Forest Model: how much Species diversity impact ES supply?

First author(s): Davide Stucchi

Other author(s): Javier Babí Almenar, Renato Casagrandi

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With an increasing urban population, there is a growing need for green spaces to enhance citizen's quality of life. As a type of green space, and nature-based solution, urban forests stand out for their extensive ecosystem services (ES) supply and derived benefits. Current models for quantifying ES supply by urban forests typically project future ES supply under the assumption that historical trends persist. However, they often neglect changes in underlying ecological dynamics and exogenous variables over time, which influence future ecosystem condition (status) and ES supply. Modelling this dynamism is critical for representing future climate-related scenarios and evaluating different urban forest management alternatives. Here we develop a pilot dynamic model for urban forests that evaluates changes in ecosystem condition over time, including changes in species diversity, and how they influence ES supply. Our individual-based, mechanistic model describes tree growth and permits interactions between trees and with the surrounding environment. The foundational equations are based on key ecological processes such as net primary productivity. These equations are parametrized using scientific literature data and tuned to better represent common tree species in Milan and fed with realistic series of exogenous variables (e.g. weather and air pollution). Progressing from a single tree to a small urban forest patch, we start modelling a few ES over time, such as carbon storage and air filtration. The model is tested in a case study in Milan, unveiling how business-as-usual tree planting policies perform differently from alternative scenarios (e.g., enhanced species diversity), thus offering valuable insights for urban forest management. Future steps include expanding the set of ES and testing the model's capacity to inform forest performance under future climate and/or technological scenarios. The goal is to obtain a dynamic model sensible to changes in internal and exogenous variables for informing sustainable urban forest management.



Keywords: ES model, Biodiversity, Carbon sequestration, Pollutant regulation, System dynamics

7. Modelling and valuing agricultural NBS impacts on ES in the Pemba–Lichinga Integrated Development Corridor in Mozambique

First author(s): Arnout van Soesbergen

Other author(s): Megan Critchley, Zuhail Tatey, Sarah Fadika, Calum Maney, James Vause, Steven King

Affiliation: UN Environment Programme World Conservation Monitoring Centre (UNEP–WCMC)

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To support green economic transition in Africa, there is an urgent need to help financial institutions and governments make more nature-positive investment decisions on a routine basis. This study in an agricultural development corridor in northern Mozambique employs a spatial modelling and valuation approach to explore possible trade-offs and synergies between cropland intensification as a land-use (project baseline scenario) and investment to reforest riparian croplands and develop agroforestry in existing croplands (natural capital approach scenario). The natural capital approach scenario demonstrates how a nature-based solution approach can deliver on multiple development objectives. It estimates increases in benefits from improved dry season water flows, avoided sedimentation of watercourses, climate change mitigation and wood fuel supply in physical and monetary terms, compared to the project baseline scenario.

Results show that returns from establishing riparian forest and agroforestry ecosystems in current cropland areas are estimated to be \$42/ha/year in terms of benefits to Mozambique based on the four ecosystem services valued. This increases to \$90/ha/year when global costs of climate change mitigation are included (i.e. when the US social cost of carbon is applied to value climate change mitigation benefits). By way of comparison, studies suggest conventional tillage maize farming in Mozambique generates profits of around \$100/ha/year. However, economic benefits realized through agroforestry crop production were not monetized. Additional co-benefits under the natural capital approach scenario include improved pollination and increases in biodiversity.

This natural capital assessment can be used by the project designers to inform nature-based solutions to agricultural irrigation issues, delivering wider community benefits (e.g. wood fuel security) and achieving national objectives for climate change mitigation and biodiversity.



Mainstreaming natural capital approaches into these types of development projects can support NbS into planning processes and foster transition to green economies, delivering better outcomes for nature and people in landscapes and seascapes.

Keywords: Agroforestry, reforestation, ES models, valuation, trade-offs

8. Assessing Urban Ecosystem Services to Support the EU Climate-Neutral and Smart Cities Mission

First author(s): João David

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Urban Ecosystem Services (UES) – the benefits humans obtain from urban ecosystems – significantly enhance the quality of life in cities by providing air cooling and air purification, temperature regulation, flood risk mitigation, habitat quality, and other vital services. However, climate and land cover changes impact UES, presenting challenges to urban areas as environmental hotspots. Therefore, mapping and quantifying changing provisioning of UES is essential for informed policy-making and scientific research.

Recently, the European Union initiated the "Climate-Neutral and Smart Cities" mission to promote selected cities in achieving climate neutrality by 2030. To meet this ambitious target, these cities must closely monitor their environmental metrics and track their progress towards sustainability. This research aims to provide key ecological insights to support the EU's mission, assisting cities in their journey towards climate neutrality.

The study employs a modelling framework that integrates publicly available high-resolution land use data with other spatial datasets and biophysical models to assess UES for this target city sample. Preliminary results assess UES potential, revealing spatial dependence and patterns of various UES within each city. These results offer accessible data for policymakers and urban planners regarding the current state of urban ecosystems. Future research will incorporate climate scenario trends and land use change projections, providing a comprehensive understanding of UES dynamics and their potential role in climate change mitigation and adaptation in EU urban areas. By delivering detailed analyses and updated spatial information,



this research project aims to enhance urban sustainability and resilience, supporting the EU's broader environmental objectives.

Keywords: Urban Ecosystem Services; Climate-Neutral Cities; Urban Sustainability; Ecological Modelling

BOOK OF ABSTRACTS

- I. SESSION DESCRIPTION
- II. SESSION PROGRAM

I. SESSION DESCRIPTION

ID: T6

Integrated decision-making: Ensuring that the values of nature, society, people and finance are considered in decision-making processes

Hosts:

	Name	Organisation	E-mail
Host:	Graeme Nicholls	Capitals Coalition	Graeme.Nicholls@CapitalsCoalition.org
Co-host(s):	Devisha Poddar	Capitals Coalition	Devisha.poddar@capitalscoalition.org
Panelists	Luke Brander Richard Kooloos Bianca Nijhof	Vrij Universiteit Amsterdam CE Delft Anthesis Group	

Abstract:

Companies depend on natural, social, and human relationships and resources for the fundamental functioning of their business. Historically, the focus of business has been directed towards their impacts on nature, through the lens of externalities. However, there is growing recognition of dependencies and impacts on all forms of capital – natural, social, human and produced. This broader prospective is increasingly influencing business and financial decision-making, as it highlights the significant material risks that must be managed and compelling opportunities that can be leveraged.

In the face of multiple crises (global heating, biodiversity loss, social inequality), understanding how various types of capital create value, both now and in the future, and recognising how businesses impact and depend on these capitals are critically important. Yet, approaches to measuring and applying such values to decision making are usually siloed and narrow in focus.

The Capitals Coalition and their global community is developing a Framework for Integrated Decision-Making, to support organizations to reveal, understand and integrate the value of four capitals in decision-making: natural, social, human, and produced capital. The Framework offers comprehensive guidance on conducting integrated capitals assessments and building confidence in valuation, leading to a series of practical steps for making well-informed, integrated decisions.



These sets of documents include (i) Steps for Integrated Decision-Making, a step-by-step document proposing practical conditions for integrated decision-making in business in a consistent and transparent way. Implementation of these steps is supported by two additional documents: The (ii) Capitals Protocol, a guidance to identify, measure and value impacts and dependencies on all capitals; and the (iii) Governance Framework for Valuation, designed to support better understanding of how capitals information has been generated, judge its fit for purpose, and summarize its use to inform the decision at hand.

In this session, we will discuss how the Framework for Integrated Decision-Making delivers the foundations to embed systems-thinking and the value of what matters in business decision-making, and thus supporting a holistic understanding of value and ensuring that outcomes are truly sustainable across the three pillars of sustainability: economy, nature, and people.

Session format:

Closed session (no open abstract submission), with invited panellists.

Session contents:

Presentation of the aim and progress on the Framework for Integrated Decision-Making, followed by roundtable discussion between panellists and audience about its utility and application of the various business decision-making processes.

II. SESSION PROGRAM

Room: Expert Street 6

Date of session: 20th of November 2024

Time of session: 11:00 – 12:30

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: T7

Making nature count: monetary valuation for transformation to nature-inclusive decision-making

Hosts:

	Name	Organisation	E-mail
Host:	Nico Polman Vince van 't Hoff	Wageningen Economic Research Foundation for Sustainable Development	nico.polman@wur.nl vince.vanthoff@fsd.nl
Co-host(s):	Peter Roebeling Luiz Magalhães-Filho Luke Brander Mieke Siebers Waldecy Rodrigues	University of Aveiro University of Aveiro Vrije Universiteit Amsterdam Foundation for Sustainable Development Universidade Federal do Tocantins	peter.roebeling@ua.pt luizlacerda@ua.pt l.m.brander@vu.nl mieke.siebers@fsd.nl waldecy@mail.uft.edu.br

Abstract:

To transform the current economic decision-making process, it is important to mainstream nature into different forms of private and public decision-making. The valuation of ecosystem services in general, and monetary valuation of ecosystem services in particular, is playing an increasingly important role in the integration of nature into private and public decision-making. Monetary valuation is institutionalized in official UN frameworks (SEEA-EA framework), is being addressed in private and influential initiatives (such as the Taskforce on Nature-related Financial Disclosures; TNFD) and has the potential to contribute to many of the targets of the Global Biodiversity Framework (GBF).

With the increase in available primary valuation studies (see e.g. ESVD), value transfer is increasingly used to estimate the (monetary) value of ecosystem services. These monetary ecosystem service values are important for sustainable natural resources management (by



internalizing the value of nature) and natural capital accounting (by recognizing the value of nature in national accounts).

However, many questions regarding the implementation and transformative nature of monetary valuation remain. How does monetary valuation substantialize in private and public decision-making? How can we tailor and scale-up value transfer for better and more accurate decision-making? Or how can we use monetary valuation to close the biodiversity finance gap? Given these opportunities and challenges, it is important to critically explore methodological considerations, assess advances and discuss applications of monetary valuation – in particular in relation to their potential role to inform decision making, underpin natural capital accounting, and facilitate transformative change towards sustainable natural resources management.

Across this session we will seek to discuss recent considerations, advances and applications of monetary valuation for the integration of nature in private and public decision-making. These may be examples of monetary valuation in private or public decision-making, methodological advances and practical innovations in value transfer and/or critical contributions and thoughts on the mainstreaming and institutionalization of monetary valuation in public and private decision-making contexts.

Goals and objectives of the session:

Researchers are invited to present their recent considerations, advances and applications of monetary valuation, underpinning the transformative change towards sustainable natural resource management. This session will give insight in the opportunities, challenges and practices of using monetary valuation in private and public decision making.

Planned output / Deliverables:

Journal Special Issue about considerations, advances and applications of monetary valuation for transformation to nature-inclusive decision-making.


II. SESSION PROGRAM

Room: Expert Street 8

Date of session: 19th of November 2024

Time of session: 11:00 – 12:30 & 14:00 – 15:30 & 16:00 – 18:00

Timetable speakers



Time	First name	Surname	Organization	Title of presentation
11:00– 11:05	Nico	Polman	Wageningen Research	Introduction
11:05– 11:20	Nalini	Rao	Electric Power Research Institut	Biodiversity and Ecosystem Services: Economic Analysis for Decision-making
11:20– 11:35	Jan Philipp	Schägner	German Environmental Agency	Reporting and Quality Standard for Environmental Economic Valuation to Support Meta-Analyses and Benefit Transfer
11:35– 11:50	Maria	Bastos	University of Aveiro	Benefits from pollution abatement in eco- sensitive areas under development stress – assessing impacts in ecosystem services value of a Natura 2000 area
11:50– 12:05	Máté	Chappon	Széchenyi István University	Valuation of Ecosystem Services within the Water Value Flow framework – a case study from Lake Velence, Hungary
12:05– 12:20	Luiz	Magalhães Filho	Federal Institute of Education, Science and Technology of Tocantins	Integrated climate change adaptation for resilient coastal communities: An ecosystem service valuation approach
12:20– 12:35	Luke	Brander	Leibniz University	Wrap-up: Future of value transfer functions
14:00– 14:13	Peter	Roebeling	University of Aveiro	Potentiating the transformation to legume-based farming systems through private and social ecosystem service valuation
14:13– 14:26	Michaela	Robers	James Hutton Institute	Considering wider peatland values
14:26– 14:39	Veronika	Liebelt	German Federal Agency for Nature Conservation (BfN)	Hedonic analysis of biodiverse urban green: a survey-based case study of 14 German cities
14:39– 14:52	Lovelater	Sebele	Birdlife International	Economic valuation of ecosystems services provided by vultures in Southern Africa
14:52– 15:05	Allesandra	Santini	University of Padova	The multifunctionality of irrigation water: an economic valuation of the ecosystem services provided by irrigation water canals in the Veneto region, Northeastern Italy.

Time	First name	Surname	Organization	Title of presentation
15:05– 15:18	Liisa	Saikkonen	Finnish Environmental Institute	Market-based approaches to quantify and value recreation related ecosystem services
15:18– 15:31	Tomas	Badura	Czech Globe	Incorporating spatial complexity and variability into stated choice experiments for biodiversity policy support
16:00– 16:15	Francisco	Alpizar	Wageningen University and Research	Keynote
16:15– 16:27	Mark	Van Oorschot	Netherlands Environmental Assessment Agency.	Assessing the dependence on ecosystems of the economic and financial system, using the new ENCORE database
16:27– 16:39	Caroline	van Leenders	Netherlands Enterprise Agency	Strategies To Scale-Up Payments For Ecosystem Services
16:39– 16:51	Anna	Biasin	Etifor	The economic and financing side of Nature-based Therapies (NbTs): an European perspective
16:51– 17:03	Frits	Bos	Netherlands Bureau for Economic Policy Analysis.	How to measure the non-use value of nature in cost-benefit analysis: the case of Bonaire's coral reefs
17:03– 17:15	Ferdinand	Lang	Leibniz Centre for Agricultural Landscape Research	Consumer preferences for nature conservation certificates improving soil-related ecosystem services and biodiversity
17:15– 17:27	Francesca	Leucci	Wageningen University	The ES approach to damage valuation: costs, benefits and improved deterrence
17:27– 17:39	Madli	Linder	Estonian Environment Agency	Socioeconomic values of ecosystem services as a tool in decision-making in Estonia
17:39– 17:51	Vince	Van 't Hoff	Foundation for Sustainable Development (FSD)	From dimes to decisions – Applying monetary values in local public decision making in the Netherlands
17:51– 18:00	Session	hosts		Wrap-up: Making Nature Count



III. ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Incorporating spatial complexity and variability into stated choice experiments for biodiversity policy support

First author(s): Tomas Badura


Other author(s): Marije Schaafsma

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Understanding the spatial distribution of preferences for both use and non-use values of biodiversity is crucial for designing environmental policies that maximize social value. Yet, the integration of spatial factors that influence these preferences and estimated values in stated preference research remains a formidable challenge. This includes designing studies that not only control for and accurately represent multiple spatial factors simultaneously, based on the actual context rather than abstract hypothetical landscapes, but also yield insights that are broadly generalizable. We introduce a novel approach designed to address these issues. It allows for the creation of numerous, individually tailored choice scenarios that exhibit a high degree of variation of spatial factors among respondents. This increases the generalizability and accuracy of results while enhancing the realism of the choice scenarios to ensure the validity of valuation scenario. Specifically, this study examines how spatial factors—such as the location of environmental changes, its characteristics, as well as the surrounding of respondents— influence preferences for enhancing existing sites versus creating new ones in terms of quantity and quality of sites that can harbour biodiversity at these locations. The approach presented here offers one of the most comprehensive and generalizable examinations of spatial factors in stated preference research to date, with results that are highly relevant for national policy. The country-level application of this spatial methodology focuses on the implementation of biodiversity strategy across Czech Republic with results of relevance for the national implantation of the EU Nature Restoration Law, the EU Biodiversity Strategy, and the Global Biodiversity Framework.

Keywords: biodiversity; non-use values; choice experiments; non-market valuation; stated preferences



2. Benefits from pollution abatement in eco-sensitive areas under development stress – assessing impacts in ecosystem services value of a Natura 2000 area

First authors(s): Maria Isabel Bastos

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Contamination induced by high-risk water pollution (HRWP) puts at jeopardy ecosystem services (ES) and values across marine, coastal, estuarine and freshwater socio-ecological systems (MCEF-SES). Several measures for reducing HRWP in MCEF-SES have been identified, though their impact on ecosystem services and values have rarely been assessed. This study develops and applies an approach to assess the environmental risk reductions and ES benefits from HRWP abatement measures in MCEF-SES surrounded by heavily industrialized and urbanized areas. The approach combines a HRWP habitat risk assessment (using InVEST-HRA) and risk-adjusted meta-analytic based ecosystem service value functions, to estimate and map ES benefits from HRWP abatement measures. A case study is provided for the Ria de Aveiro Natura 2000 coastal lagoon in Portugal, considering integrated multitrophic aquaculture (IMTA), vegetation cover (CV), short rotation forests (SRF), hazardous material road transport (HAZMAT-TR) and phytoremediation (PHYTO-R) HRWP abatement measures. Results show that individual HRWP abatement measures can, on average, decrease habitat risks by between 0.04% (IMTA) and 4.6% (HAZMAT tr) and lead to an increase in corresponding ecosystem service values of, respectively, 0.004% (+2.1 k€/yr) and 0.8% (+436.9 k€/yr). Combined measures can, on average, decrease habitat risks by up to 8.4% and lead to an increase in corresponding ES values of up to 1.7% (+986.0 k€/yr). Largest relative ES benefits from individual HRWP measures are observed for Water courses, Salines and Inland marshes (up to +2.1%, +2.0% and +1.5%, respectively); for combined measures ES benefits increase most for Water courses, Salines and Coastal lagoon, by up to +6.5%, +5.1% and +2.7%, respectively. Hence, it can be concluded that additional HRWP abatement measures across fragile, Nature 2000, MCEF-SES can lead to significant ES benefits. Moreover, it's shown that the developed approach provides a robust and replicable framework to estimate and map ES benefits from HRWP abatement measures in MCEF-SES.

Keywords: Marine, coastal, estuarine and freshwater socio-ecological systems; ecosystem services and values; high-risk water pollution; risk-adjusted ecosystem service values



3. The economic and financing side of Nature-based Therapies (NbTs): an European perspective

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The positive link between exposure to nature and human health is well-documented, leading to a growing interest in nature-based therapies (NBTs). Despite this surge, the economic valuation, cost-effectiveness, and financing potential of these therapies remain underexplored in the research. Filling this gap is critical, as valuation and financial sustainability are essential for integrating NBTs into decision-making processes.

Within the RESONATE project (Horizon), we are conducting a comprehensive cross-case study to evaluate, over the next two years, the economic value and cost-effectiveness of six NBTs. Simultaneously, we will explore the potential means of financing for these therapies. Our study aims to map and identify relationships among supply, demand, financing, and other key stakeholders in the European NBT market. Focusing on the financing perspective, the study seeks to identify mechanisms for NBT development financing, define the drivers and barriers to accessing public and private finance, and provide examples of business models using case studies.

For this session we will review the main methodologies and approaches used to assess the economic value of nature exposure and NBTs, highlighting key features and challenges. Furthermore, we will present our protocol for integrating economic evaluation into health research. Finally, we will address the challenges in making a business case for NBTs, supported by preliminary results from our analysis on their financing potential.

Keywords: Nature based therapies, financing NbT, economic valuation, cost-effectiveness, stakeholder mapping



4. How to measure the non-use value of nature in cost-benefit analysis: the case of Bonaire's coral reefs

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The non-use value of nature should be included in cost-benefit analysis (CBA), but how to include it is not straightforward. This paper discusses a cost-benefit analysis about a new harbour in Bonaire and its damage to coral reefs (Ecorys, 2022). The non-use value of the damage is estimated by a survey among Dutch citizens about their willingness to pay for the existence of coral reefs in Bonaire. This survey was part of a well-known The Economics of Ecosystems and Biodiversity (TEEB) study which among others assessed the value of Bonaire's nature (Van der Lely et al., 2012). We discuss the pros and cons of this approach. For a wide range of reasons, such stated preference methods will not lead to an adequate estimate of the non-use value, e.g. the purpose of the TEEB-study is fundamentally different and not focused on marginal changes, the relevant population is not trivial, coral reefs are an international public good and only anthropocentric values are included. Assessing the direct physical effects of the new harbour on nature seems the best way forward for this case. The methodology of biodiversity points may in some cases be used to quantify these effects. The costs of mitigation and compensation measures will probably be most helpful for assessing indirectly the value of Bonaire's nature. In practice, policy makers must balance the net monetary benefits of the new harbour with its negative physical effects on coral reefs and other nature.

Keywords: Non-Market Valuation; Natural Capital, Existence Value, Biodiversity



5. Valuation of Ecosystem Services within the Water Value Flow framework – a case study from Lake Velence, Hungary

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Lake Velence – Hungary's third-largest lake – is a nationally popular recreational area and a nature conservation site listed by the Ramsar Convention. Conflicts of interest between water users around the lake and throughout the catchment area surfaced when the lake's water level reached a record low point due to a series of climatic and anthropogenic phenomena in September 2022. This event has questioned the ability of the current water resources management scheme to successfully address future challenges posed by climate change and increasing water use.

In this study, we apply a framework based on the Water Value Flow concept to assess water availability in different water allocation scenarios while simultaneously evaluating water-related ecosystem services within the main waterbodies of the catchment area.

The water allocation scenarios include alternative operational rules for the lake and the two large reservoirs. These reservoirs were constructed 50 years ago with the primary purpose of compensating for the lake's water balance extremes. In recent decades, the secondary use of these reservoirs as fisheries has partially hampered their primary use, calling for an ecosystem service-type evaluation.

The water-related ecosystem services considered in the reservoirs and the lake include 1) water-related recreation, 2) fish production, 3) climate regulation, and 4) carbon sequestration. These services are valued in monetary terms, using available databases (TEEB, ESVD) and validated by a survey carried out during the summer of 2024, which explored water users' willingness to pay for more and-/ or cleaner water in the lake.

The Water Value Flow framework helps to assess and compare the hydrological and hydro-economic effects of water resources management interventions, thus fostering dialogue and conflict resolution between stakeholders. Policymakers can establish agreements and



compensation mechanisms based on these results in order to maximize the economic and societal benefits of using water resources.

Keywords: ES valuation, IWRM, Water Value Flow, hydro–economy, Lake Velence

6. Strategies To Scale–Up Payments For Ecosystem Services

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Ecosystems provide numerous ecosystem services, which are essential to biodiversity and humankind’s well-being and prosperity. These services have drawn increasing attention from governments, private financial actors and knowledge institutes. Target 19 of the Global Biodiversity Framework (GBF) specifically calls for “stimulating innovative schemes such as payment for ecosystem services” to increase financial resources for biodiversity conservation. The need for strategic action to achieve the targets set by the GBF is critical. Based on the three types of ecosystem services (provisioning, cultural, and regulating ecosystem services), this paper describes and visualizes how to scale up payment for regulating ecosystem services based on characteristics of these services like function, scale and value. How ecosystem services are funded in the current economic system is also taken into account.

Based on the unique characteristics of ecosystem services, our paper outlines three strategies for scaling up finance for (regulating) ecosystem services. These strategies include actions that the private and public sector can take separately, as well as in collaboration with each other. The strategies are: (1) creating nature positive markets for provisioning and cultural ecosystem services, (2) creating coherence and synergies between publicly financed regulating ecosystem services and (3) blended finance strategies based on the interconnectedness of ecosystem services. With this paper, we hope to contribute to the ongoing (international) dialogue on financing biodiversity, and to stimulate further exploration of solutions that use ecosystem services as a basis for scaling up finance and bridging the current funding gap for nature. The paper also proposes a definition for nature–positive based on the characteristics of regulating ecosystem services.

Keywords: ecosystem services, payments for ecosystem services, blended finance, nature positive, GBF



7. Consumer preferences for nature conservation certificates improving soil-related ecosystem services and biodiversity

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Recent studies have highlighted that soil-related ecosystem services are declining at an unprecedented level on a global scale. Within the European Union (EU) 60–70% of soils are in an unhealthy condition resulting in decreased provision of their ecosystem services. However, land managers generally have little incentive to invest in healthy soils, as they cannot sufficiently capture the marketable value generated by these ecosystem services. Mobilizing private investments through innovative business models, particularly nature conservation certificates, is considered conducive to encourage consumers to pay a price premium for higher levels of soil-related ecosystem services provision while providing positive incentives for land managers by offering them an additional income for the currently non-marketed services they generate. The socioeconomic feasibility of certification depends on the actual consumer preferences for the extra direct and indirect benefits. To examine these preferences, we conduct a discrete choice experiment (DCE) in Germany to assess the willingness-to-pay (WTP) of consumers for such a business model while building on Germany's first online marketplace for certified nature conservation projects – AgoraNatura. Aiming to evaluate consumer demand, we examine consumer preferences for paying for a set of selected soil-related ecosystem services improved via certified nature conservation projects. Moreover, we evaluate whether bundling soil-related ecosystem services themselves, but also with biodiversity– e.g. carbon storage, erosion control and pollination – into one marketable product will have an effect on consumer preferences compared to offering them individually. Furthermore, we examine what effect governmental funding can have on leveraging investment as well as its effect on trust into certificates.

Keywords: ecosystem services, biodiversity, certificates, choice experiment, agriculture



8. The ES approach to damage valuation: costs, benefits and improved deterrence

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The potential of liability laws of preventing environmental accidents is often underestimated due to various issues that might hinder both their efficiency and their effectiveness. Among them, the uncertain level of monetary damages to be paid in litigation is likely not to induce polluters to invest adequate money on prevention. The aim of this presentation is therefore threefold. First, it wishes to shed a light on the current legal system of environmental liability at the EU level (at regional and national level), based on the American model. Secondly, it highlights advantages and pitfalls of specific methods to calculate ecological damages in the courtroom (contingent valuation, HEA, travel cost method, etc.). While judges have been employing for decades stated-preferences and revealed-preferences methods, they seem more at ease with the restoration-cost method. Yet, this approach cannot pass the efficiency test due to many reasons (e.g., uncertainties regarding baseline conditions or the real remediation of impaired sites). From an economic standpoint, inaccuracy in the assessment of damages can provide polluters with efficient incentives to avoid accidents only in case of small accidents. But large accidents would need to be assessed through more accurate methods in order to make sure that future potential polluters will receive adequate incentives to avoid their occurrence. Apparently, the ecosystem services approach would provide a possible way forward to make liability laws more efficient and effective. Courts have discussed its application in some recent cases (e.g., the Deepwater Horizon or the Costa Rica case) and many issues of validity have been raised. After identifying the specific bottlenecks in the judicial decision-making, the last aim of the author is to investigate how the ES approach (e.g., what types of classifications) could enhance the likelihood of judges of introducing it in litigation, hence raising the deterrent effect of environmental liability laws.

Keywords: liability, accidents, courts, environmental damage assessment, ecosystem services approach



9. Hedonic analysis of biodiverse urban green: a survey-based case study of 14 German cities

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By offering various benefits, natural amenities play a significant role in enhancing the well-being of urban citizens whose city life is often associated with hecticness and stress. Urban green spaces serve citizens with recreational opportunities, aesthetic enjoyment, contribute to public health, climate regulations, cooling effect, and have an impact on the attractiveness of neighborhoods and housing prices. Thus, in view of global urbanization and biodiversity loss, the valuation of urban green spaces becomes increasingly essential.

We analyzed the impact of biodiverse urban green spaces on rental prices across 14 German cities by applying a hedonic pricing analysis. This analysis complements the existing literature by including the diverse measurements of urban green spaces and their biodiversity that we innovatively cluster as 'perceived' –variables retrieved from an online survey and 'objective' – variables, i.e. spatial data computed from satellite images. Furthermore, we analyzed rental prices in contrast to most studies that consider selling property prices. Finally, we incorporated an online survey as a source of perception data with a monetary valuation method. The key preliminary results at the aggregated level suggest that: (i) rental prices are positively correlated with the distance to the next urban green space. This raises the question of whether standard hedonic pricing analysis suffers from omitted variables bias – at least in this case – due to unobserved amenities in cities that are negatively correlated with UGS. (ii) Biodiversity of the UGS as well as around the flat have a positive, albeit not significant, effect on rental prices.

Keywords: hedonic pricing, valuation, urban green spaces, biodiversity, ecosystem services



10. Socioeconomic values of ecosystem services as a tool in decision-making in Estonia

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In 2018–2023, country-wide assessment and mapping of terrestrial ecosystems was carried out in Estonia (national MAES project ELME, co-financed by the European Union Cohesion Fund). The follow-up work, including implementation and reassessments are led by the Estonian Environment Agency.

Resulting from this work, spatially explicit map layers of ecosystem extent, condition and ecosystem services have been created and made publicly available (see the map catalogue here: <https://arcg.is/WuW9>). Along with the biophysical values, socioeconomic values of the ecosystem services were assessed and mapped.

These map layers (including the ones with monetary values) have been already implemented in real-world decision-making processes, including the exercises addressing the spatial aspect.

An important field of implementation of the layers with monetary values has been nature conservation planning. ELME layers provide numerical and spatially explicit proof of nature values giving a solid basis for justifying and zonation of the nature protection areas, and compiling sound protection rules for them. The second example of the successfully implemented use is the agri-environmental financial subsidy for enhancing ecosystem services in agro-ecosystems. This subsidy is now in force in Estonia and is based on the ELME methodology for assessing the ecological condition of agro-ecosystems. The layers with monetary values of ecosystem services have also been used to analyze how to achieve biodiversity and climate-related goals (incl. deforestation issues, afforestation, restoration, etc.) based on the data on ecosystem values. The recent success in the real-world uptake of the concept is illustrated by the Estonian Supreme Court's decision which obliged the decision makers to better consider the values of nature (and explicitly ELME results) before issuing the peat extraction permissions. The latter has led to even more and potentially influential actions towards more effective inclusion of the (monetary) values of ecosystem services in the real-world decision-making processes.



Keywords: ecosystem services, monetary values, socioeconomic values, planning, biodiversity and climate goals

11. Integrated climate change adaptation for resilient coastal communities: An ecosystem service valuation approach

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Current coastal erosion adaptation strategies typically focus on local measures, even though the real costs, impacts and benefits are influenced by combined adaptation measures implemented at the landscape scale. Therefore, adaptation measures should be identified, planned and managed comprehensively across time and space in order to maximize social, environmental, and economic benefits. This study aims to develop and apply a spatially-explicit analysis at the landscape scale that allows for the identification of efficient and welfare maximizing coastal erosion adaptation strategies from 2020 until 2100. A case study is developed for the North–West Portuguese coast, a region renowned for being one of the most erosion-prone and vulnerable areas in Europe. This study applies an Integrated Coastal Climate Change Adaptation (INCCA) approach, which combines environmental modelling with cost–benefit analysis techniques. The shoreline evolution model LTC (Long–Term Configuration) is used to simulate shoreline changes along the coast in accordance with the RCP 8.5 sea level rise scenario. Then, meta–analytic value function transfer is used to estimate local Provisioning, Regulating & Maintenance and Cultural ecosystem service values with the SSP 3 socio–economic scenario. Finally, the COAST model (Coast Optimization ASsessment Tool) is used to explore the types, dimensions and locations of coastal erosion adaptation measures that provide the largest welfare gains. Results emphasize the complex factors that influence the most beneficial beach nourishment options, which depend on site–specific conditions, land use types, ecosystem service values, and primary goals of the intervention.

Keywords: Shoreline evolution, Numerical modelling, Coastal adaptation measures, Environmental cost–benefit analysis, Meta–analysis



12. Biodiversity and Ecosystem Services: Economic Analysis for Decision-making


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For public agencies and industries managing land, measuring and evaluating biodiversity and ecosystem services, and any related impacts, is becoming increasingly important. External reporting venues such as the Taskforce on Nature-related Financial Disclosures (TNFD), the Global Reporting Initiative (GRI), or the Carbon Disclosure Project (CDP) have developed a variety of resources to help companies measure and report biodiversity impacts. The United States government recently published a national strategy to put nature on the system of national accounts, to augment current methods of cost benefit analysis to include natural capital accounting for ecosystem services and the environment. While scientists are focused on defining and monitoring biodiversity, the focus for public agencies and industry experts is on valuing and reporting changes in and impacts to biodiversity and ecosystem services to a variety of projects across their territories. We propose a spatially explicit, risk-informed approach that can be used to evaluate biodiversity and ecosystem services across different scenarios. It can be used by both public and private decision-makers to evaluate plans across their landscapes, define impacts and co-benefits, measure and report outcomes, engage with stakeholders, and manage risk associated with biodiversity investment decisions, ecosystem restoration, community and habitat protection, and climate impacts. The methodology presented can be applied to a variety of scales, bringing insight to the key question of value transfer. Case studies from New York, Ohio, Tennessee, Arizona, and California illustrate how the approach was applied to evaluate several electric power company restoration and infrastructure building activities.

Keywords: Ecosystem Service Valuation, Biodiversity, Value Transfer, Industry Decision Support, Scenarios



13. Potentiating the transformation to legume-based farming systems through private and social ecosystem service valuation

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Production and consumption of legumes and legume-based products across Europe has slowly increased over the last decade. While the potential ecosystem functions, services and values (provisioning; regulating & maintenance; cultural) from legume-based systems are recognized and complex, evidence on and realization of these benefits has proven difficult. Yet, these ecosystem services (ES) can assist stakeholders in steering transformation to legume-based systems by providing them with knowledge on how such systems can address climate change, biodiversity loss, and nutritional deficiencies. The objective of this study is to assess the state-of-knowledge on the multiple private and social ecosystem service values provided by legume-based systems. Hence, a systematic literature review (SLR) is performed, using the SCOPUS database, artificial intelligence (AI) review tools, and content analysis and synthesis. Over 3,700 papers were retrieved, of which almost 1,200 papers were considered relevant. Results show that private provisioning (mainly food and feed) and regulating & maintenance (mainly nitrogen fixation, soil quality and pollination) ES values are widely studied, and that ES values are typically assessed using direct market pricing (food and feed provision), avoided/replacement cost (nitrogen and soil quality regulation) and production function (pollination regulation) valuation methods. Social regulating & maintenance (mainly climate and water quality regulation, and biodiversity maintenance) ES values are less widely studied, where ES values are typically assessed using direct market pricing (climate regulation), avoided/replacement cost (water quality regulation) and stated preference (biodiversity maintenance) valuation methods. Social cultural (mainly aesthetics and culinary) ES values are hardly studied, using revealed and stated preference valuation methods. Transformation towards legume-based systems in Europe has the potential for the realization of these multiple ES values, and requires: i) evidence on and awareness of all ES values, ii) mapping of ES costs and benefits across benefactors and beneficiaries, and iii) creation of markets for non-market ES values.

Keywords: Legumes, Ecosystem services values, Private, Social, Systematic literature review (SLR)



14. Market-based approaches to quantify and value recreation related ecosystem services

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We develop market-based approaches drawn from simulated exchange value SEV method to spatially quantify and value freshwater recreation related services in Finland, taking into account travel costs, ecosystem condition, and the institutional context. The institutional context includes for example ownership of areas and their ecosystem services, demographic variables, and legislation that affects the use and markets of ecosystem services. We will further evaluate the applicability of the SEV based methods on marine and coastal recreation related services using recent data and models combining travel costs and contingent behavior. The work advances the methods to compile physical and monetary accounts on nature based daily recreation and marine ecosystem services and in general contributes to the methods to compile physical and monetary accounts on nature-based tourism and recreation in consideration of environmental factors and the institutional context.

Keywords: natural capital accounting, ecosystem service valuation, monetary ecosystem accounts, physical ecosystem accounts, aquatic ecosystem services

15. The multifunctionality of irrigation water: an economic valuation of the ecosystem services provided by irrigation water canals in the Veneto region, Northeastern Italy.


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Traditional flow-irrigation systems relying on water canals have been recognized as nature-based solutions for their capacity to deliver ecosystem services (ES). Besides food provision, most of the ES provided by these systems remain neglected in the decision-making processes,



rarely having an explicit economic value. Moreover, the preservation of traditional flow-irrigation systems may not be fully aligned with current policies targeting water efficiency in agriculture through technological and infrastructural improvements (e.g., drip irrigation).

This research contributes to demonstrate the multifunctionality of traditional flow-irrigation systems by accounting the economic value of ES provided by the irrigation canals managed by land reclamation consortia the Veneto region (Northeastern Italy).

Eight ES have been identified involving relevant stakeholders at regional level. Provisioning services (aquaculture and hydroelectric production) have been valued through the market price method, while regulating services (water quality and groundwater recharge) via the replacement cost method. For the cultural services (recreational activities, cultural identity, aesthetic value) and for supporting services (habitat maintenance) a Discrete Choice Experiment was implemented to evaluate the willingness to pay of the residents for the supply of these ES.

The total economic value estimated for targeted ES is 642 million €/year (35,68 €/m of canal). Although developed primarily to support agriculture, the role of irrigation canals goes beyond this representing a multifunctional component shaping Veneto lowlands. Indeed, cultural identity shows the highest value, confirming irrigation water canals are a key element of local landscapes. The economic value attached to groundwater recharge supports the idea that even if traditional irrigation systems are not as efficient as modern ones in crop irrigation, water losses ultimately feed the water table providing water for other uses.

ES assessment may inform public decision-makers in reconciling urgent challenges with sustainable water management. In particular, these results may support land reclamation consortia in the bargaining process for the renewal of the water diversion permits and regional government bodies in the application of relevant EU Directives and Regulations.

Keywords: Economic valuation, agro-ecosystem, irrigation, water.



16. Reporting and Quality Standard for Environmental Economic Valuation to Support Meta-Analyses and Benefit Transfer

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The environmental economics literature on the value of ecosystem services and natural capital has expanded substantially over the past 20 years and continues to develop in terms of methodology and diversity of primary applications. Attempts to synthesise these research findings, particularly using meta-analytic techniques, to investigate the effects of methodological choices and study object characteristics on the study results are, however, hampered by incomplete reporting and documentation within valuation studies. Successful meta-analysis requires accounting for all relevant methodological and study-object characteristics that affect the value estimate. Non-standardised reporting in the existing literature makes gathering this information from multiple studies a time-consuming and challenging procedure. Incomplete reporting on relevant methodological and study-object characteristics results either in a reduced sample size or in missing covariates within the meta-analytic model.

To overcome this obstacle, we develop a reporting standard for environmental economic valuation studies, which we propose as an obligatory appendix for all submissions and publications in the field of environmental economic valuation. The reporting template is intended to improve environmental economic valuation studies by: I) encouraging authors to thoroughly and explicitly consider their methodological choices; II) facilitating and improving the review process; III) aiding the use of valuation results in meta-analysis and benefit transfer; IV) improving the quality of meta-analytic value transfer for informing decision-making; and finally V) supporting the development of environmental valuation through the provision of richer and more precise datasets on primary studies, which is a necessary condition for a deeper discussion on which factors affect the values of ecosystem services.

Keywords: Environmental economic valuation, meta-analysis, benefit transfer / value transfer, quality standard, reporting standard



17. Economic valuation of ecosystems services provided by vultures in Southern Africa

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Africa is home to eleven species of vultures. Seven face the risk of extinction, listed as Vulnerable, Endangered or Critically endangered on the IUCN Red List. The major threats are poisoning, belief-based use and electrocutions and collisions. The loss of vultures in Asia provided a window into a catastrophic scenario without vultures and the impact of the loss of the ecosystem services they provide. In the African context, there is a knowledge gap on the importance of vultures to humans and the impact that a loss of vultures would have. To address this gap, this paper presents an economic valuation of the ecosystem services provided by vultures in Southern Africa, with a focus on Botswana, Zambia and Zimbabwe. Data were collected through four surveys targeting different beneficiary groups: 1. local communities in the Kavango Zambezi Transfrontier Conservation Area; 2. the general public within each country; 3. the international public; and 4. rangers and park managers. The ecosystem services addressed in the assessment include provisioning, regulating and cultural services. The total economic value of ecosystem services in the three countries is estimated to be just over USD 250 million per year. This is largely attributed to existence and bequest values and the sanitation and pest control service provided by vultures. Thus, although vultures are not as charismatic as the other species of interest in the continent, their conservation is highly important to the welfare and health of humans. Further work is required to be able to quantify the full value of vultures in controlling diseases in livestock and wildlife, which would enable a holistic One Health perspective on the value of this ecosystem service.

Keywords: vultures, Africa, ecosystem services, economic valuation



18. Assessing the dependence on ecosystems of the economic and financial system, using the new ENCORE database

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One the targets of the CBD Global Biodiversity Framework is to promote that businesses and financial institutes assess their impacts and dependencies on nature. The ENCORE database was developed to enable the assessment of dependencies, by compiling information on links between economic production processes and the different goods and services that ecosystems supply. It is used for screening large financial and investment portfolios, to identifying where the strongest dependencies occur. Such analyses of exposure to biodiversity issues have been done by central banks throughout the world.

The objective of this paper is taking the next step, by adding the risks of ecological degradation. It is done by combing the ENCORE dependencies with geospatial information on the ecological status of ecosystems. This combination of information makes it possible to integrate ecological degradation into financial risk analysis, adding towards the mainstreaming of nature's values in business and finance.

We will present the results of a first case study on the dependence of the Dutch economic and financial system. We used the new version of ENCORE, that contains more detailed information on economic production processes. Further, aggregated information on supply-chains is used, derived from a spatially detailed input/output model. This makes it possible to not only show direct dependencies within an economic sector, but also indirect dependencies of other sectors, mediated by global trade between sectors worldwide.

Different allocation and valuation methods are used to provide information to business and finance on the relevance of ecosystems and on potential consequences of biodiversity loss. This information can be used for awareness raising and decision making by economic and financial actors, either by central market authorities that act at a general economic level, or by individual financial institutes like banks, pension funds and investors that act on the level of individual businesses.



Keywords: mainstreaming biodiversity, financial risk analysis, ecosystem dependencies, ENCORE, supply chains, decision making

19. From dimes to decisions – Applying monetary values in local public decision making in the Netherlands

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In this session, we will explore the challenges and opportunities of applying monetary valuation data in municipal decision-making, using a recent pilot project conducted for the Dutch municipality of Eindhoven.

In 2022, the Eindhoven city council decided to purchase the Wielewaal estate (142-hectares) for 30 million euros. In addition to her ecological richness and role in biodiversity conservation, the Wielewaal also aims to serve a public function in a time and place where green spaces are under pressure. Keeping this in mind, the purpose of the municipality of Eindhoven was to comprehensively illustrate the societal benefits of the Wielewaal for the broader community through the development of a social business case

Collaborating with the Dutch Bureau of Statistics (CBS) and the National Institute for Public Health and the Environment (RIVM), the Foundation for Sustainable Development (FSD) conducted an assessment to value the ecosystem services of the Wielewaal in monetary terms. This assessment compared two scenarios: a freely accessible Wielewaal versus a closed Wielewaal.

The results showed the large public benefits related to health and existence values. More importantly, the project underscored the complexities involved in applying monetary valuation in a real-world context.

Several challenges emerged during the project. Some related to aligning data flows from RIVM, CBS, and FSD. Other challenges arose in linking biodiversity to ecosystem services. Finally, after a publication in the National Newspaper on the project and several highly engaging LinkedIn discussions (here by a thought leader in the field and here by the councilor for Nature in the



municipality of Eindhoven), the pilot project sparked the debate about when and how to apply monetary valuation data.

This session will delve into these challenges and debates, offering insights and lessons learned from the Eindhoven project to inform future applications of monetary valuation in municipal contexts.

Keywords: Monetary valuation, application, barriers, public decision-making

20. Considering wider peatland values

First author(s): Michaela Roberts

Other author(s): Antonio Ballesteros, Rebecca Gray, Nazli Koseoglu, Tareq Mzek

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Assessment of ecosystem condition is intrinsically tied to the elements of the ecosystem which we value. Land management strategies provide one option for landscape or ecosystem management which promotes a particular value or set of values (e.g., fire risk reduction).

Peatlands are an iconic landscape which, when in good condition, provide a wide range of ecosystem services. Peatlands are internationally important for their carbon storage potential, are nationally and regionally important for their role in fire risk reduction, and locally vital for energy provision, livestock grazing and culture, to name just a few.

In Scotland “good condition” peatland is recognised through its contributions to carbon and biodiversity. The management of peatland for carbon and biodiversity is a key policy area, present in the Climate Change Plan, Scottish Biodiversity Strategy, and National Planning Framework. In addition to promoting private finance options for peatland management, the Scottish Government has pledged £250 million to target peatland management in areas with the most potential for reducing greenhouse gas emissions. The value and condition of Scottish peatlands is recognised through their carbon storage within Scotland’s natural capital accounts. However, this presents only a partial understanding of the value of peatlands.

The benefits of expanding accounting of peatland condition to integrate additional services, such as fire risk reduction, are widely recognised within Scottish land management and policy.



We present results of a literature review of the current extent of valuation of wider peatland services, and how these are integrated with the policy aims of management for carbon and biodiversity. Working with key stakeholders we identify additional services not yet valued, and highlight where demand for peatland services may intersect spatially. Finally, we use data collected across Europe to highlight where socio-economic policies may promote land management strategies, in particular for peatland management for fire risk reduction.

Keywords: Peatland, carbon, economic valuation, fire risk, biodiversity

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: T8a

Ecosystem services and relational values – current state and the way forward

Hosts:

	Name	Organisation	E-mail
Host:	Johanna Schild	PBL The Netherlands Environmental Assessment Agency	johanna.schild@pbl.nl
Co-host(s):	Clara Veerkamp	PBL The Netherlands Environmental Assessment Agency	clara.veerkamp@pbl.nl
	Bart de Knegt	WUR Wageningen University & Research	bart.deknegt@wur.nl
	Nynke Schulp	VU University Amsterdam	nynke.schulp@vu.nl
	Sjerp de Vries	WUR Wageningen University & Research	sjerp.devries@wur.nl

Abstract:

In 2022, IPBES highlighted the limitations of relying solely on intrinsic and instrumental values of nature in policymaking, urging a broader consideration of relational values (IPBES, 2022). While ecosystem services often focus on tangible benefits, relational values emphasize the emotional and cultural connection people have with nature. Recognizing these connections can lead to more holistic conservation approaches and enhance nature policy effectiveness (Mattijssen et al., 2020).

Various strategies exist for integrating relational values into ecosystem services assessments, as highlighted by researchers such as Chan et al. (2016) and Stalhammer & Thoren (2019). However, the concept of relational values is still in its conceptual phase, requiring further exploration into operationalization and application. Research on ecosystem services can play a pivotal role in supporting the inclusion of relational values in policy-supportive assessments, particularly in operationalizing relational values for land use and nature policy.



This approach aligns with the concept of transformative change, which emphasize broadening the understanding of nature to encompass multiple values of nature, including relational values. Recognizing and incorporating relational values can also contribute to mental health and well-being.

We invite speakers to present advancements in relational values in relation to:

- Conceptual development of relational values: Explore the theoretical foundations and conceptual frameworks underpinning relational values, and their integration into ecosystem services assessments.
- Linking relational values to ecosystem services: Investigate the connections between relational values and ecosystem services, and how understanding these connections can inform nature conservation and natural resource management strategies.
- Application of monitoring and models: Showcase real-world case studies where monitoring and modeling techniques are used to quantify relational values, and discuss their implications for stakeholders and end-users.
- Good and bad practices: Examine both successful and unsuccessful approaches to the development and application of relational values, highlighting lessons learned and best practices for future endeavors.
- Policy implications: Discuss how insights from relational values research can inform and influence nature policy, and explore avenues for incorporating relational values into decision-making processes at local, national, and international levels.

Goals and objectives of the session:

- To obtain an overview of the current state-of-the-art of making relational values operational and the relation between ecosystem services and relational values.
- To identify gaps and opportunities in measuring and quantifying relational values, through a discussion with the participants.
- To outline a research agenda for making relational values operational.
- To identify insights for policy and decision making.

Planned output / Deliverables:

An opinion or discussion paper about policy implications, and a research agenda outlining operationalization of relational values within the ecosystem services research field.



II. SESSION PROGRAM

Room: Expert Street 9

Date of session: 19th of November 2024

Time of session: 16:00–18:00

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
16.05–16.17	Sander	Jacobs	Research Institute for Nature and Forest INBO	Scientist's relations with valuation of nature
16.17–16.29	Sjerp	de Vries	Wageningen University & Research	Relational values, nature connectedness and place attachment
16.29–16.41	Arjen	Buijs	Wageningen University & Research	Development of a scale to operationalize relational, instrumental and intrinsic values through the Nature Futures Framework
16.41–16.53	Mario	Balzan	Malta College of Arts, Science and Technology	Enhancing Ecosystem Restoration Through Nature-Based Tourism: Insights from the Maltese Islands
16.53–17.05	Johannes	Langemeyer	Universitat Autònoma de Barcelona	Digital Relational Values: Insights from TikTok's Virtual Nature Experiences
17.05–17:17	Frans	Sijtsma	Rijksuniversiteit Groningen	The Relational Value of Nature: Insights from Fifteen Years of Empirical PPGIS Research
17.17–18.00				Targeted discussion & Wrap-up



III. ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Enhancing Ecosystem Restoration Through Nature-Based Tourism: Insights from the Maltese Islands

First author(s): Mario V Balzan

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Nature-based activities have become increasingly important constituents of the tourism industry and include many outdoor activities, many of which are performed by individuals and communities within landscapes and seascapes. Propelled by improved purchasing power, digitalisation, and increased demand for nature-based interactions, this sector has considerable growth potential. Here, we examine nature-based interactions in an insular environment for their potential to align the goals of the tourism sector with those of ecosystem restoration in the Maltese Islands, including through the engagement of the public and private sectors. In this Horizon Europe SELINA demonstration project, we leverage various crowdsourced datasets to assess and map sites associated with high nature-based interactions and landscapes of unique social-ecological value. We use social media data to evaluate tourist preferences and behaviour. We extract and analyse geotagged social media posts to measure visitor engagement at sites of environmental importance, and compare this dataset to recent works conducting spatial assessments of nature-based tourism within the study area. By applying geospatial analysis and natural language processing, we map the distribution of nature-based tourism sites to provide an initial understanding of the relative amenity values of different landscapes based on site visitation. In addition to exploring the opportunities for nature-based tourism, participatory GIS surveys are conducted with businesses, residents, and tourists to evaluate the enablers and barriers for nature-based tourism and identify sites associated with different ecosystem services and amenity values. Results from this study are presented in more detail, and opportunities for the integration of biodiversity and natural capital in private and public decision-making are explored.

Keywords: recreation; ecosystem condition; ecosystem services; amenity values



2. Relational values, nature connectedness and place attachment

First author(s): Sierp de Vries

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In its framework for the valuation of nature, IPBES advocates relational values as a third type of value, next to intrinsic and instrumental values. This begs the question how this third type of value differs from the other two. Obviously, the answer also depends on how the other two types of values are defined. We argue that, at least for research purposes, it would be helpful to distinguish the three types of values more clearly. In this presentation, we propose tightened definitions for each type of value. For example, intrinsic value is defined as (and limited to) a moral value, the right to exist, regardless of nature's benefits and/or disbenefits to people. Relational value is defined as the emotional bond an individual has with a specific natural environment or element, next to possible intrinsic and/or instrumental value. While this bond may be shared with others, it can also be highly individual. And although intrinsic and relational values have in common that the nature in question is considered to be non-substitutable, we argue that they are so for quite different reasons. Next, we explore how to position the concept of relational value with regard to concepts such as nature connectedness and place attachment. Implications of the proposed tightened definitions for measuring the different values will be discussed as well.

Keywords: intrinsic value, instrumental value, relational value, IPBES



3. Digital Relational Values: Insights from TikTok's Virtual Nature Experiences

First author(s): Johannes Langemeyer

Other author(s): Alex Alonso González

Affiliation: Institute of Environmental Science and Technology, Universitat Autònoma de Barcelona, Spain


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Nature experiences are on the decline, but does this necessarily mean that environmental values are diminishing as well? The reduction in direct interactions with nature is often cited as a contributing factor to a waning appreciation of the environment and a subsequent decrease in commitment to environmental stewardship. However, the internet, particularly social media, is an often-overlooked factor that can amplify (indirect) nature experiences and foster environmental values. With more than half of the global population actively using social media, it is crucial to better understand how physical-virtual nature interactions on these platforms can shape values that support sustainable global transitions.

Langemeyer & Calcagni (2022) introduced the concept of Digital Relational Values, which are fundamental and eudaimonic values triggered by indirect experiences of nature within virtual communities. This case study aims to identify Digital Relational Values within the TikTok virtual community. Specifically, we manually analyzed video content (n=650) portraying diverse landscapes to evaluate the types of relational values and human-nature connectedness reflected and disseminated on the platform.

Building on the classifications by Chan et al. (2016) and Riechers et al. (2022), we found that only a small proportion of commonly recognized relational values were dominant on TikTok—namely, stewardship, eudaimonia, and personal identity. Additionally, we observed that certain landscapes, such as forests, wetlands, and montane-polar regions, were more likely to reflect Digital Relational Values. These values were often underpinned by experiential-emotional connections between humans and nature.

In conclusion, our research demonstrates that the TikTok virtual community serves as an important hub for the production and amplification of indirect nature experiences and the creation of digital nature values. This study underscores the need to give greater consideration to how nature values are created on social media and to deepen our understanding of the interrelationships between real-world experiences, their digital representations, and the real-world (stewardship) actions that may be triggered by virtually produced relational values.



Keywords: Relational Values, Nature Experiences, TikTok, Crowdsourced Data, Environmental Stewardship

4. Development of a scale to operationalize relational, instrumental and intrinsic values through the Nature Futures Framework

First author(s): Arjen Buijs

Other author(s): Christian Gamborg, Sabrina Dressel

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Considering nature and society as social–ecological systems is a prerequisite for understanding and shaping large–scale societal change processes (transformations). However, as recent European debates on e.g. the Nature Restoration Law has shown, transformations are inherently political and successful transformation critically depends on public support from society. This support, in part, depends upon peoples’ perceptions, values and cognition. The IPBES Nature Futures Framework (NFF) is a tool designed to explore different pathways for bringing about transformative change, focusing on positive and diverse relationships between people and nature. The NFF integrates three value perspectives: (1) nature for nature, which prioritizes the intrinsic value of biodiversity; (2) nature for society, which emphasizes nature’s direct and indirect contributions to people, including ecosystem services; and (3) nature as culture, which recognizes the reciprocal relationship between people and nature. In this presentation, we link these pathways to previous discussions on instrumental, intrinsic and relational value, with specific focus on relational values. Inspired by previous studies into the intrinsic, instrumental and relational values, we have operationalised the NFF into a psychometric scale for using in public surveys. This scale is the first validated scale to addresses values of nature from a transformative perspective. The scale is intended to capture different value perspectives seen in different societies and has been tested in four validations rounds with samples of the general public from the Netherlands, Denmark, Poland, Romania and Sweden. Here, we present the outcomes from a representative survey in these countries and the analysis of the validity and reliability of the scale. The scale can be used in scenario–studies and in national surveys into people’s perception into nature–positive futures.

Keywords: relational values, Nature Futures Framework, sustainable transformations



5. The Relational Value of Nature: Insights from Fifteen Years of Empirical PPGIS Research

First author(s): Frans Sijtsma

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The 2022 IPBES report clearly indicates that relational values to nature are underrepresented in policies and decision-making processes related to nature. This underrepresentation is partly due to a lack of systematic data on the relationship between people and nature. In this paper, we present fifteen years of empirical research on place-based relational values to nature. Our focus is on the Greenmapper software, a PPGIS (Public Participation Geographic Information System) tool, which serves a threefold function for the empirical assessment of relational values to nature.

First, the Greenmapper PPGIS software allows individuals to express place-based relational values to nature in a standardized, large-scale manner. Second, analyzing the individual data, it reveals the collective appreciation for various nature-related locations. Third, recent developments in the Greenmapper software aim to facilitate the organization of collective actions that support the management and governance of nature-related landscapes.

After discussing the nature and logic of individual value expression in Greenmapper, this paper focuses primarily on key empirical and conceptual results concerning the collective appreciation of nature-related places. We demonstrate the conceptual importance of working with a 'portfolio of loved nature places', the utility of Greenmapper data in assessing nature policy scenarios, the monetary valuation of nature via property prices, the role of Maslow's hierarchy of needs in relational values, and the use of community size as a measure of value.

The paper concludes by highlighting experimental possibilities and ideas for the third collective action function: using communities of fans of different nature areas and landscapes for idea generation and funding.

Keywords: Valuation, Place Attachment, PPGIS, Software, Spatial Planning

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: T8b

Nature on a plate. Linking people and nature in local food

Hosts:


	Name	Organisation	E-mail
Host:	Marta Derek	University of Warsaw, Poland	m.derek@uw.edu.pl
Co-host(s):	Sylwia Kulczyk	University of Warsaw, Poland	skulczyk@uw.edu.pl

Abstract:

Food is essential to our health and well-being. It also serves as a fundamental link between humans and nature: it exemplifies our dependence on nature, and how we use it to fulfil our physiological needs to satisfy hunger. Although it is commonly included as a provisioning service in many ecosystem services classifications, food also has a cultural value. This is especially pertinent in relation to local food: a concept that links the supply side of the ecosystem with human demand, via a plate.

Although the local food trend is not new, it has become even more significant in recent years due to the intense discussions about global climate change, environmental crises, and biodiversity loss. The ecosystem services concept is a powerful framework for analysing local food systems. It may also be a useful lens through which we can understand how local food production interacts with the natural environment, and what benefits it provides to humans.

In this session, we invite contributions that demonstrate how the relationship between nature and people is expressed through the concept of local food. We welcome presentations focusing on both environmental and social aspects, as we believe that bringing these two perspectives together is essential in order to understand local food, create sustainable local food chains, and identify synergies and trade-offs between the natural environment and its 'consumers'. We



encourage presentations that explore the role of local food, along with contributions that discuss the relationship between local, nation-wide, EU or global food systems.

Food for thought:

- How to build more resilient food systems that benefit both people and nature?
- Wild food as an iconic ecosystem service – a provisioning or cultural service?
- How is local food embedded into the natural environment where it is produced?
- What synergies exist between the natural environment, food, food producers and food consumers that can help local actors create successful and sustainable local food chains?
- What trade-offs between the natural environment, food, food producers and food consumers need to be addressed in order to improve the functioning of local food chains?

Goals and objectives of the session:

To share experiences on local food research within the framework of ecosystem services.

Planned output / Deliverables:

Proposing a joint paper on understanding local food through the lens of the ecosystem services concept.

II. SESSION PROGRAM

Room: Expert Street 3

Date of session: 19th of November 2024

Time of session: 16:00–18:00

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
16:00– 16:05	Marta Sylwia	Derek Kulczyk	University of Warsaw	Intro to the session
16:05– 16:10	Marta Sylwia	Derek Kulczyk	University of Warsaw	How local is local food? A systematic review of the concept



Time	First name	Surname	Organization	Title of presentation
16:10– 16:15	Tobias	Plieninger	University of Kassel, University of Göttingen	Landscape products for linking people and nature
16:15– 16:20	Sebastian	Candiago	University of Bayreuth	A socio–ecological perspective to study local food systems: the case of winegrowing under climate change
16:20– 16:25	Nynke	Schulp	Vrije Universiteit Amsterdam	Regional production of plant–based meat alternatives can support a transformation to sustainable food systems
16:25– 16:30	Priya	Sharma	Hungarian University of Agriculture and Life Sciences	Teach a man to fish: Promoting sustainable food systems by harnessing the potential benefits of fishponds for society
16:30– 17:00	DISCUSSION			
17:00– 17:05	Agita	Treimane	Latvian State Forest Research Institute 'Silava'	Pursuing multiple goals in forestry: does commercial thinning decrease bilberry cover and yield?
17:05– 17:10	Krossy	Mavakala	Ecole Régionale Postuniversitaire d'Aménagement et de Gestion intégrés des Forêts et Territoires tropicaux	Administrative bricolage in a bushmeat trade hub: decoding formal and informal interactions at Kinshasa's river ports
17:10– 17:15	Luisa F.	Eusse–Villa	University of Padova	Societal Willingness to Pay for Wild Food Conservation in Italy
17:15– 17:20	Lidia	Poniży	Adam Mickiewicz University in Poznań	Actively retired—benefits of gardening for elderly people
17:20– 17:25	Naji	Sulaiman	University of Gastronomic Sciences	Going or Returning to Nature? Insights from a Field Study on Wild Vegetable Uses in the Restaurant Industry of Lombardy, North Italy
17:25 – 18:00	DISCUSSION			



III.ABSTRACTS

first author is the presenting author unless indicated otherwise.

1. A socio–ecological perspective to study local food systems: the case of winegrowing under climate change

First authors(s): Sebastian Candiago

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Local food products are linked in a unique way to the natural and human attributes of their areas of origin. However, global drivers of change are threatening this link by altering the specific conditions under which these products are made. Winegrowing in Europe is a paradigmatic case to study the interaction between ecosystems and human demand for food production at a fine scale due to the economic, cultural, and ecological value of European vineyard landscapes. In this presentation, we show how to apply an ecosystem service framework to study viticultural systems under climate change. We further analyze how geographical indications labels can influence the benefits provided by winemaking areas in Europe under new climates. Additionally, we present a multi-indicator characterization of European viticultural areas to analyze their climate change vulnerability based on social, economic, and ecological characteristics. The results illustrate the importance of considering multiple and diverse ecosystem services in studying food systems, including cultural ecosystem services, to better support decision-makers in sustainable landscape management. We show how the rigidity of quality schemes, such as restricting the exploitation of plant varieties, can affect the supply of provisioning services in the future. Lastly, by analyzing the vulnerability of wine regions, we exemplify how interdisciplinary approaches can be used to weigh different features (e.g., availability of ecological niches, financial assets) and suggest tailored adaptation strategies for strengthening the resilience of vineyard landscapes. By focusing on these examples, the talk will shed light on methods that can be used to analyze agricultural systems and support policies, such as the EU Green deal and Farm to Fork Strategy, in preserving the values related to local food.

Keywords: Protected designation of origin; traditional landscape; terroir; food quality; adaptation.



2. Societal Willingness to Pay for Wild Food Conservation in Italy

First author(s): Luisa F. Eusse-Villa

Other author(s): Cristiano Franceschinis, Viola Di Cori, Nicolas Robert, Davide Pettenella, Mara Thiene

Affiliation: University of Padova

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Forests contribute to human well-being, offering various ecosystem services (ES), including wild foods and other products. Our research focuses on these wild forest products, which hold significant societal value across ecological, economic, cultural, and social dimensions. While previous studies have typically concentrated on formally marketed wild foods, there is a growing need to understand their broader significance as cultural ES and the factors influencing societal preferences for their supply and maintenance.

To explore this topic, we conducted a study in Italy, a country with a rich cultural heritage associated with wild foods. Using data from a discrete choice experiment (DCE), we investigated societal preferences for these ES, aiming to examine their spatial variation and identify potential drivers of heterogeneity. Our approach aimed to understand how people value these wild foods (mushrooms, wild berries, and wild herbs, specifically) and consequently map their preferences.

Our findings revealed respondents' willingness to allocate resources to forest programs that increase and conserve these wild foods, indicating their high perceived value as ES. While we detected some weak spatial heterogeneity patterns, our initial hypotheses about the influence of geographic factors were ultimately disproven. The preferences for specific wild foods were diverse but not significantly explained by proximity to forests or other spatial variables included in our models. Importantly, we found that variations in willingness to pay (WTP) might be more closely related to cultural traditions and sense of place identity rather than geographical factors.

The results of this study highlight the importance of integrating spatial dynamics to comprehensively understand societal preferences for ES, particularly in the context of local food systems. These insights can inform decision-making processes and foster sustainable management practices.

Keywords: wild foods, cultural ecosystem services, societal preferences, local food systems, spatial heterogeneity



3. Administrative bricolage in a bushmeat trade hub: decoding formal and informal interactions at Kinshasa's river ports

First author(s): Krossy Mavakala

Other author(s): Theodore Trefon, Juliet Wright

Affiliation: ERAIFT (Ecole Régionale Postuniversitaire d'Aménagement et de Gestion intégrés des Forêts et Territoires tropicaux)

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Public service provision in the Democratic Republic of the Congo (DRC) is notoriously inadequate and struggles to fully address the needs of citizens for human development. Biodiversity is similarly challenged which has resulted in the government outsourcing biodiversity conservation to international environmental NGOs. Findings from our research in Kinshasa's river ports are far-reaching because Kinshasa is one of Africa's main bushmeat trade hubs. Its population of around 18 million weighs heavily on wildlife upstream in Congo's vast forest landscapes. Administrative complexities of how public servants interact with other actors in the bushmeat supply chain has not been adequately studied in central Africa from a political economy perspective. To fill this research gap, we examined the formal and informal negotiation processes that govern the bushmeat trade. We therefore analyzed the trade through the concepts of negotiation, institutional and legal frameworks, and social norms. This research is a qualitative anthropological based. In addition to hundreds of informal conversations in the years leading up to this study, 80 formal interviews were conducted and transcribed over a period of 15 months from late 2021 to early 2023. Results point to a complex situation of 'bricolage' in which formality and informality overlap. Bushmeat bricolage in this article refers to the perpetually negotiated dynamics of pragmatic and opportunistic solutions to negotiating bushmeat trade. The strategies and drivers of relationships between actors have been analyzed and discussed. For many actors, bushmeat is far more than a monetary commodity. Its social, cultural and symbolic values also drive – and are used to account for – its trade. Delving into the administrative obstacles and opportunities of the bushmeat political economy in Kinshasa can inspire research in other central African countries where institutional landscapes have their own idiosyncrasies but also similarities in terms of public service delivery challenges.

Keywords: bushmeat, overlapping interactions, political economy, bricolage, Maluku



4. Landscape products for linking people and nature

First author(s): Tobias Plieninger

Other author(s): María García-Martín, Mario Torralba, Cristina Quintas-Soriano

Affiliation: University of Kassel and University of Göttingen

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Certain types of food, which we call landscape products here, link to low-input practices and traditional ecological knowledge, and they have multiple functions supporting human well-being and sustainability. Here we explore landscape products worldwide, with a particular focus on those from the Mediterranean region, to identify these multiple functions in the context of food commodification and landscape sustainability. Based on an expert survey, we find that landscape products support biocultural diversity in the landscapes of production, but their positive socio-economic outcomes remain limited, with problems of inequity and lack of empowerment among producers and a tendency towards intensification or abandonment of the farming practices. We distinguished three types of products based on their localness and how their qualities were shared with consumers. Overall, we show that a landscape products lens can improve food systems by fostering sustainability strategies and standards that are place-sensitive, and as such can mitigate conflicts related to food production, social justice and the environment. Co-management strategies and information policies, such as certification, labelling, product information and raising of awareness could accelerate, incentivize and catalyse actions to support landscape products in the context of sustainability strategies. Combining landscape ecology and food systems research allowed us better understand the outcomes of landscape products in the landscapes of production and suggest pathways for fostering landscape sustainability.

Keywords: Social-ecological systems; Telecouplings; Food systems; Landscape ecology; Landscape sustainability



5. Actively retired—benefits of gardening for elderly people.

First authors(s): Lidia Ponizy

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There is no doubt that European societies are ageing. The European Commission indicates that by 2030, there will be a significant increase in the number of people in the 65+ age group in almost all statistical regions of the European Union. Meeting the needs of this group and ensuring their active and healthy ageing is already a challenge for European cities.


From 2018 to 2022, we researched urban gardening as part of the FEW-meter project. We invited allotment gardeners from Poland, France and Germany to cooperate. Analyzing surveys on motivation, behaviour and benefits related to allotment gardening conducted in 2019 among gardeners involved in the project, we noticed that a significant part of allotment garden users were people over 60, and almost all of this group were retirees.

Since older people are eager to use allotment gardens, what needs do they meet in this age group?

We analyzed the benefits that allotment gardens bring to their users, especially the 60+ age group, in the context of ecosystem services.

The survey results allowed us to assess the importance of the provided provisioning services for the oldest users of allotment gardens and to what extent these benefits meet the allotment gardeners' demand for fresh fruit and vegetables. We also looked at the motivations behind owning and using an allotment garden and what benefits for mental and physical health and well-being come from time spent caring for cultivated and ornamental plants and talking to and meeting other allotment gardeners.

The results should serve as a beacon for policymakers deciding whether to create or retain small, non-commercial urban agriculture interventions. Of course, allotment gardens do not compete with commercial agriculture to provide supply services and have a larger carbon footprint. However, besides providing allotment holders with fruit and vegetables for their own use, allotment gardens, unlike conventional agriculture, provide many social benefits (also significant for the oldest inhabitants of cities), which may justify the presence of allotment gardens in cities.



Keywords: allotment gardens, ageing societies, provisioning services, cultural services, benefits from gardening

6. Abstract ESP Local Food

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Regionalized value chains are considered an important tool to deal with current sustainability challenges, and to connect humans to their living environment. But throughout Europe, regionalized value chains require crop diversification, particularly an increase in protein crops, to support a regional healthy diet. Protein crops have many co-benefits in terms of ecosystem service provision, including supporting pollinator communities and soil quality. Establishing regionalized value chains and simultaneously increasing plant protein production therefore benefits consumers and landscapes. A main barrier for developing these value chains are market opportunities for plant proteins, but plant-based meat and dairy alternatives (PBA) might provide a valorization opportunity for plant proteins. However, we lack understanding of the current status and future potential for such value chains in Europe.

We integrated publicly-available datasets with a web-derived inventory of PBA processor locations to map regionalized PBA value chains across Europe. Using processors' visions and employee interviews, we did an exploratory assessment of how processors perceive their role in the food system transition and in connecting consumers with their region.

Regions in north-western Europe demonstrate moderately-strong value chains for regionalized PBAs. The absence of PBA processors is the most widespread barrier for more regional value chains, particularly in Eastern Europe. Most of current PBA processors that source and sell regionally have actions in place to make both plant protein production and consumption more sustainable. For example, by supporting farmers to implement measures that enhance biodiversity or soil quality, or by informing consumers about the plant protein production agroecosystem. Interviews demonstrated that PBA processors expect a further growth of the PBA market. Together, our results showcase the potential to expand regionalized PBA value chains to improve sustainability throughout the EU, but regionalisation may not be possible



everywhere, highlighting the need for a cross-scale and context-specific approach to plant-based protein transitions.

Keywords: short value chains, regional food, Europe, plant-based proteins

1. Teach a man to fish: Promoting sustainable food systems by harnessing the potential benefits of fishponds for society

First author(s): Priya Sharma

Other author(s): Gergő Gyalog, Mónika Varga


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Freshwater fishpond systems, an important and growing sector of EU aquaculture production, have been recognized not only as a source of local food production and food security but also for their other regulatory and cultural aspects. These systems are complex ecological units that integrate social, environmental, and economic factors to provide a variety of ecosystem services (ES). Pond processes are also highly interactive with the surrounding environment. Therefore, to better understand the complex realities of fishpond agroecosystems and to predict future ecosystem responses, it is particularly important to have a mechanistic understanding of the many inter- and intra-system environmental interactions and their possible links to ES.

Understanding the impact of various local fishpond management practices on ES provision remains a challenge. Therefore, our work aims to make a methodological and empirical contribution by developing a process-based planning model to assess the impact of different hypothetical fishpond management scenarios (such as different stocking densities, feeding regimes, reed cover, reed management practices, etc.) on environmental interactions. Furthermore, according to the CICES classification, the quantitative model outputs were used to determine the indicators for ESs (e.g., fish produced, sediment, carbon sequestration, and microclimate regulation, etc.) and ecosystem services (e.g., waste and nutrient emissions, water use, etc.). Other ESs, such as cultural and habitat support functions, were derived based on the calculated quantitative data and some additional rules provided by experts or users.

The model-based assessment provides a clear overview of sometimes overlapping and sometimes conflicting ecosystem service indicators quantitatively. The ability of the model to



assess multiple management scenarios and provide a realistic view of the associated uncertainties should provide a sound basis for decision-makers to design and promote the ecological intensification of fishpond food systems.

Keywords: Aquaculture, Fishponds, Dynamic process modelling, Environmental interactions, Ecosystem Services

2. Going or Returning to Nature? Insights from a Field Study on Wild Vegetable Uses in the Restaurant Industry of Lombardy, North Italy

First author(s): Naji Sulaiman

Other author(s): Dauro M. Zocchi, Sara Bonafede, Chiara Nanni, Renata Söukand, Andrea Pieroni

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Wild vegetables (WVs) have been an important source of human nutrition since ancient times. Foraging is a millennia-old practice that gained more attention recently, becoming fashionable, especially in restaurants in urban areas, as they attract customers who see WVs as an innovative sensory element and specialty food. Some cooks have been using very few WVs for decades, but most chefs have only recently introduced them in their modern restaurants. Our study aims to have a deeper understanding of the diversity of WVs used by restaurants in the Lombardy region in North Italy and to know how they are introduced on different menus. We also aim to know the source of knowledge and the innovation paths related to the use/introduction of WVs in the selected sample of restaurants. Semi-structured interviews were conducted with 14 restaurant chefs and professional foragers in the Lombardy region in North Italy in 2021. The collected data was analyzed to understand the current situation and the potential developments of this practice by exploring the reasons/motivations that underpin the inclusion of WVs in restaurants. A broad spectrum of restaurants was considered to evaluate the potential differences in handling and sourcing these ingredients. Results demonstrated that this trend has mainly been driven by attempts to revitalize traditional cuisines and to generate a positive impact on health, but the actual culinary preparations based upon WVs are often original and remarkably diverge from the Italian food ethnobotanical heritage. Moreover, concerns related to the environmental sustainability of these practices have been addressed by the present study.

Keywords: ethnobotany; wild food plants; Lombardy; Italy; gastronomy



3. Pursuing multiple goals in forestry: does commercial thinning decrease bilberry cover and yield?

First author(s): Agita Treimane

Other author(s): Zane Lībiete, Didzis Elferts, Jānis Donis

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Long-term goals of multipurpose forestry include sustaining high timber yield and economic profit, low management costs, biological diversity and availability of non-wood forest products (NWFPs). In Latvia, public forests and private forests (unless restricted by the owner), are freely accessible, and foraging for NWFPs, especially berries and mushrooms, comprises several ecosystem services, from provisioning (healthy supplement to the diet) to cultural (recreation). Commercial thinning, a widely implemented silvicultural measure to decrease the mutual competition of trees thus improving productivity and vitality of the stand, yearly affects a considerable forest area significant for the before-mentioned alternative purposes. A widespread public opinion states that any silvicultural intervention reduces the abundance and yield of forest berries and mushrooms, therefore, scientifically sound data are necessary to model the availability of NWFPs under different forest management scenarios.

Our study, performed in 33 experimental sites in young and middle-aged Scots pine (*Pinus sylvestris* L.), Norway spruce (*Picea abies* (L.) Karst.) and birch (*Betula* sp.) forests, focuses on the occurrence of bilberry (*Vaccinium myrtillus* L.), changes in its projective cover, as well as yield trends after thinning. The field experiment following the before-after-control-impact (BACI) design, includes eight sample plots with control and different intensity thinning in two repetitions in each experimental site. In each plot, bilberries were assessed in 36 subplots before thinning and four, five and six years after it.

Regardless of the establishment year, the projective cover of bilberry in different intensity thinning and control plots significantly increased after thinning in all site types and stand age classes, providing data on short-term changes after disturbance. No significant change in berry yields (at 100% projective cover, both on thinned and control plots) was recorded during six years after thinning. Climatic conditions, i.e. draught during the time of flowering, had significant negative effect on berry yield.

Keywords: healthy wild food, forest berries, projective cover, commercial thinning, berry yield



4. How local is local food? A systematic review of the concept

First author(s): Marta Derek

Other author(s): Sylwia Kulczyk, Marta Grzywacz, Ada Górna, Alina Gerlée, Anna Jędrycha

Affiliation: University of Warsaw

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Food serves as a fundamental link between humans and nature: it exemplifies our dependence on nature, and how we use it to fulfil our physiological needs to satisfy hunger. The ecosystem services concept is a useful lens through which we can understand how the supply side of the ecosystem links with the human demand, via a plate. The term, however, is socially contracted. The more it is popular, the more blurred its meaning is. No consensus exists over its understanding also in the academic research. For these reasons, we have performed a systematic and wide literature review on the understanding of local food within the framework of social-ecological system. Our aim was to better understand how the concept of local food is defined and operationalized.

Our review was based on Scopus. We started by identifying all articles with “local food” in a title or in keywords (n=1580). We then chose articles with a focus on products, groups of products, or meals (n=275). Product was understood here as a link between different elements of a social-ecological system. We then analysed the chosen articles and described how the research referred to the elements of both the social and the ecological subsystems.

The results show that researchers rarely define local food, assuming that this is a commonly understood term. They hardly include core provisioning services, but rather focus on a wide array of human-based elements that co-produce it. Studies on local food focus much more on social rather than ecological part of the system.

Keywords: local food, social-ecological system, systematic literature review, nature-human relations

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: T9a

Exploring the connections between biodiversity and human health

Hosts:


	Name	Organisation	E-mail
Host:	Joana Costa Robbert Boudewijns	University of Coimbra KU Leuven	icosta@uc.pt robbert.boudewijns@kuleuven.be
Co-host(s):	Isabel Henriques Ellen Decaestecker Ben Somers Stien Heremans	University of Coimbra KU Leuven KU Leuven KU Leuven	isabel.henriques@uc.pt ellen.decaestecker@kuleuven.be ben.somers@kuleuven.be stien.heremans@kuleuven.be

Abstract:

Several ecosystem services can be linked to beneficial health effects in humans, such as the purification of water or the provision of food, mitigation of air pollution, climate regulation, and beneficial mental health effects [1,2].

In turn, the ability of ecosystems to provide ecosystem services is in large part defined by their composition, i.e. the biodiversity contained within them [3], on any scale: from a diversity in animals and vegetation, to diversity in soil and plant microbiota. Although various links between biodiversity and health have already been shown, there is still much to understand about the mechanisms behind the mutual benefits between biodiversity, ecosystem services and human health [2].

Biodiversity may also impact disease transmission, yet conflicting hypotheses suggest that a reduction in biodiversity can mean either a higher or lower transmission. After all, high biodiversity can dilute pathogens among multiple host species, reducing disease risk (the so-called 'dilution effect') [1], or promote transmission by providing a larger pool of vectors and



organisms that could be the source of novel pathogens [4]. Further research is needed to elucidate the effects of biodiversity on disease transmission, and to which extent pathogen, host and/or environmental factors play a role in which effect is predominant.

In addition, our modern lifestyle has impacts on our exposure to biodiversity. Urbanized populations, who increasingly less often come in contact with natural antigens such as in pollen or food have a higher prevalence of allergy [5]. Also a loss in food diversity in modern-day diets has been linked to a rise in non-communicable diseases [6] and less diverse gut microbiota, although the relative impact of genetics, environmental and lifestyle factors on this diversity remains only partially understood [7].


In conclusion, despite indications that biodiversity, from microbiota to plants and animals, has a beneficial effect on health, conflicting evidence exists to suggest that a high biodiversity is not exclusively linked to positive health effects alone. Moreover, the evidence linking biodiversity with direct and long-term health outcomes is scarce, which calls for additional research.

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- [2] Zhang, Yixin, et al. "Biodiversity, ecosystem functions and services: Interrelationship with environmental and human health." *Frontiers in Ecology and Evolution* 10 (2022): 1086408.
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- [5] Haahtela, Tari. "A biodiversity hypothesis." *Allergy* 74.8 (2019): 1445–1456.
- [6] Sarkar, Dipayan, Jacob Walker-Swaney, and Kalidas Shetty. "Food diversity and indigenous food systems to combat diet-linked chronic diseases." *Current developments in nutrition* 4 (2020): 3–11.
- [7] Flandroy, Lucette, et al. "The impact of human activities and lifestyles on the interlinked microbiota and health of humans and of ecosystems." *Science of the total environment* 627 (2018): 1018–1038.

Goals and objectives of the session:

The aim of this session is to showcase recent advancements in our understanding of the direct and indirect relationships that exist between genetic, species and/or ecosystem diversity on the



one hand, and human health effects, including physical and mental wellbeing, communicable and non-communicable diseases on the other.

Planned output / Deliverables:

Through the presentations and panel discussion we aim to identify gaps in our understanding of the relationship between biodiversity and human health, and to develop collaboration opportunities moving forward.

II. SESSION PROGRAM

Room: Expert Street 7

Date of session: 19th of November 2024

Time of session: 16:00–18:00

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
16:00–16:12	Karine Lalaina	Mahefarisoa	KU Leuven	Environmental, animal and human health: a “One Health” approach to protected area management and governance in Madagascar
16:12–16:24	Isabel	Henriques	University of Coimbra	The Influence of Microplastics on Pathogens and Antibiotic Resistance Spread in Rivers: A Portuguese River Case Study
16:24–16:36	Maria	Korneykova	Peoples’ Friendship University of Russia	Opportunistic fungi in urban arctic ecosystems (on the example of largest polar city Murmansk)
16:36–16:48	Rupert	Legg	Leibniz University Hannover	The effects of urbanisation and climate change on the allergenicity of pollen within urban green spaces: A systematic review
16:48–17:00	Sarah	Smet	University of Namur	Use of scenarios to evaluate the impacts of nitrogen deposition on pollen allergy prevalence in Belgium through the lens of biodiversity losses.
17:00–17:12	Jana	Verboom	Wageningen University	Pathways between nature and health; the role of awareness of nature



Time	First name	Surname	Organization	Title of presentation
17:12– 17:24	Marcelle	Lock	RIVM (Dutch National Institute for Public Health and the Environment)	Benefits for human health through nature exposure in urban green space
17:24– 18:00	All presenters	All presenters		Discussion session

III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Opportunistic fungi in urban arctic ecosystems (on the example of largest polar city Murmansk, Russia)

First author(s): Maria Korneykova

Other author(s): Anastasia Soshina

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The relevance of studying Arctic regions is growing rapidly due to the sensitive response of fragile ecosystems under climate change and increasing anthropogenic pressures. Under the urbanization impact, there is a significant transformation of abiotic and biotic properties of ecosystems, which affects the ecosystem services provided and can lead to disservices such as the emergence and accumulation of microbial species hazardous to health, including microfungi. Pathogenic and opportunistic fungal species are becoming increasingly important with the growing recognition of chronic diseases and the number of patients with severe immunodeficiencies. However, studies of opportunistic microfungi in Arctic cities are sporadic. In this case, the opportunistic microfungi of Murmansk, the largest Arctic city in the world, was studied in comparison with a background area of natural forest tundra. Mycological analysis was carried out for different components of urban ecosystems: soil cover, atmospheric air, water and lake bottom sediments.

In urban soil and bottom sediments of urban lakes there was an increase in the diversity and number of opportunistic species of microfungi from 30% in background soil/lake to 50–60% in



urban soil and 50–100% in bottom sediments of urban lakes. In the air and water, the content of species harmful to human health did not differ from the background level. This emphasizes the high indicative value of buffer components of ecosystems – soil and bottom sediments, as compared to transit components – air and water, in determining the level of long-term anthropogenic load on ecosystems. The most dangerous identified species were fungi *Paecilomyces variotii*, *Aspergillus flavus* and *Aspergillus fumigatus*, capable of causing pulmonary infections, otitis, sinusitis, endocarditis, osteomyelitis, keratitis, traumatic mycoses, peritonitis, onychomycosis. The fact of *Paecilomyces variotii* dominance in water and bottom sediments of lakes used for recreational purposes is alarming.

Keywords: disservices, soil, air, lake water, lake sediments

2. The effects of urbanisation and climate change on the allergenicity of pollen within urban green spaces: A systematic review

First author(s): Rupert Legg

Other author(s): Nadja Kabisch

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Current global environmental challenges, such as urbanisation and climate change, are shifting nature in ways that will have numerous consequences for human health. For instance, growing research over the past two decades has determined that the allergenic potential of pollen emitted within urban green spaces is increasing. A number of factors relating to urbanisation and climate change have been observed to contribute to this increasing allergenicity, including rising temperatures, air pollution, low biodiversity, abundance of allergenic species, introduction of non-native and invasive species, planning preferences for male plants in dioecious species, poor management and maintenance of green spaces, and cross-reactivity between related species. An updated collation and holistic evaluation of this evidence is required as previous reviews have been non-systematic and are over a decade old. Research conducted in the past decade, particularly given the increasing severity of climate change impacts felt across this time, should be reconsidered in an updated exploration of how allergenicity is increasing. Supporting this need, recent research has revealed a number of possible additional factors that might affect the allergenicity of pollen within green spaces, such as thunderstorms, drought, soil contamination and soil health, and even possibly night-time light pollution. The extent to which evidence agrees that these factors also influence the allergenicity of pollen remains unexamined, so a new systematic review holistically considering



all of this evidence is required. Consequently, in this paper, we systematically review the research exploring how the allergenicity of pollen in urban green spaces is affected by processes relating to urbanisation and climate change. In doing so, we construct a conceptual framework depicting all of the established ways in which the allergenicity of pollen is being influenced by global environmental change. We also highlight how green space planners can minimise the allergenicity of pollen, reducing the burden of allergenic disease.

Keywords: Allergenicity; pollen; green space; climate change; urbanisation

3. Use of scenarios to evaluate the impacts of nitrogen deposition on pollen allergy prevalence in Belgium through the lens of biodiversity losses

First author(s): Sarah Smet

Affiliation: University of Namur, Namur, Belgium

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The combustion of fossil fuels and the intensive application of artificial fertilizers in agriculture result in the atmospheric deposition of nutrients, particularly nitrogen. This phenomenon poses a growing threat to both the environment and human health. In Belgium, the exposure of ecosystems to excessive nitrogen loads significantly increases from southeast to northwest. The ecological repercussions of nitrogen enrichment include biodiversity loss, alterations in plant distributions, ecosystem simplification, and a decline in ecosystem service provisioning capacity (Tilman et al. 2001; Wang et al. 2018). Excessive nitrogen typically leads to more productive ecosystems dominated by a few highly competitive plant species, resulting in species-poor environments (Bobbink et al. 2010; Damgaard et al. 2011). It is hypothesized that changes in nitrogen concentration, plant community composition, and productivity may influence airborne pollen distributions, abundances, and allergen potency. This environmental nitrogen deposition can have direct and indirect impacts on aeroallergens, affecting the prevalence and severity of allergic diseases. The NITROPOL project aims to quantify the respiratory allergic disease burden attributable to nitrogen pollution through modification of the ecosystem diversity. Land use change scenarios and scenario-specific biodiversity changes in Belgian nature are simulated to assess potential impacts on pollen abundance and allergenicity with additional scenario specific changes being implemented in order to simulate the impact of policy actions at the urban and rural levels. At the urban levels, we propose parameters that control the density and biodiversity levels of greenspaces as well as their biodiversity levels, regulated through the mowing frequency. In rural areas, the diversity of grasslands can be controlled by regulation from the agricultural sectors, and the density of urbanization by the land use planning.



Additionally, the impacts of climate and N deposition is assessed on the abundance of birches on forested and non-forested areas and on the grasslands diversity composition.

Keywords: nitrogen deposition, pollen, allergen potency, grasslands, birch

4. Pathways between nature and health; the role of awareness of nature

First author(s): Jana Verboom

Other author(s): Esmee van den Berg

Affiliation: Wageningen University & Research

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There is a large and growing body of evidence for the fact that nature and/or biodiversity is good for our mental and physical health and wellbeing. However, there is no consensus about the pathway between nature (biodiversity) and health. In a recent paper, four domains of pathways—both beneficial as well as harmful—were suggested to link biodiversity, or nature, with human health: (i) reducing harm (e.g. decreasing exposure to air and noise pollution); (ii) restoring capacities (e.g. attention restoration, stress reduction); (iii) building capacities (e.g. promoting physical activity, transcendent experiences); and (iv) causing harm (e.g. dangerous wildlife, zoonotic diseases, allergens). In some papers, a link with gut biome was made: having a biodiverse gut biome, from contact with a biodiverse environment, was postulated as part of an alternative pathway. Another recent study points at nature awareness (“noticing nature”) as an important intermediate concept between the mere presence of nature, or nature exposure, and health benefits. In this paper we will discuss the evidence base for this latter alternative pathway. We will present the results of Wageningen master students who wrote their thesis about aspects of nature experience/nature awareness and health and/or wellbeing metrics. One of these studies found no significant extra effect of noticing nature – as an addition to the significant positive effect of spending time in nature – in a study with over 1000 participants. Is it then possible to get the positive effects of nature unconsciously? Without even noticing nature? Suggestions for future research will be given.

Keywords: nature, health, wellbeing, awareness



5. Benefits for human health through nature exposure in urban green space

First author(s): Marcelle Lock

Other author(s): Niels Schoffelen, Loes Geelen, Maciek Strak, Arjen Gootzen

Affiliation: RIVM (National Institute for Public Health and the Environment)


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This study investigates the effects of urban green space (UGS) on physical and mental health. It aims to provide an overview of which relationships can be quantified, as well as to investigate the mechanisms, complicating factors and difficulties regarding the relationship between UGS and human health.

We conducted a literature review to attain an overview of the most recent and robust findings from metareview studies on quantifiable relationships between UGS and various health outcomes. This input has been used to create an overview on quantifiable relationships between UGS and human health. Most review studies have investigated the relationship between UGS and different types of health problems, such as diabetes, heart failure, Alzheimer's, birth outcomes, and mental disorders such as depression. It is quite difficult to quantify how the prevalence of a certain disease correlates with gradients in the presence of urban green space. The mechanisms are often unclear and can be intertwined with effects of climate change, such as heat stress. Health effects due to the presence of UGS can be quantified, but it is impossible to pin it down to a specific health outcome. Also, most studies use their own definition of UGS, making it challenging to establish universal green space definition improving scientific comparability. One of the found relationships has been used to build a predictive model that calculates the general health outcome 'mortality' for urban areas, which is now part of the Groene Baten Planner (Green Benefit Planner, RIVM).

An integrated and intersectoral approach to UGS research including more detailed and standardized approaches to analyze UGS's could greatly improve scientific insights on the relevance of climate, health and city planning. We propose a couple of approaches how this can be done.

Keywords: green cities, health impact, mental health, physical health, urban green space



6. Environmental, animal and human health: a “One Health” approach to protected area management and governance in Madagascar

First author(s): Karine Lalaina Mahefarisoa

Other author(s): Raf Aerts, Karen Bisschop, Emmanuel André, Irwin Mitchell, Piet Maes, Jelle Matthijnsens, Fidisoa Rasambainarivo, Hajanirina Rakotondrainibe, Broos Van de Moortel, Isabel Vanoverberghe, Ellen Decaestecker

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Our research is based on the "One Health concept," which emphasizes collaboration and integration across various sectors, including human, animal, and environmental health. Due to anthropogenic disturbances, wildlife habitats are gradually shrinking, leading to increased interactions between wildlife and humans and their domestic animals. Therefore, our research focuses on identifying potential zoonotic pathogens (viruses, bacteria, and protozoa) in endemic lemur species in Madagascar. We compared the microbiome of lemur populations in disturbed and intact environments.

Fecal and blood samples were collected from lemurs in both disturbed and intact environments in four different protected areas. Metagenomic analysis, including shotgun sequencing to detect specific pathogens, and 16S amplicon sequencing, were performed to characterize microbial communities.

Our results showed differences in the microbiome composition between lemurs living in disturbed and undisturbed environments. Lemurs from disturbed environments had higher microbial diversity compared to those from undisturbed environments. We tested if certain microbial groups (opportunistic pathogens) associated with environmental degradation were more abundant in the microbiomes of lemurs from disturbed environments.

These initial findings suggest that anthropogenic pressures have a significant impact on the microbiome composition of lemurs, which could potentially affect the health of the hosts. Furthermore, the detection of (re)emerging infectious diseases could pose a threat to public health. Understanding how microbes respond to environmental disturbances is crucial for conservation efforts aimed at preserving biodiversity. Finally, early detection of potential (re)emerging infectious diseases will help prevent future pandemics.



Keywords: microbiome, anthropogenic disturbances, zoonoses, lemurs, Madagascar

7. The Influence of Microplastics on Pathogens and Antibiotic Resistance Spread in Rivers: A Portuguese River Case Study

First author(s): Isabel Henriques

Other author(s): Inês Alçada, Flávia Ribeiro, Isable Silva, Marta Tação

Affiliation: CFE–UC: Department of Life Sciences, Centre for Functional Ecology (CFE), Associate Laboratory TERRA, Faculty of Sciences and Technology, University of Coimbra

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Microplastics (MPs) have been reported as ideal niches for the establishment of microbial biofilms, known as the plastisphere. We measured MPs contamination in a Portuguese river (Rio Antuã) and assessed the role of these particles in the selection and spread of pathogens and antibiotic-resistant bacteria.

Samples were collected at four locations in the river and MPs were selected and quantified. Microbial DNA was purified from the MPs and surrounding water and the microbiome was analysed by 16S rDNA targeted metagenomics. An average of 78 MPs.m⁻³ were collected from the river. The main microplastic polymers detected were polypropylene (PP), polyvinyl chloride (PVC), polyester and high-density polyethylene (HDPE). The diversity and richness of microbial communities in water were higher compared to those on MPs. Differences among communities were observed at the phylum, family and amplicon sequence variants (ASVs) levels. Although many putative pathogens were enriched in water, some were more abundant on MPs, such as *Bacillus*, *Pseudomonas*, *Bifidobacterium* and *Burkholderia*.

The relative contribution of different polymers to pathogens and antibiotic-resistant bacteria spread was assessed by exposing polypropylene (PP) and polyethylene (PE) MPs at the same locations, for 21 days. After exposure, potential pathogens, namely *Acinetobacter*, *Flavobacterium* and *Mycobacterium*, were detected in MPs. Genes of the resistome and mobilome were quantified using a SmartChip Real-Time PCR. A higher diversity of genes was detected in water compared to MPs. However, a significant enrichment of genes conferring resistance to critical antibiotics, such as blaCTX-M and blaVIM, was observed in MPs relative to water.



This study confirms the presence of high concentrations of MPs in a Portuguese river. Antibiotic resistance genes and putative pathogenic bacteria were found on microplastics, likely being transported by these particles along the river and into other ecosystems. The type of polymer influences the plastisphere composition and resistome.

Keywords: Microplastics, rivers, antibiotic resistance, pathogens, one health

BOOK OF ABSTRACTS

- I. SESSION DESCRIPTION
- II. SESSION PROGRAM
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I. SESSION DESCRIPTION

ID: T9b

Healthy ecosystems for healthy people: Evidence-based benefits of nature exposure to human health

Hosts:

	Name	Organisation	E-mail
Host:	Sarai Pouso	AZTI, Marine Research, Basque Research and Technology Alliance (BRITA)	spouso@azti.es
Co-host(s):	María C. Uyarra	AZTI, Marine Research, Basque Research and Technology Alliance (BRITA)	mcuyarra@azti.es
	Rachel Oh	Helmholtz Centre for Integrative Biodiversity Research (iDiv)	r.oh@uq.edu.au
	Angel Burov	RESEARCH INSTITUTE AT MEDICAL UNIVERSITY OF PLOVDIV	angel.burov@mu-plovdiv.bg

Abstract:

The 'One Planet, One Health' theme of the ESP Conference emphasizes the interdependence of human health, animal health, ecosystem health, and environmental health, underscoring the pivotal role of nature in promoting human wellbeing. One of the ways in which nature can contribute to human wellbeing is by being exposed to nature whether intentionally (e.g. nature-based recreational activities), or unintentionally (e.g. commuting to work through parks).

The concept of nature spaces as restorative environments offering numerous health benefits for various medical conditions, represents a growing research interest. Historically, the impacts of nature exposure on human health were predominantly studied from a medical perspective, emphasizing aspects related to public health and environmental psychology. More, recent efforts have extended this perspective to encompass environmental sciences, particularly through the framework of 'ecosystem services' or '*nature's contribution to people*'.



Nature exposure and its associated health benefits are classified as cultural ecosystem services and defined as the “*biotic and abiotic characteristics that enable activities promoting health, recuperation or enjoyment through active and passive interactions*” (adapted from Haines-Young & Potschin (2018)).

While medical studies primarily focus on the direct health and well-being outcomes of exposure to nature (e.g. improved physical health, reduced risk of disease), environmental studies delve into the underlying environmental characteristics, functions and processes that enable humans to obtain benefits from nature (Pouso et al. 2023). However, both psychological and medical studies into nature’s health-promoting effect, alongside environmental and economic studies that explore human benefits from cultural ecosystem services, represent complementary bodies of knowledge exploring the same concept through distinct disciplinary lenses (Bratman et al., 2019; Sandifer et al., 2015).

Goals and objectives of the session:

In this session, we aim to synthesis key findings and evidence regarding the role of ecosystem services in enhancing human physical and mental health and wellbeing through direct and indirect exposure to healthy ecosystems. Direct exposure encompasses activities such as sports or recreational pursuits in natural settings, participation in environmental volunteering, and engagement in nature-based therapies. Indirect exposure includes activities like watching nature documentaries or enjoying views of natural landscapes from indoors. We seek contributions that elucidate how exposure to diverse ecosystems—such as urban parks, protected areas, coastal and marine environments, blue inland spaces, and agricultural landscapes—contributes to physical and mental health benefits. These benefits may include improvements in physical conditions, reductions in anxiety and depression, and the cultivation of positive emotions.

We welcome contributions that explore the environmental requirements needed to optimize nature’s impact on human health outcomes. This includes investigations into variations between ecosystem types, role of environmental quality, and contributions from environmental restoration. We are especially interested in health studies that include an environmental conservation angle – to assess tradeoffs and synergies between benefits to nature and humans. We also invite studies that examine the synergistic benefits of increased nature exposure for the natural environment. These benefits may manifest as heightened environmental awareness, strengthened pro-environmental behaviors and greater commitment to conservation efforts.

Through this session, we aim to understand the critical role of ecosystem services research in advancing our understanding of the benefits of nature exposure for human wellbeing and environmental conservation. By fostering interdisciplinary dialogue and synthesizing empirical data, we seek to strengthen the evidence base supporting the integration of nature-based solutions into public health and environmental policies.



Planned output / Deliverables:

Depending on the contributions received, we will prepare a collaborative review paper for publication, focusing on the differences and synergies between the approaches used in different research disciplines (e.g., psychology, medical, environmental research) working in the field of ecosystem benefits for human health. Contributions to the sessions will be used as means to provide case studies and examples in the paper.

Session format:

Between 2 and 3 hours: Standard session (presentations) with a time at the end for discussion

II. SESSION PROGRAM


Room: Expert Street 5

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	Introduction to the Session			
13:35	Yuanyuan	Mao	Institute of Environmental Sciences (CML), Leiden University	Not Your Typical Treatment: Quantifying the Influence of Urban Nature Types on Mental Health
13:48	Sjerp	De Vries	Wageningen University & Research, the Netherlands	Domestic gardens, private green space, and human health: associations for 21 types of health conditions
14:01	Marta	Melon		Are parks sufficient to implement nature-based recreation in urban spaces?
14:14	Tomasz	Grzyb	Faculty of Geography and Regional Studies, University of Warsaw	Cultural ecosystem services and ecosystem disservices as well-being agents: linkages and drivers in the urban riverscape context
14:27	Sarai	Pouso	AZTI,	How marine recreational activities affect human health and wellbeing?



Time	First name	Surname	Organization	Title of presentation
14:40	Uta	Schirpke	Eurac Research, Institute for Alpine Environment, Bozen/Bolzano, Italy	Benefits to people of mountain soundscapes
14:53	Chiara-Charlotte	Iodice	ILS Research gGmbH, Dortmund, Germany	A healthier planet for all – green and blue spaces and their benefits for mental health: Co-creation approaches of the GreenME project
15:06	Rachel	Oh	Helmholtz Centre for Environmental Research (UFZ); German Centre for Biodiversity Research (iDiv)	Assessing the prevalence and bias of study designs in nature and mental-health studies.
15:19	Time for Discussion			

III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Domestic gardens, private green space, and human health: associations for 21 types of health conditions

First author(s): Sjerp de Vries

Other author(s): Christos Baliatsas, Robert Verheij, Michel Dückers

Affiliation: Wageningen University & Research

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Research on nature and human health has shown that the amount of green space in the residential environment is protectively associated with a wide range of health outcomes. A common assumption behind the focus on the residential environment is that, besides its amount, the nearness of the green space is a proxy for the amount of contact with it, with the latter assumed to be instrumental in at least some of the pathways by which nature is thought to positively affect human health. Contact with own garden greenery is likely to be extensive. Nevertheless, there has been little research on the health benefits of private green space. In a environmental epidemiological study (N ~ 800 000), we looked at associations between the



amount of garden greenery and the prevalence of 21 types of health conditions, correcting for socioeconomic status at the individual and at the neighbourhood level. Results show that the amount of garden greenery is protectively associated with 16 of the health conditions, i.e., when comparing having a domestic garden with at least 50 m² of greenery with no garden being present at all. Including the amount of greenery in the wider residential environment, i.e. within 125m from one's home, did not noticeably change the outcomes. As a partial check on reversed causality, analyses were re-run with only people living at least five years at their present address. This selection hardly attenuated results either. Associations were strongest for stroke, heart disease, and intestinal tract infections, with an over 20% lower prevalence for the latter. Sex was an important moderator, with associations generally being stronger for women. Implications of the results are discussed, also with regard to potential pathways and the importance of the biodiversity of the garden greenery in such pathways.

Keywords: ecosystem services, garden greenery, morbidity, disease, disorder

2. Not Your Typical Treatment: Quantifying the Influence of Urban Nature Types on Mental Health

First author(s): Yuanyuan Mao

Other author(s): Yingjie Li, Lisa Mandle, Anne Guerry, Lingli Hou, Tong Wu, Rita de Sousa-Silva, Peter van Bodegom

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Growing evidence suggests that urban nature provides human health many benefits, with mental health being of significant importance. However, a quantitative overview of the relationship between types of urban nature and mental health is still missing, while such information is crucial for urban planning in relation to public health. We evaluate the impact of different urban nature types on mental health. A systematic review with meta-analysis is conducted to synthesize the evidence on urban nature types and mental health. We searched three main electronic databases (Web of Science, Scopus, and PubMed) and included studies that are limited to peer-reviewed original work published in English from inception until 11 January 2023. Information on urban nature type, quantity, exposure, as well as mental health indicators and measurement tools was extracted from each study. 446 studies were included in our final dataset. We conducted a preliminary analysis, focusing on a specific outcome, namely mental well-being, based on a subset of 21 studies (101 cases). This analysis showed a positive increase in mental wellbeing for each increment of overall urban nature. Both general



greenspace and grassland were significantly associated with mental well-being, with the former being beneficial and the latter being negatively related. Particularly, NDVI (Normalized Difference Vegetation Index) and street-view greenery affected mental well-being positively. Open water, general bluespace, and forests/tree types were not substantially associated with mental well-being. Our findings suggest increasing the amount of greenspace in urban residential areas within a 500-meter buffer contributes to promoting mental well-being. More consistency between studies is needed to understand the effects of specific urban nature types. Our analysis will be expanded to other mental health outcomes, such as depression, anxiety, and mood for a more encompassing assessment.

Keywords: Urban nature type, Mental health, Nature exposure, Residential buffer, Quantity


3. Assessing the prevalence and bias of study designs in nature and mental-health studies.

First author(s): Rachel R. Y. Oh

Affiliation: Helmholtz Centre for Environmental Research (UFZ); German Centre for Biodiversity Research (iDiv)

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The potential of contact with nature as a health intervention has gained significant momentum. However, the credibility of supporting evidence is contingent upon the quality of study designs, which differ in their biases and capacity to accurately assess the true effect of nature exposure on health outcomes. In this study, we empirically assessed the prevalence of various study designs used to assess relationships between nature exposure and mental health outcomes. We examined geographical, temporal and disciplinary variations in the definitions of “nature exposure” and “mental health”, as well as the diverse methods used to track changes in these factors. Our initial findings indicated that while the number of uncontrolled and observational study designs from North America was relatively small, these studies had a substantially larger combined sample size compared to others. We also identified a tradeoff between the spatial resolution of nature exposure measures and health outcomes. Crucially, complex designs (that arguably yield more credible results) varied in their control for confounders. We conclude with a discussion on the implications for evidence synthesis, and provide recommendations to broaden the portfolio of emerging research needs, emphasizing the importance of improving study design quality to enhance the credibility of findings in this field.



Keywords: nature-based health intervention; exposure; nature dose; causality; public health; evidence synthesis

4. How marine recreational activities affect human health and wellbeing?

First author(s): Sarai Pouso

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From the many benefits obtained from marine ecosystem services, opportunities for recreation are one of the most popular and valued by people. However, few studies have studied in detail the diversity of marine recreational activities (MRAs) and the manyfold ways in which each of them contributes to wellbeing. Using the Atlantic coast of Spain as case study, we analysed the contribution of coastal areas, through the practice of MRAs, to human health and wellbeing. A survey was designed to get insights into MRAs and i) motives to practice them, ii) feelings and emotions associated to their practice, and iii) their contribution to psychological restoration. Two psychometric scales were adapted and used, the Positive and Negative Affect Schedule (PANAS) scale and Restoration Outcome Scale (ROS). The survey was filled in during summer 2023 by more than 800 people. The most popular MRAs were bathing, surfing, open water swimming, SCUBA diving, rowing, seaside walking, fishing from land, and sailing. Overall, respondents had high level of experience in their specific MRA. The three main motivations to practice MRAs were to find relaxation, being in contact with the ocean and practicing sports. All MRAs highly contributed to positive emotions, with different type of emotions between MRAs and with only few cases reporting negative feelings. The ROS scale showed that MRAs positively contribute to increasing relaxation and calmness, attention restoration and clearing one's thoughts. This study suggests that the ocean, through MRAs, contributes to different aspects of human wellbeing. While this study found that all MRA had positive outcomes, each MRA contributes to different aspects of wellbeing. Also, that MRA benefits are influenced by environmental conditions, environmental status and crowdedness. In conclusion, coastal areas and MRAs need to be adequately managed, to ensure the good environmental quality that supports human health benefits.

Keywords: marine ecosystem services, cultural ecosystem services, recreational activities, human health, mental health



5. Benefits to people of mountain soundscapes

First author(s): Uta Schirpke

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Mountain landscapes provide a wide of opportunities for human–nature interactions, which contribute to physical and mental health through multisensory experiences. While research has mostly focused on visual landscape qualities, the characteristics of the soundscape are less understood. In this study, we explore the sound composition of different mountain habitats through soundscape measurements and relate these to people’s perceived qualities and well-being benefits. We found differences in acoustic characteristics along elevational gradients in terms of sound diversity and composition. Human inference on natural soundscape qualities occurred across all sites but differed in terms of sources and sounds. Quietness, natural sounds, and sounds originating from cultural activities such as cow bells were ranked higher than traffic noise and sounds related to human activities and facilities. Most important benefits included auditory pleasant experiences, restorativeness, and sense of place. Our findings contribute to a better understanding of the auditory dimension of experiential interactions, relating environmental characteristics to people’s perceptions and benefits. Thus, measuring acoustic and perceived soundscape components supports integrating soundscape characteristics into ecosystem services assessments and conservation efforts.

Keywords: Restorativeness; Soundscape quality; Human–nature interactions


6. Cultural ecosystem services and ecosystem disservices as well-being agents: linkages and drivers in the urban riverscape context

First author(s): Tomasz Grzyb

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Direct human–nature interactions have a pivotal role in shaping the well-being of urban societies. Recreational opportunities within urban green and blue spaces may beneficially contribute to various aspects of the physical and mental health of their visitors. These positive agents of well-being—often analysed under the cultural ecosystem services framework—are,



however, one side of the coin. To fully understand how intentional exposure to urban nature affects the residents, disturbing or unpleasant natural phenomena (ecosystem disservices) need to be taken into account, along with the negative effects of other visitors and shortages of amenities. Understanding synergies and/or trade-offs among positive and negative agents of well-being, along with revealing their environmental drivers, may foster the sustainable management of urban natural spaces.

This study employs the results of a representative survey with the residents of Warsaw, Poland, to identify linkages and associations among positive and negative well-being agents related to their visits along the Vistula River. A set of statements describing cultural ecosystem services and disservices was assessed by the survey participants according to their recalled memories (the citywide scale). Then, up to five most significant well-being agents were mapped by the participants and enriched with information on their preferences towards these places (the local scale). Although the results of factor analysis clearly distinguished positive and negative agents in the citywide scale, local-scale associations turned out to be not that straightforward, with principal components centred around (1) emotional attachment to the river and both positive and negative outputs of interaction with riverine nature; (2) nature-led discomfort agents and shortages of amenities; (3) sport and creativity opportunities and safety concerns, and (4) pros and cons of social life. Multinomial logistic regression was then used to identify to what extent visitation preferences affect the relationships between urban riverscape characteristics and well-being agents.

Keywords: well-being, cultural ecosystem services, ecosystem disservices, urban riverscape

7. Are parks sufficient to implement nature-based recreation in urban spaces?

First authors(s): Marta Melon

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Our research in Warsaw aimed to verify the hypothesis that areas selected for nature-based recreation are characterised by increased biodiversity and diversity, with formal green spaces like parks playing an important role. This was achieved by integrating social and environmental



parameters, taking into account both objective indicators (including the presence of rare species) and a subjective perspective. Extensive geotagging surveys were conducted among 401 working-age Warsaw residents, together with field analyses, to discern subtle differences between the points indicated in the survey and to classify these areas. Four different types of chosen natural areas were identified, but notably urban parks were key locations for contact with nature, even though objective measures of biodiversity were often low. This study highlights the need for a comprehensive understanding of how urban residents interact with and value nature, emphasising the importance of categorising areas for recreation with nature in a localised way (e.g. in one facility) and recognising the significant role of urban parks.

Keywords: biodiversity, urban green spaces, vegetation structure, urban planning, nature-based recreation



BOOK OF ABSTRACTS

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I. SESSION DESCRIPTION

ID: T11


Interregional flows of ecosystem services / nature contributions to people

Hosts:

	Name	Organisation	E-mail
Host:	Thomas Koellner	University of Bayreuth	thomas.koellner@uni-bayreuth.de
Co-host(s):	Nynke Schulp	VU University	nynke.schulp@vu.nl
	Maria Felipe-Lucia	Instituto Pirenaico de Ecología (IPE, CSIC)	mariafl@ipe.csic.es
	Evangelia Drakou	Harokopio University	e.drakou@hua.gr

Abstract:

On this one planet a multitude of ecosystem services (ES) / nature contributions to people (NCP) are flowing from regions in which they are provided to regions in which they are utilized. Such ES/NCP flows happen from landscape to regional to global scale. Mechanisms include i) international trade of food, feed, and fibers, ii) biophysical flows of regulating services, iii) flows mediated through migrating or dispersing species, and iv) information flows related to cultural services. The recent pandemics and geopolitical conflicts show the vulnerability, but also the necessity of the sustainable management of such interregional telecoupling. The European Union's Regulation on Deforestation-free products from 2023 is a step towards this. Still, regional and national studies still often neglect the dependence on distant ES/NCP and regularly disregard off-site effects in provision and use of ES/NCP. However, it is important to consider interregional flows of ES/NCP as they can cause telecouplings between regions. Through such telecouplings, a change in supplying ecosystems can affect ES/NCP beneficiaries in distant demand regions, but also the other way around ES/NCP demand can cause environmental problems in distant supply regions. For instance, inequalities originated in telecoupled systems could lead these systems to fall into maladaptive situations or socio-ecological traps. Ultimately,



policies aiming at enhancing ES/NCP in a region should not lead to ecosystem damage elsewhere. To cover this field the ESP thematic working group "Global Ecosystem Service Flows (TWG 11)" was installed during the World Conference in 2015 in South Africa.

This group invites contributions to this session. Submissions should address open research questions related to (i) quantitative assessments of interregional ES/NCP flows and telecouplings, incl. (spatial) and long-term modelling of sending and receiving regions, and accounting for ES/NCP and biodiversity embedded in these flows, (ii) quantification of drivers behind these different interregional flows (iii) the evaluation of such flows in terms of effects, i.e. benefits, damages, inequalities and sustainability both in sending and receiving regions, (iv) motivations and perceptions of different actors involved (v) options to better govern interregional conservation of biodiversity and management of ES/NCP. We welcome studies from both broad range of disciplines investigating effects of telecouplings from a biophysical as well as from a social/economic perspective in all types of habitats (i.e. marine, freshwater and terrestrial ecosystems). Specifically, linkages to the conference theme OneHealth are encouraged.

Goals and objectives of the session:

This session aims at exchange on methods and applications how to complement regional assessments of ES/NCPs with an interregional assessment of ecosystem flows to and from a specific region. This opens the possibility to present work relevant for ES/NCP on material flow analysis of trade, embodied water and land, environmental footprints as well as life cycle assessment. This session should also bring together researchers from different disciplines investigating inequality effects, valuation and sustainable managements of telecoupling from a social, economic and/or ecological perspective.

Planned output / Deliverables:

We will discuss the creation of a focus group working towards a joint position paper specifically on inequalities, power asymmetries, social-ecological-economic effects, etc. resulting from interregional ecosystem service flows.



II. SESSION PROGRAM

Room: Expert Street 8

Date of session: 20th of November 2024

Time of session: 11:00 – 12:30

Timetable speaker

Time	First name	Surname	Organization	Title of presentation
11:00	Alexandra	Marques	PBL Netherlands Environmental Assessment Agency, The Netherlands	The role of Nature's Contributions to People in sustaining international trade of agricultural products
11:12	Gabriela	Rabeschini	Senckenberg Biodiversity and Climate Research Center, Germany	Quantifying Nature's contributions to people embedded in international food trade
11:24	Anna	Mayer	Leuphana University of Lüneburg, Germany	Beyond boundaries: Identifying telecoupled flows of anthropogenic capitals in the co-production of nature's contributions to people
11:36	Davina	Vackarova	Charles University, Czech Republic	Conceptualizing ecosystem services footprint to unveil effects of consumption and international trade on ecosystem services
11:48	Charis	Chalkiadakis	University of Twente, The Netherlands	Large-scale fisheries of West Africa: A regional assessment of benefit flows using a spatiotemporal approach
12:00	Jakob	Bogenreuther	University of Bayreuth, Germany	Biodiversity impact of food waste: Quantification for supply chain stages and products in Germany
12:12	Evangelia	Drakou	Harokopio University of Athens, Greece	Transforming telecoupled supply chains through integrated modelling and participatory approaches



III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Biodiversity impact of food waste: Quantification for supply chain stages and products in Germany

First author(s): Jakob Bogenreuther

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Reducing food waste could lower pressures on land resources in supply regions and thereby contribute to the mitigation of global biodiversity loss. However, which supply chain stages and food products to target with policy measures is hardly known. Especially, a differentiation of the impact after taxa and finding the country of origin for single feed products is still missing and is therefore quantified in the present study. The food waste mass at supply chain stages and sub-stages in Germany was calculated and differentiated after 204 food products. All products were traced back to their countries of origin, using data on production and bilateral trade and converting animal products into their feed demand. Via the land cover of cropland and pastures, the impact on mammals, birds, amphibians, reptiles, and plants was quantified. Germany's avoidable food waste (food that was edible before its disposal) leads to 0.3 vertebrate and 1.5 plant species being potentially lost globally. Household-level waste is responsible for 47 % of this species loss, while food services show the largest impact per mass. The most influential products are obtained from pigs and cattle. The impact of beef consumed in Germany is twice as high as that of beef produced in Germany because the mix of countries for the feed is different. For meat from sheep, the impact is even more than ten times higher. 82 % of the impact on vertebrate taxa and 92 % of the impact on plants occur outside of Germany. Among vertebrate taxa, mainly amphibians are affected, occurring in the mainly affected country Brazil. The results can be used to formulate policies that inform consumers about the impact of food waste in supply regions or display the impact of animal products and their feed demand.

Keywords: species loss, food waste, environmental impact, value chain, animal products



2. Large-scale fisheries of West Africa: A regional assessment of benefit flows using a spatiotemporal approach

First author(s): Charis Chalkiadakis


Other author(s): Dyhia Belhabib, John Virdin, Menno-Jan Kraak, Evangelia G. Drakou

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This study investigates the impact of large-scale fisheries on the marine biodiversity and ecosystem services within the waters of West Africa. Over the past decade, increased Distant Water Fleet (DWF) presence and industrial growth in Mauritania, Senegal, Gambia and G. Bissau has led to the depletion of fish stocks, exacerbating food and job insecurity. These phenomena, coupled with a weak system of governance, illegal, unreported, and unregulated fishing (IUU) and low-value addition, has led to losses in market shares and income. It has also contributed to marine coastal pollution and to an extent decreased seawater quality caused by discharges from fish processing facilities along the coastline with a final impact on human well-being and quality of life. Our research extends current knowledge by assessing marine ecosystem service flows throughout the extent of different Exclusive Economic Zones (EEZs) within and across the scale of the marine ecosystems. We quantify and map interactions between domestic, regional, and DWF fishing activities and analyse how exports and trade impact the marine social-ecological system, considering environmental and societal costs and benefits across value chains. The study also examines the role of intermediaries such as actors or entire countries involved in the process of value addition across the supply chain. By integrating socioeconomic and environmental variables with proximity indicators, we analyse the magnitude of ecosystem service flows and model these contributions through an ecosystem service flow index based on a set of transfer mechanisms. The resulting maps illustrate the flow of marine ecosystem services to beneficiaries across ecosystems. Additionally, our maps show vulnerabilities among beneficiary groups and flow hotspots. This research provides crucial insights into the role of beneficiaries across the value chain, thereby aiding the decision-making process to preserve local and regional biodiversity and recommend interventions for informed management of marine ecosystems.

Keywords: Multi-dimensional approach, Assessment, Composite indicator, Resources distribution, Origin-Destination maps



3. Transforming telecoupled supply chains through integrated modelling and participatory approaches

First author(s): Evangelia Drakou

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The constantly declining condition of biodiversity and the ecosystem services, made it clear that there is a need for regional, national and local policy measures to substantially change, through transformation, from their design, up to the targets that are set. This becomes even more important yet challenging, under the prism of globalization, in which pressure on biodiversity and ecosystems is magnified through a continuous demand for local biodiversity outcomes, globally.

Within the BIOTRAILS Horizon Europe project, we focus on four telecoupled systems: fisheries and aquaculture outputs from Greece, cocoa from Peru, arts and crafts from Brazil and gold from Ghana. We analyzed the social parameters that could tentatively induce transformation along the supply chain. We conducted face to face interviews and surveys, with stakeholders from all parts of the supply chain. We used the Theory of Planned Behavior to explore how factors that describe individuals' Social Norms, Perceived Behavior Control and Attitude, shape their intention to adopt sustainable and biodiversity-friendly practices. The collected information was used to develop causal inference, through structural equation modelling. Our analysis revealed that across three supply chains trust in policies and the influence of social circles are shared and critical to shape individuals' decisions. Depending on the political and social context of the case studies, some parameters were more prevalent across case study. For instance lack of continuous training within all levels of employees within the aquaculture sector was identified as a critical point which might ensure transformation. Improvement of and transparency in the decision-making instruments was also highlighted in the gold case study. The produced outcomes are expected to feed into a larger system dynamics model, which takes into account the impact of these social norms in the entire supply chain system, from the point of supply up to the final consumption and use.

Keywords: Structural Equation Models, Participatory system dynamics models, cocoa, fisheries, gold



4. The role of Nature's Contributions to People in sustaining international trade of agricultural products


First author(s): Alexandra Marques

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Nature's Contributions to People (NCP) are essential for the production and trade of agricultural, forestry, and fishery commodities. Often, there is a spatial disconnect between consumers and the natural systems where the commodities are produced. Traded agricultural products are therefore dependent on nature and NCP in their region of origin. The dependencies of agricultural products on NCP are, however, insufficiently recognized by consumers and are rarely considered in global environmental governance and trade policies along value chains. Here, we synthesize studies highlighting dependencies of agricultural products on NCP in their origin locations to identify opportunities and challenges in quantifying their contribution in sustaining trade flows. We suggest three methodological steps for quantifying NCP dependencies in international agricultural trade: spatial mapping of NCP supply and demand, linking NCP to agricultural trade flows, and tracing trade flows. Each methodological step requires further development and harmonisation to enable a complete accounting of how international agricultural trade depends on NCP. Given the lack of knowledge and data on how NCP support agricultural trade, social and environmental trade-offs of natural resource management are currently hard to quantify. Quantifying the role of NCP dependencies of traded agricultural products can support their sustainable management, contribute to supply chain accountability, and serve as input to sustainable natural resource governance and foster responsibility and equity in supply chains.

Keywords: Nature's contributions to people (NCP), dependencies, telecoupling, international agricultural trade, supply chains



5. Beyond boundaries: Identifying telecoupled flows of anthropogenic capitals in the co-production of nature's contributions to people

First author(s): Anna Mayer

Other author(s): María R., Felipe-Lucia, Roman, Isaac, Berta Martín-López, Jacqueline Loos

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Telecoupling provides a lens to examine the interconnectedness of social-ecological systems (SES). Whilst considerable attention has been paid to the telecoupled flows of nature's contributions to people (NCP), little is known about the telecoupling of anthropogenic capitals – namely human, social, physical, and financial capital– that co-produce these NCP. We address this gap focusing on telecoupled flows of anthropogenic capitals in timber production, carbon storage in forests, and fodder production, pest control, and carbon storage in grasslands across three German case study sites. We understand these sites as receiving systems and identify the sending systems from which telecoupled flows of anthropogenic capitals originate. We conducted semi-structured interviews with forestry and agricultural stakeholders to explore how local and telecoupled capital flows underpin NCP co-production, and influence land use management. We use content analysis to formulate questions for a quantitative survey on telecoupling flows. The survey results will serve as a basis for creating degrees of telecoupling for each land management unit, such as a farm or a forest district, which will demonstrate the differences between anthropogenic capitals underpinning NCP co-production. For example, financial and physical capital may be telecoupled to a greater extent than social and human capital, given that resources such as agricultural machinery and subsidies frequently necessitate sourcing from distant systems. Consequently, the degree of telecoupling and reliance on telecoupled anthropogenic capitals will depend on land management approaches taken. Identifying patterns and dependencies in the telecoupling of anthropogenic capitals critical to NCP co-production highlights how reliance on telecoupled capitals can render land management units susceptible to global market fluctuations and geopolitical issues. By identifying these vulnerabilities in SES, strategies can be developed to enhance sustainability and resilience by diversifying capital sources or creating local alternatives, promoting sustainable NCP co-production and reducing dependence on globalised markets.

Keywords: Telecoupling, Anthropogenic capitals, Nature's contributions to people, Social-ecological systems, Land use management



6. Quantifying Nature's contributions to people embedded in international food trade


First author(s): Gabriela Rabeschini

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In telecoupled agri-food systems, NCP embedded in agricultural products are traded from sending to receiving systems, which are ecologically connected. This interlinkage is however not fully accounted for along value chains. Here, we quantify a regulating (pollination) and a non-material (supporting identities) NCP supporting the coffee and soy trade from Brazil's municipalities to their importing countries. For both crops, we estimate the spatial match between pollination demand and supply and the proportion of overall production potentially resulting from pollination at municipality level. Based on literature review, we identify proxies for components of nature supporting identities of coffee and soy farmers in Brazil and build municipal typologies with four categories for coffee (farm size, coffee species, Geographical Indication of origin and natural habitat integration) and three for soy (farm size, natural habitat integration and seed type). In the municipalities analysed, there is a pollination deficit (low supply and high demand) in 76 municipalities responsible for 34% of coffee production, and in 365 municipalities responsible for 68% of soy production. Approximately 25% of coffee and 16% of soy production may be attributed to pollination, with highest percentages in municipalities at the west coast for coffee and at the south for soy. Most coffee production is in municipalities characterized by smallholders, arabica coffee, with Geographical Indication and above average nature integration. Most soy producing municipalities are characterized by smallholders, modified seeds, and above average nature integration; however, more than half of production is in municipalities characterized by not-smallholders, modified seeds, and below average nature integration. Following, coffee and soy trade flows from these municipalities to their importing countries will be linked to the results. Mapping and tracing these NCP through the supply-chain will help to shed light on how trade dynamics relate to natural and cultural resource use in telecoupled agri-food systems.

Keywords: agri-food systems, pollination, supporting identities, coffee, soy



7. Conceptualizing ecosystem services footprint to unveil effects of consumption and international trade on ecosystem services

First author(s): Davina Vackarova

Other author(s): Jan Weinzettel, Trong Can Nguyen, Guiyu Wei, Amir Dadrasi

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International trade has recently attracted attention as an important driver of ecosystem services loss. Several studies document the increasing impact of international trade on ecosystem services and their economic value. Consumption in wealthy countries displaces environmental impacts beyond their borders and creates global tele-connections. Therefore, consumption takes a toll on nature in regions serving as a source of ecosystem services. Distant impacts on ecosystem services abroad are not visible to consumers nor are they accounted for in the value of traded products. The burden on ecosystem services resulting from the appropriation and conversion of ecosystems has been overlooked in global telecoupling studies.

In this contribution, we present a concept of “ecosystem services footprint” within the framework of environmental footprint family indicators. Traditionally, environmental footprints such as the carbon footprint, water footprint, material footprint or ecological footprint have focused on quantifying the direct and indirect pressures human activities place on specific environmental assets. We illustrate the concept by the analysis of the economic value of ecosystem services lost due to land conversion and production of crops, which are either directly traded internationally or enter supply chains of international trade and are induced by final demand abroad. Within the Multi-regional input-output analysis framework, we report the ecosystem services loss footprint for 49 countries and world regions based on EXIOBASE and FAOSTAT data. We discuss future outlook and policy implications, including ecosystem services accounting.

Ecosystem service footprint analysis can further contribute to studies on the role of consumer behaviour, dietary transitions and values in reducing our environmental impact on ecosystem services.

Keywords: Environmental footprint, Ecosystem services, Multi-regional input-output analysis, International trade, Final consumption

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I. SESSION DESCRIPTION

ID: T12


Understanding the linkages between global change, environmental degradation, biodiversity loss and human health and well-being

Hosts:

	Name	Organisation	E-mail
Host:	Nadja Kabisch	Leibniz University Hannover, Physical Geography and Landscape Ecology	nadja.kabisch@phygeo.uni-hannover.de
Co-host(s):	Jan Felix Drexler Tadhg Macintyre	Charité Universitätsmedizin Berlin National University of Ireland Maynooth	felix.drexler@charite.de Tadhg.Macintyre@mu.ie

Abstract:

The ongoing trend of environmental degradation and global climate and environmental change has increased pressure on human health. Climate change, biodiversity loss, landuse and landcover changes, urbanisation, and ecosystem degradation can result in the decline and loss of ecosystem services and the increased exposure to factors causing infectious and non-communicable diseases. This session, will, be based on invited contributions from highly interdisciplinary Horizon Europe Projects (e.g. Go Green Next and ZOE) exploring the links between climate change and urbanisation and health (e.g. impact of extreme weather events such as heat waves on health outcomes) and between ecosystem degradation and biodiversity loss and the emergence of zoonoses. We will jointly discuss how the approaches from the different projects and case studies may results in comprehensive evidence-based policy recommendations, modelling and risk mapping frameworks and how they could feed into monitoring schemes, early warning systems and publicly available knowledge platforms.



Invited contributions will represent projects, amongst others, funded under the topics:

- HORIZON-HLTH-2023-ENVHLTH-02-01 – Planetary health: understanding the links between environmental degradation and health impacts
- HORIZON-CL6-2023-BIODIV-01-17 – Interlinkages between biodiversity loss and degradation of ecosystems and the emergence of zoonotic diseases

Goals and objectives of the session:

Discuss global change, biodiversity loss, human health relationships and potential solutions.

Planned output / Deliverables:

Joint perspectives paper

II. SESSION PROGRAM

Room: Expert Street 9

Date of session: 19th of November 2024

Time of session: 14:00–15:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
14:00–14:10	Nadja	Kabisch	Leibniz-Universität Hannover, Germany	Session introduction
14:10–14:30	Felix	Drexler	Charité Universitätsmedizin Berlin, Germany	Contribution of ecosystem degradation and biodiversity loss to the spread of zoonotic diseases – Introducing the Horizon Europe project ZOE
14:30–14:50	Lucinda	Kirkpatrick	SENS Bangor University University of Antwerp	Restoration in the Anthropocene – time for a One Health Perspective?
14:50–15:10	Tadhg	Macintyre	Maynooth University	GoGreenNext Horizon Europe Project: Future-Proofing Urban Health
15:10–15:30		All		Discussion – follow up projects and joint policy brief



III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Contribution of ecosystem degradation and biodiversity loss to the spread of zoonotic diseases – Introducing the Horizon Europe project ZOE

First author(s): Nadja Kabisch


Other author(s): Prof. Dr. Felix Drexler

Affiliation: Leibniz Universität Hannover, Physical Geography and Landscape Ecology

Contact: nadja.kabisch@phygeo.uni-hannover.de

Human induced ecosystem degradation and biodiversity loss has been discussed to contribute to the emergence and spread of zoonotic diseases. The extent how ecosystem degradation and biodiversity loss contributes to the risk of zoonosis is, however, not entirely clear. In tropical biodiversity hotspots in Guatemala, Costa Rica and Mexico and in temperate regions in Slovenia and Slovakia impacted by deforestation, related land use changes but also forest restoration measures, the EU-funded ZOE project, researches the connections between forest ecosystem degradation and restoration, biodiversity loss, human behaviour and the emergence of zoonotic diseases. The talk at the ESP in Wageningen will present the ZOE framework and will show how the interdisciplinary research team with expertise in geography, geobotany, disease ecology, virology, immunology, epidemiology, sociology, psychology, and anthropology will use cutting-edge technologies and community engagement to inform understandings of these connections and propose means of mitigating the escalating risks to environmental health and human well-being.

Keywords: Zoonosis, forest degradation, human behaviour, restoration



2. Restoration in the Anthropocene – time for a One Health Perspective?

First author(s): Lucinda Kirkpatrick

Other author(s): Herwig Leirs, RESTOREID Consortium

Affiliation: Bangor University, Antwerp University

Contact: lucinda.kirkpatrick@uantwerpen.be

Restoration is being touted as the solution to a myriad of problems created as a consequence of human activity. However, restoration is a challenging process; often biodiversity recovery is incomplete or only occurs at certain trophic levels, and restoring areas always requires local community buy in and involvement. Most restoration does not consider the One Health implications of both changes in biodiversity and also changes in human interaction with the environment, with the result that there is a tension between biodiversity as a protective influence against zoonotic disease spillover (dilution effect) and biodiversity as a source of zoonotic disease (amplification). We are currently in the UN's decade of restoration, so it is highly timely that we further understand the mechanisms that underpin the relationship between biodiversity change and spillover risk. Furthermore, restoration is an anthropogenic activity, which requires community involvement and buy in for success, therefore understanding the socio-economic drivers behind how people interact with restored areas from the local to the national level is imperative when trying to ensure that restoration efforts are successful. In this talk, I will present the newly funded Horizon EU project, RESTOREID, which will investigate the complex relationships between biodiversity, mechanisms of spillover risk and human interactions with the environment in ecosystems undergoing restoration activities.

Keywords: Restoration, Disease spillover, zoonotic disease, biodiversity, species assemblages



3. GoGreenNext Horizon Europe Project: Future-Proofing Urban Health

First author(s): Tadhg Eoghan Macintyre

Other author(s): Annalisa Setti, Mario Balzan, Andrew Coogan

Affiliation: Innovation Value Institute, Insights SFI Centre for Data Analytics, Maynooth University, TechPA research Cluster, Inland University of Applied Sciences Norway

Contact: tadhg.macintyre@mu.ie

GoGreen Next, a €6 million Horizon Europe project led by Maynooth University, will deliver a comprehensive evidence-based policy oriented approach model to convey how ecosystem health and human health are connected. Using a multi-dimensional health approach based on planetary health, the research and innovation action addresses the challenge of climate change by focusing on the benefits to environmental and human health of nature-based solutions and other climate mitigation initiatives. Attempts to assess climate anxiety (e.g. Yale global survey methodology) can support citizens understanding of their own climate views (e.g. concerned, cautious, alarmed etc.) but don't connect to pathways for action. This survey approach which was designed to explore polarisation in attitudes about a narrow set of climate related topics, overlooks the psychological barriers to change and how recent research on psychological processes can support our thinking about future scenarios. Our goal is to assess using a novel interactive survey on the challenges of biodiversity loss, climate anxiety and use of green space across both attitudinal and behavioural dimensions, the readiness of individuals to engage in behaviour change and engage in sustainable activities. What will the impact be on society? In GoGreen Next we aim to support cities will be more aware of citizens needs, values and preferences for future initiatives and interventions. We will empower citizens to create their own route to change and be aware of the potential benefits for them in the short, medium and long term. We will promote future health ambassadors who have the potential to model behaviours for citizens across the generations to follow. And finally, we will develop a new suite of evidence-based policy instruments to support high level policy changes and help cities realise their ambitions for 2030 and beyond.

Keywords: Nature-Based Solutions, Well-Being, Biodiversity, Planetary Health, Future thinking

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: T13a


Trade-offs in implementing nature-based solutions

Hosts:

	Name	Organisation	E-mail
Host:	Nadja Kabisch	Leibniz University Hannover, Physical Geography and Landscape Ecology	nadja.kabisch@phygeo.uni-hannover.de
Co-host(s):	Luis Inostroza	Mendel University in Brno	luis.inostroza@mendelu.cz

Abstract:

Global environmental changes, such as climate change and urbanisation, have numerous direct and indirect effects on human health and wellbeing especially during extreme weather events like heat waves and floods. Nature-based solutions (NBS) have been introduced to address societal challenges such as those resulting from global environmental changes, providing alternatives to standard grey solutions and manifold benefits in the form of ecosystem services. NBS are systemic solutions that use nature and green elements to restore or create feedback loops between social, ecological, and technological systems in the urban landscape and deliver multiple co-benefits such as restoring, sustaining, and establishing human health and wellbeing. Conceptualisations of the relationship between how NBS provide ecosystem services and their co-benefits for health and wellbeing mostly illustrate the positive – solution-oriented effects, but less discuss the challenges and potential trade-offs with implementing specific NBS. Such trade-offs could be related to the creation of potentially adverse health effects such as contributing to allergenic pollen production or to mosquito-borne diseases (e.g. West-Nile Virus) which may be related to the implementation of green-blue infrastructure increasing mosquito abundance in cities. In this session, we will discuss such potential trade-offs to health and well-being related to NBS



implementation and potential strategies to cope with them in social–ecological–technological systems, with a special focus on urban ecosystems.

Goals and objectives of the session:

Present and discuss urban case studies of potential trade-offs to health and well-being related to NBS implementation and potential strategies to cope with them.

Planned output / Deliverables:

Case study learning and exchange, potential joint perspective paper.

SESSION PROGRAM


Room: Success Avenue 1

Date of session: 20th of November 2024

Time of session: 11:00–12:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
11:00–11:05	Nadja	Kabisch	Leibniz Uni Hannover	Session introduction
	Luis	Inostroza	Mendel University in Brno	
11:05–11:20	Carl	Anderson	Leibniz University Hannover	A systematic review of urban ecosystem disservice classification systems and frameworks
11:20–11:35	Charlotte	Stijnen	Faculty of Geosciences, Utrecht University	Uncovering rivers, dreams and dilemmas: An urban river daylighting case study in New York City
11:35–11:50	Uta	Schirpke	Eurac Research	Simulating urban heat mitigation in a virtual city to support the implementation of nature-based solutions in European cities
11:50–12:05	Atila	Kálmán	Széchenyi Egyetem (University Győr)	The multiple benefits of stormwater management in the implementation of nature-based solutions – the effectiveness of the Green City programme



Time	First name	Surname	Organization	Title of presentation
12:05– 12:20	Giorgiana	Raluca Barbu	Faculty of Geography, University of Bucharest	Climate resilience through nature-based solutions: A network analysis approach
12:20– 12:30	Nadja Luis	Kabisch Inostroza	Leibniz Uni Hannover Mendel University in Brno	Closing general discussion

II.ABSTRACTS

The first author is the presenting author unless indicated otherwise.'

1. A systematic review of urban ecosystem disservice classification systems and frameworks

First author(s): Carl C. Anderson

Other author(s): Andreas Metzemacher, Blal Adem Esmail

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Urban green spaces and green features are beneficial for protecting biodiversity and contributing to human well-being in the form of ecosystem services (ES). Although there are numerous benefits to urban vegetation, trade-offs also occur – sometimes referred to as ecosystem disservices (ED). To maximize ES among residents with diverse values, experiences, and world-views, it is important to focus on concurrently minimizing ED through appropriate planning and management supported by interdisciplinary research. Conceptual frameworks and classification systems have been proposed to guide such research, but it is unclear to what degree these have been taken up, how much they converge or diverge from each other, and their applicability across contexts. We conduct a systematic, but targeted, literature review of existing ED classification systems and frameworks in the context of urban ecosystems to take stock of this emerging body of research. We find strong uptake of several highly cited classifications and frameworks, but also substantial variation among articles both within and across fields. We draw on lessons learned from the reviewed articles to create a composite framework that combines ES and ED and includes key factors such as human perception and



both proactive and reactive ecosystem management. We call for increased consideration of ED research that recognizes its interconnection and ultimate role for maximizing ES, based on replicable conceptual understandings of this critical concept.

Keywords: ecosystem disservices, ecosystem services, urban green infrastructure, public perception, urban greening

Keywords: Urban Green Spaces, Regulating Ecosystem Services, Cultural Ecosystem Services, Synergies and Trade-offs, Spatial Analysis

2. Uncovering rivers, dreams and dilemmas: An urban river daylighting case study in New York City

First author(s): Charlotte Stijnen

Other author(s): Katinka Wijsman, Niki Frantzeskaki

Affiliation: Department of Spatial Planning and Human Geography, Utrecht University

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As cities embrace nature-based solutions (NBS) to address urban challenges, they will also have to embrace and deal with the inherent trade-offs that come along with the planning and governance of urban NBS. Our prior literature scoping review of empirical evidence on urban NBS trade-offs indicates three groups of trade-offs; rigid, governance and functional trade-offs, which manifest differently across the planning cycle stages with differentiated implications for environmental justice. Scrutinizing urban NBS trade-offs through a justice lens helps to uncover the political dynamics involved in the planning and governance choices of urban NBS, and the differentiated ramifications thereof for diverse constituencies. Urban river daylighting – which involves removing historic streams from underground pipes and bringing them back to the surface – causes a vast change in the urban landscape, thereby posing an interesting context in which to analyze urban NBS trade-offs. This research looks into the planning and design stage of an urban river daylighting project in The Bronx, New York City to unpack the trade-offs at play. To analyze how trade-offs manifest in this project, interviews were held with actors directly and indirectly involved with the planning and design of the daylighting, as well as short interviews with local residents, employees in the neighborhood, and park users, on their opinions of the project. The case of Tibbetts Brook shows how issues of land-use and spatial restrictions cause concessions, how differentiated perspectives of benefits and costs associated with the daylighting plans are expressed, as well as the challenges of organizing an



inclusive process under a project timeline. Daylighting Tibbets Brook highlights the complexity of renaturing cities and the interconnected infrastructural, social and ecological factors which cause dilemmas, while also showcasing how restoring Tibbets Brook holds potential for ecological and social reparations.

Keywords: urban river daylighting, trade-offs, inclusive, planning, cities

3. Climate resilience through nature-based solutions: A network analysis approach

First author(s): Giorgia Raluca Barbu

Other author(s): Mihai Răzvan Niță, Andreea Niță

Affiliation: Doctoral School of Geography, Faculty of Geography, University of Bucharest, Romania

Contact: giorgianabarbu11@gmail.com

Nature-based solutions are essential for climate resilient city planning. Prioritising biodiversity in decision-making processes helps to maximise ecosystem services, build resilient communities and promote investment in nature-based initiatives. However, the implementation of nature-based solutions is a difficult process, with many challenges: at the regulatory level, at the financial level or in practice. Here, we show that projects targeting nature-based solutions are a key – component in the review and implementation of public policies in the field of biodiversity and adaptation to climate change. Thus, we highlight the potential of analysing the link between the scientific results of these projects and the policy objectives within the framework of the EU Biodiversity Strategy 2030 and the EU Strategy for Climate Change. In this study, we propose an approach regarding the implementation of nature-based solutions in different geographical areas. Our study is based on: (1) Analysis of 130 projects funded under Horizon 2020 and Horizon Europe, using keywords to identify them; (2) Establishing the elements of analysis, which include partner countries in projects, the number and type of partners, the level of funding, the type of nature-based solutions, and their geographical distribution; (3) Analysis of the needs for nature-based solutions in policy documents; and (4) Network analysis in the planning of nature-based solutions. The results of our study show that network analysis plays an important role in supporting decision-makers, facilitating the visualization of relationships among the actors involved in the implementation of nature-based solutions, and providing information on the complementarities and trade-offs within the green initiatives.



Keywords: nature-based solutions, climate resilience, projects, network analysis, public policies

4. The multiple benefits of stormwater management in the implementation of nature-based solutions – the effectiveness of the Green City programme

First author(s): Attila Kalman

Other author(s): Máté Chappon, Katalin Bene


Affiliation: Széchenyi István University

Contact: at.kalman@gmail.com

Urban areas are facing significant challenges from the adverse effects of climate change due to land use changes caused by urbanization. The increase in grey paved surfaces increases run-off, thus the risk of flash floods, but also increases the heat island effect of these areas significantly, as well as their negative impact on biodiversity. Future urban development requires sustainable, holistic approaches to mitigate and adapt to these changes. The focus of this paper is to measure and quantitatively assess the Hungarian “Green city” development program in the scope of nature-based solution implementation.

The project has created green spaces in nearly 200 cities. The aim was to increase biodiversity, improve ecosystem services and mitigate the negative impacts of climate change on human living conditions. The newly created or expanded green spaces were essentially designed to achieve this objective. The objective and subjective benefits of the projects, cost and carbon quantification of the investments were assessed and evaluated in a multi-criteria evaluation methodology. Data about the projects were collected from open-source government databases.

Besides other parameters, the lack of and the implementation of rainwater management during project design and development were assessed, compared with regular, tap-water based irrigation. Carbon-footprint based, and remedial cost-based evaluations were calculated to show the effectiveness of the projects. Many projects lacked the holistic approach and multi-benefit design, which controversially resulted in negative social and/or environmental impacts. The “Green City” program provides valuable insights into the role of nature-based solutions, combined with rainwater management in urban development strategies aimed at combating and adapting to climate change. The study quantifies the importance of a holistic design and the possible multiple benefits of implementation. Specifically, it devotes considerable attention to



rainwater harvesting and formulates proposal to policy makers for future developments to achieve balanced environmental, social, and economic benefits.

Keywords: nature-based solution, rainwater retention, sustainability, green-house-gases, stormwater management

5. Simulating urban heat mitigation in a virtual city to support the implementation of nature-based solutions in European cities

First author(s): Uta Schirpke

Other author(s): Alberto González-García, Sandra Rome, Ignacio Palomo

Affiliation: Eurac Research, Bozen/Bolzano, Italy

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Nature-based Solutions (NbS) are a promising way to halt the decline of urban green spaces (UGS) and to support the provision of multiple ecosystem services. The new EU Nature Restoration Law therefore requires EU Member States to restore 20% of ecosystems and to increase urban green space in cities and towns by 3% by 2040 and 5% by 2050. Among a wide range of co-benefits of NbS, there is a particular need to improve the vegetation-based mitigation of the urban heat island (UHI) effect across European cities, UHI amplified by global warming. However, to implement most effective NbS, a better understanding of the characteristics of UGS is still needed. In this study, we aim to evaluate the effectiveness of NbS with regard to a future increase in heat waves. In specific, we address (1) how differences in configuration and distribution of UGS (i.e., size, tree canopy cover, and spatial arrangement) will affect urban heat mitigation, and (2) what the limits of NBS against extreme future heatwaves are. Based on the average characteristics of European cities, we designed a virtual city and simulated the heat mitigation of UGS using InVEST under three climate change scenarios and different characteristics of NbS, hypothesizing that different combinations of size, tree canopy cover, and spatial distribution of UGS will have different effects on the urban heat mitigation. Furthermore, we evaluate the results with regard to potential beneficiaries and NbS implementation costs. The outcomes of this study can support the future design of UGS in cities accounting for issues related to environmental efficiency, justice, and transformative change.

Keywords: Urban heat island, Urban cooling, Urban green spaces, Nature-based solutions, EU Nature



BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: T13b

Linking Ecosystem Services and Nature-based Solutions for Transformative Change

Hosts:

	Name	Organisation	E-mail
Host:	Edna Cabecinha	University of Trás-os-Montes and Alto Douro (UTAD), Department of Biology and Environment, CITAB, Portugal; IUCN Commission on Ecosystem Management	edna@utad.pt
Co-host(s):	Emmanuelle Cohen-Shacham	IUCN Commission on Ecosystem Management	minacs@gmail.com

Abstract:

The concept of ecosystem services (ES) has gained importance in recent years as a framework for understanding the benefits that nature provides to human well-being. Similarly, nature-based solutions (NbS) have emerged as an innovative approach to address complex societal challenges, biodiversity and human health and wellbeing. This session aims to explore the intersection between ES and NbS, focusing on their potential to drive transformative change towards sustainable development in social-ecological interactions context while meeting human needs.

The NbS implementation can address immediate challenges such as climate change adaptation, disaster risk reduction, and biodiversity conservation and promote long-term resilience and sustainability. By investing in NbS, local communities can enhance ecosystem services, improve human well-being, and build more sustainable and resilient societies.

Linking ecosystem services and NbS holds great potential for transformative change. By explicitly recognizing and quantifying the benefits that nature provides, decision-makers can better integrate the value of ecosystems into policy and planning processes. This can lead to more informed decision-making that prioritizes protecting and restoring critical ecosystems.



In conclusion, linking ecosystem services and nature-based solutions offers a pathway towards transformative change. By recognizing the value of nature and harnessing its power through innovative solutions, society can achieve a more sustainable and resilient future for both people and the planet. In this session, we aim to highlight the importance of integrating ES and NBS into decision-making processes to unlock their full potential and drive transformative change at the local, regional, and global scales.

During this event, we are aiming to explore how NbS can improve the provision of ES and foster transformative change and how the Global Standard for NbS can assess these changes. During the Session, we welcome the presentation of case studies or research projects that show how the link between NbS and ecosystem services knowledge/tools in different geographic and ecological contexts can drive transformative change.

Goals and objectives of the session:

The objectives of this session are to:

- present the Global Standard for NbS to raise the awareness of the ESP community on NbS implementation and this global tool.
- learn, through presentations of case studies and relevant studies, ways that the two concepts can be used and complement each other to address global challenges and foster transformative change.

The session's objectives are congruent with the “Ecosystem services, one planet, one health” conference theme, with a special focus on the thematic stream: Ecosystem services and conditions for transformative change.

Planned output / Deliverables:

A summary of the case studies presented, main discussion points, and ideas for new research collaborations on the link between NbS and ecosystem services and the challenges to adapt to promote transformative change.

A full scientific manuscript will be prepared on the link between ecosystem services and NbS, with the potential participation of those contributing to the discussion.

II. SESSION PROGRAM


Room: Success Avenue 1

Date of session: 18th of November 2024

Time of session: 14:00–15:30 & 16:00–17:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
14:00	Emmanuelle	Cohen-Shacham	IUCN-CEM, USA	Nature-based Solutions – from definition to implementation
14.15	Edna	Cabecinha	UTAD/CITAB, Portugal IUCN-CEM	Linking Nature-based Solutions and Ecosystem Services to tackle societal challenges
14:30	Titouan	Dubo	IRD, CNRS, Grenoble INP, IGE, Université Grenoble-Alpes, Grenoble, France	Assessment of ecosystem services under future scenarios of the European Nature Restoration Law in the Alps
14:45	Claudia	Carvalho-Santos	Centre of Molecular and Environmental Biology, Minho, Portugal	Trees4Water: Cost-effectiveness of Riparian Forest Buffers in Farmlands to Improve Water Purification
15:00	Philip	Roche	INRAE, AMU, UMR RECOVER, France	Build local Nature-based Solutions projects with co-benefits for the environment, society, and biodiversity
15:15	Mónica Q.	Pinto	UTAD/CITAB, Vila real Portugal	<i>Integrating Nature-based Solutions and Ecosystem Services to foster Urban Resilience</i>
15:30	Sien	Kok	Wageningen University and Research	Integrated assessment of river – floodplain management strategies for the Rhine Branches in the Netherlands
15:30–15:45	Discussion			
BREAK				
16:00	Phoebe	King	University of East Anglia, UK	From local solutions to catchment-wide management: an investigation of upstream-downstream trade-offs when upscaling nature-based flood risk management
16:15	Livia	Shamir	Stefano Boeri Architetti, Dipartimento di Ricerca	Parco Italia. A project to extend, connect, protect and enhance the network of natural areas in Italy
16:30	Veronika	Strauss	Leibniz Centre for Agricultural Landscape Research	Carbon Farming for Climate Change Mitigation and Ecosystem Services – Potentials and Influencing Factors



Time	First name	Surname	Organization	Title of presentation
16:45	Agata	Cieszewska	Warsaw University of Life Sciences	Ecosystem services in urban housing estates – NbS context
17:00	Alberto	González–García	Univ. Grenoble–Alpes, CNRS, France	Co–benefits of nature–based solutions exceed the costs of implementation
17:15	Robert	Philips	The Royal College of Art, Napier University, British Council	A participatory planning tool to share knowledge and discuss landscape tradeoffs between ecosystem services and to inform implementation of Nature–based Solutions
17:30	Maria João	Cardoso	Environment and Sustainability Unit of Santarém Municipality, Portugal	Perception of the value of riparian ecosystems – a case study of reconversion from heavy techniques to Nature–Based Solutions
17.45	Swantje	Gebhardt	Copernicus Institute of Sustainable Development, Utrecht University	A participatory planning tool to share knowledge and discuss landscape tradeoffs between ecosystem services and to inform implementation of Nature–based Solutions
18.00 – 18.30h	Discussion			

III. ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Perception of the value of riparian ecosystems – a case study of reconversion from heavy techniques to Nature-Based Solutions

First author(s): Maria Cardoso

Other author(s): Marco Arruda, Diogo Dias, Ana Alves, Ana Gama, Andreia Lopes

Affiliation: Environment and Sustainability Unit of Santarém Municipality, Portugal

Contact: mjcardoso@cm–santarem.pt

The ribeira do Canavial, is a tributary of the Tagus river and belongs to the Alviela river basin, saw a business–as–usual investment, that encompassed the impermeabilization of the banks by applying cement and plastic sheeting, becoming an artificialized stream, transforming the natural space into a monofunctional one with loss of Biodiversity.

The reconversion and renaturalization of the stream is a success case in terms of empowering local action in 2024, restoring the natural habitat of native fauna and flora into



a living laboratory, by planting vegetation that are more attractive to pollinators and provide shade in order to reduce evaporation and maintain water flow, which has decreased due to a lack of rainfall caused by Climate Change.

Nature-Based Solutions (NBS) are the fundamental pillar of the stream transformation through Natural Engineering Techniques, which have played a key role in stabilizing, consolidating and shading the banks, combined with the removal of exotic flora (e.g. *Arundo donax* and *Ailanthus altissima*), have boosted the recovery of the Riparian Ecosystem.

River rehabilitation reverted the destruction of Ecosystem Services caused by stream artificialization and created a multifunctional site, where agricultural activity is intertwined with the natural environment, with gains in agriculture through the predation of agricultural pests and the increase in pollinators, allowing the local community to benefit from it, stimulating a new perception of the value of ecosystems and human well-being.

This stream integrates the municipal project Rehabilitate Section by Section (RTT) which has already rehabilitated 23 river sections in a decade, with the involvement of the population and reaching more than 6000 meters in length in Santarém Municipality.

RTT integrates public participation as a pillar in the recovery of river ecosystems, using NBS and natural engineering techniques, spreading technical and scientific knowledge about new approaches to coexistence between agriculture and nature, within watercourses.

Keywords: River Rehabilitation, Ecosystem Services, Nature-Based Solutions, Pollinators; Public Participation

2. Trees4Water: Cost-effectiveness of Riparian Forest Buffers in Farmlands to Improve Water Purification


First author(s): Claudia Carvalho-Santos

Other author(s): Elif Ozturk, Emanuel Escobar, Ana Francisca Castro, Ana Faria Lopes

Affiliation: Centre of Molecular and Environmental Biology & IB-S Institute for Bio-Sustainability, University of Minho, Braga, Portugal

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Riparian forests are commonly related to the provision of several ecosystem services, including water purification and the control of soil erosion. This nature-based-solution acts as filter buffer for the reduction of diffuse pollution, mainly from agricultural activities. Despite several studies addressing the impact of riparian forest scenarios on river water quality improvement, there is a lack of comprehensive analysis regarding the cost-effectiveness of these options. This study aims to assess the cost-effectiveness of riparian



forest scenarios in decreasing the concentrations of suspended sediments, nitrates, and phosphorus to the river, supported by the outputs from the hydrological model SWAT. Using Cávado river basin as a case-study, in NW Portugal, the environmental effectiveness of two scenarios of riparian forests with buffer widths of 2.5m and 5m was calculated in targeted polluted sub-basins, where intensive dairy farming prevails. The SWAT model was effectively calibrated and validated for discharge, sediment, and nutrients to the River Cávado showing a good agreement between observed and simulated values. Costs associated to riparian forests involves several components, including plantation, maintenance and opportunity costs, gathered from several databases, including National Statistics of Portugal and National Forest Federation. The results indicate that incorporating a 5m riparian forest buffer is the most effective scenario to increase water purification, and the least costly pollutant to mitigate is sediment, with around 500€ per mg of reduced sediment in the river. Detailed calculations of opportunity costs offer nuanced insights into the economic implications of converting farmland to riparian forests. Hydrological modelling provides valuable outputs for simulating scenarios to inform cost-effectiveness analyses and transdisciplinary studies, aiding in decisions to enhance water quality and ecological status in river basins. Cost-effectiveness analyses of nature-based-solutions is an important step to the implementation of financing schemes to promote ecosystem services provision for effective transformative change.

Keywords: SWAT, Cávado River basin-PT, Environmental Effectiveness, Nature-based-solutions, Cost-Effectiveness

3. Ecosystem services in urban housing estates – NBS context

First authors(s): Agata Cieszewska

Other author(s): Gabriela Maksymiuk, Renata Giedych, Marcin Łaczyński, Magdalena Kuchcik, Dorota Pusłowska-Tyszewska, Joanna Adamczyk-Jabłońska, Marzena Suchocka

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Nature-based solutions (NbS) significantly influence the implementation of Ecosystem Services. In areas with strong exposure to climate change, such as urbanized areas, residents are increasingly faced with problems with heat waves, changes increasing frequency and intensity of extreme weather events as well as torrential rains. All these elements affect the living conditions of residents and are observed not only on the scale of entire cities but also on the local scale – a housing estate. The study examined the benefits that can be realized by various NBSs that can be applied at the scale of a housing estate. This applies to plant landscaping elements, forms of urban gardening, rainwater management solutions as well as solutions related to buildings and technical structures. Based on the literature analysis and own research, parameterization of ecosystem services



for 37 NbS was carried out using quantitative and qualitative methods. The key here was to present NbS from such a perspective that residents saw the need to use it in their housing estates. Each NbS brings specific benefits and effects of the climate change adaptation. The parameterization was not strictly technical in nature, but was selected in a way that highlighted the benefits (i.e. the ES) for the residents. Quantitative parameterization concerned services such as oxygen production, CO₂ sequestration, pollution reduction, reduction of stormwater runoff, stormwater retention, while qualitative parameterization was carried out for biodiversity and cultural benefits. The proposed solution was used as part of gaming workshops in 5 housing estates in Warsaw using the serious game 'Neighborhood with climate' (<https://coadapt.pl/en/game/>). The workshops indicated the residents' preferences in the selection of NBS and, consequently, the implementation of the ES in a housing estate.

Keywords: urban NbS, local ecosystem services, adaptation to the climate change, serious games

4. Assessment of ecosystem services under future scenarios of the European Nature Restoration Law in the Alps

First author(s): Titouan Dubo

Other author(s): Ignacio Palomo, Alberto González-García, Sandra Lavorel

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The European Commission's recent adoption of the Nature Restoration Law aims to restore at least 20% of the degraded ecosystems within the European Union (EU) by 2030. While a recently published impact assessment study highlights the law's general potential for climate change adaptation and biodiversity conservation, its specific outcomes and co-benefits, especially in mountain region such as the Alps, remain unclear. To address this gap, we assessed the potential outcomes of achieving specific targets of the law within the Alpine Space – a region experiencing rapid global change. Specifically, we identified optimal areas for the implementation of the EU Law and evaluated the ecosystem services that the implementation of Nature-based Solutions (NbS) would provide in the Alps if several law targets are met. Finally, we performed a cost benefit analysis taking into account the cost of interventions and their benefits. Our findings emphasize the importance of comprehensively evaluating the multifunctionality of NbS and the diverse benefits of the Nature Restoration Law to guide future decision-making processes.

Keywords: Climate change adaptation ; Nature-based Solutions ; Ecosystem services ; European Alps ; EU policy



5. Co-benefits of nature-based solutions exceed the costs of implementation

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Presenting author:

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Nature-based solutions' potential for multiple benefits across ecosystems and societies justify their uptake in policy and implementation. This study contributes to closing the gap in quantifying the multiple outcomes of nature-based solutions by evaluating the multifunctionality of 83 nature-based solutions actions in the Alps. We assessed biodiversity co-benefits and the monetary value of four ecosystem services (heatwave mitigation, flood regulation, climate regulation, and landslide protection) provided by these nature-based solutions to their respective beneficiaries. We showcased the diversity of nature-based solutions implemented in the Alps, with forest nature-based solutions having high values for the four ecosystem services, river and wetland nature-based solutions showing high values for biodiversity, and urban nature-based solutions contributing a lower biodiversity value but being highly cost-effective and benefiting a larger population. We estimated a 2.8-to-1 return on investment by considering the total monetary value and the total costs of the nature-based solutions, benefiting a total of 91,324 persons. We highlight the need for integrating biodiversity and multiple ecosystem services for future nature-based solutions funding and implementation, together with their role to mitigate and adapt to climate change.

Keywords: Ecosystem services, nature-based solutions, biodiversity, ecosystem services quantification, monetary valuation

6. From local solutions to catchment-wide management: an investigation of upstream-downstream trade-offs when upscaling nature-based flood risk management


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Natural flood management (NFM) is a nature-based solution that is widely recognised as an option to reduce flooding whilst providing numerous ecosystem services (ES) for society and



the environment (IUCN Criterion1). To address the threat of increasing flood risk posed by climate change, transformational change is required to scale up NFM from localised solutions to widely adopted catchment management. This paper presents a case study of four river catchments in the UK where opportunities are emerging for scaling up NFM in upstream, rural areas to complement downstream flood infrastructure, including SUDs, in urban areas (Criterion2). Implementing NFM at a catchment scale will not only change the appearance of landscapes but also give rise to potential ES trade-offs between the 'providers' of upstream land for flood control and the 'beneficiaries' of reduced flooding downstream (Criterion6). Taking a qualitative approach, we conduct 5 focus groups (n=17

participants) designed to foster discussion and knowledge exchange between upstream farmers and downstream communities (Criterion5). Results reveal that both upstream and downstream participants hold strong affinities to contemporary aesthetics of the rural landscape and express sympathies with tasking farmers to deliver regulating ES (flood regulation) when their traditional vocation is to deliver provisioning ES (food and fibre). Despite the prominence of landscape aesthetics in cultural identity, beneficiaries were willing to prioritise flood risk management (regulating ES over cultural ES) and to pay farmers to deliver NFM (Criterion4). Specifically, beneficiaries had preferences for NFM options that delivered flood attenuation (floodplain storage) and wider ES benefits (native tree planting), such as biodiversity enhancement (Criterion3). Lastly, evidence from this study promotes the application of 3D-catchment visualisations and the opportunity for discussion and knowledge exchange to build social processes that can facilitate greater understanding of catchment-wide community values to underpin and foster transformative change (Criterion8).

Keywords: Climate-change adaptation, catchment-based approach, ecosystem-based adaptation, payment for ecosystem services, social learning

7. Integrated assessment of river - floodplain management strategies for the Rhine Branches in the Netherlands


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The EU is progressively encouraging the uptake of nature-based solutions in aquatic ecosystems including river systems, as seen in e.g. the Water Framework Directive, and the EU Nature Restoration Law. At present, the majority of policy appraisal studies in this domain has a limited scope, focusing on e.g. flood risk mitigation or ecological restoration benefits. Assessment of a wider scope of impacts is essential to gain insight in the various benefits



and trade-offs of implementing nature-based solutions in river – and floodplain management.

In this study, we analyzed the supply of 13 ecosystem services (ES) under more conventional versus nature-based river-floodplain management strategies for the Rhine Branches in the Netherlands, designed to target issues like flood risk, drought risk, riverbed incision and ecological restoration. In order to quantify ES supply, we modelled biophysical and hydrological changes (including elevation, land use, land cover, stage-discharge relationships and inundation duration) under the strategies, using a range of tools, and linked these to ES indicators.

Changes in ES supply are connected to changes in hydrological conditions and/ or changes in land use and vegetation management. Our results show that strongly regulated, mono-functional river – and floodplain management has overall lower ES supply than more integrated, nature-based management. Due to the stronger need for land use change when embedding nature-based solutions, there is a trade-off with agricultural production in the floodplains. Our results can inform formulation of management strategies and support stakeholder dialogue in the Rhine branches. At the same time, our approach demonstrates how the ES framework can be used as part of a holistic policy appraisal framework in river-floodplain management – e.g. by serving as a basis for prevalent ex-ante evaluation tools like extended cost-benefit analysis.

Keywords: river-floodplain management, ecosystem services, nature-based solutions, trade-off analysis

8. Integrating Nature-based Solutions and Ecosystem Services to foster Urban Resilience


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Climate change, population growth, and economic development pose significant challenges to socio-ecological systems, particularly in urban areas. Cities must navigate issues such as urban heating, air and water pollution, biodiversity loss, ecosystem degradation, and urban sprawl, which affect economic activities, human health, and overall well-being. Nature-based Solutions (NbS) have emerged as effective strategies to address these challenges by leveraging Ecosystem Services (ES) to enhance human health and well-being. This study mapped and assessed ES in an urban green area (UGAs) in Penafiel City Park within the River



Cavalum Valley (Portugal), to evaluate NbS implementation in supporting ES, and its potential to foster Urban Resilience.

The analysis revealed a diverse distribution of ES across four homogeneous areas in the UGA (A, B, C, and D). Provisioning services, such as wild plants for nutrition and fibres, were prevalent in UGAs A, B, and D. Regulating and maintenance services, including noise attenuation, visual screening, control of erosion rates, and hydrological cycle regulation, were observed in all UGAs, with UGA C showing the highest presence. Cultural services, fostering physical and intellectual interactions with nature, were also significant, particularly in UGAs B and C. The findings highlight the potential of UGAs in Cavalum Valley to contribute to climate change adaptation through several ES. The unevenness in ES presence underscores the need for adapted NbS strategies. UGAs B and C, which exhibit higher levels of cultural, regulating and maintenance services, are particularly effective in enhancing human well-being and addressing urban challenges. In contrast, the absence of specific ES in UGA D indicates the potential for targeted NbS interventions to strengthen its ES capacity.

Integrating NbS in urban planning within the Cavalum Valley can effectively address global change challenges. ES studies are crucial for implementing proper NbS, ensuring that urban green spaces are optimally leveraged to enhance resilience, health, and well-being in urban settings.

Keywords: Nature-based Solutions, Ecosystem Services, Urban Resilience, Urban Green Areas

9. Build local Nature-based Solutions projects with co-benefits for the environment, society, and biodiversity


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Ecosystem Services (ES) and Nature-Based Solutions (NBS) are related concepts that only partially overlap. The NBS approach includes operational considerations to preserve biodiversity and long-term benefits for humans and nature, which are not included in the ES approach. While the ES framework is formulated as the flow of benefits from nature to society, the NBS approach promotes co-benefits for the environment, society, and biodiversity. The NBS approach also focus on actions to propose solutions based on biodiversity and ecological processes, while ES research is more oriented on evaluating the benefits coming from ecosystems. Interdisciplinarity, coupled with social, economic and biodiversity co-benefits appear to be essential to NBS large scale implementation.



We aim here to present an ambitious research program on Nature-Based Solutions (NBS) called SOLU-BIOD, which will bring together the French research community to address a comprehensive range of questions related to NBS. Co-piloted by CNRS and INRAE, this program, with a budget of over 44 million euros over nine years (2023–2032), originates from a French government investment plan. It aims to be transformative in tackling the challenges of implementing innovative NBS in various territories.

The SOLU-BIOD program's activities are structured around seven strategic projects and research calls. One of these projects is a network of eleven living labs (LL), geographically spread across mainland France and overseas territories, focusing on the program's four priority socio-ecosystems: urban, coastal, agricultural, and protected areas. We are currently setting up these living labs for a four-year period. At the end of these experiments, we hope to disseminate effective, replicable practices for setting up NBS in areas with similar challenges and environments and to identify the most beneficial ES for local communities. LLs appear to be an excellent way of exploring and evaluating systemic Nature-Based Solutions in territories through the co-construction of dialogue and studies between scientists and stakeholders

Keywords: Nature-based solutions, NBS, program, SOLU-BIOD, transformative, France

10. Carbon Farming for Climate Change Mitigation and Ecosystem Services – Potentials and Influencing Factors

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Unprecedented challenges imposed by climate change force the agricultural sector to increase its resilience to more frequent and more severe weather extremes. At the same time, agriculture itself must contribute to climate change mitigation. Carbon Farming (CF) is a possible nature-based solution that links climate mitigation to climate adaptation while providing multiple additional Ecosystem Services (ES). However, both the climate change mitigation potential and the ES supply provided by CF measures depend on site-specific and measure-specific factors, which implies uncertainty about the outcome of CF implementation. In addition, most CF measures compete with agricultural crop production in a temporal or spatial manner, which ultimately hinders adoption of CF measures by farmers.

In this talk, we elaborate on the CF measures (1) cover cropping, (2) integration of legumes/perennials into crop rotations, (3) short rotation coppice, (4) silvoarable



agroforestry, (5) afforestation of marginal agricultural land, and (6) partial rewetting of cropland on drained organic soils, highlighting their climate change mitigation potential as well as their impacts on the supply of ES, alongside with factors influencing the magnitude and direction of those impacts.

We further present a concept for mapping effects of CF measures based on site-specific demand for ES as well as opportunity costs, that can be used to identify locations where CF implementation can be expected to yield a high beneficial effect.

Keywords: agriculture, carbon farming, carbon dioxide removal, co-benefits, trade-offs

11. Parco Italia. A project to extend, connect, protect and enhance the network of natural areas in Italy.

First authors(s): Stefano Boeri


Presenting author: Livia Shamir

Other author(s): Marco Marchetti, Fabio Salbitano, Giorgio Vacchiano, Simone Marchetti, Sofia Paoli, Luis Pimentel

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Parco Italia is a national afforestation and reforestation program in urban, peri-urban, and rural areas, aiming to gradually establish a national ecological network by connecting protected areas, national and regional parks, and Natura 2000 sites through restoration interventions along hiking and cycling paths. With the systematic establishment and development of trails such as the Sentiero Italia, promoted by the Italian Alpine Club, and the walking routes promoted by the Italian Touring Club, along with the expansion of buffer zones around the routes and protected natural areas, the semi-abandoned villages in the Inner areas could become outposts throughout the territory for the monitoring and sustainable management of forests. At the same time, through slow mobility and ecotourism, they could become a driver for local economies. To narrow down potential intervention areas, priority afforestation areas have been identified through a national mapping to determine where the restoration of natural ecosystems is most urgent and where Ecosystem Services could have a bigger impact on the local population. A multi-criteria analysis was used to quantify environmental challenges that forest plantations may contribute to address, both in cities (focused on services such as air temperature cooling, mitigation of air pollution, and recreational potential) and in semi-natural areas (focused e.g., on improving ecological connectivity, mitigating hydrogeologic hazards, or restoring riparian corridors). Each criterion has been quantified and scored, providing a first indicator of the places with the most urgent needs for tree planting. The feasibility of tree plantation projects also takes into account social, economic, legislative, or stakeholder-related



constraints. Finally, a bottom-up approach is used to complete the top-down assessment, by taking into account and trying to reconcile the needs and preferences of all local stakeholders, in terms of recreation, traditional uses, and cultural significance of the landscape, coexistence with agricultural or other economic activities.

Keywords: natural areas, parks, urbanism, ecology, ecological corridors, green and blue infrastructures

12. Nature-based Solutions – an operational framework for implementation

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Nature-based Solutions (NbS) have been developed by the International Union for the Conservation of Nature (IUCN) and its Commission on Ecosystem Management as definitional and operational framework for addressing major societal challenges.

NbS are actions to protect, manage and restore natural or modified ecosystems, which address societal challenges, effectively and adaptively, providing human well-being and biodiversity benefits. NbS were designed to address multiple interrelated societal challenges, such as climate change, disaster risk, biodiversity loss and ecosystem degradation, as well as ensuring food security, water security, social and economic and human health.

The NbS definition and their eight principles, served as the basis for developing the Global Standard on NbS, which, with its eight criteria and 28 indicators, can help diverse stakeholders to set a common basis of understanding for what NbS are; and provide a robust framework, to design, implement, assess, adapt and improve NbS interventions.

This first presentation will serve as an introduction to the IUCN/CEM work on NbS to the ES community, and it will set the scene for all following presentations. The ES tools and science used in the following (case) studies can strengthen NbS interventions, while they are incorporated into their planning, implementation and assessment. Improved NbS can better address societal challenges and play a major role in driving transformative change.

Keywords: Nature based-Solutions, Global Standard for NbS, Societal challenges



13. Nature-based Solutions – an operational framework for implementation

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In the past few years, Nature-based Solutions (NbS) arose worldwide to address a full range of societal challenges, while increasing ecosystems' resilience, guaranteeing the provision of ecosystem services (ES), and benefiting biodiversity. An innovative approach linking NbS and ES to enhance the resilience of ecosystems and biodiversity, while addressing several societal challenges, was tested through ALICE project (<https://project-alice.com>). ALICE primary goal was to promote NbS implementation and identify its benefits to ES delivery and biodiversity conservation across Atlantic landscapes. The project co-produce, with key stakeholders, a framework design for the development and implementation of NbS at the watershed scale. The Global Standard for NbS was used in the River Paiva watershed, Portugal, to assess the 8 criteria and indicators in the implementation of NbS intervention in the field. This was an essential step, to upscale scale and increase the impact of the NbS intervention, prevent negative outcomes or misuse, and help policymakers and other stakeholders to assess and adaptively improve the interventions' effectiveness.

A participatory approach with stakeholders at local, regional and national levels in promoting inter-institutional and multi-disciplinary coordination, was fundamental to maximize the NbS' impacts at policy level and strengthen decision-making. The link between NbS and ES can offer an innovative management approach by and for communities that require collaborative, participatory, and multilevel governance across sectors and procedures. This provides an opportunity to better integrate the agendas of climate action, disaster risk reduction, and biodiversity conservation into a coherent and holistic approach.

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Keywords: Ecosystem Services, Nature based Solutions, Atlantic Landscapes, Integrated Landscape Management; IUCN Global Standard for NbS

BOOK OF ABSTRACTS

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I. SESSION DESCRIPTION

ID: T13c

Nature-based solutions with societal nexus as a key for transformative change

Hosts:

	Name	Organisation	E-mail
Host:	Diana Dushkova	Helmholtz Centre for Environmental Research – UFZ, Leipzig, Germany	diana.dushkova@ufz.de
Co-host(s):	Dagmar Haase	Humboldt Universität zu Berlin, Germany; Helmholtz Centre for Environmental Research – UFZ, Leipzig, Germany	dagmar.haase@ufz.de

Abstract:

Ecosystem services provisioning undergoes change as ecosystems undergo transformation due to climate change, urbanization, land use intensification as well as technogenic pollution and disruption. It results in ecosystem fragmentation, the introduction of invasive species, and the expansion of managed land uses into natural ecosystems. Recognizing that the situation is expected to deteriorate and acknowledging that nature is the foundation of human and other life forms' existence and well-being, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and the Intergovernmental Panel on Climate Change (IPCC) call for proactive, transformative actions to meet both national and international objectives for biodiversity, climate, and sustainable development by 2030 and beyond. As outlined by IPBES in 2019, transformative change refers to a comprehensive restructuring that encompasses technological, economic, and social dimensions. This reorganization involves a shift in paradigms, objectives, and values, aiming to ensure the conservation and sustainable use of ecosystems and their biodiversity, enhance human quality of life, and promote sustainable development. The growing number of studies emphasized that ecosystems, biodiversity and climate are deeply intertwined, underlying the need for a unified approach to address the



interdependent crises of biodiversity loss and climate change. In this regard, the role of Nature-Based Solutions (NBS) in addressing the twin biodiversity and climate crises by providing multiple co-benefits is broadly recognized in both scientific discourse and policy. This is demonstrated by the variety of NBS-related projects supported by the EC Research and Innovation programs. Still, their capacity but also existing trade-offs and conflicts for driving transformative change have yet to be fully investigated.

In this session, we will explore:


- the role(s) of NBS and nature-based adaptation in transformative change,
- successful strategies and examples illustrating the significance of nature-based actions in addressing climate challenges,
- approaches to ensuring climate actions do not harm biodiversity and ecosystem services,
- NBS approaches that combine climate action, biodiversity support and social justice,
- mechanisms fostering sustainable and biodiversity-friendly outcomes for small and large-scale transformative change, and,
- the involvement of decision-makers, stakeholders, and the general public in advancing the dialogue on biodiversity and climate action under fair conditions.

We are inviting scientists, practitioners, decision-makers, and representatives of citizen groups to attend this session and share their experiences by presenting frameworks, conceptual approaches, implementation strategies, social innovations, etc., to collaboratively identify crucial next steps to promoting transformative change for nature.

Goals and objectives of the session:

With this session, we are aiming to address the following questions:

- How NBS and nature-based adaptation can contribute to transformative change?
- What are the successful strategies/practice examples that demonstrate the importance of action for nature in tackling climate challenges?
- How to achieve that climate actions will avoid negative impacts on biodiversity and ecosystem services?
- What are the mechanisms that support more sustainable and biodiversity-friendly outcomes that drive transformative change on both small and large scale?
- What role in this regard play decision-makers and stakeholders from all groups/sectors, especially those seeking active dialogue on biodiversity within their respective domains,



as well as the general public to guarantee social fairness when it comes to NBS implementation?

Planned output / Deliverables:

We are planning to organize a Special Issue in one of the peer-reviewed academic journals or a blog chain in The Nature of Cities (TNOC) based on the selected papers from the session.

Session format:

As we are planning to organize our session in form of speed talks and long joint talk (5 min, and joint discussion), we would most probably need 1,5–2 h (10 min intro, approx. 1 h of speed talks consisting of in total 15 short presentations, 20–30 min discussion)

II. SESSION PROGRAM

Room: Success Avenue 1

Date of session: 19th of November 2024

Time of session: 11:00 – 12:30 & 14:00 – 15:30 & 16:00 – 18:00

Timetable Speakers

Part 1: NBS integrated within BGI and sustainable practices (11:00–12:30)

- 1) **Introduction to the Session:** *Diana Dushkova, Dagmar Haase*. Nature-based solutions with societal nexus as a key for transformative change
- 2) *KOUSHIK CHOWDHURY*. Blue infrastructure as nature-based solutions for urban sustainability: Evaluating local perceptions from four Indian megacities
- 3) *Solen Le Clec'h*. Nature-based Solutions in agriculture: A strategy to transform the sector
- 4) *Maisam Rafiee*. Mapping Critical Zones of Societal Challenges: A Case Study in Kabul City
- 5) *Max López-Maciel*. Understanding the adoption of nature-based solutions in urban environments: insights from the diffusion-of-innovation theory
- 6) *Claudia Parenti*. Urban transformation through phytoremediation for healthier soil and land management. The case of Milan Metropolitan area

Subpart 2: Co-creating NBS for transformative change (14:00–15:30)

- 7) *Chengcheng Feng*. The Role of Resident Practices in Urban Soil Management and Ecosystem Service Enhancement: A Case Study of Wageningen
- 8) *Siobhan McQuaid*. Progress towards Nature Positive: national and global initiatives led from Ireland



- 9) *Diana Dushkova, Olga Ivlieva*. From informing to empowerment: levels of co-creation and roles of stakeholders in development and implementation of nature-based solutions
- 10) *Gerd Lupp*. Co-creating transformative NBS for inclusive communities – Insights from the EU project TRANS-lighthouses
- 11) *Gerd Lupp*. Co-creation and Co-Governance of Nature-based solutions
- 12) *Ina Sieber*. Building Resilient Coastal Communities through Nature-based Solutions and Empowerment Tools

Subpart 3: Integrating NBS in Policy, Planning and Governance processes for transformative change (16:00–18:00)

- 13) *Andrea Benedini*. Nature-based solutions for pluvial flood adaptation: the role of spatial planning to support transformative change
- 14) *Anastasia Konstantinova*. Towards Sustainable Urban Ecosystems: Planning and Management Transformation in Russia
- 15) *Roy Remme*. Aligning urban nature-based solutions with ecosystem services for transformative change
- 16) *Sabrina Lai*. Strengthening regional resilience in urban and regional planning through nature-based solutions: focus on nutrient retention
- 17) *Marek Hekrlé*. Unlocking the Benefits of Nature-Based Solutions: Economic Assessments and Policy Innovations
- 18) *Mina Di Marino*. Nature-based solutions to climate change adaptation in urban areas: a Norwegian planning perspective
- 19) *Anna Marín-Puig*. Unpacking the transformative potential of NbS: A focus on vulnerability and justice

Discussion – chairs + presenters + participants (15–20 min)



III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Nature-based solutions for pluvial flood adaptation: the role of spatial planning to support transformative change

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In recent years, climate changes have increasingly impacted pluvial flooding occurring in our cities. In this context, flood risk management has become a priority for urban planning agendas. There is also a growing advocacy towards a paradigm shift from conventional interventions to nature-based solutions. This has raised awareness of the need for new planning strategies, processes and tools for managing flood risks. Nonetheless, there are very limited studies focusing on how to operationalize the paradigm shift into practice. This research aims to explore emerging planning approaches to flood risk management by conducting a comparative analysis between the two cities of Copenhagen and Oslo. Both cities are indeed vulnerable to pluvial flooding, and they have committed to adopting nature-based solutions to flood risk management. A mixed-method approach was used in this study, consisting of content analysis of municipal policies and planning strategies, interviews with key decision-makers from different city departments, and spatial analysis. The main findings show that, on the one hand, Copenhagen has developed a comprehensive and structural plan that includes more than 300 nature-based interventions, which are being built by public and private stakeholders. On the other hand, Oslo has approved an action plan, the goals of which are primarily to develop knowledge on urban pluvial flooding, as well as provide regulations and guidance for private developers. These two approaches have produced different mechanisms leading to the transformation of the cities (both at small and large scales). Copenhagen has adopted a systematic approach to transform consolidated areas, while Oslo has supported the implementation of nature-based solutions in the transforming city. The study discusses the legislative, financial, policy, and planning limitations and opportunities found in the two cities. There is a further need for the development of adaptive approaches and inter-departmental collaboration to contribute to transformative changes in cities.

Keywords: Urban flooding, Flood risk, Resilience thinking, Climate adaptation, Cloudburst



2. Blue infrastructure as nature-based solutions for urban sustainability: Evaluating local perceptions from four Indian megacities

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Blue infrastructure delivers multiple economic, social and ecological benefits to the residents of the city which can enhance their ability to urban sustainability challenges. However, scientific evidence linking traditional forms of blue infrastructure as nature-based solutions to urban sustainability challenges and in particular localisation of the urban sustainability is limited. Using the perceptions from the 616 urban dwellers in four Indian megacity, this paper used a quantitative methodology to demonstrate how blue infrastructure can be seen as nature-based solutions that can help to mitigate urban sustainability challenges. In doing so this paper used descriptive statistics, spearman correlation and binary logistic regression to analyse the data. Our result showed that nature-based solutions provide multiple ecosystem services to the urban residents with regulating services and biodiversity are prominent. Both neglected and well-maintained nature-based solutions demonstrated significant for urban sustainability but they contribute differently. The socio-cultural characterises of the respondents significantly influence their opinion on the significance of nature-based solutions in urban sustainability. The information presented in this paper will be of interest to practitioners, researchers, and policymakers working to promote nature-based solutions and urban sustainability in developing countries, as well as those interested in restoration of urban blue infrastructure as a strategy for advancing the transformative change in the process of urban development.

Keywords: Nature-based solutions, Urban sustainability, Blue infrastructure, Ecosystem services, India.



3. Nature-based Solutions in agriculture: A strategy to transform the sector

First author(s): Solen Le Clec'h

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Transformational change is required to respond to the Anthropocene polycrisis (WEF, 2023). The agricultural sector relies on ecosystems that provide several ecosystem services (ES), while significantly impacting them. Nature-based solutions (NbS) tailored for farming systems have emerged as promising contributions to solving several societal issues. Working within the H2020 MERLIN project, we focus on restoring freshwater ecosystem functions following the IUCN global standard for NbS (2022). We aimed to support the transformation of the European agricultural sector by developing a strategy for the sector to mainstream NbS, using a transformation framework (Carmen et al., under review). The strategy would support field measures (e.g., soil management); farm measures (e.g., smart buffer strips) to catchment measures (e.g., wetlands or flood plain reconnections). The strategy combined a literature review, stakeholder analysis, interviews, and two sectoral round tables with key stakeholders from the European agricultural sector. The strategy offers a vision of the agricultural sector where NbS are part of regular farming practices and enable resilient, productive, and sustainable farming systems that are interconnected. Farmers are recognized and valued by society as providers of multiple ES, resolving several societal issues, at several spatial levels. The strategy relies on six key actions that need to be urgently taken to transform the sector:

- 1) Engaging and assisting farmers to adopt NbSs;
- 2) Increasing society's understanding & support;
- 3) Improving policy and regulatory frameworks;
- 4) Setting up a network of local NbS coordinators;
- 5) Accelerating relevant innovations; and
- 6) Creating financing mechanisms that reward NbS.

These actions require the involvement of many stakeholders groups, beyond farmers and their representatives, e.g. finance institutions, media and policy makers. Recent political events



illustrate that transformations are often resisted, due to vested interests and concern that working with nature will perpetuate uneven allocation of costs and benefits within the agro-food system.

Keywords: Agriculture, Nature-based Solutions, transformation framework, freshwater, multi-scale.

4. From informing to empowerment: levels of co-creation and roles of stakeholders in development and implementation of nature-based solutions

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Nature-based solutions (NBS) are increasingly acknowledged as a systematic, cost-effective and locally-adapted approach that utilizes natural systems and community engagement to address a range of societal challenges. Integrated into blue-green infrastructure, NBS incorporate natural elements and processes into both urban and rural areas through tailored, resource-efficient interventions, thereby enhancing sustainability and resilience of socio-ecological systems. By providing examples from RECONNECT* and EmpowerUs** projects, this research examines the transformative potential of NBS and illustrates their significance in tackling triple planetary crisis (climate change, pollution, and biodiversity loss). Along with assessing the effects of NBS in transformative change (e.g. through demonstrating successful strategies and models of NBS), it also focuses on the roles of stakeholders in these processes and the value of co-creation. In particular, we analyse different levels of co-creation used within the NBS co-development and co-implementation processes, starting from stakeholder informing, going through involvement and engagement and reaching empowerment. We present the frameworks for co-monitoring and co-evaluation of NBS impact from the sustainability perspective (to assess the environmental, social, and economic benefits delivered by NBS) as well as provide conceptual approaches and tools to empower stakeholders to become the drivers of sustainability transformations.

Keywords: Nature-based solutions, sustainability transformation, co-creation, stakeholder engagement, community empowerment



5. The Role of Resident Practices in Urban Soil Management and Ecosystem Service Enhancement: A Case Study of Wageningen

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Urbanization increases worldwide, and in the Netherlands, urban areas are projected to cover more than 17% of the territory by 2040. Development of urban ecosystems coincides with constructing Technosols – man-made soils in which “properties and functions are dominated by technical human activity”. The choice of Technosols’ materials, design and management may be crucial for the delivery of ecosystem services and shall be considered to support sustainable development of urban green infrastructures.

A considerable part of urban soils is located in private urban green spaces and is managed by residents, whose soil literacy and maintenance preferences strongly influence soil quality and determine Technosols’ functionality. Therefore, understanding relationships between the soil literacy, personal preferences in green spaces’ maintenance and resulting urban soils’ quality and functions is essential for enhancing the ecosystem services provided by urban green infrastructures.

This study focuses on Wageningen, known as the "City of Life Sciences," as a case study. We conducted a comprehensive questionnaire to examine the green space management practices of Wageningen residents, including aspects such as soil condition and management strategies. The survey aimed to create a group profile of the residents and assess their soil literacy. Besides, interviews with different stakeholders (soil experts, product suppliers, etc) were conducted to understand the current and potential role of soils in sustainable development of urban green infrastructures, the ecosystem services they can provide and indicators to be used for the ecosystem services’ assessment and monitoring.

By analysing the management practices and their effects on soil quality, this study provided insights into the role of residents in maintaining and improving urban soils. The research outcomes will help to identify better practices in soil management to optimize ecosystem services in urban environments, contributing to broader applications in other urban settings and enhancing our understanding of sustainable urban soil management.



Keywords: Urban soils; ecosystem services; urban green space

6. Towards Sustainable Urban Ecosystems: Planning and Management Transformation in Russia

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An application of ecosystem services (ES) and nature-based solutions (NBS) frameworks in decision-making is essential for sustainable urban development. It meets objectives for biodiversity conservation and sustainable use of ecosystems, as well as humans' quality of life and well-being enhancing. This is also true in Russia, where the rich knowledge base on urban ecosystems borders challenges of their implementation into policy and practice, specifics for the urban environment management drastically differ between the cities and decision-making rarely involves different stakeholders. The presented experience of five years of research aimed at supporting decision-making in sustainable urban development in the context of global environmental change includes important steps in assessing and analyzing the social aspects of planning and management of urban blue-green infrastructure (UBGI). For this purpose, various approaches were used including participatory practices and methods (surveys, interviews, document analyses, observations) in different cities of Russia, such as Moscow, Yekaterinburg, Rostov-on-Don, Apatity, St. Petersburg. These studies were aimed at (1) assessing nature values for residents and identifying needs for improving UBGI; (2) understanding the current state of ES and NBS implementation in practice and policy; (3) analyzing of practices in decision-making; (4) developing approaches for sustainable planning of UBGI and translation of the ES concept into environmental governance; (5) engaging various stakeholders in projects on UBGI sustainable development. The analyzes of the obtained experience gives a view on diverse limitations in ecosystem management that exist at different levels including strategic (the lack of regulatory specification of ES and NBS; the lack of public demand and the conflict of interests among stakeholders), conceptual (the lack of methodologies for assessing ES; uninformed stakeholders) and tactical (the lack of guidelines and practical experiences) levels. Addressing these challenges could advance transformative change in the sustainable use of ecosystems in Russia.



Keywords: ecosystem services, sustainable urban development, ecosystem management, participatory approaches, decision-making

7. Strengthening regional resilience in urban and regional planning through nature-based solutions: focus on nutrient retention.

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Nature-based solutions (NbS) are deliberate, strategic, evidence-based interventions that mimic, utilize, or are inspired by natural processes to address societal challenges. They are scientifically designed to emphasize the incorporation of biodiversity, ecosystem services, and sustainable resource management to promote environmental, social, and economic benefits. While NbS have been around in the literature for over fifteen years, only in the last ten years have studies on NbS and urban or regional planning started to emerge. However, only a few concern wetlands, conceived of as NbS that help addressing flood control and disaster mitigation, wastewater management, and nutrient retention. The latter aspects are especially crucial in effectively supporting regional and urban circular economies: by enabling water reuse, the consumption of fresh water is minimized, which contributes to climate adaptation.

In this study, the significance of NbS for nutrient retention is explored by coupling scientific and grey literature review with case-study analysis. A taxonomical classification of NbS to address nutrient retention is hence derived, including, for instance, constructed wetlands, natural wetlands or ponds, riverine buffers, vegetated buffer strips. For each element in the taxonomy, the main features are then outlined, including the most appropriate scale and management level, advantages and limitations, overview of the ecosystem services provided, hence highlighting co-benefits and the multifunctional character of the NbS.

The taxonomical classification here developed serves as a valuable tool for guiding planning decisions aimed at supporting circularity in water management and enhancing the environmental resilience of both urban areas and regions.

The study is developed within the project “e-INS” (Project Code ECS0000038), funded by the European Union – NextGenerationEU through the National Recovery and Resilience Plan (NRRP), Mission 4 Component 2 Investment 1.5 – Call for tender no. 3277 issued by the Italian Ministry of University and Research (MUR).



Keywords: Nature-based solutions, NbS, nutrient regulation, urban and regional resilience

8. Co-creating transformative NBS for inclusive communities – Insights from the EU project TRANS-lighthouses

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Nature-based solutions (NBS) bring together solutions and approaches to simultaneously provide environmental, social and economic benefits towards more sustainable communities. However, there is a lack further scientific evidence especially on the expected socio-cultural benefits and how indirect drivers such as not well conducted participation processes impact a proper and successful implementation. This often hinders that NBS unveil their full potentials and hindering processes to gain momentum or the uptake of NBS in a broader scale.

The EU-funded project TRANS-lighthouses (TRL) aims to unlearn, rethink and reframe the main components of NBS and their co-creation processes to achieve better, more social and more ecologically just NBS. Based on the TRL conceptual framework, we look at the four dimensions (1) transformative participatory governance, (2) enabling new human-nature relations, (3) rethinking economic logics shaping NBS and (4) social aspects. Reviewing literature and the OPPLA project data banks, gaps were identified especially when considering how to successfully create more inclusive co-creation processes and evaluating NBS performance from a community perspective. Together with pilot cases co-creating NBS, evidence is created, best practice as well as lessons learned are drawn from more mature assessment cases sharing their experiences.

We will provide insights in our most recent ongoing work compiling sets of indicators for NBS by critically reflecting and reviewing existing collections such as handbooks especially in terms of socio-ecological analysis along the four dimensions of the TRL conceptual framework. Looking at the reviewed indicators in handbooks and literature, most of them cover technical aspects on NBS, are mainly expert-driven and only a few of them consider socio-ecological aspects and do not take stakeholder perspectives into account. In detail, in several cases scales and how to measure them are missing or difficult to employ in the context co-monitoring.



Keywords: Nature-based solutions, Transformation, Co-Creation, Justice, Human-Nature Relations

9. Co-Creation and Co-Governance of Nature-based solutions

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Successful implementation of Nature-based solutions (NBS) and their social acceptance depend on stakeholder engagement from the very beginning of the co-creation processes. Analysing different EU funded sibling NBS projects following Living Lab approaches, two ways help to structure and guide co-creation processes: Co-Creation Stages/Phases or Building Blocks.

Looking at the different projects, five key co-creation stages or phases can be identified – (1) co-diagnostic, (2) co-design, (3) co-implementation, (4) co-evaluation/ monitoring and (5) co-amplification/ replication. All analysed projects had systematic approaches to identify and map stakeholders to activate co-creation processes. For the co-design phase, similar key principles, guidelines of participatory design models and approaches have proved to be useful. One element is good communication for informing, involving and empowering through sharing knowledge. Governance network typologies and actors' constellations support understanding and guiding towards new governance networks. For the participatory assessment and evaluation of NBS benefits, a number of often similar methodologies and tools were most useful.

While stages support to develop the different phases of the co-creation process of NBS, Building Blocks provide an overview of the different dimensions of co-creation processes. co-creation processes build on a number of Blocks from different categories:

(1) Founding principles blocks are the basis for the co-creation process.

(2) Stakeholder engagement blocks ensure outreach beyond the usual suspect including those who are often neglected or marginalized.



(3) Context specific building blocks are essential to successfully engage stakeholders.

(4) Inclusive approaches to encourage stakeholders to bring their skills to create added value and multiple benefits to NBS.

The understanding of building blocks is useful to reflect upon and plan the co-creation processes before initiating them highlighting important dimensions to be considered. The building blocks approach can support the identification of complementarities and contradictions, common grounds and is an alternative approach for inclusive co-creation process.

Keywords: Nature-based solutions, co-creation, co-governance, building blocks, co-creation phases

10. Unlocking the Benefits of Nature-Based Solutions: Economic Assessments and Policy Innovations

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Nature-based solutions (NBS) have become an integral part of most climate change adaptation strategies. Although the positive effects of a single small-scale NBS are often uncertain, NBS as a whole are generally associated with a wide range of societal benefits. However, implementation of NBS providing sponge function faces numerous barriers, including uncertainties, lack of funding, ownership issues, low awareness of benefits, lack of owner motivation, and spatial differentiation between the implementation site and the areas where benefits are realized (e.g., upstream-downstream relationships in flood risk reduction).

While subsidies are being used to enhance the provision of NBS benefits, supporting tools and policy instruments need to be developed to overcome other barriers. One effective approach is to use economic assessments to establish the economic case for NBS and address the unequal distribution of costs and benefits among different stakeholders (residents, owners, farmers,



decision-makers, etc.). Considering both the positive and negative impacts (in terms of ecosystem services and costs) can help allocate resources efficiently to NBS that combine climate change adaptation, biodiversity support, and social justice. Developing and testing such innovative policy instruments and governance frameworks is one of the main aims of the Horizon Europe project SpongeBoost (2024–2027).

Using the economic assessment of three NBS-supported sponge functions implemented in urban and rural areas, it is possible to demonstrate the wide range of benefits and their beneficiaries. In addition to promoting biodiversity and developing public areas, many exclusively private benefits can also be identified. Based on this, recommendations can be made on how to involve more actors in implementing NBS to drive the transformative change.

Keywords: Awareness, barriers, decision-making, nature-based governance, wetlands

11. Nature-based solutions to climate change adaptation in urban areas: a Norwegian planning perspective

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Over the last decade, scholars and policy makers have recognized the Nature-Based Solutions (NBS) as key-tools to challenge climate change mitigation and adaption. Despite the rise and active promotion of NBS in the international and local debates, relatively little is known about what has been effectively done (and not yet done) at the different levels of governance and planning. The main outcomes of this study refer to research conducted by an interdisciplinary group of experts on climate, water and ground water management, urban planning and laws – from NIVA, the Norwegian Institute for Water Research and the Norwegian University of Life Sciences, commissioned by the Norwegian Environment Agency (Miljødirektoratet). The study first focuses on the challenges in implementing NBS in planning, and secondly, the main outcomes from the four selected municipalities of Trondheim (in central Norway), Stavanger (in south-western Norway), Indre Østfold (in south-eastern Norway) and Bodø (in northern Norway) are presented. Document analysis and five focus groups/interviews with the municipal managers (experts on urban planning, climate, environment and water security) were conducted. This study shows that the municipalities have acknowledged the relevance and



need for NBS to tackle the climate changes. A variety of NBS have been identified that contribute to ecosystem restoration, habitat, flood protection and water retention, as well as soil restoration and heat regulation. Nonetheless, other tools and concepts, such as blue–green factor, blue–green structure and ecological compensations, are currently used for integrating climate change adaptation in the municipalities. There are still barriers for implementing NBS (e.g. understanding of the concept itself among practitioners and local private actors and the use of other notions adopted in earlier plans). The study contributes to the current debate on the implementation and upscaling of NBS to further address climate, biodiversity, water and health issues among decision–makers, citizens and practitioners.

Keywords: Nature–Based Solutions, climate changes, practitioners, decision–makers, planning challenges

12. Unpacking the transformative potential of NbS: A focus on vulnerability and justice

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Achieving human adaptation, reducing inequality, and meeting biodiversity goals require societal transformative change, as emphasized in the latest IPES (2019) and IPCC (2022) reports. Nature–based Solutions (NbS) are increasingly recognized as transformative responses to global policy challenges. While some efforts have been made to conceptualise the transformative potential of NbS, less attention has been given to approaches that address the systemic issues underlying vulnerability. This paper presents a conceptual framework based on extensive literature on social vulnerability to climate change adaptation and the justice aspects of ecosystem services. By approaching NbS from context–specific vulnerability perspectives, the framework aims to enhance societal transformative response capacities, incorporate diverse values and knowledge systems, and ensure justice in the upscaling process of NbS.

Keywords: Transformative adaptation, NbS, Vulnerability, Justice, Upscalin



13. Building Resilient Coastal Communities through Nature-based Solutions and Empowerment Tools

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To face escalating coastal challenges from climate change and anthropogenic pressures, there is an urgent need for Nature-based Solutions (NbS) to drive transformative change in coastal social-ecological systems. NbS development offers a promising pathway, particularly when involving and empowering local communities. Responding to a request from the Horizon Europe ‘EmpowerUs’ project, an Expert Working Group facilitated by Eklipse—a knowledge brokerage mechanism bridging the biodiversity science-policy gap in Europe—explored how NbS can empower coastal communities and foster social-ecological resilience. The EWG conducted a Rapid Evidence Assessment on NbS and so-called Empowerment Tools (ET) applications in European coastlines, including the United Kingdom, EU Outermost Regions, Overseas Countries and Territories, and other OECD states, assessing their role in enhancing empowerment and coastal resilience.

The study highlights the critical nexus between coastal resilience, NbS, and empowerment frameworks. Key results indicate that NbS projects incorporating participatory approaches are more successful in tackling challenges related to social justice, human health, and economic development. However, standardized approaches to measure participation and empowerment outcomes are lacking in the literature. We categorize six distinct groups of ET—Education Tools, Knowledge Tools, Platform/Dialogue Tools, Governance Tools, Co-creation Tools, and Community-led NbS—showcasing their effectiveness in empowering coastal communities. Community-led NbS, designed with engagement and knowledge co-creation processes, act as powerful ET, fostering ownership and sustainable environmental management.

The study underscores the need for systemic approaches, multi-level governance, and consideration of socio-cultural diversity to improve NbS effectiveness and enable social-ecological resilience. We also provide recommendations for researchers and policymakers, such as increasing longitudinal studies to monitor intervention outcomes and funding community-based NbS initiatives, emphasizing adaptive pathways and collaborative governance. These insights offer a valuable resource for planning future NbS projects and coastal Living Labs,



contributing to the broader objective of achieving transformative change for biodiversity, climate, and sustainable development.

Keywords: Nature-based Solutions, Empowerment, Resilience, Europe, Coastal Communities

14. Developing Landscape Metrics for Mapping Societal Challenges: Application to the Kabul Region

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Cities and metropolitan regions face numerous societal challenges that require detailed landscape analysis to support sustainable spatial planning. Nature-based solutions (NBS) represent a cost-effective approach for addressing several of these societal challenges.

This research aims to develop and implement a systematic approach using spatial indicators and landscape metrics to map and prioritize societal challenges in metropolitan regions. The objectives are to identify key issues, assess their spatial distribution, and provide actionable insights for urban planning. Insights on mapping societal challenges are so far rare, especially in the Global South. This study focuses on the Kabul Region (KR), selected due to its rapid urbanization, diverse socio-economic challenges, and limited existing research on urban issues.

The research design involves a systematic approach of literature review, assessment, metric development, mapping, and validation. Firstly, key NBS publications and frameworks identified through snowball analysis are reviewed to assess societal challenges for their feasibility of being addressed through NBS and their relevance to KR. Secondly, landscape metrics and spatial indicators are developed through a targeted literature review. Thirdly, societal challenges are mapped using selected indicators and landscape metrics in KR, involving spatial multi-criteria analysis to weight and combine each indicator's impact, identifying hotspots and cold spots. Finally, findings are validated through Focus Group Discussions (FGD) with community experts.



The results focus on the case study application in the KR, which includes the development of detailed priority maps highlighting areas for intervention. These maps identify specific hotspots and cold spots of societal challenges, providing a clear spatial distribution of issues that need addressing.

This approach enhances decision-making for sustainable development and resource allocation, providing a replicable model for other metropolitan areas to promote urban resilience and sustainability.

Keywords: Landscape metrics, Mapping, Societal challenges, Spatial analysis, Urban planning

15. Aligning urban nature-based solutions with ecosystem services for transformative change


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In an increasingly urbanized world, the concepts of ecosystem services and nature-based solutions are crucial for tackling critical challenges, such as climate change, public health risks, and biodiversity loss. Nature-based solutions and ecosystem services can serve as foundations for creating transformative change that empowers both humans and non-human species. However, ambiguity in definitions and in the relationship between ecosystem services and nature-based solutions complicates comprehensive research efforts as well as their effective application in policy and planning in urban systems. We present a framework to clarify and explicitly relate the two concepts, enhancing their applicability in the management of urban challenges. We explore the role nature-based solutions play alongside social and technological solutions to aid integrative approaches to different types of challenges. Within the framework, addressing urban challenges serves as the starting point for the development and implementation of nature-based solutions. Nature-based solutions alter the flows of ecosystem services that are produced by an ecosystem by altering the performance of the ecosystem or by changing how people engage with the ecosystem. This results both in changes in the target ecosystem services, as well as non-targeted ecosystem services, leading to benefits. Using two illustrative case studies, we show how the framework can be applied to two urban challenges that are expected to increase in intensity in cities across the world: stormwater management



and urban heat stress. Moreover, we highlight key research topics that will benefit from more integrated use of nature-based solutions and ecosystem services. The framework helps emphasize co-benefits, and can be used to help make co-benefits and multifunctionality explicit in urban decision-making and planning processes – aspects that are indispensable for much needed transformations in and around cities.

Keywords: Framework, solution space, cities, social-ecological-technological interaction, biodiversity

16. Understanding the adoption of nature-based solutions in urban environments: insights from the diffusion-of-innovation theory


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The implementation of Nature-Based Solutions (NBS) in urban areas presents significant potential for addressing environmental challenges such as climate change, biodiversity loss, and urban resilience. However, their adoption is often limited by various barriers that can be understood through the lens of Everett Rogers' Diffusion of Innovation (DOI) theory. DOI theory outlines the stages through which innovations are adopted within a social system, categorizing adopters into innovators, early adopters, early majority, late majority, and laggards. By examining these stages, we aim to understand the factors influencing the adoption of NBS, such as innovation characteristics, communication channels, time, and the social system involved. Through DOI theory, we can relate NBS as "innovations" and point the stages for adoption: from initial awareness and understanding (knowledge stage) to forming attitudes and evaluations (persuasion stage), making decisions to adopt (decision stage), implementing NBS in urban settings (implementation stage), and reinforcing adoption decisions based on outcomes (confirmation stage). The theory's application can clarify factors influencing NBS adoption, including innovation characteristics (relative advantage, compatibility, complexity, triability and observability of NBS), communication channels, and the socio-technical contexts of urban environments. The objective of this study is to review empirical insights from previous studies to disentangle through the DOI concepts the actual knowledge, information, and perceptions among potential adopters of NBS. Results underscore the importance of enhancing profit benefits, reducing risk, and improving ease and convenience of installation to significantly



boost green roof adoption rates. These insights can be relevant for urban planners and policymakers aiming to promote sustainable urban development and urban resilience. Future research could explore alternative adoption frameworks to analyse adoption dynamics of NBS complementary to the use of the DOI theory.

Keywords: Nature-based solutions, Adoption, Diffusion, Innovations

17. Progress towards Nature Positive: national and global initiatives led from Ireland

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Presenting Author: Siobhan McQuaid

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In this paper we describe two inter-connected projects, working towards nature positive from different perspectives.

The first is built around financing mechanisms for nature restoration at farm level. Through the BiOrbic SFI funded research project (working name ReFarm), the Trinity College Dublin research team is inviting businesses based in Ireland to play a role in financing action for nature restoration at farm level. The research builds on existing successful projects working with farmers (particularly in High Nature Value farming, or HNVf, systems), and natural capital accounting, to help build simple, effective governance structures to deliver and monitor outcomes, as well as ensure effective, timely payments to farmers (for habitat quality and actions to restore habitats). Aligned with other initiatives in Ireland (such as public finance under CAP programmes), the work also aims to support sustainable livelihoods in rural areas. This addresses a number of actions highlighted in the Irish National Biodiversity Action Plan, specifically in relation to exploring ways to combine private and public finance to fund national targets for climate, water and biodiversity action, as well as Just Transition.

The second is taking a global perspective. Go Nature Positive! is a collaborative initiative backed by the European Commission dedicated to accelerating awareness and transformative action towards a nature-positive economy among policymakers, investors, businesses, and wider society. The partners – led by Trinity College Dublin, and including global collaborators / pilots studies of Nature-based Enterprises – have come together to address key systemic challenges



through research, demonstration and transformational leadership. The first output of Go Nature Positive! will be the delivery of a clear EC definition and conceptual framework for the nature-positive economy (NPE). Research will consider valuable existing knowledge from business and insights from other initiatives. Through collaboration the project aims to build pathways and partnerships towards an inclusive nature-positive economy.

Keywords: Nature Positive economy, restoration, payments for habitat quality and ecosystem services, finance for nature

18. Urban transformation through phytoremediation for healthier soil and land management. The case of Milan Metropolitan area

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Contemporary urban systems face the challenge of regenerating a relevant number of areas whose soil health has been compromised by anthropogenic activity. These spaces range from significant dismissed industrial areas to small vacant or agricultural polluted plots, which need remediation to be reintegrated. Urban regeneration and remediation are intertwined processes, primarily market-driven, often resulting in interventions in the more profitable areas and further abandonment of less economically appealing sites.

Reclaiming urban soil conditions is challenging due to the high costs of traditional remediation methods and the bureaucratic complexity. This calls for a more accessible approach to regeneration. In the context of extended biodiversity loss, restoring soils has become a primary area of investigation and intervention. This urgency is reflected in the political actions of national and communitarian bodies, as evidenced by soil management and restoration strategies.

This contribution explores the application feasibility of phytoremediation in Milano's metropolitan context. It develops a methodology to identify suitable sites for this technique, which uses plants to treat soil contamination and contributes to increasing the city's natural capital and urban green spaces. Phytoremediation, as a nature-based solution, offers a more environmentally friendly alternative to traditional reclamation while providing ecosystem



services that improve urban quality by enhancing urban biodiversity, reducing pollution, and improving habitat health.

The research creates guidelines to help decision-makers and public administration identify areas suitable for this remediation approach. This involves mapping abandoned, degraded, and potentially contaminated urban areas that could benefit from phytoremediation intervention. The study also assesses the feasibility of implementing Phyto techniques, prioritizing the polluted sites included in the ecological network or the urban green provision, and develops practical instructions for designing phytoremediation projects in these areas. This new approach has the potential to significantly influence urban development, offering a sustainable solution to the pressing issue of soil restoration.

Keywords: Phytoremediation, contaminated soils, soil restoration, nature-based solutions

BOOK OF ABSTRACTS

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- III. ABSTRACTS

I. SESSION DESCRIPTION

ID: T13d

Can minimum requirements for Nature-based solutions support the implementation and reduce risks of greenwashing in EU marine and coastal environments?

Hosts:

	Name	Organisation	E-mail
Host:	Christian Riisager-Simonsen	Technical University of Denmark, National Institute of Aquatic Resources	chrii@aqua.dtu.dk
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Abstract:

In recent years, Nature-Based Solutions (NbS) have emerged as tools to foster sustainable development and addressing social, economic and environmental challenges simultaneously, due to their delivery of various ecosystem services. Despite their promise, uncertainties in their scope, effectiveness, and access to finance hinder their widespread deployment.

In the context of marine and coastal ecosystems, the implementation of NbS faces additional complexities due to diverse stakeholder perceptions, varying interpretations of the concept, and potential risks of coming into conflict with different policies. This is further enhanced by a lack of relevant implementation standards, which leaves NbS vulnerable to misuse and greenwashing allegations. To address these challenges, the Horizon project TRANSEATION aims to develop environmental minimum requirements for marine and coastal NbS. These requirements will provide much-needed clarity and guidance to stakeholders involved in NbS implementation from consultancies to investors. To advance this work, this 'Solution forum' invites participants at ESP



to help identify how anticipated impacts or trade-offs between on ecosystem services from NbS should be documented at a minimum at different project phases, to reduce the risk of greenwashing and guide deployment.

The aim will be to outline a paper on “how to account for ecosystem services in different project phases of marine and coastal NbS deployment”.

The project will set the scene by providing the first insights from previous expert workshops, interviews, literature reviews, and policy analysis on the development of environmental standards and minimum criteria, enabling participants to understand how the requirements might be used in the future. The workshop will end, with next steps, including how the draft requirements will feed into future work on building rating systems for marine and coastal structures.

Goals and objectives of the session:

Identify what the main risks are for poor implementation of proposed NbS in marine and coastal contexts at different project phases

Identify what would be relevant minimum requirements for ES accounting in projects related to the deployment of marine and coastal NbS at different project phases

Identify what the relevant and realistic level of ES impact documentation would be for different actors at different project phases (i.e. planning, construction, operation, decommissioning).

Planned output / Deliverables:

Paper submitted to the journal ‘Nature-Based Solutions (Elsevier)’ with the tentative title: How to account for ecosystem services in different project phases when deploying marine and coastal NbS

II. SESSION PROGRAM


Room: Expert Street 7

Date of session: 18th of November 2024

Time of session: 11:00–12:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
10	Christian	Riisager-Simonsen	DTU Aqua	Intro to session, its aims and expected outcomes



Time	First name	Surname	Organization	Title of presentation
		What are the risks for poor implementation of proposed NbS		
5	Christian	Riisager-Simonsen	DTU Aqua	What drives the implementation of proposed marine NbS
10	Johanna	Schumacher	IOW	Lessons from the systems approach, examples of risks
30			Group work	Risks at different project phases
		Minimum requirements as a potential solution – but which?		
10	Christian	Riisager-Simonsen,	DTU Aqua	The TRANSEATION project's hunt for relevant minimum requirements for marine and coastal NbS
10	Louise C.	Flensborg	DTU Aqua	What can we learn from a systematic literature review
10	Christian	Riisager-Simonsen,	DTU Aqua	What do the stakeholders think preliminary results from a systematic stakeholder engagement process
45			Group work	What minimum requirements for ES accounting at different project phases could be relevant when deploying NbS?
15	<i>Christian</i>	<i>Riisager-Simonsen,</i>	<i>DTU Aqua</i>	Next steps – for the TRANSEATION project and the outlined position paper
	<i>Christian</i>	<i>Riisager-Simonsen,</i>	<i>DTU Aqua</i>	Final wrap to be or not be a NbS online survey



III. ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Minimum requirements for Nature-based solutions in EU marine and coastal environments

First author(s): Christian Riisager-Simonsen

Other author(s): Louise C. Flensburg, Johanna Schumacher

Affiliation: Technical University of Denmark, DTU Aqua

Contact: loufl@aqua.dtu.dk

In recent years, Nature-Based Solutions (NbS) have emerged as tools to foster sustainable development and addressing social, economic and environmental challenges simultaneously, due to their delivery of various ecosystem services. Despite their promise, uncertainties in their scope, effectiveness, and access to finance hinder their widespread deployment. In the context of marine and coastal ecosystems, the implementation of NbS faces additional complexities due to diverse stakeholder perceptions, varying interpretations of the concept, and potential risks of coming into conflict with different policies. This is further enhanced by a lack of relevant implementation standards, which leaves NbS vulnerable to misuse and greenwashing allegations. To address these challenges, the Horizon project TRANSEATION aims to develop environmental minimum requirements for marine and coastal NbS. These requirements will provide much-needed clarity and guidance to stakeholders involved in NbS implementation from consultancies to investors. To advance this work, this 'Solution forum' and presentation invites participants at ESP to help identify how anticipated impacts or trade-offs between on ecosystem services from NbS should be documented at a minimum at different project phases, to reduce the risk of greenwashing and guide deployment. The project will set the scene by providing the first insights from previous expert workshops, interviews, literature reviews, and policy analysis on the development of environmental standards and minimum criteria, enabling participants to understand how the requirements might be used in the future. The workshop will end, with next steps, including how the draft requirements will feed into future work on building rating systems for marine and coastal structures.

Keywords: Nature Based solutions, Standards, Sustainability, Marine and coastal structures

BOOK OF ABSTRACTS

- I. SESSION DESCRIPTION
- II. SESSION PROGRAM
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I. SESSION DESCRIPTION

ID: T17a

Natural Capital Accounting in economy and finance

Hosts:


	Name	Organisation	E-mail
Host:	Alessandra La Notte	Senior Consultant at European Dynamics	alessandra.la-notte@ext.ec.europa.eu
	Domenico Pisani	European Commission Joint Research Centre	domenico.pisani@ec.europa.eu
Co-host(s):	Ioanna Grammatikopoulou	European Commission Joint Research Centre	ioanna.grammatikopoulou@ec.europa.eu

Abstract:

The structure of integrated accounting systems enables to connect ecosystem services accounts to the economic accounts used by economists and financial analysts in their tools and models. The importance of ecosystem services in Sustainable Finance is gaining momentum and the possibility to integrate ecosystem services into general equilibrium models is becoming a concrete possibility. The purpose of this session is collect experiences, initiatives or simply ideas to integrate ecosystem services accounts into economy and finance and start setting the ground to map in a consistent way the pillars that bridge ecosystems to socio-economic systems through services.

Goals and objectives of the session:

This session welcomes contributes on initiatives, applications and research proposals on how to connect ecosystem services accounting to economic and financial models and tools. The contributions could be both theoretical and empirical.



At the moment in fact there is a lot of interest on how to insert ecosystem into economic policies and financial analyses but there is a total lack of clarity on how to effectively do it.

Based on the contributions that will populate this session, we hope to set up a well-structured discussion and eventually identify the pillars that mark this learning path.

Planned output / Deliverables:

If the session will collect a meaningful number of contributions, the following options can be considered:

To write a JRC Technical Report (as an example, check previous publication <https://publications.jrc.ec.europa.eu/repository/handle/JRC123667>)

To propose a special issue (as an example, check previous collection https://oneecosystem.pensoft.net/topical_collection/94/)

Session format:

Standard session (presentations)

II. SESSION PROGRAM

Room: Success Avenue 1

Date of session: 18th of November 2024

Time of session: 11:00 – 12:30

Timetable speakers

Time	Name	Surname	Organization	Title of presentation
10:00 – 10:05	Domenico	Pisani	European Commission Joint Research Centre (EC JRC)	Introduction to the session
	Alessandra	La Notte	Consultant on Natural Capital Accounting	
10:05– 10:15	Johannes	Förster	Helmholtz Centre for Environmental Research – UFZ	Synergies and differences between national and corporate reporting of biodiversity and ecosystem services – a comparison of UN SEEA EA and CSRD
10:15– 10:25	Kätlin	Aun	Statistics Estonia	Options to determine ecosystem contribution in the valuation of timber and crop provisioning ecosystem services



Time	Name	Surname	Organization	Title of presentation
10:25– 10:35	Domenico	Pisani	European Commission Joint Research Centre (EC JRC)	Ecosystem services in a simple macroeconomic framework
10:35– 10:45	Hanna	Fiegenbaum	Leipzig University– IMISE	Integrating resilience into nature–based carbon credits
10:45– 10:52	Domenico	Pisani	First round of questions	
10:52– 11:02	Josselin	Roman	European Commission Joint Research Centre (EC JRC)	Ecosystem services in a simple macroeconomic framework
11:02– 11:12	Alessandra	La Notte	Consultant on Natural Capital Accounting	The assessment of nature–related risks: from ecosystem services vulnerability to economic exposure and financial disclosures
11:12– 11:22	Francesco	Sica	Università La Sapienza di Roma	The assessment of nature–related risks: from ecosystem services vulnerability to economic exposure and financial disclosures
11:22– 11:30	Domenico	Pisani	Second round of questions and conclusions	



III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Synergies and differences between national and corporate reporting of biodiversity and ecosystem services – a comparison of UN SEEA EA and CSRD


Presenting author: Johannes Förster^a (johannes.foerster@ufz.de)

Other authors: Athanasios Sassalos^a, Karsten Grunewald^b, Sophie Meier^b, Bernd Hansjürgens^a, Tobias M. Wildner^a

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^b Leibniz Institute of Ecological Urban and Regional Development (IOER), Weberplatz 1, D–01217 Dresden, Germany

Since 2024, the Corporate Sustainability Reporting Directive (CSRD) requests large companies to assess and report on material impacts and dependencies on biodiversity and ecosystem services following the requirements defined by the European Sustainability Reporting Standard (ESRS) for Biodiversity and Ecosystems. We assessed whether national reporting in accordance with the United Nations System of Environmental–Economic Accounting – Ecosystem Accounting (UN SEEA EA) can provide information that is relevant for CSRD reporting of corporates. Thereby, we used the national reporting in Germany as a case study and compared it with CSRD requirements. The CSRD requires companies to assess, if their activities have material impacts and dependencies on biodiversity and ecosystems. If this is the case, companies have to disclose information on both their potential and actual impacts and dependencies on biodiversity and ecosystems. The assessment of actual impacts and dependencies requires the use of measured data from within a company. In contrast, the assessment of potential impacts and dependencies can make use of other information available on biodiversity and ecosystem services at the location of a company. This raises the question, whether information from national reporting based on UN SEEA EA can be used by corporates for CSRD reporting. As information from national reporting is statistically robust and officially recognised, such data could also be beneficial for the transparency, quality assurance and comparability of corporate sustainability reporting. Furthermore, corporate sustainability reporting could also provide insights into the interlinkages of the economy and nature across major economic sectors. Ideally such information will help to identify potential risks and opportunities and inform decision making both within companies and at national level. This work is part of the Bio–Mo–D Project with Value Balancing Alliance (VBA) acting as partner for



piloting approaches for including biodiversity and ecosystem services into corporate accounting and decision making (<https://bio-mo-d.ioer.info/en>).

Keywords: ecosystem accounting, corporate reporting, biodiversity

2. Options to determine ecosystem contribution in the valuation of timber and crop provisioning ecosystem services

Presenting author: Kätlin Auna (katlin.aun@stat.ee)

Other authors: Kaia Orasa, Üllas Ehrlich^b, Grete Luukas^a

^a Statistics Estonia, Tatari 51, 10134 Tallinn, Estonia

^b Tallinn University of Technology, Ehitajate tee 5, 19086 Tallinn, Estonia

With the approval of the ecosystem accounting as a statistical concept (and partly also as a standard), a need for a new stream of statistical literacy has appeared. The purpose of the ecosystem services account is to connect ecosystem services to the economic accounts used by economists and financial analysts in their tools and models. For the integration of ecosystem accounting to SNA common framework described in SEEA EA should be developed further. The definitions, valuation methods, semantics and communication are important as the concept of ecosystem accounting is new and the knowledge on methods and how to use the information is not yet widespread. The paper addresses parallel methods for the assessment of the ecosystem service of crop provision and timber provision ecosystem services. Different methods express ecosystem contribution to the service in various degrees. Similarities and differences are discussed and the communication issues regarding the results of the alternative approaches for given ecosystem services are described and links to expected users and applications are considered. The selection of the valuation methods for ecosystem services are based on the suggestions outlined in UN SEEA EA and Guidance Notes on accounting for ecosystem services by Eurostat relevant to the implementation of the regulation of European environmental economic accounting. The work is based on efforts carried out in the framework of Eurostat grants "Development of the land account and valuation of ecosystem services regarding grassland ecosystem" (831254-2018-EE-ECOSYSTEMS), "Development of the ecosystem accounts" (881542-2019-ENVECO), "Development of the environmental accounts" (101022852-2020-EE-ENVACC) and "Development of the forestry, environmental subsidies and ecosystem accounts" (101113157-2022-EE-EDG).

Keywords: ecosystem services, valuation, ecosystem contribution, crop provision, timber provision



3. European SMEs' Exposure to Ecosystems and Natural Hazards: A First Exploration

Presenting author: Domenico Pisania^a (domenico.pisani@ec.europa.eu)

Other authors: Serena Fatica^a, Dominik Hirschbühl^a, Ioanna Grammatikopoulou^a, Alessandra La Notte^b

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^b International Consultant on Natural Capital Accounting, Milano, Italy

Nature-related financial risks have emerged as critical concerns for policymakers and financial actors. Central to this issue are ecosystem services, which play an integral role in various production processes but may be interrupted due to the degradation of nature. This article delves into the vulnerability of European SMEs by combining firm-level exposures to ecosystem service dependencies with regional information on the relative abundance of ecosystem services provisioning and the risk of natural hazards. Focusing on long-term debt positions to gauge financial stability implications, the results reveal moderate nature risks for European SMEs at the current stance but also highlight a possible concentration of risks and a need to further refine the use of available indicators.

Keywords: ecosystem services; natural capital; nature degradation; physical risks; environmental risks; ENCORE; risk management; SMEs

4. Integrating resilience into nature-based carbon credits

Presenting author: Hanna Fiegenbaum^a (hanna.fiegenbaum@gmail.com; hanna.fiegenbaum@uni-leipzig.de)

^a Leipzig University IMISE, Institut für Medizinische Informatik, Statistik und Epidemiologie, Härtelstraße 16–18, 04107 Leipzig, Germany

Total Economic Valuation (TEV) offers a comprehensive approach to valuing the benefits derived from nature by considering both use and non-use values (Costanza et al., 1997; Pearce & Moran, 1994). Although the Nature's Contributions to People (NCP) approach to valuation (Díaz et al., 2018; Pascual et al., 2017) moves beyond the dichotomy of instrumental versus intrinsic valuations of nature by incorporating broader value perspectives (Pascual et al., 2023; IPBES, 2022), in the context of natural capital accounting and nature or climate finance, the valuation of ecosystem services still tends to dominate (e.g. Brander et al., 2024). It primarily operates by valuing individual ecosystem services and aggregating their values. In the academic literature,



approaches have been suggested that aim to account for interdependencies of ecosystem services and for higher-order services such as resilience or maintenance (Laurila-Pant et al., 2015; Kumar, 2012; Admiraal et al., 2013; Quaas et al., 2019). However, this integration is often absent in financing instruments such as nature-based carbon credits from forestry (Balmford & Swinfield, 2023) due in part to their commodification mechanisms. Beyond influencing investment and land management choices, this can not only lead to undervaluation but also result in incomplete de-risking strategies. The presentation aims to explore and encourage the incorporation of resilience and adaptation into nature-based carbon credits and their de-risking strategies.

Keywords: nature-based carbon credits, nature-based climate solutions, biodiversity resilience value, biodiversity insurance value

5. Ecosystem services in a simple macroeconomic framework

Presenting Author: Josselin Roman^a (josselin.roman@ec.europa.eu)

Other Authors: Bjorn Dohring^b, Ioanna Grammatikopoulou^a, Alessandra La Notte^c, Beatrice Pataracchia^a, Domenico Pisania^a, Christophe Planas^a, Alessandro Rossi^a, Anna Thum-Thysen^a, Mayra Zurbaran Nucci^a

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Economic activity is exerting increasing pressure on natural ecosystems while it depends at the same time on the provision of the services that these ecosystems provide. In this paper, we build on the conceptualisation of ecosystem services in line with the statistical framework developed by the United Nations namely the System of Environmental Economics Accounting Ecosystem Accounting (SEEA EA). We use a simple aggregate production function augmented with the direct and indirect contribution of ecosystem services to illustrate the dependence of economic activity in EU Member States on forest ecosystem assets. Simulating the degradation of ecosystems 25 and 60 years ahead, we show that the negative impact on economic activity in the EU could be sizeable. This is particularly so when we assume that fixed capital and labour cannot easily substitute for the loss of forest assets. While our analysis is limited to one type of ecosystem and our quantification purely illustrative, our framework serves as a proof of concept for tools that could usefully inform macroeconomic policy decisions for the medium-term.

Keywords: Forest ecosystem services, natural capital, potential output



6. The assessment of nature-related risks: from ecosystem services vulnerability to economic exposure and financial disclosures

Presenting author: Alessandra La Notte^a (alelanotte@gmail.com)

Other authors: Alexandra Marques^b, Marco Petracco^c, Maria Luisa Pracchini^c, Mayra Zurbaran-Nucci^c, Ioanna Grammatikopoulou^c, Marialuisa Tamborra^c

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Nature-related risks can lead to financial losses. The connection between ecosystems and socioeconomic systems is complex and multifaceted. Ecosystem services are the ecological processes that serve human needs. The degree to which a specific ecological process fails to meet specific human needs could be a useful metric able to ground the cascade of risks to which companies, governments, financial institutions can be exposed. Linking the ecosystem services dimension and the risk dimension is the first step in building a framework that introduces ecosystems into sustainable finance. The growing need to factor nature into financial and business decisions prompted the formation of a Taskforce on Nature-related Financial Disclosures, meant to develop a risk management and disclosure framework to report and eventually act on nature-related risks and opportunities. This paper describes how to use the Integrated system for Natural Capital Accounts to measure and account for ecosystem vulnerability, which constitutes the first component of nature-related risk. Based on ecosystem vulnerability accounts, it is possible to also assess sectoral exposure to risk. Ecosystem vulnerability accounts could represent a valuable source of information for the TNFD, enabling it to assess impacts and dependencies. A case study of the agricultural sector in Europe is presented.

Keywords: nature-related risk; ecosystem accounting; natural capital accounting; ecosystem services vulnerability; financial disclosures

7. Using remote sensing to manage the economic value of urban natural capital: Gross Forestry Product appraisal through the night lights data

Presenting author: Francesco Sica^a (francesco.sica@uniroma1.it)

^a Sapienza University, 00196 Rome, Italy



The purpose of this study is to discover evidence and a more direct approach for determining the total economic value of ecosystems to be included in the decision-making process that drives cities' richness equipment. The competition between city's natural and economic assets is investigated, and economic-environmental accounting criteria are identified to move beyond the Gross Domestic Product (GDP) towards the Gross Ecosystem Product (GEP). A remote sensing accounting approach is examined through the night-time light data as proxy for city productivity and environmental quality. As the ecosystem of interest is selected to take into consideration the urban forest. In order to estimate the Gross Forestry Product (GFP) pertained the urban landscape, the correlation between the spatial extent of urban forests ecosystem, socioeconomic indicators of yearly GDP and the night light sources measured by satellite inside the set of 22 megacities is examined. Data on night-time light intensity is provided by the night-time light product, which serves as a stand-in for information on tree canopy cover ($R^2=0.76$) and urban profitability ($R^2=0.71$) spatial distribution. The correlation analysis validates the feasibility of employing GDP and nocturnal data to describe the richness of cities under the economic and ecosystem perspective. The difference between GDP values computed with and without night-time light data embodies the total economic value of the urban ecosystems, in this case the Gross Forestry Product, as a 1997 study by Sutton and Costanza widely demonstrated with concern the implementation of the night-time light data to capture the intangible wealth of cities. The suggested study calls into question the standard interpretation of urban wealth moving economic assessments towards ecosystems' economic relevance. The night-time lights proves to be a good proxy for megacity economic GEP, making it an innovative instrument for models of economic growth and ecosystem services footprint in urban landscape.

Keywords: Natural capital; economic value; Gross Ecosystem Product; night light data

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: T17b


Advancing the role of ecosystem accounting in urban areas, fine-scale applications, and impact assessments

Hosts:

	Name	Organisation	E-mail
Host:	Trond SIMENSEN	Norwegian Institute for Nature Research	trond.simensen@nina.no
	Javier BABÍ ALMENAR	Politecnico di Milano	javier.babialmenar@polimi.it
Co-host(s):	Bálint CZÚCZ	Norwegian Institute for Nature Research	balint.czucz@nina.no
	Graciela M. RUSCH	Norwegian Institute for Nature Research	graciela.rusch@nina.no
	Chiara CORTINOVIS	University of Trento	chiara.cortinovis@unitn.it
	Davide GENELETTI	University of Trento	davide.geneletti@unitn.it
	David N. BARTON	Norwegian Institute for Nature Research	david.barton@nina.no
	Maria KORKOU	Norwegian Institute for Nature Research	maria.korkou@nina.no
	Renato CASAGRANDE	Politecnico di Milano	renato.casagrandi@polimi.it

Abstract:

There is growing research and policy interest in developing standardized ecosystem accounts, moving beyond ad-hoc mapping and assessment of ecosystems and their services. The adopted United Nations System of Environmental Economic Accounting – Ecosystem Accounting (SEEA-EA) provides a consistent accounting framework which ensures certain level of standardization while enabling flexibility to accommodate accounts at various spatial levels and decision-making contexts. While SEEA-EA is a valuable tool for consistently monitoring changes in ecosystems,



their rules and principles still need further testing and adjustment, particularly in highly modified ecosystems and systems that require high resolution data to capture the relevant features for accounting, such as urban ecosystems, agroecosystems, site-specific environmental impact assessment projects, and municipal planning.

This session will focus on two core topics:

1. The application of ecosystem accounting to highly modified ecosystems, such as urban ecosystems and agroecosystems.
2. The integration of ecosystem accounting into existing environmental policies, Environmental Impact Assessment (EIA) and territorial planning, especially for fine-scale applications.

The session will build on recent experiences of hosts studying the advancement of ecosystem accounts for urban ecosystems, and their application to inform site-specific projects and municipal plans.

For example, urban ecosystem accounts may play a key role in tracking net restoration targets of the Nature Restoration Law for cities and towns, as well as in biodiversity offsetting and no-net-loss objectives. Additionally, the amendment of the Directive on environmental accounts suggests using urban ecosystem accounts to track changes in temperature and humidity regulation services in urban areas.

In terms of fine-scale applications, ecosystem accounting can provide a comprehensive socio-ecological overview, expanding beyond current practices in impact assessments and planning that typically focus on rare, threatened or endangered nature. Also, ecosystem services are often targeted in EIAs, but there is currently no standardized methodology for their assessment. For example, the socio-ecological impacts of infrastructure development projects can be analyzed more comprehensively within an accounting context.

In this session, we will encourage discussions by both researchers and practitioners on:

- Conceptual, methodological, or practical advancements in urban ecosystem accounting and other highly modified ecosystems.
- The suitability of ecosystem accounting for environmental impact assessment and territorial planning, including land-use priority setting and specific projects.

Contributions can range from specific case study applications and ecosystem accounting pilots to conceptual contributions and analyses of challenges and opportunities for ecosystem accounting applications at the local level, including their potential to support policy design and decision-making.



Goals and objectives of the session:

The overall aim of this session is to discuss conceptual, methodological, and operational advances in applying ecosystem accounting to fine-scale applications and urban ecosystems in Europe. The session is open to research-oriented and practitioner-oriented studies, as well as work developed collaboratively among researchers, practitioners, and public institutions.

A practical goal is to bring together professionals who are tackling issues that arise when applying SEEA EA to fine-scale applications and developing urban ecosystem accounts at local, regional or national levels. To support this, a panel discussion and open debate will be held at the end of the session, and the possibility of creating a new ESP sub-group will be discussed with speakers and attendees.

Of particular interest to this session are studies focused on the following key themes:

1. Framework integration, technological advancements, and policy impact/relevance.
2. Applications of ecosystem accounting to urban and regional planning, and land-use allocation including housing, recreation, industry, mining, transport infrastructure, energy infrastructure development, and priority setting of restoration and nature conservation areas.
3. Assessment of proposed development projects and expected landscape changes using ecosystem accounting (ecosystem extent accounts, indicators of ecosystem condition, and ecosystem services).
4. Local or regional ecosystem accounts for urban ecosystems and their specific policy and planning applications at municipal, metropolitan, or regional level.
5. Conceptual and operational aspects of SEEA EA when applied to urban ecosystems to ensure ecological robustness and policy/planning value.
6. New methods or approaches for compiling specific accounts (extent, condition, ecosystem services, monetary ecosystem assets) in urban ecosystem accounting.
7. The development of urban biodiversity accounts, such as those starting to be compiled for other ecosystems.

The session welcomes any research or practical work on ecosystem accounting applied to fine-scale applications and highly modified ecosystems beyond the listed topics.

Planned output / Deliverables:

Potential outputs of this session, depending on the number and type of contributions collected, will include:

1. A special issue or thematic volume in a peer-reviewed journal featuring studies presented during the session and welcoming other relevant studies.
2. The organization of an ESP thematic working sub-group focused on applying ecosystem accounting to fine-scale applications and urban ecosystems.

II. SESSION PROGRAM


Room: Expert Street 6

Date of session: 19th of November 2024

Time of session: 11:00–12:30 & 14:00–15:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
11:00 11:06	Hosts & co-Hosts of Session T17b		–	Introduction to the Session
11:06 11:18	Javier	Babí Almenar	Politecnico di Milano NBFC	Thematic urban ecosystem accounts: challenges, lessons and ways forward.
11:18 11:30	Trond	Simensen	Norwegian Institute for Nature Research	A Comparative Review of Project-Level Ecosystem Accounting Methodologies.
11:30 11:42	Bart	Immerzeel	Norwegian Institute for Nature Research	Zooming in on ecosystem accounting: a gap analysis of INCA-Tool's suitability for local and regional decision-support.
11:42 11:54	Lori	Giagnacovo	VITO	Dynamic fine-scale habitat mapping to facilitate ecosystem extent accounting and biodiversity monitoring.
11:54 12:06	Giulia	Capotorti	Sapienza University of Rome	Current opportunities and challenges for urban ecosystem typification and assessment in Italy.
12:06 12:18	Jonathan	Reith	Federal Statistical Office of Germany	Assessing Urban Ecosystems in Germany: Extent, Condition, and Services.
12:18 12:30	Victor Javier	Colino Rabanal	University of Salamanca	Quantifying the Economic Value of Ecosystem Services in Vineyards of Castilla y León, Spain: A Logic Chain Methodology.
12:30 14:00	LUNCH BREAK			
14:00 14:12	Bálint	Czúcz	Norwegian Institute for Nature Research	The dependence of urban microclimate regulation on ecosystem characteristics – a qualitative evidence synthesis.
	Marton	Kiss	University of Szeged	



Time	First name	Surname	Organization	Title of presentation
14:12 14:24	Mattias	Gaglio	University of Ferrara	Wetland type matters: evaluating distinct sets of ecosystem services for reliable ecosystem accountings.
14:24 14:36	Graciela	Rusch	Norwegian Institute for Nature Research	Biodiversity and ecosystem services in performance standards that evaluate impacts of infrastructure development projects.
14:36 14:48	Maria	Korkou	Norwegian Institute for Nature Research	Policy and Planning Relevance of Oslo's City's Biodiversity Index.
14:48 15:00	Arron	Wilde-Tippett	Norwegian University of Science and Technology	Ecosystem accounting: pathways for impacting municipal spatial planning in Norway.
15:00 15:30	PANEL DISCUSSION & OPEN DEBATE			
-	Informal Discussion about the potential creation of an ESP sub-group (After the Session – Location & Time to be decided)			

III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Dynamic fine-scale habitat mapping to facilitate ecosystem extent accounting and biodiversity monitoring

First author(s): Marcel Buchhorn


Presenting author(s): Lori Giagnacovo

Other author(s): Bruno Smets, Bert de Roo, Tim Jacobs

Affiliation: VITO

Contact: marcel.buchhorn@vito.be

The United Nations Statistical Commission standard on the SEEA Ecosystem Accounting and the Convention of Biodiversity Global Biodiversity Framework (GBF) requires ecosystem extent maps as a base to derive accounts and indicators. VITO has developed a unique method of creating ecosystem extent accounts for Europe based on detailed EUNIS habitat maps. The habitat mapping method comprises a complex hierarchical workflow with many input features among LiDAR, climate and soil data, and optical satellite data, and requires field-validated geolocations linked to accurate EUNIS classifications. Once the database contains sufficient training data for



all EUNIS classes, this method could be upscaled to create a global wall-to-wall habitat map, which will be explored in the upcoming ESA WEED (World Ecosystem Extent Dynamics) project. Although the habitat maps are an intermediate product in the extent accounting, they contain important information when it comes to landscape planning since the habitats (in comparison to ecosystem extents) can be linked to a Red List status that indicates their need for conservation or restoration. Besides, yearly habitat maps raise possibility of change detection and eventually also scenario analysis.

Keywords: SEEA-EA, habitat mapping, ecosystem extent, Integrated Natural Capital Accounting, landscape planning

2. Wetland type matters: evaluating distinct sets of ecosystem services for reliable ecosystem accountings

First author(s): Mattias Gaglio

Other author(s): Mattias Gaglio, Mattia Lanzoni, Fabio Vincenzi, Giuseppe Cstadelli

Affiliation: Department of Environmental and Prevention Sciences, University of Ferrara, Italy

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Following the launch of the System of Environmental–Economic Accounting – Ecosystem Accounting (SEEA-EA) by the United Nations in 2021, ecosystem accounting has become a prevalent means of incorporating natural capital value into policymaking processes. Nevertheless, the reliability of such a tool depends on the accuracy and reliability of data at the level of individual ecosystems. This aspect is of particular importance when applied to deltaic environments, where aquatic ecosystems provide different and distinct bundles of ecosystem services (ES).

The present study aims to evaluate the diverse sets of ES delivered by four transitional wetlands, representing the aquatic ecosystems of the Po delta (Italy), based on empirical data gathered from primary sources. The results demonstrate that wetlands exhibit considerable variation in their qualitative and quantitative values, contingent upon their specific uses, management practices, and ecological characteristics. Coastal, closed lagoons and saltworks are primarily utilized for provisioning and cultural ES with direct market value, while other ES are of lesser monetary significance. In contrast, the value of regulating ES (i.e. water regulation) is prevalent in the inner wetlands.



Although primarily utilized for productivity purposes, the wetlands of the Po Delta exhibit distinct sets of ES according to their specific features and differ in total ES value. By providing a detailed understanding of the ES provided by different wetland types, this study highlights the importance of tailored management practices to maximize the ecological and economic benefits of these critical ecosystems. The findings indicate a clear need for ecosystem-level studies in deltaic environments as a foundation for the scaling up of ecosystem accounting at regional and national levels.

Keywords: Ecosystem accounting, River deltas, SEEA-EA, Ecosystem-level studies, Wetlands

3. Zooming in on ecosystem accounting: a gap analysis of INCA-Tool's suitability for local and regional decision-support

First author(s): Bart Immerzeel


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The European Commission has proposed the introduction of national ecosystem accounts following SEEA EA guidelines, and standards are under development for the creation of ecosystem accounts by statistics bureaus at the EU member state level. At the same time, ecosystems are for a large part managed at lower administrative levels, and the creation of local ecosystem accounts can therefore be a useful decision-support tool. A potential opportunity exists in the regional and local application of ecosystem accounting methods currently developed for the national level. INCA-Tool is a flagship tool for ecosystem services accounting, currently under development at VITO and being tested for national accounting by statistical bureaus across Europe. Whether INCA-Tool can be useful as a tool for regional and local ecosystem accounting depends on how well it answers to decision maker's needs regarding reporting requirements, policy setting, spatial planning and impact analysis.

We present the results of an analysis of the relevance and practical usefulness of ecosystem services accounts created by INCA-Tool for the regional and local level in Norway. We present physical and monetary ecosystem service accounts for one county and three municipalities, and the results of a workshop in which we present and discuss these INCA-Tool outputs with county and municipal decision makers. This leads to a gap analysis based on the workshop results, showing the fit between decision maker needs and INCA-Tool's contents, temporal and spatial resolution, output formats, accessibility of data inputs, uncertainty in outputs, user-



friendliness, and compatibility with local and regional accounting, reporting and spatial planning systems. Finally, we suggest adaptations to INCA-Tool models, data inputs and outputs to better answer to local and regional decision-support needs.

Keywords: Ecosystem accounting, INCA-Tool, local decision-support, ecosystem service

4. Biodiversity and ecosystem services in performance standards that evaluate impacts of infrastructure development projects

First author(s): Graciela M. Rusch

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The importance of protecting biodiversity and ecosystem services has been repeatedly highlighted in recent assessments and new international obligations related to the Kunming-Montreal Agreement. At the same time, new infrastructure development, including from the energy sector, increasingly puts pressure on nature. An allocation of areas to renewable energy infrastructure implies a trade-off with other land-uses, including nature conservation and the protection of ecosystem services. These conflicting objectives places great demands on the processes for renewable energy development projects, and the private sector has an important role in making effective protection of nature an integral part of all planning and development of renewable energy.

Recently, considerable emphasis has been placed to revert trends of biodiversity and ecosystem functions loss. For the goals to be credible, the implementation should follow a systematic approach to quantify and manage impact. To this end, standards to help the private sector manage biodiversity impacts have been developed, among others, the IFC performance standard on “Biodiversity Conservation and Sustainable Management of Living Natural Resources” (PS 6), which has been specifically tailored toward the private sector operating in infrastructure development projects.

We first present an overview of the concepts embedded in the mitigation hierarchy; a decision-support tool often used in Environmental Impact Assessments (EIA), which assumes an assessment of the magnitude of impact on nature. We present the IFC PS 6 criteria to assess local impacts of infrastructure development projects and relate them to the mitigation hierarchy



using the example the Norwegian Nature Diversity Act and the national guidelines for EIAs. We finally identify gaps in how EIAs evaluate impacts on ecosystem services and discuss the potential of ecosystem accounting at the local level to bridge these gaps.

Keywords: EIA, Mitigation Hierarchy, Private sector, ecosystem accounting

5. A Comparative Review of Project-Level Ecosystem Accounting Methodologies

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Environmental impact assessments (EIAs) are currently the most central knowledge base for assessing the environmental consequences of development projects. However, EIAs have faced criticism for varying quality, legitimacy, and relevance in planning and permitting processes, and they are not tailored to cover emerging knowledge needs such as quantitative biodiversity offsetting or corporate sustainability reporting (CSR) Corporate Sustainability Reporting (CSR). Ecosystem accounting offers a novel framework for integrated cross-scale analysis of ecological, economic, and social impacts, but examples of project-level implementations and best practice guidelines are still limited. Improved planning methods and tools are needed to balance society's need for areas for development with ambitious goals for nature conservation, restoration, and no-net-loss land management.

In this study, we review 20 existing fine-scale, project-level ecosystem accounting tools and approaches from the temperate-boreal zone, with the aim of identifying relevant applications and areas of use. We assess key properties of the methods including thematic scope, data requirements, methodological complexity, and relevance to various purposes such as layout and alternative selection, application of the mitigation hierarchy, CSR, and quantification of net biodiversity loss or gain. We compare project-level ecosystem accounting approaches with EIA requirements by use of document studies, summary statistics and multivariate statistical analyses.



Results will reveal key properties of existing methods for fine-scale, project-level ecosystem accounting, assess how they relate and differ, how they compare to traditional tools such as EIAs, and how they meet novel requirements for CSR, as well as 'no net loss' / 'net gain' policies that implicitly rely on accounting concepts.

Based on our findings, we will highlight knowledge needs, suggest improved practices, and discuss implications for policy and decision-making.

Keywords: Ecosystem accounting , Environmental impact assessments, Corporate Sustainability Reporting

6. Ecosystem accounting: pathways for impacting municipal spatial planning in Norway

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The global loss of biodiversity and natural capital driven by land use change, is a risk for vital ecosystem services, such as air and water filtration, food provisioning, climate regulation and wellbeing. Ecosystem accounting (EA) is a framework for documenting ecosystem extent, condition and the goods and services which they produce. Questions remain about the way in which this new framework for organising data can be implemented and utilised in spatial planning. Research in planning support tools (PSTs) highlights an implementation gap due to a lack of understanding of decision makers' expectations as well as of the planning context. We draw on decision theory to understand how EA can contribute to zonal planning practice. We complement this with qualitative data from planning professionals to understand the divide between policy and practice. Systems engineering is then used to conceptualise the planning system and practice in Norway. In Norway, municipalities hold the authority over local planning through the Planning and Building Act (2008). We provide systems models of zonal planning, indicating how ecological data is utilised with the view of addressing gaps that can be filled by EA data. Finally, we propose a new theory to activate participation in planning through the use of framing of EA data.

Keywords: Ecosystem Accounting, Systems Engineering, Spatial Planning.





7. Thematic urban ecosystem accounts: challenges, lessons and ways forward.

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Ecosystem accounts can serve as a framework to monitor changes not only in natural ecosystems, but also in anthropogenic ones such as urban ecosystems. Urban ecosystems are both drivers of global and local biodiversity change, and the primary living spaces for humans. This makes urban ecosystem accounts a valuable tool for revealing trade-offs between multiple benefits and for informing diverse sets of policies at various spatial levels. Developing a global urban ecosystem accounting framework could also help enhance our understanding of urban ecosystems and their sustainable management. To introduce the topic of the session on “Advancing the application of ecosystem accounting to urban ecosystems”, we discuss the potential development of a global urban ecosystem accounting framework based on SEEA-EA thematic accounts. Moving from a review of the literature, we outline key challenges in thematic urban ecosystem accounting, and present potential solutions based on lessons and approaches gathered from past experiences. Our analysis shows that urban ecosystem accounts share challenges with accounts of most ecosystems. However, challenges related to ecosystem extent and condition accounts are mainly specific to urban or anthropogenic ecosystems. Various approaches have been used to define and classify urban ecosystems, but there is no global consensus in terms of delimitation and classification yet, at least from an accounting perspective. The analysis also highlights that policy uses of urban ecosystem accounts are varied but often unclear, with local policy push potentially lacking in part due to this issue. As a final reflection, we note that urban ecosystem challenges are interrelated, and some are dependent on each other. This reflection sets the stage for the ESP session, where current conceptual, methodological, and operational advances (and strategies) for addressing these challenges will be discussed.

Keywords: cities; natural capital; ecosystem services; urban sustainability; science for policy.



8. Current opportunities and challenges for urban ecosystem typification and assessment in Italy

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Current challenges for sustainable, resilient and safe urban ecosystems require integrated approaches, able to strength the science–policy interface [1]. Especially, current EU regulations, which include thematic accountings for urban ecosystems, devoted measures for nature restoration in cities, and the foreseen monitoring of soils under the Soil monitoring Law, call for the support of scientific research as regards the definition of i) viable urban boundaries, ii) urban ecosystem types and sub–types, iii) reference systems with proper and multi–responsive indicators and iv) baseline conditions.

In Italy, a country with an outstanding complexity for both natural setting [2] and settlement history and geography [3, 4], such challenges are similarly complex. The implementation process of the upcoming regulation on Ecosystem Accounting (SEEA–EA) was therefore started by building a broad and interdisciplinary working group, within which not only different institutions but also a number of scientists from the National Biodiversity Future Center (NBFC) are actively interacting. The interdisciplinary group represents an opportunity to compare and align different approaches for the definition, delimitation and assessment of urban ecosystem types and sub–types in Italy, with an active debate on the challenges already identified at the EU level and on those arising from national peculiarities (e.g. FUA vs LAU reference frameworks; DPSIR indicators for distinguishing sub–groups; structural, configurational and socio–economic condition indicators and respective baselines).

The wish is that outcomes from the work shall represent a benchmark for preparing the national restoration plan required by the recently approved EU Nature Restoration Law, especially as for articles 8 and 14.4, and, concurrently, a national–level urban ecosystem accounting pilot useful for other countries, especially from Mediterranean Europe.

[1] Vaidya, Chatterji, 2020. DOI: 10.1007/978–981–32–9927–6_12

[2] Blasi et al., 2018. DOI: 10.1080/11263504.2018.1492996



[3] Cimini et al., 2023. DOI: 10.3390/land12010155xxx

[4] Istat, 2017. Forme, livelli e dinamiche dell'urbanizzazione. ISBN: 978-88-458-1916-2

Keywords: interdisciplinary approach, urban ecosystem typification, condition assessment, SEEA-EA thematic accountings, Nature Restoration Law

9. The dependence of of urban microclimate regulation on ecosystem characteristics – a qualitative evidence synthesis

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Presenting author: Bálint Czúcz

Other author(s): Attila Novák, Ronald Kolcsár, Csenge Lékó-Kacsova, Bálint Czúcz

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Ecosystem characteristics and ecosystem services are both boundary objects with diverse (and often incompatible) interpretations and operationalisations in the different disciplines working with them. A good understanding of the relationships between ecosystem characteristics and services is necessary for the identification of ecosystem condition variables, which can support meaningful ecosystem management. Nevertheless, while there is a lot of primary research addressing relationships between particular ecosystem characteristics and services, the heterogeneity of basic concepts, indicators, and assessment methods make traditional quantitative (aggregative) synthesis methods challenging. Therefore, we explored the applicability of qualitative knowledge synthesis methods to assess the relationships between indicators of ecosystem condition and services. In this presentation, we present the first results of our work in the case of urban microclimate regulation. More concretely, we applied Critical Interpretive Synthesis, which can be characterised with an iterative approach in refining the research question, selecting from the literature and in making the synthesis. The pool of analysed papers was collected from Web of Science, and the set of search terms was optimised iteratively, with the help of preselected benchmark studies. Then a predefined set of information was collected from each paper (e.g. spatial scale of the analysis, cascade level of ES indicator, etc.). During the review we identified groups of similar indicators, methods, etc into "synthetic constructs", connecting them with "synthesising arguments" based on the studies reviewed. The research gaps we identified (e.g. developing and testing ES indicators, which have strong well-being relevance) can help the orientation of further analyses in the topic.



Keywords: ecosystem condition, urban ecosystems, condition indicators, qualitative methods, Critical Interpretive Synthesis

10. Policy and Planning Relevance of Oslo's City's Biodiversity Index

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Urban areas have rich biodiversity and play a crucial role in its conservation. Given that green spaces and natural areas support a variety of species and habitats, it is important to monitor the progress of biodiversity conservation through urban biodiversity accounts. The development of urban biodiversity accounts is similar to those initiated for other ecosystems.

This study aims to uncover the policy and planning relevance of the City Biodiversity Index. Using the Singapore Index framework, we assessed its applicability in urban planning and policy in Oslo, Norway. By employing the methods outlined in the Singapore Index guidelines, we evaluated a comprehensive range of 12 city-wide indicators that cover biodiversity and ecosystem services within the urban environment. Based on feedback from municipal planners, we adapted the Singapore Index for Oslo City. We evaluated its effectiveness as a tool to monitor the implementation of Oslo's new Biodiversity Action Plan. We conducted a mapping analysis to show the biodiversity indicators and illustrate the CBI in Oslo. Lastly, we further discussed the potentiality for integration with urban ecosystem accounting being developed in Oslo. The quantitative analyses found that Oslo scores 34 points (out of 48) on the City's Biodiversity Index. The municipal planners' feedback showcased the potentiality and usefulness of that measurement.

Overall, our study provides critical insights into integrating biodiversity into urban policy and planning.

Keywords: urban, ecosystem, Biodiversity Index, policy, spatial planning



11. Assessing Urban Ecosystems in Germany: Extent, Condition, and Services

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The German Ecosystem Accounts are based on the United Nations International Statistical Standard for Ecosystem Accounting (SEEA-EA) and the amended Regulation on Environmental Accounts by the European Union (691/2011). The Extent and Condition Accounts for Germany have already been published, and the accounting system shall be both standardized and consistent over time, yet adaptable to different ecosystems.

Urban ecosystems are crucial, as they are the most altered landscapes and hotspots of ecosystem services (ES) as most people live there and demand ES benefits. Based on the extent and condition of urban areas, the urban accounts allow for the calculation of the ES provided. The German approach is to use only the strictly urban areas (settlements and transport infrastructure) and therefore only apply the condition to these areas, thereby e.g. excluding urban forests. This approach differs from Eurostat, which uses the more extensive concepts of the degree of urbanization (DEGURBA) or Functional Urban Areas (FUA). The latter can incorporate commuting zones situated outside of cities.

The presentation will explain the decisions made regarding urban extent, condition, and services (e.g., local climate regulation or air filtration) and examine the obstacles of accounting nationally while producing statistics in a highly diverse environment such as urban areas. Furthermore, it will analyze the implications of different urban area scales in terms of condition indicators (e.g., the proportion of green spaces) and services (e.g., which vegetation influences city cooling and what falls outside the scope).

Keywords: Urban areas, Ecosystem Accounting, SEEA-EA, Condition Account, Air Filtration



12. Quantifying the Economic Value of Ecosystem Services in Vineyards of Castilla y León, Spain: A Logic Chain Methodology

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This study focuses on the economic valuation of ecosystem services provided by vineyards in Castilla y León, Spain, employing the United Nations System of Environmental Economic Accounting (SEEA) framework. Castilla y León, with its key Appellations of Origin (AOs) such as Ribera del Duero, Rueda, and Toro, offers an optimal context for this analysis. By integrating economic and environmental data through extended logic chains, this study adapts and extends the SEEA framework to identify ecosystem services present in vineyards and the value factors influencing their availability. Furthermore, within the three main categories of ecosystem services, one provisioning service, three regulating services, and four cultural services have been economically evaluated. The applied methodology enables an economic valuation, estimating approximately 75 million euros for the three groups, with regulating services contributing the most significant monetary value. To examine the effect of local factors, a valuation was applied to 10 cases of vineyards, which have been sampled in the field, with specific data on vegetation cover presence and management practices (conventional or ecological). This analysis highlighted variations in ecosystem service values due to different local factors, emphasizing the importance of tailored management strategies. The integration of local data and the extended SEEA framework provides a robust tool for the economic valuation of ecosystem services. This approach not only enhances the accuracy of valuation but also facilitates the development of sustainable vineyard management practices by revealing the economic benefits of them. Although conservative, this valuation establishes a lower limit on value estimates and serves as a critical tool for informed decision-making in both environmental and economic policy. In conclusion, the methodology presented underscores the necessity of incorporating local environmental and management factors in the economic valuation of ecosystem services.

Keywords: Ecosystem services, vineyards, economic valuation, SEEA, Appellations of Origin

BOOK OF ABSTRACTS

- I. SESSION DESCRIPTION
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- III. ABSTRACTS

I. SESSION DESCRIPTION

ID: T18a

Mainstreaming ecosystem services approach and fostering transformative governance to enhance planning in socio-ecological systems

Hosts:


	Name	Organisation	E-mail
Host:	Nica Claudia Caló	Martin-Luther University Halle-Wittenberg (MLU)	nica.calo@geo.uni-halle.de
Co-host(s):	Nastasja Scholz	LUP – Luftbild Umwelt Planung GmbH	nastasja.scholz@lup-umwelt.de
	Stefan Knauß	MLU Halle-Wittenberg/ UFZ Leipzig	stefan.knauss@geo.uni-halle.de

Abstract:

Degradation of nature is an established issue, and today, governments throughout strive to restore it. A strong and equitable governance structure is essential to overcoming the many obstacles that must be addressed. A more comprehensive systemic reform that would allow for the required adjustments in all policy areas is being more and more discussed about. Over the years, the scientific community has placed a great deal of attention on the One Health and the ecosystem services as functional approaches to effectively and in essence reform our current economic system.

The purpose of the planned session is to facilitate a cross-sector, cross-disciplinary, and interdisciplinary conversation regarding a more effective governance structure that would enable the incorporation of a socio-ecological perspective into the existing economic system.

The following questions will guide the discussion:


- 
- What quantitative, qualitative, and interdisciplinary methods can help achieve a holistic understanding of the natural environment, taking into account the interdependence of different ecosystems and their role and services in supporting human well-being and sustainable governance?
 - What tools can better help to assess the design and implementation of all policy sectors in order to enable the achievement of biodiversity conservation goals, in accordance with social needs?
 - How do we address potential conflicts in worldviews, paradigms, policy goals and values?
 - How do we ensure that we create the necessary conditions (i.e., policy, ecological, societal) for the delivery of ecosystem services?
 - How to support stakeholders' involvement and conflict management, facilitating the governance process and local community awareness?
 - What changes in our economic system would be needed to move towards a more balanced socio-ecological systems?
 - How to ensure that the discussion can be really addressed at all levels of the socio-ecological system?
 - What specific tools can be considered, besides the accounting system and the Gross Ecosystem Product (GEP)?
 - What is the current state of environmental (biodiversity) mainstreaming in sector policies and policy designs?
 - What is the role of sub-national policy makers and how sub-national policy making can contribute to the successful achievement of main biodiversity strategy goals?

Goals and objectives of the session:

The purpose of the planned session is to facilitate a cross-sector, cross-disciplinary, and interdisciplinary conversation regarding a more effective governance structure that would enable the incorporation of a socio-ecological perspective into the existing economic system.

Planned output / Deliverables:

The overall format of the session will be a scientific discussion, with small groups of experts alternating to present some input towards the key questions put up by the co-hosts of the session. As the final result of the discussion, each expert group will gather more specific recommendations regarding the information or research that is required as well as the primary challenges, based on the best practices that have been presented. The ultimate expected output will be a preliminary mind map draft, which will serve as the starting point for drafting a joint



paper. The possibility to build up a new partnership to develop a joint project proposal in the framework of upcoming calls for proposals will be taken into consideration.

II. SESSION PROGRAM

Room: Expert Street 4

Date of session: 21st of November 2024

Time of session: 11:00–12:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
11:00– 11:05	Nica Claudia; Nastasja; Stefan	Caló; Scholz; Knauß	MLU; LUP; UFZ	Ecosystem services valorization for a better nature restoration governance in urban and peri-urban areas
11:05– 11:15	Karsten	Grunewald	IOER	Ecosystem services and biodiversity in government and corporate accounting
11:15– 11:25	Alessandro	Bosso	Art-ER	The assessment of ecosystem services as a tool to support governance, planning and policy making: the case of Emilia-Romagna region (Italy)
11:25– 11:35	Franck	Binard	Saint Emilion Wine Council	Overview on the environmental policy in Saint-Emilion area to enhance environment and biodiversity
11:35– 11:45	Silvia	Ronchi	DASTU Politecnico di Milano	Planning for environmental Equity: Insights from Italian case studies
11:45– 11:55	Asef	Ayatollahi	National Biodiversity Future Center, Politecnico di Milano	Role of Ecosystem Services and Urban Biodiversity Variables in Co-creation and Co-monitoring Procedures for Social Impact Assessment
11:55– 12:05	Gargi	Vats	Centre for Rural development and Technology – Hauz Khas India	Exploring Socio-Cultural and Socio-Ecological Change Dynamics in an Indigenous Community of India
12:05– 12:30				Q&A / Short World Café



III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Overview on the environmental policy in Saint-Emilion area to enhance environment and biodiversity

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Raising awareness on climate and environmental issues, coupled with societal pressure, have put the environment and biodiversity at the top of government agendas. In France, public environmental initiatives have been multiplied over the past twenty years. Recently, national programs have strongly supported the planting of hedges in agricultural areas, given the numerous benefits on biodiversity, landscapes, soil quality, water infiltration capacity, and as a solution for climate change.

In the Saint-Emillion region, listed as a World Heritage Site, the Wine Council of Saint-Emillion (CVSE) actively contributes to the promotion of the environment and biodiversity.

A key measure was the modification in 2023 of the requirements for the Saint-Emilion appellations to include environmental certification after an intensive work led by the Environment Commission of the CVSE, in collaboration with Institut National de l'Origine et de la Qualité (INAO).

To go further, 6 axes have been identified to improve soil quality, reduce pesticide use and develop nature-based solutions, diversify landscapes, preserve water resources and deal with climate change. The planting of hedges could be a solution to meet these challenges. The CVSE involves local stakeholders to support the preservation of existing hedges and the planting of new ones and works on the deployment of ecological corridors by carrying out an inventory and mapping of existing landscape features. The aim is to identify areas where planting hedges and trees would be necessary to enhance landscape and biodiversity and to model future plantations, taking into account the risks of frost and drought. Many studies are caring out to



evaluate and quantify the ecosystem services provided by this practice (e.g. carbon storage, biodiversity).

Despite these efforts, a number of technical, economic and sociological obstacles remain. The challenge is to show winegrowers that these plantations are not constraints but real opportunities. The aim is to remove all the obstacles, particularly operational ones (e.g. local plant production and sourcing, maintenance issues). These efforts must be coupled with the valorisation of environmental services via labels and certifications and proof of the benefits induced by these practices.

Keywords: public policies, local stakeholders, landscape feature, ecosystem services, Saint-Emilion

2. Role of Ecosystem Services and Urban Biodiversity Variables in Co-creation and Co-monitoring Procedures for Social Impact Assessment


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Social impact assessment (SIA) of re-naturing measures in urban areas offers a holistic perspective on complex interactions and trade-offs between humans and nature. While traditionally, the conduction of SIA and evaluation is mainly short-term standardized and expert-oriented, new methodologies are more flexible and focused on community engagement and integration of social-ecological variables in urban areas with more long-term perspectives. Focusing on the aforementioned issues, in this contribution, we present a case of the participatory approach of SIA with the integration of ecosystem services (ES) and urban biodiversity (UB) variables in monitoring and evaluation procedures. This research is based on co-creation and co-monitoring activities conducted in the pre-intervention phase at the Mirabal Garden in Milan, Italy, to establish an urban living lab with the engagement of citizens, local institutional representatives, and other local experts. Within this framework, through a systematic review of ES and its benefits on society, a series of indicators, impacts, and benefits with their measurement methods have been extracted from the literature. After



contextualization for the case study, this collection was proposed to the local actors for selection and evaluation. In this procedure, citizens, with a selection of their preferred ES and benefits, identified their priorities and expectations for implementation and assessment in and around the Mirabal Garden area. Alongside inputs from workshops, this data, categorized in a repurposed social–ecological system framework, provided a sufficient basis for forming causal loop diagrams to better simulate pattern interactions between nature and society in the case study. Such simulations not only address the power dynamics between local actors, decision–makers, and biophysical environments but also, with the addition of monitoring inputs, generate ecosystem services for the local community in a long–term perspective.

Keywords: urban ecosystem service, co–creation, co–monitoring, social impact assessment, evaluation indicators

3. The assessment of ecosystem services as a tool to support governance, planning and policy making: the case of Emilia–Romagna region (Italy)

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In recent years, in Emilia–Romagna have been developed several projects of assessment and mapping of ecosystem services in biophysical and monetary terms. ART–ER, the joint stock consortium that acts as regional development agency, carried out these projects, at different territorial scale, to support regional government, local authorities and companies decision making processes, on the base of natural capital value. The projects involved different sectors. Agriculture have been deeply analysed through Life projects SOIL4WINE, AGRESTIC and DRIVE, defining the contribute of sustainable agricultural practices (e.g. cover crops, green mulching and reduced tillage) to biodiversity conservation, climate change mitigation and adaptation, local development. Feasibility studies of Payments for Ecosystem Services to remunerate farmers have been built at site scale. Some examples of public and private mechanisms:

- reclamation fee reduction for sustainable farmers supporting soil erosion protection
- tourist tax income redistribution for sustainable farmers improving landscape quality



- bank incentive for sustainable farmers increasing groundwater storage
- voluntary carbon credits for farmers increasing carbon stock in soil

An innovative study on gross ecosystem product has been carried out in a rural area of Appenines and will support the offsetting and conservation policies defined by a territorial plan at provincial scale. The study lead to the economic quantification of the natural capital of the territory and gives relevant information to rethink relationships between mountain area and the city.

Finally, Arcadia Horizon project foresees a sperimentation about how Regional Authority can implement an adaptation strategy exploiting nature based solutions. In particular the focus is on forests role and how a sustainable management can support ecosystem services able to reduce floods and landslides, protect biodiversity and increase the wood value chain. The approach is at catch basin scale and will support the integration of different regional policies (e.g. on water management, climate change, forestry).

Keywords: gross ecosystem product, payments for ecosystem services, natural capital, decision making, land management

4. Ecosystem services valorization for a better nature restoration governance in urban and peri-urban areas

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Nature degradation is a proven problem and its restoration is a goal for European countries. To reach it, many hurdles have to be overcome from the perspective of finding proper solutions and also in the stakeholders involvement and the management of different interests. An effective and fair governance process is therefore a key element. Better governance instruments to recognize the importance of ecosystem services in maintaining a healthy and sustainable environment by promoting their use in spatial planning, development and decision-making process is needed. A new partnership to discuss a new project idea to raise awareness about the benefits of ecosystem services, such as biodiversity conservation or water regulation, has



been developing. Through work with local communities, governments and stakeholders to identify areas where ecosystem services can be enhanced or restored, the project idea's approach is based on a holistic understanding of the natural environment taking into account the interdependence of different ecosystems and their role and services in supporting human well-being and sustainable governance, through quantitative, qualitative and interdisciplinary methods. The aim is to use innovative tools and techniques to assess the current state of ecosystems in urban and peri-urban areas, identify opportunities for restoration and develop strategies for their implementation in the form of policy instruments. These tools and data will support stakeholders' involvement and conflict management, facilitating the governance process and local community awareness. Ultimate goal is to create more livable cities that are resilient to environmental challenges such as climate change or biodiversity loss. By restoring ecosystem services in urban and peri-urban areas, biodiversity and air quality can be improved and enhanced, flooding risk reduced and other benefits that contribute to a healthier and more sustainable future for all provided.

5. Ecosystem services and biodiversity in government and corporate accounting

First author(s): Karsten Grunewald

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The contribution looks at the question of how biodiversity and ecosystem services can be incorporated into economic reporting at governmental and corporate level (target 14 and 15 in the Kunming Montreal Global Biodiversity Framework). We first provide an overview of information sources and data products for ecosystem accounts available at national level in Germany. The results of these accounting systems, which can be integrated into political and economic decision-making, should be easily understood by the general public and provide a basis for scientific analyses. As “flow” variables, information on ecosystem services contributes to societal well-being by improving decision-making processes, in particular by demanding and supporting a greater appreciation of nature, measurable via biodiversity and ecosystem service indicators.



A new paradigm is emerging both in companies globally and within European regulations, namely the explicit consideration of nature and its services as the basis for holistic corporate reporting, management and financing. As impacts on biodiversity and ecosystems as well as interdependencies between ecosystem services can be highly specific, depending on the sector, company activity and location, more detailed, sector-specific information will be needed in the future – ideally also from national accounting. Finally, we look at which institutions and actors can influence the field of action and discuss how the process of expanding economic reporting to include natural capital can be viewed as a “social innovation”.

Keywords: Biodiversity, Corporate accounting, Ecosystem accounting, Ecosystem services, Sustainability reporting

6. Planning for environmental Equity: Insights from Italian case studies

First authors(s): Silvia Ronchi

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The relationship between socio-economic status, urban forms and urban biodiversity, particularly regarding bird species richness, highlights the need for social equity in urban planning. In cities, wealthier areas often display higher biodiversity conditions, revealing a ‘Luxury Effect’ where affluent neighbourhoods have more access to and resources for managing green spaces and environmental initiatives.

This inequality demands targeted policies and planning strategies to improve biodiversity in lower-income urban areas, ensuring equitable distribution of Ecosystem Services (ES) and access to green spaces for improving human well-being and ecological health.

The rapid intensification of urbanization processes often leads to habitat loss, increased pollution, and greater demands on natural resources. The ‘New Urban Agenda’, adopted at Habitat III in 2016, emphasizes the urgent need for sustainable urban development that integrates biodiversity conservation and equitable access to green spaces.



Urban planning plays a crucial role in addressing these types of contemporary challenges as decisions made in a planning process can help create and protect urban green spaces by recognizing their collective value and ensuring that future urban development transformations have measures to ensure the maintenance of biodiversity.

Adopting a performance-based planning approach offers strategic tackles to enhancing biodiversity and ES in urban areas offering a more flexible and adaptive framework for urban development. By integrating green infrastructure and NBS, urban areas can improve their environmental performance, resilience, and adaptability to climate change reducing environmental inequalities and ensuring that all communities have access to the benefits of green spaces. Indeed, ES mapping and assessment provide knowledge on the performance of ES, particularly highlighting the influence of urban form on biodiversity enhancement and sustainability outcomes. Dense urban environments, characterized by high population density and compact built forms, often present challenges for biodiversity but also opportunities for innovative green and blue infrastructure. However, a paucity of literature explores in detail how urban forms and socio-economic factors influence urban biodiversity.

The research – developed under the Italian National Recovery and Resilience Plan and specifically for the project “National Biodiversity Future Center NBFC” – aims to verify the interaction of socio-economic factors, ES provision and urban biodiversity in some Italian cities to define and promote advanced urban planning techniques to create more sustainable and equitable cities. Some relevant key urban areas parks are selected as case studies, the first pilot area of investigation is the ‘Parco del Valentino’ in the city of Turin (North-west of Italy), aiming to explore possible existing correlations among multiple variables (i.e., socio-economic, biodiversity as bird species richness and ES).

Keywords: Environmental justice; Performance-based planning; Luxury effect



7. Exploring Socio–Cultural and Socio–Ecological Change Dynamics in an Indigenous Community of India

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Sartang is a very lesser known and under researched indigenous community of West Kameng district, Arunachal Pradesh, North East India. Historically, they were hunter–gatherers and practiced a religion called Bon, which was present in the area before the spread of Buddhism. They always had a hunter gatherer kind of lifestyle that connected them with their environment or natural surroundings through their cultural and traditional beliefs, rituals and practices. They are now moving towards adopting new cultures and traditions. This in turn is bringing a socio cultural change in their society which in turn is also disrupting their socio–ecological systems and worldviews. Before this cultural extinction takes place, the community should be studied to capture its world views and sustainable practices, as it has remained historically neglected and highly under–researched. In order to examine the community, field work was conducted in four villages and their adjacent hamlets. Qualitative research methods, such as ethnography, semi–structured interviews, and participant observations, were employed. Additionally, secondary data was obtained by referring to archives. The study's findings suggest that Sartang's connection with nature is multifaceted, as they selectively hunt certain animals while refraining from hunting others based on certain beliefs. They also safeguard forests as they consider them sacred where they neither hunt nor fell trees or allow anyone else to do so. Therefore, this demonstrates that the community perceives nature not as a distinct entity, but rather as an integral part of themselves and vice versa. However, the current situation is undergoing a transformation due to the influx of other cultures such as Christianity and Buddhism, alongside the process of modernity. Ultimately, this is leading to the degradation of forests and socio–ecological systems, which is a direct consequence of the diminishing of ties with nature. This story depicts how indigenous populations worldwide are transforming.

Keywords: Arunachal Pradesh, Indigenous Community, Sartang, Socio–Ecological Systems, Transformation

BOOK OF ABSTRACTS

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I. SESSION DESCRIPTION

ID: T18b

Ecosystem services science for evidence-based transformative changes in decision-making

Hosts:

	Name	Organisation	E-mail
Host:	Benjamin Burkhard	Leibniz University Hannover	burkhard@phygeo.uni-hannover.de
Co-host(s):	Joana Seguin	Leibniz University Hannover	seguin@phygeo.uni-hannover.de
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Abstract:

The importance of healthy ecosystems and the services they deliver has increasingly been acknowledged, most recently confirmed in the EU's Nature Restoration Law. The assessment of Ecosystem Services (ES) is a powerful approach to raise awareness on human dependence on a functioning, biodiverse environment. Hence in recent years, assessing ecosystem condition and services moved into the focus of various Strategies and Directives, such as the EU Biodiversity Strategies 2020 and 2030. The related MAES (Mapping and Assessment of Ecosystems and their Services) initiative has provided the conceptual, methodological, knowledge and data base for comprehensive assessments and accounting of ecosystem condition and services on different spatial scales, including the EU-wide assessment (2020) and assessments in all EU member states. Knowledge and data for different ecosystem types and their respective conditions are constantly improving and increasingly available.

While many research projects have already delivered a wide range of assessment results, IPBES reports indicated that uptake of it in real-world is still very limited. Quite recently, new research



emerged focusing on diagnosing challenges, barriers, and pitfalls when it comes to achieving actual uptake of ES assessments. Furthermore, the barriers for uptake may vary in scope, need, and use of terminology between the diverse sectors (public, private, finance).

In this session, we want to give the floor to presenters and studies from diverse sectors to present their challenges of ES implementation in decision-making supporting transformative change. Among others, we are interested in discussing challenges related to methods and data, science-stakeholder interfaces, science communication, and uncertainties. We want to hear stories of success as well as failure, in order to learn from them and conjointly develop best-practice guidelines to overcome barriers of ES uptake for the future.

This session aims to share experiences from real-world cases in different sectors, including public, private and finance, on how integrated ecosystem assessments can be performed and taken up in policy and decision-making contexts. The session will identify (1) possible solutions how to overcome barriers to ES uptake and (2) suitable good/best practice examples to learn from and improve uptake / progress towards real-world implementation.

Goals and objectives of the session:

We want to reflect on aspects that increase or hamper the process from ES assessments to decision-making uptake and implementation. This session facilitates sharing experiences from various sectors and creating joint knowledge among participants on how to overcome existing barriers limiting the uptake of ES assessments in the decision-making context.

Planned output / Deliverables:

We aim for a vivid discussion on the present barriers to successful implementation/policy uptake of ES assessments and how to overcome those. Expected outputs include a joint publication/policy briefs and/or special issue in an international journal, depending on participants' interests and motivation

II. SESSION PROGRAM


Room: Expert Street 8

Date of session: 18th of November 2024

Time of session: 11:00–17:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
11:00 – 11:15	Davide	Geneletti	University of Trento, Italy	Session T18b Introduction
11:15 – 11:30	Carla	Washbourne	University College London, United Kingdom	How can Early Career Researchers contribute to the science–policy interface?
11:30 – 11:45	Malte	Hinsch	Leibniz University Hannover, Germany	Bridging Science and Stakeholders: Pollination Ecosystem Service Modelling for Sustainable Landscape Management in Lower Saxony
11:45 – 12:00	Laura	De Luca Peña	Ghent University, Belgium	Assessing Blue Economy Sustainability: An Ecosystem and Life Cycle Approach for an Evidence–Informed Policy Making
12:00 – 12:15	Anindita	Debnath	Wildlife Institute of India, India	Tracking Carbon Over Decades: Monitoring Ecosystem Services in the Askot Landscape, Indian Himalayas
12:15 – 12:30	Vince	van ‘t Hoff	Foundation for Sustainable Development, Wageningen, Netherlands	From dimes to decisions – Applying monetary values in local public decision making in the Netherlands
12:30 – 14:00	Lunch break			
14:00 – 14:15	Joana	Seguin	Leibniz University Hannover, Germany	How to make ecosystem services science outcomes applicable for evidence–based decision–making?
14:15 – 14:30	Katie	Wilson	UNEP–WCMC, United Kingdom	Science–Policy–Society Dialogue: Horizon Project SELINA
14:30 – 14:45	Stefano Davide	Murgese	SEAcop STP, Turin, Italy	The Masterplan SWITCH: agriculture for active ecosystems management, at service of local communities and for climate change adaptation



Time	First name	Surname	Organization	Title of presentation
14:45 – 15:00	Jarumi	Kato–Huerta	University of Trento, Italy	Enhancing Justice Dimensions for Integrated Ecosystem Assessment: Implications for Decision–Making
15:00 – 15:15	Marija	Bockarjova	University of Twente, Netherlands	Mechanisms behind a transformative change: Nature, well–being, inclusiveness and economic performance
15:15 – 15:30	Paulo	Pereira	Mykolas Romeris University, Vilnius, Lithuania	Systematic review on mapping and assessing ecosystem services in urban and peri–urban areas
15:30 – 16:00	Coffee break			
16:00 – 16:15	Aveliina	Helm	University of Tartu, Estonia	Implementation of the results of ecosystem assessments in decision making in Estonia
16:15 – 16:30	Sigvard	Bast	KTH Royal Institute of Technology, Stockholm, Sweden	Green infrastructure and ecosystem service mapping for planning
16:30 – 16:45	Roxanne	Lorilla	Harokopio University of Athens, Greece	Integrating ecosystem services into development plans: Is there space to address and minimise the tradeoffs between nature and grey infrastructure?
16:45 – 17:00	Anna	Sperotto	Ca' Foscari University of Venice, Italy	Adopting an Ecosystem Services perspective for the Water–Energy–Food Nexus assessment: opportunities and challenges for a transformative change in the Adige river basin (Italy)
17:00 – 17:15	Mendy	van der Vliet	Planet Labs PBC, Haarlem, Netherlands	The development of satellite–based assessment of landscape restoration: reflections from a co–design approach
17:15 – 17:30	Joana	Seguin	Leibniz University Hannover, Germany	all session hosts: Wrap up and final discussion



III. ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Mechanisms behind a transformative change: Nature, well-being, inclusiveness and economic performance

First author(s): Marija Bockarjova

Other author(s): Carmen Anthonj, Javier Martinez, Julia Foellmer, Paula Janeka

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Educating a new generation of academics and practitioners on the ecosystem services (ES) and their value is essential for future nature-inclusive and well-informed societies. In this presentation, we plan to reflect on teaching the value of ES at the University of Twente, the Netherlands. We offer a dedicated elective course on ecosystem services as benefits to people to students with diverse backgrounds. Teaching ES value as part of this course, involves a range of methods to convey the economic, ecological, and intrinsic values of ES. These methods include traditional lecturing introducing multiple conceptual perspectives on value, inviting guest speakers, and organizing visits to natural sites to observe ecological interventions firsthand. These approaches help deepen understanding and articulation of how ecosystems and human society are intertwined. In addition, we use the InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs) tool, which allows students to apply theoretical knowledge to real-world scenarios. This hands-on experience helps them understand the process of identifying, mapping, quantifying and monetizing selected ecosystem services, making the learning process more tangible and relevant.

In this contribution, we aim at discussing the balance between economic valuation with broader ecological and intrinsic values, to support the broader goal of ES education of promoting responsible environmental stewardship of the students. With our approach to ES education, we aim at students developing understanding, critical thinking and problem-solving skills, preparing them for informed decision-making in their future profession and ability to articulate, visualise and quantify ES and their values.

Keywords: Value typologies, educational methods, InVEST tool



2. Assessing Blue Economy Sustainability: An Ecosystem and Life Cycle Approach for an Evidence-Informed Policy Making

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The escalating exploitation of marine resources is placing unprecedented pressure on ecosystems, potentially leading to irreversible changes. Effective management of human activities is crucial for the safeguarding of the marine environment. Policy instruments are essential for ensuring a sustainable Blue Economy. However, there are concerns about their effectiveness in guiding relevant stakeholders. This study aims to analyse the incorporation of comprehensive and quantitative environmental impact assessment tools in legislation supporting sustainable Blue Economy activities. It also highlights the importance of these tools for evidence-informed policymaking through the development and application of such a tool to a multi-use offshore case study.

This study examines the marine policy landscape and identifies key legislation promoting the sustainable growth of the Blue Economy. It also explores how well environmental impact assessment tools, such as ecosystem services and life cycle assessments, are integrated within existing legislation. The analysis of current legislation reveals a significant gap in providing guidance on which methodologies to use for measuring sustainability impacts. To address this, the study advocates for incorporating quantitative and comprehensive environmental sustainability impact assessment methodologies, based on integrating life cycle and ecosystem services assessment, into legislation. This approach could provide a systematic framework for assessing environmental sustainability within marine activities.

To demonstrate the applicability of a life cycle and ecosystem-based methodology, the environmental sustainability of co-locating offshore wind energy and a mussel farm in the Belgian North Sea was quantified. The findings reveal that the positive impacts of these activities outweigh the negative ones. Moreover, this study identifies areas for enhancing the methodology to better align with policy objectives and explains the science-policy interface as a co-learning environment.

This study highlights the importance of employing scientifically rigorous methods to inform policy decisions in marine resource management, contributing to the sustainable development of the Blue Economy.



Keywords: ecosystem services assessment, life cycle assessment, sustainable Blue Economy, evidence-informed policy, multi-use of marine space

3. Tracking Carbon Over Decades: Monitoring Ecosystem Services in the Askot Landscape, Indian Himalayas

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Forests are essential in preserving biodiversity and providing various ecosystem services (ES) that contribute to the overall ecosystem health. One of the key services includes regulating terrestrial-based carbon sequestration and storage. Globally, large-scale anthropogenic alteration of natural habitats has led to increased concentration of CO₂ in the atmosphere, accelerating climate change. The Himalayas play a crucial role in the global carbon cycle, exhibiting significant influences on the Earth's climate and ecosystems. The present study was conducted in the Askot landscape (elevation 600m–6500m), in Pithoragarh district of Uttarakhand, India, encompassing a total area of approx. 4496 km². The landscape is majorly snow-covered while the forested area holds sub-tropical, temperate, & alpine vegetation, offering a diverse habitat that supports several threatened species of conservation importance. This study aims to quantify carbon storage in the Askot landscape and assess changes over the last three decades (1990–2020) using Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST). Thirteen land-use land-cover (LULC) classes were delineated with high-resolution Satellite data and validated through field survey. For each of the LULC classes Above Ground Carbon (AGC) stock value was compiled from literature. In InVEST, the Carbon Storage & Sequestration model was used for further analysis. The result indicated a total loss of 8.24% in the past 30 years. Despite being the most diverse forest and storing a high amount of CO₂, the lesser Himalaya experiences constant changes in land use patterns driven by anthropogenic activities as well as natural disasters. Such declines in AGC storage imply the carbon potentially being released into the atmosphere and may amplify far-reaching ecological consequences in Himalayan ecosystems, and regional climate patterns.

Keywords: Above-ground carbon, InVEST, Climate change, Forest health



4. Bridging Science and Stakeholders: Pollination Ecosystem Service Modelling for Sustainable Landscape Management in Lower Saxony

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Evidence-based sustainable landscape management requires linking scientific research with stakeholder perspectives. The ModBieN project has successfully illustrated this approach by adapting an existing model for pollinator habitat suitability in collaboration with wild bee experts and local stakeholders in Lower Saxony, Germany.

The ModBieN project took an interdisciplinary approach, combining ecological modelling techniques with stakeholder engagement. Initially, a habitat suitability map for pollinators was modelled using a spatial modelling framework that took into account parameters such as available floral resources, nesting sites and landscape connectivity. Through iterative consultations with wild bee experts and regional stakeholders, adjustments were made to the modelling approach to better reflect local ecosystem dynamics. Key changes included the integration of ecosystem condition parameters into the modelling process.

This interdisciplinary approach provided valuable insights into pollination ecosystem services performance and habitat suitability across Lower Saxony. By incorporating stakeholder inputs, the model was refined to better capture the complex interactions between wild bee populations and their environment. Presenting the results at a regional workshop gave stakeholders the opportunity to engage directly with the research findings and to contribute their perspectives and reservations. Through interactive discussions and hands-on activities, participants gained a deeper understanding of the challenges and opportunities for sustainable landscape management in the region.

The ModBieN project highlights the importance of science communication and stakeholder engagement in bridging the gap between research and practice. The diverse communication methods, including workshops, presentations and interactive tools facilitated meaningful dialogue and knowledge exchange among participants and reflects the different perspectives and priorities of local stakeholders. By fostering communication and collaboration, the project laid the foundation for future initiatives to promote biodiversity conservation and ecosystem management in the region.



Keywords: Sustainable landscape management, stakeholder engagement, pollinator habitat suitability mapping, interdisciplinary research, science communication

5. Enhancing Justice Dimensions for Integrated Ecosystem Assessment: Implications for Decision-Making

First authors(s): Jarumi Kato–Huerta

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The EU Horizon project SELINA (Science for evidence–based and Sustainable decisions about natural capital) aims to enhance the consideration and uptake of ecosystem services, ecosystem condition, and biodiversity information in decision–making processes. As such, a key project output is the Framework for Integrated Ecosystem Assessment (FIEA), designed to facilitate this process.

SELINA's FIEA is a comprehensive six–phase approach (frame, scope, design, assess, disclose, act) for ecosystem assessment designed to support decision–making and foster transformative societal change. This research explores how the framework could be further enhanced by incorporating diverse justice dimensions throughout the FIEA phases, for example, by examining how addressing justice might guide and inform each framework stage, from framing the assessment to acting on its results. For instance, in the 'frame' phase, justice implications could guide the identification of targeted stakeholders. In the 'assess' phase, equity indicators could be integrated to evaluate ecosystem services' benefits and distribution of burdens.

Furthermore, we investigate the potential impact of incorporating justice dimensions in SELINA's 15 public and private Demonstration Projects. These projects offer a unique opportunity to test how this approach might guide policy processes in diverse European contexts, including how equity considerations influence the assessment process and resulting decisions.

The study aims to demonstrate the transformative potential of integrating justice principles and dimensions into FIEA. It hypothesises that a justice–oriented approach could lead to more equitable, sustainable, and socially beneficial ecosystem management decisions in public and private decision–making contexts.

Keywords: ecosystem services assessment, equity, justice dimensions, decision–making



6. Implementation of the results of ecosystem assessments in decision making in Estonia

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In 2018–2023, country-wide assessment and mapping of terrestrial ecosystems was carried out in Estonia (national MAES project ELME, co-financed by the European Union Cohesion Fund). The follow-up work, including implementation and reassessments are led by the Estonian Environment Agency.

The resulting map layers of ecosystem extent, condition and ecosystem services are made publicly available, including the catalogue of map layers: <https://arcg.is/WuW9>.

The map layers have already been widely implemented in various fields, especially by the stakeholders dealing with spatial planning and biodiversity issues providing a valuable input for decision makers.

Among the examples of the real-world implementation is planning, justifying and zonation of the nature protection areas, and assessing the effectiveness of the protection regimes. The layers have also been used for analyzing the functionality, condition and the actual habitat connectivity of the planned green network as it has been designated in the spatial plans of different levels (local government, county, state).

The agri-environmental subsidy for enhancing ecosystem services in agro-ecosystems is in place based on the methodology worked out in ELME.

The layers have also been used to analyze how to achieve biodiversity and climate-related goals through spatial land use planning (incl. deforestation issues, afforestation, restoration, etc.), as well as in environmental impact assessments and various cross-disciplinary (human needs, nature values, technical infrastructure limits, etc.) spatial planning exercises, e.g., for choosing the locations for wind farms. The recent progress in the real-world uptake and towards transformative change is illustrated by the Supreme Court's decision which obliged the decision makers to consider better the values of nature (and explicitly ELME results) before issuing the peat extraction permissions.



The success of the uptake seems to be driven by the real world (societal) need for holistic interpretation of nature values, which has been lacking so far, but is about to change.

Keywords: ecosystem condition, ecosystem services, spatial planning, biodiversity and climate goals

7. Integrating ecosystem services into development plans: Is there space to address and minimise the tradeoffs between nature and grey infrastructure?

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The EU Green Deal (EGD) sets a series of policy objectives aiming at improving developmental policies to comply with sustainability practices. On that aspect, transportation infrastructure is one of the EGD sectors, which is addressed to support economic development and improve human well-being. Still, implementing grey infrastructure can influence the supply of multiple ecosystem services (ES) and significantly modify the aspects of well-being that can be supported by a region. In this research piece, we seek to explore the role of developmental plans in the supply of ES and aspects of human well-being under different management scenarios. As part of the GUARDEN project, we apply participatory modeling approaches, in the Narbonne Regional Nature (NRN) Park in France, an area rich in biodiversity and ES, where the development of a high-speed railway line is designed. Through Bayesian Belief Networks (BBNs) we mapped nature's contributions as identified by local stakeholders (e.g. access to nature and biodiversity, cultural and natural heritage value). We assessed the potential well-being aspects that can be improved or deteriorated across the agricultural, transportation, and biodiversity protection sectors. The developed BBN models consider quantitative, qualitative and spatially-explicit data, providing information on the current state and future trajectories of ES under different management and climate scenarios. We engaged a broad range of stakeholders from all sectors through a series of workshops, which allowed us to design the graphical network, identify management priorities and future visions, and understand the level of information that needs to be produced and included within the decision-making process. A series of maps were produced that identified the areas where multiple benefits can be provided and locations in which some benefits might be lost. Our experience indicated that the probabilistic nature of the results enhanced the overall transparency of the process, as well as the stakeholders' trust in the



research outputs. Ensuring that stakeholders are integrated across all stages of the modelling process, enables us to increase the uptake of ES assessments towards real-world implementation for efficient ecosystem management.

Keywords: stakeholder knowledge, probabilistic models, ecosystem benefits, European Green Deal, decision support

8. Green infrastructure and ecosystem service mapping for planning

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In rapidly growing metropolitan regions, the intensive land use changes often result in degradation and loss of nature areas, negatively affecting ecosystem services (ES) and biodiversity. In Sweden, planning decisions on new housing areas are taken by the municipalities, which affect ES capacity and demand. In growing urban regions, the need for new housing often overrules the need for ES and biodiversity, but cities also have the potential to be forerunners in planning for transformative change. In the Stockholm region, the County Administrative Board launched an action plan for green infrastructure (GI), aiming to strengthen both biodiversity and ES, targeting to support planning. The aim of this study is to map the capacity and demand for selected ES, compare with the GI plan and discuss scale problems, spatial mismatches and possibilities for multifunctionality, related to planning practice.

The study area is the southern part of Stockholm metropolitan region, embracing eight municipalities in a gradient from urban to periurban. We map ES potential and demand concerning heat mitigation, stormwater retention, nature-based recreation, and habitat quality, comparing these to each other and to the GI plan, in a planning practice perspective. The results show the spatial inconsistencies between ES capacity and demand due to the disparate conditions between highly urbanized landscapes with small nature fragments and more rural land use in the periurban landscapes. This relates to different planning instruments and needs. The existing GI plan mainly represent biodiversity and cover only to a minor extent the other ES, with the exception of NB recreation, while its status in planning remains unclear. Proportions and location of nature areas related to urban densification versus sprawl need further attention



for balancing different types of ES. Furthermore, municipal planning needs stronger coordination with other sectors affecting ES, not at least forestry and transport planning.

Keywords: Green infrastructure, ecosystem service capacity, ecosystem service demand, biodiversity, planning practice

9. The Masterplan SWITCH (Ecosystem Services and Water management for the InTegration of Climate Change adaptation and Habitat quality): agriculture for active ecosystems management, at service of local communities and for climate change adaptation.

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Climate change causes modifications of hydrological cycle at local scale, with consequences water availability and the occurrence of extreme events.

In 2022, northern Italy was affected by a serious drought, which affected ecosystems, biodiversity and local communities, such as the Chierese–Carmagnolese Food District (CCFD), an association of 27 municipalities (located south of Turin) aimed at promoting local agriculture and sustainable practices.

Following these events, the CCFD promoted the definition of the Masterplan SWITCH for the identification of Nature Based Solutions (NBS) to create water reserves for periods of water scarcity. The plan defines adaptation solutions to increase resilience by fostering ecosystem services (ES) provided by natural and agro–ecosystems.

Based on ES assessment and suitability levels for groundwater recharge processes, Nature Based Solutions (NBS) were identified in order to improve ecosystem conditions (EC), ES provision and biodiversity (BD).

NBS consist of local and areal interventions. The former are managed aquifer recharge systems (MAR), by creating new habitats for rainwater harvesting and infiltration areas, that also contribute to reduce flood risk. The latter are addressed to the agricultural sector and consist in



the adoption of practices aimed at increasing EC, BD and the provision of ES by agro-ecosystems.

Farmers are currently being involved in the activities of Horizon Europe SELINA Project to implement this second type of intervention, by developing management models that reduce dependencies and impacts on natural capital, by applying of the Natural Capital Protocol. This will allow the identification of good and economically viable practices that can be applied in other rural contexts.

This work shows how decision-making based on ES concepts is a key element in transformative changes towards sustainable agriculture models that foster synergies between farming and natural ecosystems as an adaptation strategy that maximises co-benefits for local communities and the environment.

Keywords: ecosystem services, biodiversity, agriculture, natural capital protocol, climate change adaptation, managed aquifer recharge

10. Systematic review on mapping and assessing ecosystem services in urban and peri-urban areas

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Although the health of the ecosystem in urban areas is reduced compared to forests or grasslands, it is well known that cities supply a wide range of ecosystem services (ES). From a planning point of view, mapping is crucial for better decision-making. Therefore, mapping and assessing ES is critical to improving well-being in cities. Since urbanization is a global phenomenon and the ES supplied by cities are critical, it is crucial to understand the development of mapping and assessment of ES in urban areas. This work aims to systematically review the studies focused on mapping and assessing ES in urban and peri-urban areas. We used the Preferred Reporting Items for Systematic Reviews and Meta-alpha Methods, using the combination of the words “Ecosystem services”, “urban areas”, “peri-urban”, “city”, “cities”, “forecasting”, “prediction”, “map”, “future”, and “mapping”. 2,664 articles were observed between 2000 and 2023. From these, 1,626 duplicates were identified. In the screening stage,



1,038 studies were discarded. The criteria for selecting the works were: not written in English, studies that did not map ES, non-peer-reviewed articles and literature review articles. Finally, 207 studies were selected. The results showed increased studies focused on mapping and assessing ecosystem services in urban and peri-urban areas between 2011 and 2013. Most of the work was conducted in China and Europe and focused mainly on ES supply. Regulation ES was most identified, especially the Regulation of physical, chemical, and biological conditions. The provisioning ES most studied was Biomass, and Cultural ES was direct, in-situ, and outdoor interactions with living systems that depend on the presence in the environmental setting. Quantitative methods were preferred. Social Values for Ecosystem Services and Integrated Valuation of Ecosystem Services and tradeoff methods were the most used. Very few works forecasted ES in urban areas and validated the model's results.

Keywords: Systematic review, ecosystem services, mapping, Urban and peri-urban areas, degradation

11. Adopting an Ecosystem Services perspective for the Water-Energy-Food Nexus assessment: opportunities and challenges for a transformative change in the Adige river basin (Italy)

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The Water-Energy-Food (WEF) nexus approach offers a comprehensive framework to understand the interdependencies and trade-offs among water, energy, and food security. Incorporating Ecosystem Services (ESs) into this approach ensures a more sustainable and holistic assessment. Mountain ecosystems, which provide crucial services such as water regulation, soil fertility, biodiversity, and carbon sequestration, directly influence water availability and quality, as well as energy and food production systems. Ignoring these services in WEF nexus assessments can lead to incomplete decision-making, potentially exacerbating resource conflicts and undermining sustainability goals.

An analysis of spatio-temporal relationships between multiple ESs under current and future scenarios of land use and climate change was conducted in the Adige river basin (Italy) to



investigate possible conflicts between water, energy and food security in mountain regions and to identify opportunities for a transformative change.

As a first step, single indicators representing each sector of the WEF nexus were calculated and spatially assessed at the sub-basin scale for the years 2006, 2012, and 2018. These indicators included water provisioning, crop yield, soil retention, landscape diversity, and carbon storage. A correlation analysis by means of the Geographical Weighted Regression model, was then performed to map critical areas for multiple ESs provision to the WEF nexus, identifying where synergies and trade-offs are likely to arise.

Future scenarios of climate and land use change were considered to calculate the same indicators and identify changes between the reference year (2018) and future scenarios (2050). Additionally, ESs bundles were identified using Self-Organizing Maps (SOM) to cluster sub-basins with similar ESs patterns, suggesting collective management with targeted measures. Based on these results, different types of sectorial measures were proposed, describing multiple combinations of physical, economic and climatic pathways. These measures serve as a foundation for discussing a shared management strategy to ensure long-term sustainability of the WEF nexus.

Keywords: Ecosystem Services, WEF nexus, transformative change, mountain areas, Adige river basin

12. How to make ecosystem services science outcomes applicable for evidence-based decision-making?

First author(s): Benjamin Burkhard


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The EU Horizon project SELINA (Science for evidence-based and Sustainable decisions about natural capital) started in June 2022 and has been running for over 2 years now. SELINA's main aims are to review the state-of-the-art of ecosystems and their services-related science and the provision of guidance for evidence-based decision-making that supports the protection,



restoration and sustainable use of our environment. It is time for a first outlook with lessons learnt and interim conclusions.

In the project, 50 partners from all 27 EU member states and 4 other European countries collaborate to develop solutions for increasing the uptake of the Ecosystem Services concept in the public and private decision-making context. How do we need to tailor integrated ecosystem services assessments in order to make them useful and applicable in real-world contexts? What are the needs of the users and do scientists have adequate responses? Can we propose practical solutions and recommendations to improve the science/decision-making interface? How can scientists and decision-makers adapt their language and acting in order to be heard?

In this talk, we will give insights into the ongoing works of SELINA, including the creation of a comprehensive knowledge base, the establishment of Communities of Practice in the countries or our efforts on finding a common language across disciplines. Furthermore, we will share our experience from the collaboration with the 15 SELINA real-world Demonstration Projects on integrated ecosystem services assessments.

Keywords: Communities of Practice, integrated ecosystem services assessment, decision-making

13. From dimes to decisions – Applying monetary values in local public decision making in the Netherlands

First author(s): Vince van 't Hoff


Other author(s): Mieke Siebers

Affiliation: Foundation for Sustainable Development

Contact: vince.vanthoff@fsd.nl

In this session, we will explore the challenges and opportunities of applying monetary valuation data in municipal decision-making, using a recent pilot project conducted for the Dutch municipality of Eindhoven.

In 2022, the Eindhoven city council decided to purchase the Wielewaal estate (142-hectares) for 30 million euros. In addition to her ecological richness and role in biodiversity conservation, the Wielewaal also aims to serve a public function in a time and place where green spaces are under pressure. Keeping this in mind, the purpose of the municipality of Eindhoven was to comprehensively illustrate the societal benefits of the Wielewaal for the broader community through the development of a social business case



Collaborating with the Dutch Bureau of Statistics (CBS) and the National Institute for Public Health and the Environment (RIVM), the Foundation for Sustainable Development (FSD) conducted an assessment to value the ecosystem services of the Wielewaal in monetary terms. This assessment compared two scenarios: a freely accessible Wielewaal versus a closed Wielewaal.

The results showed the large public benefits related to health and existence values. More importantly, the project underscored the complexities involved in applying monetary valuation in a real-world context.

Several challenges emerged during the project. Some related to aligning data flows from RIVM, CBS, and FSD. Other challenges arose in linking biodiversity to ecosystem services. Finally, after a publication in the National Newspaper on the project and several highly engaging LinkedIn discussions (here by a thought leader in the field and here by the councilor for Nature in the municipality of Eindhoven), the pilot project sparked the debate about when and how to apply monetary valuation data.

This session will delve into these challenges and debates, offering insights and lessons learned from the Eindhoven project to inform future applications of monetary valuation in municipal contexts.

Keywords: Monetary valuation, application, barriers, public decision-making

14. How can Early Career Researchers contribute to the science-policy interface?

First author(s): Carla-Leanne Washbourne

Other author(s): Ranjini Murali, Nada Saidi, Sophie Peter, Paola Fontanella Pisa, Thuan Sarzynski, Hyeonju Ryu, Anna Filyushkina, C. Sylvie Campagne

Affiliation: University College London

Contact: c.washbourne@ucl.ac.uk

The interface between science and policy is a complex space, in theory and practice, that sees various actors and perspectives coming together to enable policy-relevant evidence to support decision-making. Early Career Researchers (ECRs) across disciplines are increasingly interested in working at the science-policy interface to support evidence-informed policy, with the number of opportunities to do so increasing at national and international levels. However, there are still many challenges limiting ECRs participation, not least how such a complex space can be



accessed and navigated. While recommendations for engaging at the science–policy interface already exist, a practical ‘map’ of the science–policy interface landscape, which would allow for ECR participation in evidence co–production and synthesis, is missing.

Setting out to facilitate the engagement and participation of ECRs producing policy–relevant evidence around biodiversity and ecosystem services, the authors, who are ECRs themselves, co–created a ‘mind–map’ – a tool to review the landscape of and leverage access to the science–policy interface. The mind–map was developed through reviewing published literature, collating personal experiences of the ECR authors, and validating against wider peer perspectives in an ECR workshop during the 7th Plenary of the Intergovernmental Science–Policy Platform on Biodiversity and Ecosystem Services (IPBES). This co–created tool sees ECR engagement in (co–)producing evidence at the science–policy interface as an interaction of three main factors: the environment of the ECR, which mediates their acts of engagement at the science–policy interface leading to outcomes that will ultimately have a reciprocal impact on the ECR’s environment. We believe it has applicability as a tool for planning and process mapping as well as self–reflection and evaluation. We hope that it will be useful for structuring and initiating discussions, experience sharing and peer–learning processes within ECR groups and in supporting discussion with colleagues and across organisations.

Keywords: Biodiversity, Boundary Organizations, Capacity Building, Ecosystem Services, Science–Policy Interface, Implementation Science

15. Science–Policy–Society Dialogue: Horizon Project SELINA

First author(s): Katie Wilson

Other author(s): Ceire Booth

Affiliation: UNEP–WCMC

Contact: katie.wilson@unep-wcmc.org

SELINA is a Horizon Europe–funded project designed to transform decision–making processes in both the public and private sectors. By enhancing the integration of Biodiversity, Ecosystem Conditions, and Ecosystem Services information, SELINA aims to drive more informed and effective environmental strategies. The project leverages transdisciplinary knowledge–sharing to offer comprehensive guidance on protecting, restoring, and sustainably managing our environment.

SELINA recognises that successful development and implementation of environmental policy at the EU and Member State level, in part, relies on the availability of robust evidence and



information. The research community therefore has a critical role to play in improving the quality and accessibility of the knowledge, tools and methods that are required to strengthen the evidence base for informed decision-making. However, to support the use of policy-relevant research in public decision-making, it's important that there is an ongoing dialogue between science, policy and society to understand better how research and policy can inform one another to achieve better societal outcomes.

With a particular focus on the research advancements happening in the SELINA project, this Science-Policy-Society Dialogue will bring together researchers and stakeholders from the public sector to share knowledge, experiences, and perspectives on how ecosystem service information can support public decision-making. This dialogue will provide a basis for validating the policy entry points that SELINA's research and products are relevant for, collecting new insights on how the SELINA project can better tailor its products to support public decision-making needs and promote the use of SELINA's Compendium of Guidance that is being developed to support public and private decision-making needs.

Keywords: Science, Policy, Biodiversity, Decision-Making

16. The development of satellite-based assessment of landscape restoration: reflections from a co-design approach

First authors(s): Mendy van der Vliet

Other author(s): Yoann Malbeteau, Darren Ghent, Sander de Haas, Karen L. Veal, Thijs van der Zaan, Rajiv Sinha, Rasmus Houborg, Richard A. M. de Jeu

Affiliation: currently unaffiliated, performed this research while working at Planet Labs PBC, Haarlem, Netherlands

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Monitoring of ecosystem health and ecosystem services is considered necessary to support the proposed EU Nature Restoration Law. It will enable decisions that improve the effectiveness of restoration activities. Despite the recent increase in ecosystem services (ES) assessments, their uptake by stakeholders for use in decision-support is still very limited as described in the recent Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) reports. Recommendations for ES assessments from a recent review of guidance documents includes the consideration of the appropriate spatial scale and resolution, data availability, scalability, and the inclusion of ecosystem condition. Based on the IPBES Values Assessment, ES assessments are also recommended to let stakeholders participate in outlining the purpose and the design of the assessment and to communicate outcomes clearly on the specifications of the



input data. In the present study, we co-designed an approach to assess the effectiveness of landscape restoration using long-term and high resolution satellite observations. The purpose and design of this work was based on the results of user journey mapping. We investigated the potential of several satellite datasets of different spatial resolutions and data availability to detect restoration changes. For two restoration areas in Tanzania, we estimated the restoration effectiveness as the amount of water retained by the top layer of the soil ($\sim 13\%$ average increase), a soil temperature drop ($\sim -0.5^\circ\text{C}$) and an increase in surface greenness ($\sim 50\%$ average increase) in 3.5 years. This approach illustrates the impact of restoration initiatives on the landscape and supports the reporting of comprehensive metrics to partners and donors.

Keywords: restoration effectiveness, ecosystem services assessment, satellite observations, co-design, impact

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: T19a

Ecosystem Services and Big Data: New Concepts, New Approaches, New Networks

Hosts:

	Name	Organisation	E-mail
Host:	Johannes Langemeyer	Universitat Autònoma de Barcelona	johannes.langemeyer@uab.cat
Co-host(s):	Michael Sinclair Andrea Ghermandi Fulvia Calcagni	University of Glasgow University of Haifa Universitat Autònoma de Barcelona	Michael.Sinclair@glasgow.ac.uk aghermand@univ.haifa.ac.il fulvia.calcagni@uab.cat

Abstract:

In an era where big data is revolutionizing our understanding of the world, the potential it holds for enhancing ecosystem services (ES) research is immense. Bridging the gap between big data analytics and ES understanding has the potential to illuminate novel pathways to a sustainable future. ESP Thematic Working Group 19 stands at the forefront of this transformation, advocating for the integration of novel digital data sources – such as user-generated content and mobile phone data – with innovative social, environmental, and spatial data science techniques. This session will delve into the innovative ways big data can illuminate the co-production of environmental values and knowledge and offer new insights into human-nature relationships. Join us at the forefront of this exciting frontier, where new concepts, approaches, and networks emerge to redefine the understanding of our relationship with the natural world and the interdependence of human, ecosystems, and planetary health.



Goals and objectives of the session:

- To stimulate debate: Create a platform for discussions on the challenges and opportunities presented by big data in ES research.
- To facilitate communication: Strengthen the network among ES researchers, practitioners, and policymakers focused on the intersection of big data and ES.
- To gain novel insights: Creating novel understanding of (cultural) ES and relational values from a digital perspective.
- To promote big data application: Showcase cutting-edge research and methodologies that leverage big data for the characterization of ES
- To develop methods and support: Offer guidance on best practices, data access, reproducibility, ethical data use, and navigating regulatory landscapes.
- To foster interdisciplinary collaboration: Encourage synergies between social, ecological and computational science to unfold in ES research and beyond.

Aligning with Conference Themes:

- Ecosystem Services and Health: This session will explore how big data can reveal the complex interactions between ecosystem services and public health, emphasizing the potential for transformative policies and practices that enhance both ecological and human well-being.
- Ecosystem Services and Conditions for Transformative Change: We will discuss how insights from big data can inform and catalyze conditions for transformative change towards sustainability, including the promotion of the UN Sustainable Development Goals, and focusing on digital relational values and the co-creation of knowledge for action.

Planned output / Deliverables:

New Concepts, New Approaches, New Networks under ESP Thematic Working Group 19

Session format:

10 min presentations will be followed by a facilitated discussion and networking session for participants to build connections, share experiences, and forge collaborative projects.



II. SESSION PROGRAM

Room: Expert Street 2

Date of session: 20th of November 2024

Time of session: 11:00 – 12:30

Timetable Speakers

Time	First name	Surname	Organization	Title of presentation
11:00 – 11:10	Andrea	Ghermandi	University of Haifa	Social media data and cultural ecosystem services: Lessons learned and new research frontiers
11:10 – 11:20	Fulvia	Calcagni	Universitat Autònoma de Barcelona	Objectivizing the subjective: co-creation of a standard protocol for cultural ecosystem services coding based on social media content
11:20 – 11:30	Michael	Sinclair	Urban Big Data Centre, University of Glasgow	Mobile Phone Applications: A new Frontier of Big Data Collection
11:30 – 11:40	Luning	Li	Urban Big Data Centre, University of Glasgow	Understanding urban green space usage from mobile phone application data
11:40 – 11:50	Johannes	Langemeyer	Universitat Autònoma de Barcelona	Virtual Communities for Transformative Change: How Human–Nature Experiences Trigger Digital Relational Values
11:50 – 12:00	Xueyuan	Liang	Vrije Universiteit Brussel	The identification and classification of digital relational values of urban natural environments in the weibo virtual community.
12:00 – 12:30	Discussion and Networking Opportunities			



III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Social media data and cultural ecosystem services: Lessons learned and new research frontiers

First author(s): Andrea Ghermandi

Affiliation: University of Haifa

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Since the pioneering studies of the early 2010s, which used counts of geotagged photographs from platforms like Flickr as proxies for investigating outdoor recreation in natural sites, the integration of social media data into ecosystem services research has advanced significantly. While early research primarily focused on counting relevant social media data items based on their metadata, the field has since evolved to analyze the semantics of the user-generated content itself—particularly of photographs and texts—including with the assistance of sophisticated data analytics techniques like natural language processing and computer vision. Recent advances in Artificial Intelligence promise to further revolutionize the depth and breadth of insights that can be derived from social media posts and to extend the scope of multimodal analyses. The field has also faced critical challenges. Recent restrictions on data access from platforms once central to this research, such as Twitter/X, have prompted the search for alternative, more sustainable data sources and led to question the long-term viability of this field of research. Additionally, foundational issues like data representativeness, and best practices for inclusive and ethical research remain underexplored. Here, I will discuss key lessons learned, current trends, and potential future directions through an up-to-date review of the growing body of literature that leverages social media data to study cultural ecosystem services. Furthermore, drawing on recent studies from natural parks in Israel, I will provide initial insights into pressing questions about differences in users' socio-demographics across platforms and differences in the content that users choose to share through various media formats and across the broad spectrum of available digital platforms—issues that have been inadequately explored to date. Finally, I will offer a forward-looking perspective on the discipline's trajectory, highlighting anticipated challenges and innovations.

Keywords: Cultural ecosystem services, Digital footprints, Passive crowdsourcing, User-generated content, VGI



2. Objectivizing the subjective: co-creation of a standard protocol for cultural ecosystem services coding based on social media content

First author(s): Fulvia Calcagni

Other author(s): Johannes, Langemeyer, Andrea, Ghermandi

Affiliation: ICTA-UAB

Contact: fulvia.calcagni@uab.cat

In an urbanizing world with ecosystems increasingly being degraded and people lacking direct nature experiences and perceptions of dependency, cultural ecosystem services (CES) are increasingly gaining importance in maintaining and fostering people's relational values and environmental stewardship. However, assessments of CES – and associated relational values – still face methodological hurdles due to their subjective, context-specific and intangible nature. Recently, approaches based on crowdsourced data, such as photographs and texts from social media platforms (e.g., Flickr, Twitter, Instagram), have been gaining momentum. Yet, the development of such approaches is still at the experimental phase and lacks a shared and grounded protocol for application, covering both the technical aspects of classifying the individual CES revealed by the data as well as the ethical issues related to the management of the data and associated metadata. This hinders cross-study comparisons and validations, as well as the uptake of this promising technique by decision-makers and a wider societal acceptance of this research approach. Building on a literature review, 4 testing case-study applications, and a workshop session organized during the Ecosystem Services Partnership (ESP) conference in 2022, we present the collectively designed and tested standard protocol for the assessment of CES and relational values through the analysis of visual and text information retrieved from social media data.

Keywords: Cultural Ecosystem Services, Social Media, Standard coding protocol



3. Mobile Phone Applications: A new Frontier of Big Data Collection

First author(s): Michael Sinclair

Affiliation: The University of Glasgow

Contact: michael.sinclair@glasgow.ac.uk

Over the past decade, social media has played a pivotal role in advancing our understanding of cultural ecosystem services (CES), providing invaluable insights into human interactions with natural and cultural environments. This rich vein of research has produced a multitude of methodologies and applications, significantly expanding the CES landscape. As we look to the future, a pressing question emerges: what's next in the evolution of data sources for CES studies?

A burgeoning data revolution is taking place in the realm of location-based services, which may provide answers to this question. The advent of mobile phone applications on GPS-enabled devices has initiated a new era of data collection, characterised by a structural resemblance to social media metadata but distinguished by its immense volume and collection mechanisms. Data generated by a growing array of mobile phone applications offers a substantial increase in quantity and an unprecedented resolution in space and time, presenting untapped potential for new directions in CES research.

While this extensive data source offers considerable potential to further explore intricacies of human-nature and human-culture interactions, it also introduces significant ethical and technical challenges which may be even greater than those posed by social media. Addressing these challenges necessitates a careful examination of how location-based data can be ethically and effectively utilised to enhance our understanding of CES, while ensuring the privacy and security of individuals. This talk will explore such a question and what lies beyond social media data for CES research.

Keywords: Mobile phone data, Bias, Big data, Ethics, Greenspace



4. Understanding urban green space usage from mobile phone application data

First author(s): Luning Li

Other author(s): Michael Sinclair

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Parks and other green spaces play a crucial role in fostering sustainable, healthy, and socially equitable urban environments. Urban planning and green space management gain valuable insights from information on green space usage; however, collecting such data is often limited and requires significant effort. The temporally dynamic data generated by mobile phone applications offer a promising source for studying human mobility in urban areas. This data, derived from GPS and Wi-Fi signals collected by a variety of mobile applications, provides detailed information about people's movements over time. Such data open new possibilities for understanding the spatial and temporal dynamics and the interactions between humans and nature in various urban environments. Despite its potential, the novelty and limited access to this data mean that its utility and applicability are not fully explored. This study aims to investigate the types of information on urban green space usage that can be extracted from mobile phone application data. In our study, we assess the use of urban green spaces through several dimensions: visit counts, user dwell time, heatmaps, spatial and temporal patterns, demographics, and green space catchment areas. The analysis utilizes two extensive and independent datasets from Huq and Tamoco, each containing three years of data for a large and diverse urban region (Glasgow, Scotland). Our results indicate that mobile phone application data can provide valuable insights into the use and movement within urban green spaces, provided that the data's inherent limitations are acknowledged. By comparing these datasets as sources of knowledge on urban green space usage, we highlight the strengths, weaknesses, potentials, and challenges associated with using mobile phone application data to inform sustainable spatial planning and green space management in cities.

Keywords: Mobile phone data, Urban green space, Huq, Tamoco

5. Virtual Communities for Transformative Change: How Human–Nature Experiences Trigger Digital Relational Values

First author(s): Johannes Langemeyer

Other author(s): Fulvia Calcagni, Giulia Benati, Thalía Dancuart-Coelho, Priscila Gonçalves, Xueyuan Liang, Roos Mouthaan, Alba Ortiz-Naumann, Alex Rivera-Campo, Ramin Soleymani-Fard

Affiliation: Institute of Environmental Science and Technology (ICTA), Universitat Autònoma de Barcelona (UAB)

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We witness the rapid loss of people’s opportunities to experience nature—what Miller (2005) has referred to as ‘the extinction of experiences’—and this has been assumed to create a downward spiral of people’s willingness to protect nature. Yet, with half of the global population using the internet and an increasing number of people spending more of their time online than in nature, virtual communities counteract this trend. Positive relationship between the use of Twitter and Youtube and the propensity to advocate for environmental care have been shown. We argue that virtual communities are essential for shaping relational values of and about nature, in order to encourage environmental stewardship and to foster global



transitions. We introduce Digital Relational Values (DRVs) as fundamental and eudemonic values that are developed within virtual communities, triggered by indirect experiences of nature.

We trace these values across large social media networks and develop and apply innovative social–ecological computational approaches that allow to (a) identify DRVs across different social media platforms, (b) understand how they spread across virtual communities, and (c) examine the relationship between virtually produced DRVs and physical environmental stewardship.

We thereby aim to challenge the assumption of an “extinction of experiences” and the consecutive decline of nature values and care for the environmental. We further aim at strengthening the importance of relational values as a foundation for environmental stewardship and contribute to a novel understanding of a physical–virtual continuum in the generation of nature benefits and values.

Keywords: Digital relational values, Extinction of experiences, Social media, Environmental stewardship

6. The identification and classification of digital relational values of urban natural environments in the weibo virtual community

First authors(s): Xueyuan Liang

Other author(s): Francesc Baró, Johannes Langemeyer, Frank Canters, Fulvia Calcagni, Priscila Gonçalves, Ramin Soleymani–Fard

Affiliation: Department of Geography, Vrije Universiteit Brussel (VUB), Institute of Environmental Science and Technology (ICTA), Universitat Autònoma de Barcelona (UAB)

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The urbanization trend on our planet has led to the loss of opportunities to experience nature in the physical world, which is commonly referred to as “the extinction of experience”. With the prevalence of social media platforms, virtual communities provide people with entertainment and information, allowing them to indirectly experience nature and shaping the so-called digital relational values (DRVs). However, the conceptualization of nature’s DRVs is still in its infancy, and a well-developed classification system has yet to be established. Like Twitter and other social media platforms, Weibo, the most popular social media platform in China, also forms its unique virtual community where DRVs are shaped. This research aims to establish a classification system and provide replicable classification approaches for DRVs in the Weibo virtual community.



Weibo text and image data from June 1, 2023, to May 31, 2024, are collected by search terms related to multiple landscape types. A temporal sampling method is used to select subsample datasets to initiate the manual coding analysis of text and image content to identify and classify DRVs. In this process, coding lexicons and protocols are established for text and image data. The iterative manual coding is performed in different steps and by three different researchers. The relative performance of text and image data in capturing DRVs is compared through descriptive statistics of DRVs.

This research can help support the future understanding of DRVs and enhance comprehension of human–nature interactions in virtual environments, promoting the conservation and stewardship of the natural environments.

Keywords: Digital relational values; Human–nature relationships; Urban nature; Big data; Social media platform

BOOK OF ABSTRACTS

- I. SESSION DESCRIPTION
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I. SESSION DESCRIPTION

ID: T19b

Artificial Intelligence and Ecosystem Services – Advancements in AI in the field of ecosystem services for transformative change

Hosts:

	Name	Organisation	E-mail
Host:	Vince van 't Hoff	Foundation for Sustainable Development	vince.vanthoff@fsd.nl
	Pedro Cabral	Nanjing University of Information Science & Technology	cabral@nuist.edu.cn
	Felicia O. Akinyemi	Karlstad University, Sweden	felicia.akinyemi@kau.se
Co-host(s):	Mieke Siebers	Foundation for Sustainable Development	mieke.siebers@fsd.nl
	Bruna Almeida	University of the Azores (UAc)	bruna.campus.unl@gmail.com
	Guojie Wang	Nanjing University of Information Science & Technology	gwang@nuist.edu.cn
	Jan Haas	University of Helsinki, Finland	jan.haas@kau.se
	Sara Alibakhshi	KTH Royal Institute of Technology	sara.alibakhshi@helsinki.fi
	Xi-Lillian Pang	Karlstad University, Sweden	xip@kth.se
	Ewa Orlikowska		ewa.Orlikowska@kau.se

Abstract:

Artificial intelligence (AI) is quickly emerging as a powerful tool for rethinking the way we understand, monitor, and manage ecosystems and their services. From satellite image analysis to natural language processing, AI technologies offer innovative solutions for extracting valuable insights from complex data types and provide a way to effectively and efficiently gather and analyze vast amounts of data. In a world with increasing reliance on technological advancements to map, model, assess and monitor ecosystem service changes, harnessing the power of AI has the potential to transform the way we understand and approach ecosystem services (ES) and their



functions (EF). This is not a goal in itself, but it should ultimately serve to account for the value of nature in an equitable way in decision making. Taking a one health perspective allows to balance environmental, social and economic needs with intrinsic value of nature.

This session aims to contribute to transformative change via highlighting and discussing advances in the field of ES related to AI. We aim to set the scene by highlighting the transformative potential and key challenges of AI. We will discuss best practices and inspiring examples to spark imagination to use AI in the diverse field of ES. For example, how can learning algorithms such as machine learning, deep learning and transfer learning support the assessment of ES and EF? Given the diverse methods available, including using GeoAI to derive indicators from remote sensing images, data extraction to effectively gather, streamline and standardize relevant information from scientific literature (and contribute to the ESVD), how can AI be leveraged to enhance the assessment and modelling of the supply, demand and flow of ES and EF? How does AI contribute to meeting the growing demand for inclusion to cater to “peoples’ obligations to nature” and “nature’s contribution to people” in ES and EF assessment? What are the trade-offs and synergies among ES and EF in different scenarios?

Furthermore, the session will highlight the importance of collaborative efforts in guiding the rapid developments in AI and ES research. By fostering discussion, awareness of each other’s projects and interdisciplinary collaborations between ecologists, data scientists, policymakers, and other stakeholders, we can leverage collective expertise to address key challenges and discuss new opportunities in ES assessment and management.

We cordially invite you to contribute to our session with an abstract related to a broad range of perspectives regarding the transformative potential of AI for ES. Not limited to and including best practices and ethical, methodological, applicational considerations of AI in mapping and assessing ES. Communications to be presented at this session will be possibly considered for either a synthesis paper or a review paper showcasing knowledge gaps in AI use in ES in empirical or modelling contexts.

Goals and objectives of the session:

- Explore Recent Advancements: To showcase and discuss the latest advancements in AI technologies and methodologies relevant to ecosystem services research, including data extraction, analysis, and interpretation.
- Promote Collaboration: To foster interdisciplinary collaboration and knowledge exchange among researchers, practitioners, policymakers, and other stakeholders interested in leveraging AI for ecosystem services assessments and management.
- Share Best Practices: To identify and share best practices for integrating AI technologies into existing research methodologies and workflows.



- **Address Ethical Considerations:** To raise awareness and facilitate discussions around the ethical considerations, potential biases, and limitations associated with AI-driven approaches in ecosystem services research, and to explore strategies for mitigating risks and ensuring responsible use of AI technologies.
- **Inspire Innovation:** To inspire innovation and creativity in the application of AI technologies to address pressing environmental challenges and promote sustainable management of ecosystems and their services.
- **Identify Opportunities:** To identify opportunities for future research, collaboration, and capacity building in the intersection of AI and ecosystem services, with the aim of advancing scientific understanding, informing policy decisions, and enhancing conservation efforts.

Planned output / Deliverables:

Possibly a special issue/a paper based on discussions during the day.

II. SESSION PROGRAM

Room: Expert Street 5

Date of session: 18th of November 2024

Time of session: 14:00–15:30 & 16:00–17:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
14:00–14:05	Vince	Van 't Hoff	Foundation for Sustainable Development (FSD)	Introduction
14:05–14:20	Ferdinando	Villa	ARtificial Intelligence for Environment & Sustainability (ARIES)	Keynote: From open to integrated ES science with AI
14:20–14:30	Felicia O.	Akinyemi	Karlstads Uiversity	A Spatial Data Science and Remote Sensing approach to predicting drought impacts on agricultural production in tropical dryland contexts
14:30–14:40	Hugo	Deléglise	Université Grenoble Alpes	Integrating optimization-based AI methods, ecosystem services and ecological connectivity to strengthen Peru's protected area system towards the 30*2030 target.
14:40–14:45	Q&A			Presentations 1&2
14:45–14:55	Nils	Barthel	Leibniz University Hannover	Comparative Analysis of MaxEnt and Deep Learning Approaches for Modelling Humpback Whale Distribution in Northern Iceland
14:45–15:05	Robbe	Neyns	Free University Brussels	Automated mapping of bee-friendly trees: a novel approach to enhance pollinator conservation
15:05–15:10	Q&A			Presentations 3&4
15:10–15:20	Pedro	Cabral	Nanjing University of Information Science & Technology	Assessing Determinants of Forest Gross Primary Productivity in China Using Machine Learning Approaches



Time	First name	Surname	Organization	Title of presentation
15:20– 15:30	Jinzhou	Wu	Free University Brussels	Mapping the allergenicity of urban green spaces using very-high-resolution remote sensing data
15:30– 15:35	Q&A			Presentations 5&6
16:00– 16:05	Vince	Van 't Hoff	Foundation for Sustainable Development (FSD)	Introduction
16:05– 16:15	Philip	Roche	French National Institute for Agriculture, Food, and Environment (INRAE)	Leveraging AI for Enhanced Systematic Reviews: Insights from Ecosystem Condition Indicators
16:15– 16:25	Stefano	Balbi	ARTificial Intelligence for Environment & Sustainability (ARIES)	Navigating connected data and models through semantics for better ecosystem services modelling and accounting
16:25– 16:35	Robert	Costanza	University College London	Beyond GDP with AI
16:35– 16:45	Q&A			7&8&9
16:45– 17:10	Small groups	Discussion		Discussion 4 statements on ES and AI considering data, ethics and the future
17:10– 17:25	Plenary	Discussion		Discussion 4 statements on ES and AI considering data, ethics and the future
17:25– 17:30	Vince	Van 't Hoff		Wrap-up



III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. A Spatial Data Science and Remote Sensing approach to predicting drought impacts on agricultural production in tropical dryland contexts

First authors(s): Hannah Kemper

Presenting author: Felicia O. Akinyemi

Other author(s): Felicia O. Akinyemi, Klaus Greve

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Droughts represent a threat to agricultural production and ecosystem services. Considering the expected impact of global warming, the severity and damages by droughts will increase further. To address this issue, the implementation of a drought early warning system is a crucial step to avoid crop failure, malnutrition, and hunger. For the conceptualization of such an early warning system, the study employs a GeoAI approach based on Spatial Data Science and Remote Sensing. There is the need to define thresholds for specific indicators, disseminate the warning and a proper understanding of drought dynamics.

The research was conducted for the study area of Botswana using a combination of yield statistics and remote sensing based data on vegetation conditions and rainfall. Further variables included the Southern Oscillation Index (SOI) to describe effects of El Niño. The methodology centers around data processing and applying geospatial analytics in python, e.g. Exploratory Data Analysis and Machine Learning.

The results confirm correlations between temperature, rainfall and crop yields, as previously identified by theory. Furthermore, the study concludes with reasonable thresholds of the most important variables (including the Standardized Precipitation Index (SPI) and SOI), value classifications and crop predictions that are essential for the creation of drought early warning systems and the improvement of food security.

The identified methodology successfully derived reasonable thresholds for further use in practice. Considering the large amount of input data, our GeoAI approach captures the complex dimension of droughts, e.g. the impacts on the production of staple crops as a form of food



provisioning ecosystem services. The potential to use this GeoAI led approach for data gathering from varied data sources and analyzing indicators effectively was recognized. Several shortcomings include the quality of the input data, the spatial scale selected for the analysis. Further research is required to validate these thresholds.

Keywords: Drought, machine learning, early warning system, remote sensing, Standardized Precipitation Index

2. Navigating connected data and models through semantics for better ecosystem services modelling and accounting

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We present the role of AI in the ARIES (ARtificial Intelligence for Environment and Sustainability) modelling approach of federating data and models through a shared semantic layer, enhancing traceability, accountability, and reuse of scientific products.

An example of distributed architecture developed under the European Space Agency (ESA) project “Pioneering Earth Observation Applications for the Environment – Ecosystem Accounting” (PEOPLE–EA) is presented, which allows for the integration and composition of models with distributed building blocks. In this architecture, ARIES serves as the semantic front–end powered by the k.LAB software stack; OpenEO provides data and processing workflows via UDP/UDF catalogues; and INCA prepares ecosystem services data and models according to EU ecosystem accounting standards.

In this work we demonstrate the relevance of Earth Observation (EO) for ecosystem accounting, suggesting new avenues for the integration of state–of–the–art technological solutions that also serve as a blueprint to enable a new paradigm for open and integrated science.



The system supports retrieval and processing of data from satellite EO programs like ESA Sentinel and NASA Landsat. This architecture facilitates the creation of models that are integrated and composed of distributed building blocks.

The architecture delineates a clear separation between resources (data and models) and semantics (used to precisely define their content), with resources being uniquely identified and peer-reviewed. Semantics orchestrates these resources, enabling dynamic execution of computational workflows based on user queries.

This work emphasizes the transition from open science to deeply integrated science, ensuring that data and model resources live online, independent of their semantic orchestration, and are peer-reviewed and maintained on the web.

In conclusion, we advocate for building and maintaining a common knowledge base on ecosystem services, promoting good practices, standards, datasets, algorithms, protocols, and platform APIs. This integration aims to bridge communities, data, and models for intercomparison and reuse, ultimately contributing to a better global understanding of nature's role in human wellbeing.

Keywords: Artificial Intelligence, Semantics, Ecosystem services modelling, SEEA-EA, Integrated Natural Capital.

3. Comparative Analysis of MaxEnt and Deep Learning Approaches for Modelling Humpback Whale Distribution in Northern Iceland

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This paper compared the established MaxEnt and a more novel deep learning approach for modelling the distribution of humpback whales (*Megaptera novaeangliae*) in northern Iceland. It examined the mechanisms, structures, and optimisation techniques of both approaches, highlighting their differences and similarities. For this, monthly distribution models for the



Skjálfandi Bay were created, spanning from 2018 until 2021, using presence-only sighting data and satellite remote sensing data. Additionally, the trained models were used to create distribution projections for the year 2022, solely based on the available environmental data. The results were compared using the established Area Under the Curve value. The findings indicate that both approaches have their limitations and advantages. MaxEnt does not allow continuous updating within a time series, yet it mitigates the risk of overfitting by employing the maximum entropy principle. The deep learning model is more likely to overfit, but the larger weight network increased the model's capability to capture complex relationships and patterns. Ultimately, the results indicate that the deep learning model had a higher predictive performance in modelling both current and future humpback whale distributions. Additionally, the outcome provides insight into the interaction between environmental influences and the distribution of humpback whales. Despite inherent limitations, deep learning in particular showed promising results and prompts further research in a broad range of applications, such as biodiversity monitoring and the sustainable management of marine resources.

Keywords: Distribution Models, Artificial Intelligence, Environmental Drivers, Comparative Analysis, Skjálfandi Bay

4. Integrating optimization-based AI methods, ecosystem services and ecological connectivity to strengthen Peru's protected area system towards the 30*2030 target.

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Previous conservation planning in Peru, a mega-biodiverse country, focused primarily on biodiversity. Achieving the 30% target set by the Kunming-Montreal Global Biodiversity Framework (GBF) requires addressing numerous ecological and social aspects. We present a conservation planning approach integrating with AI methods: biodiversity, ecosystem services, human impact, ecological connectivity, and ecoregional representativity.

Our approach emphasizes two key ecosystem services in Peru: carbon and water services. We evaluate carbon services using the realized carbon value index, which equally weights carbon



sequestration, carbon stored in living plant biomass and soil carbon. For water services, we consider the realized water provisioning services index, focusing on human needs for clean water, and the water retention index, focusing on ecosystem vitality.


Most existing frameworks are based on human expert analysis and/or classic spatial planning methods (e.g., GIS software, heuristic methods), which are not always sufficient to tackle the problem in all its complexity. Advanced AI methods, including integer linear programming and constraint programming, achieved optimal, constraint-satisfying and balanced protected area selections. These methods offer a robust alternative to heuristic approaches to address complex issues such as multi-criteria optimization and ecological connectivity integration.

This work is co-produced with Peruvian stakeholders in the choice of methodology, data sources and parameters. Regular meetings, workshops and capacity building were organized to ensure the relevance, trust and effective use of results.

Our results identify Peruvian areas of high ecological value to supplement the existing 17.88% of protected areas, aiming to achieve the 30% target in terms of biodiversity, carbon and water related ecosystem services, ecoregional representativity, and ecological connectivity.

This work serves as a fundamental component of Peru's territorial planning, supporting the GBF's objectives. It highlights the importance of integrating advanced spatial conservation planning methods with co-production approach, ecological and social factors, paving the way for further research and practical applications.

Keywords: Conservation planning; Water availability; Carbon sequestration; Ecological connectivity; Artificial Intelligence.



5. Automated mapping of bee-friendly trees: a novel approach to enhance pollinator conservation

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The worldwide decline in bee populations has sparked concerns regarding the stability of global ecosystems and agricultural productivity. As pollinators, bees are essential for the reproduction of numerous plant species, including those in urban environments. This study aims to assess the relationship between wild bee nesting sites and critical floral resources in cities. Thirty-four wild bee species collect pollen and nectar from willows, yet most of these species are oligolectic. We focus on a monolectic bee species, the *Andrena vaga* (grey-backed mining bee). They solely rely on the pollen of *Salix* trees as a source of protein for the growth and development of offspring. Specifically, we investigate the influence of the proximity to *Salix* (willow) trees on the preferred nesting locations and nest aggregation size of the *Andrena vaga*. The location of bee nesting sites were gathered through field work. We produce a city-wide tree *Salix* map using an automated approach to mapping bee-friendly trees. Our methodology utilizes multi-temporal satellite imagery, a tabular transformer deep learning algorithm, and a LiDAR-derived 3D tree model. The satellite imagery dataset consists of 40 (8-band) PlanetScope images with a spatial resolution of 3 m, these are used to extract and identify the unique phenological pattern associated with *Salix* trees. To ensure the adequate transferability of the deep learning model, the tabular transformer is extended with an enhanced spatio-temporal embedding. We apply this approach to the middle-size city of Braunschweig, Germany, to produce a comprehensive map of *Salix* occurrence throughout the city. The resulting map enhances our understanding of the relationship between these floral resources and bee nesting sites. Our method hopes to contribute to scalable and efficient solutions for identifying and conserving critical floral resources for the provision of pollination services in an urban context.

Keywords: Deep learning, pollinator conservation, remote sensing



6. Leveraging AI for Enhanced Systematic Reviews: Insights from Ecosystem Condition Indicators

First author(s): Philip Roche

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Effective evidence synthesis is crucial for integrating scientific research into decision-making processes, particularly in the environmental sciences. The exponential growth of scientific publications poses significant challenges in conducting comprehensive systematic reviews. This presentation explores the application of Generative AI, specifically the GPT-3.5 model, to streamline the systematic review process for studies on ecosystem condition indicators.

As part of the Horizon Europe SELINA project, our study demonstrates the development and implementation of an AI-driven approach to literature screening, emphasizing the importance of precision in prompt design and query parameter settings. We employed the GPT-3.5 model to classify publications based on their relevance to the topic of ecosystem condition indicators, achieving significant improvements in efficiency and accuracy compared to traditional manual screening methods.

The model was trained using a robust set of inclusion and exclusion criteria tailored to the multidimensional nature of ecosystem condition. We iteratively refined the prompt to enhance the model's performance, ultimately achieving an 83% accuracy rate, compared to human reviewers, in selecting relevant literature. This process involved the systematic identification of key terms and the exclusion of unrelated studies, ensuring a comprehensive and focused evidence synthesis.

Our findings highlight the potential of AI tools to reduce the time and resources required for systematic reviews while maintaining high standards of rigor and replicability. We also discuss the implications of this approach for future research, including the potential for integrating AI models into various stages of the systematic review process, from initial screening to full-text analysis.

By presenting a case study in ecosystem condition indicators, this presentation underscores the transformative potential of AI in environmental science research. It offers valuable insights for



researchers and policymakers seeking to enhance the efficiency and scope of evidence synthesis in the face of an ever-growing body of scientific literature.

Keywords: Systematic review, Large Language Models, Screening

7. AI and economic valuation – Leveraging AI for extraction and annotation of scientific literature into the Ecosystem Services Valuation Database

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The Ecosystem Services Valuation Database (ESVD) is the largest global database with monetary values of ecosystem services, consisting of 10,800 monetary values from 1,355 scientific studies and official reports. The ESVD consists of over 100 variables with information on ecosystem types and services, location and valuation methods among others. Effective annotation of these studies into the ESVD structure is crucial to leverage the value of research on ecosystem services into different forms of public and private decision-making. This abstract pilots the application of Generative AI, specifically the GPT-3.5/4 models, to extract and annotate data from scientific studies on ecosystem services in the ESVD.

Developing tailored large language models has the potential to significantly reduce the time of coding the thousands of valuation studies currently analyzed by human efforts, while also reducing human-made errors in the coding process.

In collaboration with SymbaioSys, the Foundation for Sustainable Development (FSD) conducted a small piloting study for the Dutch Ministry of Nature using GPT-3.5/4 for data annotation from valuation studies. The pilot project demonstrates the development and implementation of an AI-driven approach to analyze scientific papers and extracting relevant information to be directly integrated in the ESVD structure. We trained and tested the 3.5/4 model in the extraction and analysis of monetary valuation data and compared results with existing valuation data already in the ESVD.

Our findings highlight progression over time, with almost 0% accuracy on many variables to relatively high levels of accuracy (70%) in the annotation of several variables in relatively simple



studies (defined as containing only 1 monetary value). The project emphasized the importance of prompt design, parameter settings and the understanding of relation between variables in the context of scientific information. Dealing with challenges related to the model's understanding of relation, ambiguity and interpretation, which are highly associative tasks, is pivotal for this endeavor to be successful.

Keywords: Large language models, GPT-3.5/4, scientific literature, monetary valuation

8. Mapping the allergenicity of urban green spaces using very-high-resolution remote sensing data


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Over the past decades, pollen allergy has become one of the most widespread public health issues. The number of individuals having allergies to pollen has dramatically increased, especially in urban and industrial areas. Quantifying the allergenic potential of urban green spaces and developing allergy sensitive strategies for green space management and planning are therefore becoming increasingly important. Mapping the allergenicity of urban parks requires detailed information on tree species and tree crown volume which for many cities is not available or is not updated on a regular basis. This study assesses the potential of very high-resolution remote sensing for mapping allergenic tree genera and proposes a workflow for quantifying the allergenic potential of urban green spaces (UGS). Using a convolutional network approach six allergenic genera are mapped within 52 urban green spaces across the Brussels Capital Region. The classification model achieves an overall accuracy of 0.86, with precision for the six genera ranging from 0.82 to 0.92. By combining the obtained map with tree crown measures derived from airborne LiDAR data an assessment of the allergenicity of the 52 UGS is made, accounting for misclassification bias in the mapping of tree genera. Allergenicity values are generally lower for more formally designed parks in the center of Brussels, while higher values are obtained for parks located in the periphery of the region.



Keywords: urban green spaces; allergenic trees; allergenic potential; remote sensing; LiDAR; convolutional neural networks; deep learning

9. Assessing Determinants of Forest Gross Primary Productivity in China Using Machine Learning Approaches

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The global carbon balance is significantly impacted by gross primary productivity (GPP), which is influenced by different drivers at varying degrees. In this study, we assess the performance of two machine learning models (Random Forest and XGBoost) in explaining 29 years of forest GPP in China mainland (1990–2018). Using open datasets, we model forest GPP with climatic, topographic and anthropogenic variables. To evaluate the performance of the forest GPP models, three metrics were used, namely the coefficient of determination (R^2), the Mean Absolute Error (MAE), and the Root Mean Square Error (RMSE). The Random Forest outperformed XGBoost model using 10 explanatory variables and identified the most important forest GPP drivers as being temperature (26%), precipitation (19%), solar radiation (11%), forest fragmentation index (FFI) (9%) and soil moisture (8%). A spatial heterogeneity assessment using geodetectors confirmed 4 out of the 5 most important factors identified by the RF model. Additionally, it identified the climate zones as also being an important driver. Overall, we conclude that climatic drivers play a very important role in determining forest GPP in China. However, FFI also emerges as an important anthropogenic factor that needs to be efficiently monitored and managed for achieving China carbon neutrality objectives. Machine learning approaches using open data sources seem to be a very straightforward way of estimating climate related variables.

Keywords: Machine learning, Ecosystem services, Geodetectors, Forest fragmentation; Climate change

BOOK OF ABSTRACTS

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- II. SESSION PROGRAM
- III. ABSTRACTS

I. SESSION DESCRIPTION

ID: T20

Advancing Health Equity and Environmental Justice through Ecosystem Service Research

Hosts:

	Name	Organisation	E-mail
Host:	Francesc Baró	Vrije Universiteit Brussel (VUB)	francesc.baro@vub.be
Co-host(s):	Johannes Langemeyer	Universitat Autònoma de Barcelona (UAB)	johannes.langemeyer@uab.cat
	Brenda Maria Zoderer	University of Natural Resources and Life Sciences	brenda.zoderer@boku.ac.at
	Felipe Benra	Leuphana University of Lüneburg	felipe.benra@leuphana.de

Abstract:

In recent years, the ecosystem service (ES) research field has increasingly considered and focused on the multiple equity and justice implications attached to ES assessments (see for example the systematic review by Calderón–Argelich et al., 2021). This includes important work recognizing the (un)equal provision and distribution of ES and their benefits across space and time, the need for disaggregation across different socio-economic and demographic beneficiary groups with differing needs and vulnerabilities, the relevance of (un)balanced power relationships, institutional arrangements, and individuals' capabilities in driving (un)equal access to ES, and the importance of considering procedural and recognition justice components to address these imbalances. Despite these advancements, more research is needed to understand how ES research can advance health equity and environmental justice issues in its multiple dimensions.

This session proposal hence seeks to delve into the complex dynamics between ES, health/wellbeing equity, and environmental justice. It aims to foster a deeper understanding of



how disparities in access to and benefits from ES contribute to health inequities and social-ecological injustices. Therefore, the session will feature a diverse range of contributions addressing the main objectives of the ESP working group on “Justice in ES research”, including:

- Explore the linkages between ES and justice outcomes in its multiple dimensions and criteria.
- Develop methodologies for the research on justice and equity in relation to ES, including assessments of unequal production and distribution of ES among different groups of stakeholders and on how inequalities in needs and capabilities might hinder access to those ES.
- Explore social differences in needs, values, and knowledge systems to better understand the conditions under which unequal ES production and distribution leads to inequitable health and well-being outcomes.
- Bridge the gaps between different disciplinary backgrounds, as well as learn from different geographical contexts (e.g. urban and rural studies), with a focus on European case studies.
- Reflect on the justice implications of doing ES research (e.g. how different methodological choices might produce (un)equal ES outcomes or hide existing injustices).

References:

Calderón-Argelich, A., Benetti, S., Anguelovski, I., Connolly, J.J.T., Langemeyer, J., Baró, F., 2021. Tracing and building up environmental justice considerations in the urban ecosystem service literature: A systematic review. *Landscape and Urban Planning* 214, 104130.

Goals and objectives of the session:

The session is meant to keep fostering a community of researchers who are addressing justice and equity considerations in ES research (ESP Thematic working Group on “Justice in ES research”), including European collaborations and networks, and plan future outcomes in the frame of the working group. The session also aims to provide contributors to the ongoing Special Issue on “Equity and Justice in ES research” (*Ecosystem Services* journal) a platform to share and discuss their findings/advancements.

Planned output / Deliverables:

There is no a specific output planned, but potential synergies in the dissemination of the research contributions (beyond the ongoing Special Issue) will be explored during the session.



II. SESSION PROGRAM

Room: Expert Street 2

Date of session: 18th of November 2024

Time of session: 11h – 15:30h

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
11:00	Francesc	Baró	VUB (session host)	Session introduction: Part I
11:05	Felipe	Benra	Leuphana University Lüneburg	Diverse framings of equity and justice in ecosystem services research
11:15	Carl	Anderson	Leibniz University Hannover	Urban green space visitation for cooling off from extreme heat: A justice assessment using public participation GIS (PPGIS)
11:25	Helena	Duchková	Global Change Research Institute CAS; Charles University	Winners and losers of urban spatial design: Heat exposure and microclimate cooling across population groups
11:35	Anna Giulia	Castaldo	Politecnico di Milano	Evaluating heat mitigation inequities: a case in the federal district of Brasilia
11:45	Kate	Farley	UK Centre for Ecology & Hydrology	Comparing socioeconomic variation in greenspace benefits in two European cities
11:55	Johannes	Langemeyer	ICTA–UAB (session host)	Panel discussion I
12:30	LUNCH BREAK			
14:00	Francesc	Baró	VUB	Session introduction: Part II
14:05	Elsa	Gallez	VUB	Assessing inequities in children's use of green spaces after school hours using participatory GIS
14:15	Elsa	Gallez	VUB	Schools Staff's Enablers and Barriers to Support Children's Equitable Use of Green Infrastructure in Brussels



Time	First name	Surname	Organization	Title of presentation
14:25	Yuxin	Pu	VUB	Assessing Inequalities in Exposure and Accessibility to Urban Nature-based Solutions for Older Adults Living in Long-term Care Facilities.
14:35	Divya	Subramanian	DS Urban Analytics	Evaluating menstrual hygiene practices, participation in recreational ecosystem services, and health equity: A case of Bhopal, India
14:45	Ernesto	López Morales	Universidad San Sebastian	Eco-gentrification in Patagonia: Environmental Justice in urban-to-rural Urbanization
14:55	Felipe	Benra	Leuphana University Lüneburg (session host)	Panel discussion II
15:10			All hosts	ES Equity WG outlook/discussion
15:20				End of session

III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Urban green space visitation for cooling off from extreme heat: A justice assessment using public participation GIS (PPGIS)


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Extreme heat in urban areas is projected to increase due to climate change and characteristics of individuals can increase their vulnerability. Understanding how residents are adapting in urban spaces is important for promoting equitable and environmentally just adaptation planning. Public green spaces (PGS), a type of urban green infrastructure (UGI) under the



nature-based solutions (NbS) umbrella, reduce temperatures in cities and provide cooling oases for visitors on hot days. Green spaces and associated benefits have varying degrees of availability, access, and quality within different neighborhoods and for different people. We conduct a survey using the public participation geographic information system (PPGIS) platform Maptionnaire to explore the degree of equitable use of green spaces as cooling oases in Bochum, Germany. We assess equity as the condition that capacity for green space use matches residents' reliance (assessed according to stated demand, risk perception, and vulnerability to heat). We find that 1) cooling is a valued ecosystem service and visitation motivator; 2) future planning should prioritize elderly and lower-income residents/visitors; and 3) neighborhood green space access is rated highly but availability and quality show some spatial inequity. Our findings can inform environmentally just adaptation planning in Bochum and provide a methodological template for researchers and other global cities facing extreme heat.

Keywords: climate justice, social vulnerability, risk perception, ecosystem services, urban green infrastructure (UGI)

2. Evaluating heat mitigation inequities: a case in the federal district of Brasilia


First author(s): Anna Giulia Castaldo

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Paranoá (Brazil) is a small city near the primary urban area of Brasília, exhibiting an urban pattern characterized by extensive soil sealing and limited vegetation cover. Urban planning regulations have historically lacked any context-requirements for permeable land. Nevertheless, the area plays a crucial role in mitigating environmental risks for the whole urban context, as it is located upon one of the primary aquifer recharge areas. The present study uses bivariate Pearson's correlation to evaluate how the heat mitigation index's spatial patterns of the InVEST Urban Cooling (UC) model differ for vulnerable groups based on socio-demographic factors in Paranoá. By evaluating the nighttime heat mitigation index for both Paranoá and Brasília, which captures the variability in surface thermal response, the results reveal a significant disparity in urban cooling capacity between the two areas. The UC model, in line with increasingly common findings that highlight differences in how wealthy and poor cities address climatic hazards, underscores this inequality: Brasília benefits from a higher provision of cooling, while Paranoá exhibits a markedly lower cooling capacity. The study then explores Paranoá, which records a



higher number of vulnerable socio–demographic groups. The findings uncover further inequalities in the distribution of the ecosystem service benefits among the most vulnerable groups, emphasizing the need for the stratification of inequalities into ecosystem service studies when designing Nature–based Solutions strategies. Finally, the study examines the implications of the urban morphology and the social structure and proposes potential Nature–based Solutions to mitigate heat and provide further ecosystem services.

Keywords: heat mitigation, inequality, vulnerable groups, ecosystem services, nature–based solutions

3. Winners and losers of urban spatial design: Heat exposure and microclimate cooling across population groups

First author(s): Helena Duchková


Other author(s): Davina Vačkářová

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Extreme heat has become an exacerbating issue for many cities and their residents. The growing effects of climate change combined with the trends in urban expansion, development and other anthropogenic pressures are increasing urban temperature, further threatening residents' wellbeing and health. Urban heat can be mitigated by cooling services of ecosystems, but these are usually not evenly distributed within a city. The spatial design of cities can thus lead to disparities in exposure to extreme heat and the provision of ecosystem benefits such as microclimate cooling. This raises questions such as: Who are the beneficiaries of urban ecosystem cooling benefits? Who remains exposed to the impacts of heat?

This study investigates the distribution of microclimate cooling benefits among urban residents in Prague, Czech Republic. We employed the Urban Cooling InVEST model to estimate heat mitigation and identify areas with cooling benefits and areas of heat exposure during the day and night. These were then correlated with residential data to establish the average and identify deviations among various demographic and socio–economic population groups. The analysis did not indicate any outlying beneficiaries. However, some groups (non–Czech nationalities, ethnic minorities) receive fewer cooling benefits in their place of residence and surroundings. These groups are thus disadvantaged within the spatial design of the city. This study provides insights into intra–urban disparities in the provisioning of microclimate cooling by ecosystems. The findings can support adaptation planning that promotes equity and resilience to climate



change. The presentation also addresses limitations related to data, scale, methods, uncertainties in results, and discusses accessibility to benefit areas and the need for interventions to bridge the gap in cooling provision among different population groups.

Keywords: heat exposure, microclimate cooling, distributive environmental justice, urban planning, socio-economic disparities

4. Comparing socioeconomic variation in greenspace benefits in two European cities

First author(s): Kate Farley

Other author(s): Danial Owen, David Fletcher, Alice Fitch, Janice Scheffler, Laurence Jones

Affiliation: UK Centre for Ecology & Hydrology


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Socioeconomically deprived populations are at greater risk from adverse health outcomes relating to air pollution and often bear the additional burden of living in areas with higher exposure to pollution. The emerging 3–30–300 urban-greening rule provides guidance to improve equitable access to trees and greenspace but has not been tested.

We modelled how the rule could reduce PM_{2.5} exposure in two socioeconomically contrasting cities, Paris and Aarhus, compared with current land use. We used air quality models and socio-economic data to measure disparities in initial exposure to pollution across population subgroups, and exposure to reduced PM_{2.5} concentrations provided by greenspace. Socioeconomic data were disaggregated to residential buildings: households in poverty, age group, citizenship and education. Population-weighted averages for PM_{2.5} concentration and area of trees (m²) were compared across baseline and 3–30–300 scenarios.

Under the rule improvements in air quality were identified for all socioeconomic groups in both cities. In Paris, at baseline, more vulnerable populations were exposed to higher concentrations of PM_{2.5}. Application of the rule improved air quality for these populations but did not reduce the gap in exposure between more and less privileged groups. In contrast, for Aarhus, where baseline exposure was higher for higher-income and other privileged groups, the greatest improvements were indicated for the lowest income populations.

Implementation of the 3–30–300 rule could potentially improve air quality and reduce adverse health outcomes. However, equitable outcomes of the rule are dependent upon existing spatial



distribution of socio-economic groups. Thus, the gap between PM_{2.5} exposure for high- and low-income groups is not always decreased and could widen inequalities depending on the existing quantity and type of green space (e.g., trees vs grass). Co-benefits arising from green infrastructure such as mental health and social connectedness should also be considered and integrated analysis of multiple ESS benefits should be conducted.

Keywords: Urban, health, equity, air quality, green infrastructure

5. Schools Staff's Enablers and Barriers to Support Children's Equitable Use of Green Infrastructure in Brussels

First author(s): Elsa Gallez

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Because school environments are usually evenly distributed across urban areas, they can play a key role in mitigating children's inequitable access to residential green infrastructure (GI) and related benefits. The availability and increasingly promoted use of school-related GI (i.e. green schoolyards and off-site natural areas visited during school hours) offer various opportunities for children to engage with nature through formal or informal learning. By providing recreational and educational services, school-related GI is known to positively contribute to children's emotional, cognitive, social, and physical development.

However, many studies report that school staff experience a set of physical (e.g., distance, road safety), personal (e.g., fear of nature, lack of time or funding), and institutional (e.g., curriculum requirements) barriers to organizing nature-based outdoor activities in and outside the schoolyard. Integrating outdoor learning into the curriculum and allocating more time and funding for nature-based activities appear as potential solutions. To date, no studies have analysed how these enablers and barriers are perceived differently depending on schools' socio-demographic characteristics.

To fill this research gap, our study aims to examine school staff's enablers and barriers to support children's use of school-related GI, considering an equity perspective. To this end, a participatory GIS (PGIS) survey was disseminated to all preschool and primary schools (targeting



school directors and teachers) located in the Brussels Capital Region, complemented by several semi-structured interviews in disadvantaged schools.

The study reveals that most schools organize short visits to off-site GI at least once a month and day-long visits at least once a year. Trees and vegetable gardens are present in most schoolyards but are rarely used for educational purposes. Time constraints, lack of financial resources and limited staff are reported to be the main barriers to organizing off-site visits. More preliminary findings, especially on the equity analysis, will be presented at the conference.

Keywords: nature-based solutions; outdoor learning; children; environmental justice

6. Diverse framings of equity and justice in ecosystem services research

First author(s): Bruno Locatelli


Presenting author: Lasse Loft

Other author(s): Felipe Benra, Davide Geneletti, Lasse Loft, Jacqueline Loos, Barbara Schröter, Klara Winkler, Brenda Maria Zoderer

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Ecosystem services (ES) are integral to environmental justice, in particular because they unevenly contribute to the well-being of different communities. Effective ES management and governance can promote equitable access and ensure that marginalized groups are not excluded from ES benefits, while recognizing the interests of multiple stakeholders and fostering fair decision-making. Although environmental justice is a multifaceted concept encompassing distributive, procedural, and recognition dimensions, most research on justice in ES has focused primarily on distributional aspects. Recent reviews indicate a growing interest in integrating environmental justice concerns with ES, but also highlight gaps in understanding how justice and equity are framed and addressed in different contexts. We systematic reviewed the scientific literature to identify the major framings of the relationship between ES and justice. Through qualitative and quantitative analysis of 217 papers from an environmental justice perspective, we identified five distinct framings, i.e. particular conceptualizations of the relationship between ES and justice that ultimately influence what (in)justices can be rendered visible or invisible. Each of the framings ‘Space’, ‘Access’, ‘Values’, ‘PES’ (Payments for ES), and ‘Instruments’ is associated with specific research questions and methods on ES, which determine environmental justice judgements. The plurality of framings identified in this paper highlights the complexity of environmental justice as a concept and underscores the



importance of considering diverse viewpoints and experiences in addressing injustices in relation to ES.

Keywords: justice; equity; fairness; framings; systematic review

7. Assessing inequities in children's use of green spaces after school hours using participatory GIS

First author(s): Amy Phillips

Presenting author(s): Elsa Gallez


Other author(s): Frank Canters, Sylvie Gadeyne, Francesc Baró

Affiliation: Vrije Universiteit Brussel

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Due to the multiple ecosystem services they supply, exposure to and use of green spaces can have positive impacts on children's mental, physical, cognitive, and behavioral development. Despite these benefits, there are well-documented inequities in the provision of green spaces, leading to limited access for children in deprived urban areas. Understandings of these inequities remain incomplete, as there is insufficient research on the actual use of green spaces by children and the factors influencing their usage. This research aims to better understand parents' perceptions of the factors that enable and limit children's use of public green spaces after school hours. It further aims to identify how use of green spaces by children varies based on a combination of 1) the location of the child's school in relation to the green spaces most frequently visited, 2) parents' socio-demographic status, and 3) parents' orientations toward nature. To study these factors, a participatory GIS survey was launched in the Brussels Capital Region, Belgium, targeting parents of children aged 3–12. The survey asked parents how often their children visit green spaces on weekdays, which enablers and barriers their children experience in using green spaces, and to locate the green spaces their children use most on a map. Respondents also identified the cultural ecosystem services provided by green spaces that they consider most important for children. Results reveal that a lack of time is a significant barrier for children who do not visit green spaces after school, while having accessible green spaces and no private garden are strong enablers. Preliminary findings also suggest that children from higher-income families visit green spaces after school less frequently than those from lower-income families.

Keywords: children, schools, urban green spaces, environmental justice, PPGIS



8. Assessing Inequalities in Exposure and Accessibility to Urban Nature-based Solutions for Older Adults Living in Long-term Care Facilities

First author(s): Yuxin Pu

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Cities worldwide are increasingly facing the interconnected challenges of climate change and ageing populations, with older adults being especially vulnerable to climate-related extreme environmental events. In this context, Nature-based Solutions (NbS) have been proposed as actions that can tackle such challenges by contributing to urban climate change adaptation and providing multiple ecosystem services to the older population, including social interactions and recreational opportunities enhanced physical and mental health.

Aware of the multiple benefits of NbS for older adults, an increasing number of studies have investigated the equity implications in older adults' exposure and access to urban NbS. However, most studies lack a focus on older adults living in long-term care facilities (e.g., rest homes, senior centers, services flats). Because of the high vulnerability of this older population group in terms of health condition and mobility limitations, access to NbS and ecosystem services must be provided within or in the immediate surroundings of these facilities.

This research assesses the spatial patterns of older adults' exposure and access to NbS within and around long-term care facilities located in the Brussel Capital Region, also considering potential equity implications using socio-economic indicators at the neighborhood and facility levels.

The preliminary findings indicate that publicly owned care facilities have larger NbS within the compound area and easier access to nearby public green spaces, while those operated by private companies and non-profit organizations are mostly located in greener neighborhoods where the proportion of NbS is higher in a certain buffer distance. Higher exposure to NbS from care facilities for older adults also shows a negative association with neighborhood vulnerability indicators (e.g. low-income population), but not with care facilities' affordability (daily/monthly package price).



Keywords: socio–environmental equity, nature–based solutions, older adults, care facilities, urban green space

9. Evaluating menstrual hygiene practices, participation in recreational ecosystem services, and health equity: A case of Bhopal, India

First author(s): Divya Subramanian

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Access to menstrual hygiene management (MHM) along with clean water and sanitation facilities is a fundamental right for menstruating persons across the globe. In the global south, many women and girls from the lower income groups practice poor MHM on account of resource shortfall. Inadequate MHM along with myths and taboos regarding menstruation further hinder women's access to education, occupation, and recreation. The 'male' coded gendered cities seldom provide safe avenues for women's participation in navigating the city. Additionally, poor MHM during menstruation can significantly reduce women's mobility. To evaluate the factors impacting women's participation in recreational ecosystem services (RES), a survey of fifty women belonging to the lower income groups was conducted in the urban areas of Bhopal, India. The survey questionnaire was designed to gather information regarding personal MHM practices, access to clean water and sanitation resources, socio–economic profile, MHM products awareness, daily routines including recreational activities data, along with physical movement and RES use patterns. The survey participants included women who were in the age group of 18 years to 50 years. The survey highlighted severe lack of awareness regarding good MHM practices among the participants. Instances of unavailability of clean water and sanitation facilities specifically during menstruation leading to severe health impacts were recorded. The survey revealed a significant negative impact of menstruation and MHM practices on women's mobility and participation in the RES. This study further identified policy recommendations that could help mobilize women towards a more active lifestyle and follow good MHM practices during menstruation.

Keywords: Menstrual Hygiene Management, Recreational Ecosystem Services, Physical Activity, Health Equity



10. Eco-gentrification in Patagonia: Environmental Justice in urban-to-rural Urbanization

First author(s): Ernesto López-Morales

Other author(s): Luis INOSTROZA

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This study delves into the intricate relationship between gentrification and ecosystem services (ES), proposing that variations in ES and social displacement indicators can be correlated and observed qualitatively. This research case study is Patagonia, a significant, barely urbanized region in South America. Its focus on urban-to-rural migration and low-density urbanization is novel, as they have not been extensively explored in ecological gentrification research so far.

Human well-being in Patagonia has a rich history deeply rooted in utilizing natural capital and ES for employment and sustenance. These include water, air, wood, livestock, plant production, ecosystem management, cultural identity, and recreational activities. However, the recent influx of new residents seeking these benefits has significantly strained these resources.

Gentrification is widely accepted as changes in the built environment resulting in socioeconomic upward mobility and various forms of displacement, exclusion, and home loss. This eco-gentrification approach allows for the assessment of unequal co-production and distribution of ES. It examines how inequalities in needs and capabilities may hinder access to these essential services and well-being by the less affluent population.

The first part of this study involves mapping and valuing ES using official environmental data. This information is compared spatially with a visualization of the increase in land and property prices as an indicator of gentrification. Additionally, the study examines residents' socioeconomic changes using a Displacement Index based on 2002, 2017, and 2024 census data to understand population turnover trends.

The second part of the research is equally significant. It involves consulting with local communities to understand the changes in access to ES since 2019. This participatory approach delves into distributional, procedural, and recognitional aspects of planning and decision-making regarding the urbanization of this area. The paper critically reflects on the implications of justice and the contribution of eco-gentrification research to ES analysis.

Keywords: Gentrification; Ecosystem services; Eco-gentrification; Patagonia

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: O1


Early career voices and visions for ecosystem services research within the One Health framework in a time of global change

Hosts:

	Name	Organisation	E-mail
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	Maria Viota	University of the Basque Country (UPV/EHU)	viota.maria@gmail.com

Abstract:

Ensuring a stable flow of ecosystem services (ES) is critical for human well-being, which depends on maintaining and enhancing ecosystem health. This principle is the cornerstone of the One Health framework, which seeks to improve the health and well-being of all species and ecosystems. Both paradigms prioritise addressing current constraints to resilience and sustainability of positive health and development outcomes. Achieving a sustainable and resilient world will require a shift in our societal vision, through pivotal changes in the human-nature relationship, to mainstream the benefits of nature across society.



As Early Career Researchers (ECRs) are the future generation of scientists, our voices, perspectives and visions are vital to the future trajectory of ES research and to driving transformational change. While many ECRs are familiar with cutting-edge technologies such as AI, machine learning, and smart devices, there is also a recognised need for exposure to keep pace with the continuous evolution of ES framework.

Recognising this importance, the Young Ecosystem Services Specialists (YESS) network is hosting an inclusive and comprehensive session aimed at facilitating the exchange of innovative ideas in ES research, fostering collaboration, and exploring opportunities to extend the One Health framework. The session will provide a platform for ECRs to showcase their ongoing research in flexible formats, engage with a dynamic community of fellow researchers, and expand their professional networks. The session will be followed by a World Café for ECRs focusing on priority biomes, transdisciplinary working and the implementation challenges of transformative change.

Goals and objectives of the session:

1. To showcase the range of novel ecosystem service science research from ECRs that address diverse issues related to societal and ecosystem well-being.
2. Understand cases and experiences related to transformative changes in ecosystem services research from ECRs.
3. Foster collaboration among ECRs and other stakeholders to enhance the impact and mainstreaming of ecosystem services research.

Planned output / Deliverables:

The session will provide an overview of the latest research on ES carried out by ECRs. It will delve into the challenges faced by ECRs and explore potential solutions to these issues. Additionally, the session may propose ideas for YESSs' future direction, activities, and initiatives as an active supporting network for ECRs working in ES research. Recommendations for YESS and ESP can be examined to coordinate activities that navigate both networks through forthcoming changes. Based on the outcomes of the World Café, a research/comment paper will also be produced.



II. SESSION PROGRAM

Room: Expert Street 3

Date of session: 20th of November 2024

Time of session: 11:00–12:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
11:00			Introduction of YESS and session organisation	
11:10			Warm-up activities – mapping projects across EU from which YESSers are involved	
11:20	Jomme	Desair	Environmental Social Science Research Group (ESSRG)	Empowering Early Career Researchers for Transformative Change in Biodiversity Research and Policy
11:30	Vince	Van t' Hoff	Foundation of Sustainable Development	Making Nature Count 2024 – Updating the ESVD in 2024 to fit supply and demand.
11:45	Luis	Inostroza	Mendel University in Brno	Understanding the academic and publishing ecosystem: An editor's perspective on scientific production
12:00	Ishaq Hafiz	Khuzama	University of Campania "Luigi Vanvitelli", Italy	Enhancing Ecosystem Services by Introducing Multifunctional Land Use Management in a Semiarid Pastoral System in Portugal.
12:10			World Café and Discussion	



III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Empowering Early Career Researchers for Transformative Change in Biodiversity Research and Policy

First author(s): Karmen Czett

Presenting author(s): Jomme Desair

Other author(s): Tyler Kulfan, Kata Fodor, Louise Vercruysse

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Engaging early career researchers (ECRs) in biodiversity research and policy-making is essential, as they bring fresh perspectives, innovative ideas, and a deep commitment to addressing environmental challenges. Their involvement ensures a more inclusive approach to decision-making, fostering transformative change. However, empowering ECRs to participate in policy-related research and actively engage in science-policy-society interfaces (SPSIs) remains a significant challenge. This session introduces two ECR-driven networks, A4Cap and BioAgora ECRN, aimed at building ECR capacity for broader inclusion and greater impact.

A4Cap is a network of Alternet Summer School alumni and ECRs from Alternet partner institutes designed to create a collaborative, inclusive community for capacity building and networking among ECRs. Activities include assemblies for skill transfer, co-publishing, and transdisciplinary projects—organised via a non-hierarchical structure. The network focuses on integrating new members and ensuring long-term engagement and impact through capacity-building events and collaborative opportunities, emphasising transdisciplinary approaches and transformative change.

The BioAgora Early Career Researcher Network fosters collaboration and capacity development among ECRs within the BioAgora project. The network organises regular meetings and interactive workshops to strengthen interdisciplinary collaboration, integrate diverse perspectives, and enhance ECRs' collective impact. An upcoming workshop at the annual meeting will gather ECR perspectives on inclusive engagement strategies within SPSIs, fostering a more participatory research environment. The network also plans to engage early career policymakers, bridging the gap between researchers and policymakers early in their careers.



Both initiatives strive to establish collaborations with other ECR networks, building a broader coalition of early career experts in biodiversity conservation. They aim to amplify members' impact, share best practices across different fields and regions, and serve as models for engaging ECRs in the science–policy–society nexus. Through their collaborations, these networks seek to drive progress in biodiversity conservation, ensuring that ECRs play a central role in shaping a sustainable future.

Keywords: capacity building; biodiversity conservation; science–policy–society interfaces; early career researchers; inter- and transdisciplinary collaboration

2. Understanding the academic and publishing ecosystem. An editor's perspective on scientific production

First author(s): LUIS INOSTROZA

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Starting a career in the academy is challenging. The academic system is highly complex and many times confusing, making the start of an academic career difficult to young scholars. While common practices, protocols and behaviours are well-defined within the scientific arena, they are often not explicit. The most fundamental procedural knowledge that young researchers need to successfully navigate the academic landscape must be learned implicitly through mentoring –if you are lucky enough to have found good mentors– or simply by doing and failing. While the offer of pieces of training in the academic and publishing system is increasing, still, a sense of mystery about many activities that scientists perform remains. From aspects of having criteria to choose a good conference (what makes a conference good), clarifying your objectives for attending a particular conference, understanding what indexation or impact factor means, or simply having a clear picture of the important distinction between scientific research and scientific publication, within knowledge production, are very common areas where things remain unclear even at advanced career stages. This confusing panorama has been the breeding ground for predatory publishers and predatory conferences. The publish or perish modus operandi in the academic system is also showing that a more profound crisis in the scientific arena is unfolding, threatening the foundations of the knowledge production domain. In this presentation, many of these ideas will be discussed. The aim is to discuss the future of science, especially in the context of ecosystem services science.

Keywords: knowledge production, scientific publication, research, academic career



3. Making Nature Count 2024 – Updating the ESVD in 2024 to fit supply and demand

First author(s): Vince van 't Hoff

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This abstract aims to provide a discussion on the current standing of the ESVD, its applications, challenges and embeddedness within the international context and frameworks.

After several years of quick developments, the Ecosystem Services Valuation Database (ESVD) has reached over 11,400 monetary values for all ecosystem services and all ecosystem types all around the world. In addition, scientific developments have given space for the integration of monetary valuation data in the scientific, public and private domains. Papers have been written, AI has been piloted and value transfer functions have been developed to better estimate the value of ecosystem services on the basis of bio-physical and socio-economic indicators. The information in the ESVD has been made publicly and freely available on ESVD.net which includes visual representations of the data, a value transfer tool and summary statistics per ecosystem type.

Next to these developments, the monetary valuation data in the ESVD has been increasingly applied in financial and private sector to measure impacts and dependencies on nature and within the policy domain of the Global Biodiversity Framework (GBF) among others. These monetary ecosystem service values are important for sustainable natural resources management (by internalizing the value of nature) and natural capital accounting (by recognizing the value of nature in national accounts).

However, many questions regarding the implementation and transformative nature of monetary valuation remain, also in the scientific domain. How to better link the ESVD and the scientific community and how to fill data gaps? Given different opportunities and challenges, it is important to critically explore methodological considerations, assess advances and discuss applications of monetary valuation – in particular in relation to their potential role to inform decision making, underpin natural capital accounting, and facilitate transformative change towards sustainable natural resources management.

Keywords: ESVD, monetary valuation, application, policy, scientific developments



4. Impact of Climate Change on Forest Ecosystem Services in Southern Iberian Peninsula: The Modulating Role of Lithology

First author(s): Hafiz Khuzama Ishaq

Other author(s): Simona Castaldi, Daniel Fishburn, Victor Lechuga Ordoñez, Carlos Salazar-Mendias, Luis Merino Martín, Benjamin Viñegla Perez, José Antonio Carreira, Ana Rey

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Forests play an important role in climate change mitigation and supporting of human well-being providing important ecosystem services (ES). Thus, it is crucial to understand how ongoing climate change is impacting the ESs that forest provide. Mediterranean forests are one of the hotspots of biodiversity in the world as well as one of the most threaten areas by climate change. Forests productivity is limited by water scarcity, so future predictions of droughts impose a serious threat to these forests. Despite the increasing awareness of the importance of lithology as a crucial factor for the vulnerability of forests to climate change, the combined impacts of decreasing precipitation and lithology has not been investigated so far. This study was carried out in the context of a large project called LITHOFOR (Modulating role of lithology in the response of Mediterranean forests to climate change) with the aim of understanding if and how lithology modulates the impact of decreasing precipitation on forest ESs. In particular, carbon sequestration in biomass and soils, biodiversity, nutrient cycling and water retention. The study area includes three Sierras located along a natural precipitation gradient from 700 to 1400 mm yr⁻¹ in the South of Spain (province of Malaga). This represents a unique experimental set up where *Pinus pinaster* forests (maritime pine) grow at the three locations on three distinctive geological substrates (calcareous, peridotite and metapelite). Intensive field data collection was conducted over the course of the project involving above and belowground measurement of 900 trees (45 plots). Preliminary results suggest that forests growing on more stressful lithological conditions store less carbon aboveground but more belowground. Furthermore, these forests were less sensitive to drought and exhibit great belowground biodiversity. The findings have direct implications for forest managers, aiding in the development of targeted conservation strategies and climate change adaptation plans.

Keywords: Climate change, forest ecosystem services, lithology, biodiversity hotspot, *Pinus Pinaster*

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: O2

Transforming ecosystem services research through knowledge co-production and participatory approaches


Hosts:

	Name	Organisation	E-mail
Host:	Ina Sieber	Kassel Institute for Sustainability, Universität Kassel, Germany	ina.sieber@uni-kassel.de
Co-host(s):	Cathleen Cybèle Jarumi Kato-Huerta Andreas Braun	La Réunion Développement University of Trento, Trento, Italy Kassel Institute for Sustainability	cathleen.cybele@lareuniondeveloppement.re jarumi.katohuerta@unitn.it andreas.braun@uni-kassel.de

Abstract:

Against the backdrop of evolving environmental challenges and the need for sustainable, equitable and just resource management, this session addresses the transformative potential of co-producing knowledge in ecosystem services research. Ecosystem services, i.e. the benefits people derive from ecosystems, are closely linked to societal well-being and economic prosperity. Understanding, valuing and managing these services, which are often supported by strategies such as Nature-based Solutions (NbS), requires interdisciplinary collaboration, stakeholder engagement and innovative methodologies.

This session will provide a platform for researchers, practitioners, policy makers and stakeholders to explore how knowledge co-production processes can revolutionise ecosystem services research. Through knowledge co-production, or co-creation, which involves the active engagement of diverse stakeholders throughout the research process, new insights can be



generated to build collective understanding and develop innovative solutions to complex environmental problems. The co-benefits of such co-creation processes include enhanced awareness, capacity building, and positive spill-over effects.

This session opens up an arena for ES research that applies participatory and co-creation methodologies to explore the potential, opportunities, and challenges of such interactive, collaborative, and process-based research. We welcome all case studies that explore different approaches to co-creating knowledge, ranging from participatory action research, NbS co-production and citizen science initiatives. These methods not only democratise knowledge production, but also empower communities and stakeholders to actively participate in decision-making processes that affect their environment. Yet, challenges arise, as stakeholders are heterogenous groups with diverging interests and power relations at play, challenging conventional approaches to research. The session will share real-world examples where the co-production of knowledge has been applied for transformative change in ecosystem management. From restoring degraded ecosystems to building resilience in the face of climate change, with an impact on economic development, collaborative research efforts have the potential to achieve positive outcomes for people and nature.

The session's outcomes are broad: first, the session aims to inspire to use the knowledge co-production as a powerful tool to advance ecosystem services research and promote sustainability. Second, by harnessing the collective wisdom and expertise of diverse case studies, the session targets a shared publication, e.g. on the potential of co-production methodologies as a path to a more resilient, equitable and sustainable future for ecosystems and the communities that depend on them.


Goals and objectives of the session:

We want to facilitate experience sharing & joint knowledge production among researchers applying such knowledge co-production methodologies. We also aim to catalyse collaborations for co-authoring concrete scientific manuscripts on shared experiences. For this reason, we invite two types of presentations:

- (A) presentations that give a structured overview of the process of co-produced ES research
- (B) presentations that apply multiple participatory approaches in a tiered approach (for example: interviews, focus groups, expert assessments, PGIS), or identify future trends and priorities for future assessments.

Planned output / Deliverables:

We will invite the session participants to a pre-conference preparatory activity through a web survey. The outcomes of this activity will be presented at the session. In addition, for



presentations of type (A), we will give the presenting authors several questions in the form of a template, covering several aspects of assessment design, governance, and implementation.

At the end of the session we also plan to create a structured discussion on commonalities and the publication opportunities that they offer. Based on the (oral and poster) presentations, outcomes of the web survey, and the discussion session, we will negotiate a special issue in leading ES journal for publishing joint papers examining selected aspects of participatory and co-production methodologies.

Session format:

Standard session (presentations)

II. SESSION PROGRAM

Room: Success Avenue 1

Date of session: 21st of November 2024

Time of session: 11:00 – 12:30 & 13:30 – 15:30

Timetable speakers

Time	First Name	Surname	Organization	Title of presentation
11:00 – 11:14	Connie	Lopez		Rural Community Perceptions of Nature's Contributions to People (NCP) in a Wet Forest Protected Area: A Case Study in Northwestern Colombia, South America.
11:28 – 11:42	Alhassan	Ibrahim	James Hutton Institute	Challenges and transformations for large-scale peatland restoration: experience from working with European peat extraction stakeholders
11:42 – 11:56	Miguel	Moreira	Centre for Functional Ecology – Science for People and the Planet (CFE), TERRA Associate Laboratory, Department of Life Sciences, University of Coimbra, Portugal	Participatory mapping as territorial co-management tool through the spatial depiction of ecosystem services in the Portuguese Biosphere Reserves
11:56 – 12:10	Matteo	Giacomelli	Copernicus Institute of Sustainable Development, Utrecht	Including the perspective of stakeholders in landscape planning through the Ecosystem Services co-production



			University, the Netherlands	framework: an empirical exploration in Le Marche, Italy
12:10–12:24	Erica	Garau		Spatially combining social participatory with biophysical mapping. The role of landscape geographical components on perceived distribution of ES supply.
Lunch Break				
13:30 – 13:42	Cecilia	Zagaria		Co-developing and operationalizing a Multi-Criteria Analysis framework for the monitoring and evaluation of agroecological farming systems in Europe
13:42 – 13:54	Loes	Verkuil	Vrije Universiteit Amsterdam, the Netherlands	Perceptions of drivers and ecosystem services by agroecological farmers in the Netherlands
13:54 – 14:06	Swantje	Gebhard		A participatory planning tool to share knowledge and discuss landscape tradeoffs between ecosystem services and to inform implementation of Nature-based Solutions
14:06 – 14:18	Gerid	Hager	International Institute for Applied Systems Analysis (IIASA)	Observing biodiversity and ecosystem services with farmers: bottom-up pathways for engagement and knowledge co-production
14:18 – 14:30	Annemarie	Walczuck	Carl-von-Ossietzky Universität Oldenburg, Germany	Future Proof Grasslands: Enhancing Ecosystem Services through Effective Governance and Integrated Water
14:30–14:42	Edgars	Jūrmalis		Forest, park or nature conservation area? Engaging stakeholders in studying forest recreation.
14:42–14:54	Eliska	Tichopa		Collaborative Management of Ecosystem Services: Participatory Workshops in Natura 2000 Areas
14:54 – 15:06	Eirini	Gallou	University of Strathclyde	Practice-based reflections on the transformative potential and co-production capacity of methods for CES values capturing: lessons from small island context
15:06 – 15:30	Ina	Sieber	Kassel Institute for Sustainability, University of Kassel, Germany	The Transformative Potential of Participatory and Co-production Approaches in Ecosystem Services Research



III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Practice-based reflections on the transformative potential and co-production capacity of methods for CES values capturing: lessons from small island context

First authors(s): Eirini Gallou

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Understanding, valuing and managing ecosystem services, , i.e. the benefits people derive from ecosystems with a focus on cultural ones (CES), requires interdisciplinary collaboration, stakeholder engagement and innovative methodologies. This abstract provides a critical reflection of the experience of the researcher working with interviews and structured surveys as well as with less structured participatory methods (values and priorities workshops) on capturing the values of local community and leaders of ecosystem services at small island setting (Greece, island of Samothraki).

The Samothrace case will revolve around citizen-driven perceptions and values captured via tools like citizen surveys (Vlami et al 2020) and participatory workshops (Gallou & Alexopoulos, 2018, unpublished workshop report) that bring together stakeholders with different levels of power and expertise around assessing significance of C(ES) on a particularly challenging, resource-restricted islands context. It introduces a sustainable resource use perspective, integrated spatial zoning considerations in decision making and proposes new tools for synthesising co-produced value assessments (Gallou and Fouseki, 2019) and priorities for local level action.

Cultural and natural protected areas are included in the assessment (MAB proposed areas and nationally protected archaeological site) offering additional input around the complexity of assessing ecosystem services within the presence of trade-offs around protecting the symbolic, cultural and landscape aesthetic values of those.



The synthesis of findings and reflection on process and engagement of specific segments of stakeholders within each approach, will lead to grounded suggestions for ‘realising’ knowledge co-production in diverse contexts.

Discussion will include a focus on co-production capacity to capture top-down vs bottom-up values and perception (policy, citizens) and how the findings can be used in local decision-making contexts required to support localised actions on harnessing CES.

The paper critically counterpoises the aspect of assessing values around CES with co-production methods with similar scholarly approaches on pluralistic values from the discipline of critical heritage studies.

Keywords: Cultural ecosystem services, values assessment, co-production, local policy makers, participatory methods

2. Spatially combining social participatory with biophysical mapping. The role of landscape geographical components on perceived distribution of ES supply.

First authors(s): Enrica Garau

Other author(s): Josep, Pueyo-Ros, Amanda, Jiménez-Aceituno, Garry, Peterson, Albert, Norstrom, Anna, Ribas PDepartment of Geography, Institute of Environment, IMA-UdG, University of Girona, 17071 Girona, Spainalom, Josep, Vila-Subirós

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Social-ecological systems are characterized by multiple social and ecological interactions that reshape both ecological and social structures. Landscapes, understood as complex social-ecological systems, are typically formed through a variety of interactions between people and nature over long periods. Thus, ecosystem services (ES) provide a conceptual framework to examine and analyze social-ecological interactions in landscapes. Despite this, most approaches to landscape planning and ES mapping primarily emphasize the biophysical aspects rather than the social and cultural dimensions.

This raises important questions: What are the spatial relationships between social values and landscape features? How do different geographical features relate to people’s perception of



ecological processes? How can participatory approaches support knowledge co-production to improve sustainable environmental policies based on a shared understanding of landscapes?


This communication starts from the premise that participatory mapping can be employed to create spatial representations of people's perceptions, mental models, and local knowledge of ES, fostering collaboration, knowledge co-production, and co-design of shared visions of the landscape among participants.

We employ participatory mapping to explore how people's perceptions of provisioning, regulating, and cultural ES supply areas align or diverge with the landscape features in two Mediterranean river basins in north-eastern Catalonia, Spain.

Our findings indicate that random forest and geographically weighted regression techniques effectively correlate landscape features with stakeholders' perceptions of ES supply areas. These results reveal that stakeholders associate various geographical elements, such as reservoirs, mountains, and wetlands, with different types of ES supply areas more significantly than with ecological or biophysical indicators. This highlights that the ecological dynamics underlying ecosystem functions are often invisible and not fully comprehended.

Incorporating these informations into participatory landscape planning and practices can render the “invisible visible”, increasing stakeholder awareness, facilitating the development of more effective environmental policies, and fostering social understandings of ecological processes for transformative conservation policies.

Keywords: Social-ecological systems, Stakeholder perceptions, Participatory mapping, Knowledge co-production, Spatial analysis



3. Observing biodiversity and ecosystem services with farmers: bottom-up pathways for engagement and knowledge co-production

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Biodiversity and associated ecosystem services (ES) are essential for agroecosystem resilience, sustainability, and long-term food security. Traditionally, agricultural land management focused on short-term economic returns has been prioritized over management for environmental health and ES. Current mechanisms for encouraging farmers to use biodiversity-sensitive land management and food production practices are often applied at the individual farm rather than the landscape level, and they tend to be imposed top down from an EU or national level. At the same time, biodiversity and ES monitoring is infrequently carried out and gaps persist in demonstrating improvements to farmland biodiversity and ES. The EU “FRAMEwork” project addresses these challenges by supporting farmer- and community-led innovation. The project empowers eleven farmer groups, so-called ‘farmer clusters’, across nine European countries to improve biodiversity-friendly farming on a landscape scale as well as to observe and monitor biodiversity on their farms in partnership with researchers and local communities. While these farmer groups work as a collective to deliver landscape-scale management, supported by a group facilitator, locally run citizen science activities enable farmers and the local communities to understand and observe biodiversity and associated ES. This presentation provides a structured overview of the process of action-based co-production of knowledge based on a model of local stakeholder engagement at the science-society interface (Danielsen et al. 2022) coupled with the concept of value creation stories and storytelling (Wenger et al. 2011). It outlines several emerging activity pathways to engage farmers and local communities in context-specific learning about and conducting biodiversity and ecosystem services observations using citizen science methods and approaches.

Keywords: biodiversity observations, monitoring, citizen science, farmers, community engagement



4. Challenges and transformations for large-scale peatland restoration: experience from working with European peat extraction stakeholders

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While peatlands comprise only 3% of the global land area, fully functioning peatlands store up to 75% of atmospheric carbon, are home to precious biodiversity, and can be managed to help mitigate flood, drought and fire risks. However, management of peatlands has historically included draining for agriculture and forestry, extraction for burning for fuel and producing growing media. Europe has, therefore, lost over 50% of its peatlands, while the remaining are degraded and unable to provide their vital ecosystem services.

Implementing nature-based solutions (NbS) as a land management strategy could help restore peatlands to reduce their carbon emissions, contribute to fire risk reduction, and improve water flow regulation and biodiversity. However, the scale of degradation and diverse stakeholder interests in peatland values mean restoration should occur through transformative actions within the landscape context and multi-stakeholder collaboration.

This research shares the experience of co-developing transformative strategies to upscale peatland restoration through NbS and working with peat extraction stakeholders. The co-development process involved identifying an umbrella representative, following which stakeholder mapping was used to select private, public and non-governmental stakeholders to form a community of practice (CoP). Moreover, multiple interactions, including roundtables, interviews and bilateral discussions were used to understand the peat extraction sector and their priorities for peatland management. Finally, cooperation points were identified and used to develop future scenarios for large-scale restoration of peatlands through multi-stakeholder collaboration. We learned that since the peat extraction sector operates on a very small proportion of peatlands, they feel unfairly targeted and reluctant to take responsibility for the actions of major users of peatlands, such as agriculture and forestry, or manage peatland for specific services, such as reduction in fire risk. The CoP was dominated by for-profit organisations; hence, their support for large-scale restoration depends on how it benefits their business sustainability.

Keywords: Transformative peatland restoration; peat extraction sector; co-production; ecosystem services; nature-based solutions



5. Forest, park or nature conservation area? Engaging stakeholders in studying forest recreation.

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In 2024, a research project focusing on exploring user needs, management challenges and environmental pressures in urban and peri-urban/rural forests in Latvia was started. Using three distinct areas as case studies and combining a wide range of data collection and analysis methods, the project aims to develop recommendations for stakeholders and area managers and improve the links between recreational user groups.

The involvement of interested parties in the project is implemented via: 1) stakeholder identification for the model areas; 2) close cooperation with area managers; 3) informative events and involvement of stakeholders in project activities; 4) citizen science events.

Stakeholder identification revealed a complex set of public and private stakeholders for two areas, where the distance to adjacent urban centers defined the spectrum and number of private stakeholders and the level of nature protection regime influenced available recreational activities.

Area managers have been involved in the project since the proposal stage and remain closely incorporated in the project activities, but levels of involvement and general interest in such synergetic research projects can be discussed. A survey on managers' perspective has explored the aspects of infrastructure and waste management specific for each area and applied forest management methods. The results revealed several management challenges, such as poorly defined management targets and nature conservation-related restrictions and conflicts between several user groups, for example, hikers and skiers/mountain bikers.

So far, the project team has participated in two events organized in case study areas, with information about the research activities and a mini survey of the area visitors. The mini-survey results revealed the most- and least-liked aspects of the areas, as well as most frequent activities performed there.



The study is supported by Latvia Council of Science, grant No. lzp-2023/1-0137, 'Environmental impacts and management implications in forest areas important for recreation in Latvia'.

Keywords: urban and peri-urban forests, managers' perspective, societal preferences, ES tradeoffs, citizen science

6. Rural Community Perceptions of Nature's Contributions to People (NCP) in a Wet Forest Protected Area: A Case Study in Northwestern Colombia, South America.

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This master research investigates the influence of different types of capital—natural and anthropogenic—on the co-production of perceived Nature's Contributions to People (NCP) in the Cuervos Regional Integrated Management Districts protected area. Spanning 501.6 hectares, the area is characterized by premontane humid forest, with an average temperature ranging from 18 to 24°C and an annual rainfall exceeding 4,000 mm. The region comprises high open mountain forest (45.8%) and agricultural land (28.5%). It is inhabited by rural communities engaged in cattle raising, subsistence agriculture, and forest resource use, with limited access to basic services. Farm sizes range from 1 to 20 hectares.

Utilizing a participatory and qualitative approach, we engaged rural and farming communities through workshops and semi-structured interviews with key stakeholders. Our findings reveal that NCPs rarely arise from nature alone; they typically emerge from the interaction between natural and anthropogenic capital, affecting people both positively and negatively. The relationships between actors and their influence on different forms of capital are crucial in maintaining, creating, or producing these contributions.

Understanding the benefits that nature currently provides to people in this protected area, and the capitals required for their co-production, is essential for developing future strategies for sustainable natural resource management, rural development, and the overall health of the protected area. Furthermore, by identifying key actors and their influence on NCPs, we can



enhance collaboration between public, private, and community stakeholders. This improved collaboration is essential for effective decision-making and management of capitals, thereby generating positive impacts on NCPs and improving the quality of life for communities within the protected area.

Keywords: Nature's Contributions to People (NCP), Participatory Qualitative Research, rural communities

7. Participatory mapping as territorial co-management tool through the spatial depiction of ecosystem services in the Portuguese Biosphere Reserves

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Joana ALVES

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Ecosystem services (ES) supply depends on land-use governance and management decisions, where stakeholders in a landscape can be both beneficiaries and/or co-producers of ES. Participatory methodologies are crucial for linking territory needs to the sustainability of ES supply. In this sense, public participation geographical information system (PPGIS) approaches seek to understand the location of specific natural values and human perceptions and preferences for future land use and development. Biosphere Reserves (BRs) are pivotal for studying and fostering sustainable interactions between humans and nature. Hence, the linkage between the spatial depiction of ES based on stakeholders' perceptions and BR territories' governance may be a powerful tool to enhance its sustainable management. This study employed a PPGIS approach targeting local stakeholders across the 12 Portuguese BRs, to map its key ES using the Nature's Contributions to People (NCP) classification typology. Stakeholders actively mapped NCP within their BR territory, highlighting Habitat creation and maintenance (NCP 1), Physical and psychological experiences (NCP 16), and Supporting identities (NCP 17), underscoring the significance of the endogenous natural and cultural values from the BRs territories. In the analysis of mapped results, we identified NCP hotspots, pinpointing the most valued areas for conservation or restoration efforts. Zonation analysis within BRs was also assessed, revealing the perceived effectiveness of the different zones by local stakeholders. Our



study also provided valuable insights into non-material NCP from a local perspective, together with the place-based perception of regulating and material NCP provision. We outline that PPGIS may serve as a feasible GIS-based decision support system, offering a comprehensive assessment of NCP, especially for cultural values which are not easily quantified by remote methods. Therefore, participatory approaches such as PPGIS may play a crucial role in BRs governance, enhancing sustainability and equity by integrating local stakeholders' perceptions into land use planning.

Keywords: Natural resources governance, Nature's Contributions to People, Participatory planning, Stakeholders, PPGIS

8. The Transformative Potential of Participatory and Co-production Approaches in Ecosystem Services Research

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There is an increasing relevance of participatory and co-production approaches in ecosystem services (ES) research, particularly for the effective implementation of ES mapping and assessment at local and regional levels. This talk explores the transformative potential of these approaches, drawing insights from a pre-conference survey conducted to gather information on various participatory research methods, their aims, and the desired outcomes. The survey targeted a diverse group of ESP stakeholders, including researchers, practitioners, and community members involved in ES research and application.

Our findings highlight several key aspects: the diversity of participatory methods being employed, ranging from community workshops and focus groups to citizen science initiatives and collaborative mapping. The aims of these methods vary but commonly include enhancing the relevance and accuracy of ES assessments, fostering local engagement and ownership, and integrating traditional and local knowledge with scientific data. Desired outcomes frequently cited by respondents encompass improved decision-making, greater social equity, and increased ecological sustainability.

During our presentation, we will delve into the survey results, showcasing case studies that exemplify successful participatory and co-production efforts. These examples will illustrate the



tangible benefits of these approaches, such as heightened community awareness and more robust, context-specific ES management strategies. Moreover, we will address the challenges and limitations identified, including potential power imbalances, the need for capacity building, and the time-intensive nature of participatory processes.

The talk will conclude with an interactive discussion, inviting participants to share their experiences and perspectives on the implementation of participatory approaches in ES research. This exchange aims to foster a deeper understanding of the conditions under which these approaches can most effectively contribute to transformative change in ES research and practice.

Keywords: Citizen sciences, transformative change, participation

9. Perceptions of drivers and ecosystem services by agroecological farmers in the Netherlands


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Agroecological farm management has been recognized as a more sustainable alternative to conventional, highly industrialized farming systems, through the improvement of ecosystem services (ES). As farmers are directly responsible for managing agroecosystems, their decisions to transition to agroecological practices have a large influence on the environment. However, it is unknown how the perceptions and knowledge systems of farmers regarding their environment relate to management choices. Better understanding of these perceptions and related drivers can help create appropriate incentives for sustainable practices. This study assesses the drivers of farmers to transition from conventional management to agroecological practices, in relation to their perceptions on ES in their direct environment. The study is executed in the highly industrialized agricultural sector of the Netherlands. We co-created Fuzzy Cognitive Maps (FCM) with individual agroecological dairy farmers. The participants identified drivers for farm transformation for a range of predefined agroecological practices, and linked these to perceived effects on ES. The individual maps were combined into one FCM that shows the relations between relevant drivers, practices and ES. The results show that relevant drivers were operational costs, revenues and personal values such as ethics or resource autonomy and being less reliant of agro-industry. Overall, these results suggest that financial



strategy and personal beliefs are most influential upon agroecological transitions. Cost reduction was achieved mostly through pasture management practices, such as rotational grazing, and on-farm feed production. Revenues are increased mainly through nature management subsidies. Farmers indicated that the practices had a clear impact on biodiversity (through pasture management and landscape elements) and animal health (through animal welfare practices, robust breeds, and pasture management), and to a lesser extent soil quality and water availability. The perceived drivers and environmental benefits of measures can provide an important argument for policy makers and farmers to support agroecological transformations.

Keywords: Agroecological transitions, drivers of change, ecosystem services, Fuzzy Cognitive Mapping, farm management

10. Future Proof Grasslands: Enhancing Ecosystem Services through Effective Governance and Integrated Water

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Grassland farming is a central element in northwest Germany which plays a crucial role in achieving the sustainability transformation of rural areas. Approximately one-third of the agricultural land in Germany is permanent grassland. This cultural landscape provides various ecosystem services (ES) for humans (Gerowitt et al. 2013). Due to advancing climate change, the region faces more frequent and intense rainfall in winter and/or severe drought periods in summer (IPCC 2022). This situation increasingly challenges the existing management methods in both agriculture and water management, as well as flood protection. In light of these developments, a transformation towards integrated water management, which includes proactive water retention alongside traditional drainage, appears essential. This also requires an adjusted design of agriculture and other land uses, such as flood protection.

Against this backdrop, the transdisciplinary project "Future Proof Grasslands" (FPG) examines the socio-ecological transformation in two study areas in northwest Lower Saxony. Within the framework of the project, an iterative co-creation process (Mauser et al. 2013) is undertaken, involving cooperation among local and regional stakeholders from agriculture, water management, and science. Based on three future scenarios, solution-oriented approaches are



developed to strengthen ES by adapting water management to climate change. This contribution outlines the conceptual framework of the transdisciplinary collaboration within the FPG project and presents initial findings regarding prevailing governance structures (Vervoort und Gupta 2018) and the operationalization of the ES concept (Burkhard et al. 2012; Abson et al. 2014; Malmborg et al. 2021) in the context of grasslands. The following questions are the focus:

- What actor and governance structures exist in the context of grasslands in northwest Lower Saxony?
- Which ES characterize the grasslands in northwest Lower Saxony?
- What indicators can describe and assess the ES?
- How can the ES be located within the existing actor and governance framework?

Keywords: ecosystem services, governance, participation, water management, co-creation

11. Co-developing and operationalizing a Multi-Criteria Analysis framework for the monitoring and evaluation of agroecological farming systems in Europe

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Other author(s): Jeroen Groot, Aline Fockedey, Carla Barlagne, Jean-Luc Gouridine, Nathalie Mandonnet, Raquel Luján Soto, Elisa Oteros Rozas, Bertrand Dumont

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Agroecological interventions hold the potential to significantly transform our global food systems and increase the supply of numerous ecosystem services, including carbon storage, biodiversity conservation, nutrient cycling, and cultural services through the revitalization of rural communities. As a result, European policy is increasingly promoting agroecology and the development of transdisciplinary agroecological research to identify conditions under which such co-benefits can be achieved. This initiative has led researchers and practitioners to co-develop monitoring and evaluation frameworks, presenting a standardized means to build comparable evidence on the benefits of agroecology. These frameworks not only aim to support



results-based advocacy and policy-making in Europe, but also hold the ambition to directly contribute to local agroecological transition processes. However, few studies have examined the extent to which both these goals can be achieved, thus offering limited guidance on how to balance the demands of delivering salient and legitimate results at both local and supra-national scales. This research presents findings from the co-development and operationalization of a multi-criteria analysis framework to monitor and evaluate the impacts of agroecological interventions in three “Innovation Hubs” in Spain, Belgium, and Guadeloupe. These Hubs represent spaces of established science-practitioner agroecological collaboration, respectively evaluating the impacts of cover cropping in orchards, reduced tillage in organic arable systems, and crop-livestock integration in mixed farms. We showcase how conducting transdisciplinary research in these highly-diverse settings, facilitated by a reflexive project governance context focused on adaptive learning, resulted in a co-developed framework suited to the realization of both ambitions. Following a presentation of the co-development methodology, we present results on (1) the co-benefits and trade-offs of implementing agroecological interventions in the three Hubs based on a comparison of a common set of indicators aligned with EU policy objectives, and (2) lessons learnt on common challenges and tension-points, of value to future transdisciplinary projects.

Keywords: co-development; agroecology; monitoring and evaluation; reduced tillage; crop-livestock integration; cover cropping; experimentation

12. A participatory planning tool to share knowledge and discuss landscape tradeoffs between ecosystem services and to inform implementation of Nature-based Solutions

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Stakeholders in landscape planning are often faced with the challenge of balancing multiple demands for different ecosystem services. To assist actors with identifying ecosystem services tradeoffs and resolving societal challenges, a myriad of tools are available. However, existing approaches fall short to simultaneously integrate various ecosystem services, explicitly simulate spatial configuration effects, provide an understandable representation of the system for stakeholders with different expertise, and enable a dialog between them. Utilizing expert consultations and focus group-like interactions, we developed PLACES – Participatory



Landscape Configuration Effects Simulator. This tool estimates the influence of land use configurations on multiple ecosystem services in real-time and visualizes the tradeoffs among them. PLACES acts as a boundary object at the science-policy interface as it allows stakeholders of various backgrounds to create land use scenarios that are desirable according to their valuation of different ecosystem services. Moreover, through the interaction with maps of ecosystem services gains and losses, stakeholders get to experience spatial processes and the complexity of landscape planning.

PLACES is adaptable to different contexts, as such, we have applied it as a serious game at a mixed stakeholder workshop on the agricultural landscape in the Dutch province of Noord-Brabant. There, we gathered data to evaluate its usefulness to facilitate communication and understanding of landscape complexity. PLACES provided insights on spatial processes and sparked a discussion on the societal and economic goals for the landscape. Through the participatory approach and the ecosystem service tradeoffs in the study area, the participants contemplated the diverse interests and power relations of involved actors. Finally, the participants discussed the challenges and possibilities of transforming the landscape by incorporating Nature-based Solutions on a landscape scale such as sustainable agricultural practices and nature restoration.

Keywords: ecosystem services tradeoffs, land use planning, participatory planning tool, stakeholder communication

13. Including the perspective of stakeholders in landscape planning through the Ecosystem Services co-production framework: an empirical exploration in Le Marche, Italy

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Research on Ecosystem Services (ES) has become dominant in landscape planning to frame the relationship between people and nature. Increasingly, studies are stressing that most ES do not flow from nature alone but require a significant human contribution, known as ES co-production. However, there is a lack of understanding on how different stakeholders contribute to ES co-production. Here, we integrated the social actors perspective in landscape planning using questionnaires and focus groups in a local case study in Le Marche, Italy. We found that



respondents acknowledge co-production in a wide range of ES with major share of cultural ES. Mostly self-perceived as users and managers, local stakeholders invest in their activities mainly human and social capitals, while physical and financial capitals gain importance in the case of provisioning services. Our findings embraced the multiple aspects of human-nature interaction, offering the opportunity to bridge different sectors, such as agriculture, eco-tourism as well as resilience toward extreme events, toward a multifunctional vision of landscapes. The integration of the ES co-production framework proved useful in fostering the access of social actors to decision-making.

Keywords: Ecosystem services; co-production; landscape planning; nature contributions to people; land management; stakeholders.

14. Collaborative Management of Ecosystem Services: Participatory Workshops in Natura 2000 Areas

First author(s): Blanka Loučková

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Participatory approaches have emerged as an important component of ecosystem service (ES) assessments, reflecting a growing recognition of the need for inclusive stakeholder engagement in ecosystem service evaluation. This methodology integrates local knowledge and preferences into the assessment process, enhancing the relevance and applicability of findings for diverse communities. This study explores the role and impact of participatory workshops in the assessment and evaluation of ES within the Natura 2000 areas in the Czech Republic. The study was conducted within the LIFE-IP One Nature project through a series of 12 workshops in 3 protected areas held from 2022 to 2024, key local and regional stakeholders were actively engaged in identifying, prioritizing, and mapping ES. The workshops focused on managing trade-offs and fostering sustainable practices, incorporating diverse stakeholder perspectives, including nature protection representatives and local business sectors, to ensure a comprehensive and collaborative approach to ecosystem management. The methodological approach involving participatory mapping and iterative stakeholder involvement highlighted the synergies and conflicts among various ES, providing insights into stakeholder preferences and influence in decision-making processes. The results show not only the distribution of



ecosystem services mapped with stakeholder inputs, but also potential hot spots of ecosystem service synergies. The momentum gained by participatory assessments is attributed to their ability to bridge scientific and local knowledge. Additionally, this approach facilitates the incorporation of ES into everyday use, ensuring that local stakeholders directly engage with the concept and benefit categories. Overall, this study demonstrates the value of participatory processes in enhancing the governance and sustainable utilization of ES in protected areas.

Keywords: participatory approaches, ecosystem services, stakeholder engagement, participatory workshops, Natura 2000

BOOK OF ABSTRACTS

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

I. SESSION DESCRIPTION

ID: O3

Teaching ecosystem services around the globe – your lessons learnt

Hosts:

	Name	Organisation	E-mail
Host:	Nina Schwarz	University of Twente	n.schwarz@utwente.nl
Co-host(s):	Marija Bockarjova Wieteke Willemen	University of Twente University of Twente	m.bockarjova@utwente.nl l.l.willemen@utwente.nl

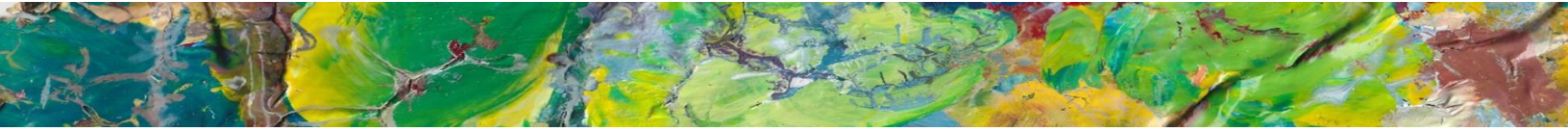
Abstract:

Many of us are teaching and give training about ecosystem services (ES), and know this is a non-trivial task. In this hands-on session, we aim at collecting tips on learning methods, formats and materials, identifying key challenges, implications from teaching for our own research and sharing lessons learnt about the dos and don'ts of teaching ecosystem services. Teachers involved in teaching at universities, schools, training professionals and in other contexts are invited! We hope to learn from each other and inspire participants for their own teaching.

Presenters can either talk about a course they are teaching, designing a course or (re-)evaluating their teaching. We encourage diverse types of contributions, such as pitching the challenges in ES teaching and the lessons learnt, or getting feedback from the audience by giving a mini lecture (10min) or an interactive unit to teach a certain concept or method related to ecosystem services, sharing perspectives on education approaches in the context of ES (Open Education, Inclusion). The aim is to learn together.

Do you want to join us? Submit your 'abstract' indicating the topic you want to present or get feedback on, and for what the audience is of your training/teaching, include any weblink you feel is useful to share (syllabus, video, learning outcomes).

Goals and objectives of the session:



Participants find inspiration in the range of examples how the ecosystem services concept is taught in different settings. Presenters can receive feedback on their talks / teaching units.

Planned output / Deliverables:

A collection of challenges faced when teaching ecosystem services in different contexts and a list of lessons learnt. Challenges and lessons learnt could be published as a position paper if participants are interested.

II. SESSION PROGRAM

Room: Expert Street 2

Date of session: 18th of November 2024

Time of session: 16:00–17:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
16:00	Davina	Vačkářová	Global Change Research Institute of the Czech Academy of Sciences	Teaching Ecosystem Services: Insights from a Decade of Course Curricula, Exercises, and Pedagogical Lessons
16:10	Alexander	van Oudenhoven	Leiden University	Teaching ecosystem services to an interdisciplinary and critical student population
16:20	Monika	Leuenhagen	Bielefeld University	How can the ecosystem services approach contribute to interdisciplinary teaching?
16:30	Nina	Schwarz	University of Twente	Design and development of accessible e-learning materials on urban green spaces in the tropics.
16:40	Francesc	Baró	Vrije Universiteit Brussel	Greening the City: Teaching Ecosystem Services in Urban Studies
16:50	Marija	Bockarjova	University of Twente	Teaching ecosystem services: understanding their value
17:00	Fiorella	Iaquinta	Universidad de la República	Intersection of the ecosystem approach to human health (Ecohealth) and Latin American extension traditions: teaching experiences in health-environmental issues
17:10	Click here to enter text.	ALL	Click here to enter text.	Discussion on challenges and ways forward



III. ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Greening the City: Teaching Ecosystem Services in Urban Studies

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Other author(s): Elsa Gallez, Amy Phillips

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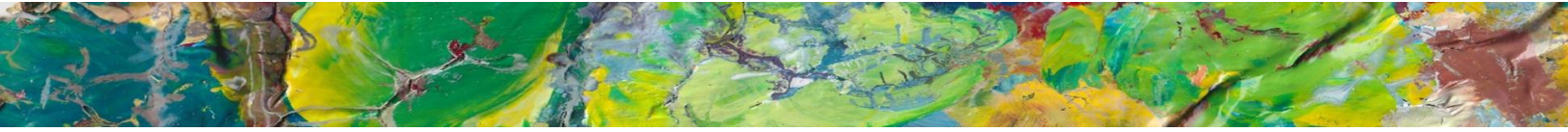
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Greening the City is a 6 ECTS course offered in the VUB MSc programs in Urban Studies, Geography, and Spatial Planning and Urban Design since the academic year 2021–2022. Students have very diverse educational and international backgrounds as the Urban Studies and Geography programs are highly interdisciplinary and taught in English.

One of the main learning goals of the course is that students master state-of-the-art theories, concepts, and ideas from urban ecology, with a focus on (urban) ecosystem services, green infrastructure and nature-based solutions. Students also get familiar with methodological approaches and tools for assessing urban nature and its benefits to urban residents (e.g., there is a hands-on session on i-Tree Eco) and develop a critical view on urban greening policies through the lenses of environmental justice scholarship.

The course loosely builds on a “flipped classroom” approach combining traditional lectures with student-led presentations and debates. In these debates, students are asked to review mandatory readings and other materials critically, and to share and discuss their insights with each other. The evaluation is based on the quality of these presentations and debates and two assignments: a short blogpost/media piece intended for a wide (non-academic) audience (all are available online from this site: <https://greeningthecityvub.wordpress.com/>) and an individual essay on a well-researched topic related to the course contents (a few students have even managed to publish their essay in the “Nature of Cities” platform – <https://www.thenatureofcities.com/essays/>).

In this session, we would like to share our lessons learnt from the first three editions of this course, based on the lecturers’ experiences, as well as the students’ feedback on what has worked and what could be improved. We are also happy to receive feedback/ideas from other



colleagues teaching (urban and non-urban) ES courses and engage in a discussion on key challenges and how we could address them.

Keywords: urban ecology, urban ecosystem services, urban environmental justice, flipped classroom, lessons learned

2. Teaching ecosystem services: understanding their value

First author(s): Marija Bockarjova

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Educating a new generation of academics and practitioners on the ecosystem services (ESS) and their value is essential for future nature-inclusive and well-informed societies. At the University of Twente (UT, the Netherlands), we offer a dedicated elective course on ecosystem services as benefits to people. From a teacher's perspective, it involves a range of methods to convey the economic, ecological, and intrinsic values of ESS. These methods include traditional lecturing introducing multiple perspectives on value, inviting guest speakers, and organizing visits to natural sites to observe ecological interventions firsthand. These approaches help deepen understanding and articulation of how ecosystems and human society are intertwined. In addition, we use the InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs) tool, which allows students to apply theoretical knowledge to real-world scenarios. This hands-on experience helps them understand the process of identifying, mapping, quantifying and monetizing selected ecosystem services, making the learning process more tangible and relevant. While tools like the InVEST model are valuable for applying and visualizing ESS concepts, the broader goal of ESS education is to instill a deep understanding and appreciation of the essential services ecosystems provide and the importance of their preservation. Balancing economic valuation with broader ecological and intrinsic values, we aim at promoting responsible environmental stewardship. By adopting this combined approach to ESS education, we aim at students developing understanding, critical thinking and problem-solving skills, preparing them for informed decision-making in their future profession.

Keywords: Value typologies; educational methods; InVEST tool



3. Intersection of the ecosystem approach to human health (Ecohealth) and Latin American extension traditions: teaching experiences in health-environmental issues

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Nowadays there is a conscious concern about the relationship between environment, society and human health. Evidence of the environmental problems is increasing, as is the loss of ecosystems functions and services that are essential for human well-being. This preoccupation has gained great importance in social, political and academic spheres. Transcending traditional health-environment approaches implies to connect aspects linked to environmental management and determinants of health, within a framework of holistic understanding and political action. This way of thinking must be introduced in the early stages of the academic journey. Like other universities in the region, Universidad de la República has claim Latin American extension traditions and generated changes in the study plans of undergraduate students introducing this approach into academic training. It presents territorial, participatory, transdisciplinary and critical thinking research concepts for the collective approach to problems of social interest. In this context, we present how from natural sciences we are introducing these concepts to our students and how to take them into action. Throw different programs the intersection of the ecosystem approach to human health (Ecohealth) and Latin American extension traditions are presented. The aim is to provide elements for a comprehensive approach to health-environment problems in territories. Besides, train university students who are critical and committed to social problems. Finally, we want to present opportunities and challenges linked to this intersection. The potential to resize the health processes of other university functions mediated by action and by solving in conjunction with social actors could be an opportunity. Challenges are related to transdisciplinary dimension, as well as to the time required to generate change in society in this kind of process. We hope that our teaching experience help others to introduce holistic approaches to students, allowing them to link health and environment, generate knowledge and transform it into actions.

Keywords: EcoHealth, Latin American Extension, Natural Sciences, Education



4. How can the ecosystem services approach contribute to interdisciplinary teaching?

First author(s): Stefanie H. Boltersdorf

Other author(s): Monika Leuenhagen, Stephan Unger, Nils Hasenbein

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Land use and pressure on ecosystems continue to increase, even in times of crisis and conflict. Land use often needs to be planned on a multifunctional basis to protect species, habitats and environmental media, and to take into account the different social perspectives and needs of those involved.

Students who will be working on solutions to these conflicts in the future will need in-depth knowledge of how to identify and assess the state of ecosystems and the impact of projects that cause ecosystem degradation. They also need an interdisciplinary overview to be able to consider the different social perspectives on the changing use of the environment. Students should also be able to actively and appropriately apply and implement such knowledge and skills to plan suitable nature-based interventions.

Some experience of how these objectives can be achieved is already available from courses in environmental science, landscape analysis and ecology, or the application of geographic information systems, where students work on topics related to the adaptations and transformations required in urban and rural areas in the context of global change. Important aspects include collaboration with researchers from other disciplines and practitioners, scenario-based learning and the integration of practical teaching through fieldwork and excursions.

The potential benefits of considering ecosystem services (ES) as a protected good and integrating them in the context of planning have already been described. The concept of ES can also be further integrated into teaching: building on ES as a framework concept to describe ecosystem services also from the perspective of the economy, health, education, tourism and other social systems, interdisciplinarity and diversity of perspectives can be anchored in theory. We present conceptual ideas, experiences and challenges as a basis for discussion.

Keywords: Applied teaching, Landscape analysis, Ecosystem services, Interdisciplinarity, Scenario-based learning



5. Design and development of accessible e-learning materials on urban green spaces in the tropics.

First author(s): Nina Schwarz

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What do urban planners and managers need to know about the role of nature in the context of urban planning challenges worldwide, especially in the tropics? This is the overarching question our e-learning module on urban green spaces is covering. Our e-module provides open and accessible digital learning materials for higher education and professional training, that can be given as a standalone course of about 40 hours or within a course. The learning materials consist of micro-lectures, reading, quizzes and practical exercises. We developed the course for a project on urban green in Paramaribo, Suriname (www.groenparamaribo.org).

We share our insights on course design, implementation and evaluation focusing on the open and accessible character. For design, we followed the Arena Blended Connected (ABC) curriculum design approach. For each learning activity, the ABC approach provides a list of digital technologies (e.g., acquisition by video or animation), making us aware of the options we had.

For implementation, we expected our target audience not to have reliable internet connection. Therefore, we implemented the course so that it can be used offline which limited options for interactivity. We used the free and open source tool eXeLearning (<https://exelearning.net>) as platform for our learning materials. Our choice to share the e-module under a creative commons license limited our options for reading materials, especially older papers which were not openly accessible or sharable.

Developing teaching materials is a team effort. For example, university teachers in Suriname provided feedback after the initial design. Students checked the materials for clarity and time required. Throughout the process, we also received support from colleagues who facilitated the course design, moved materials into eXeLearning, went over all scripts and helped recording the micro-lectures. The course is accessible under <https://doi.org/10.5281/zenodo.6907816>.

Keywords: Urban ecosystem services, education, e-learning, evaluation, tropics



6. Teaching Ecosystem Services: Insights from a Decade of Course Curricula, Exercises, and Pedagogical Lessons

First authors(s): Davina Vackarova

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This contribution focuses on over a decade of accumulated experiences and knowledge in teaching ecosystem services at Charles University in Prague, Czechia. It highlights the evolution of the course curricula, showcasing various exercises and teaching methodologies designed to deepen students' understanding of ecosystem services, including its scientific basis, methods, and practical applications. Developed since 2012, this elective course for environment and geography students at the Faculty of Science has continuously evolved, with ongoing improvements enhancing its effectiveness.

The presentation will also address the challenges encountered, such as the multidisciplinary nature of the topic, and provides a brief reflection on potential obstacles. Additionally, it will discuss the accessibility of teaching materials, emphasizing the use of international reports, scientific papers, and other resources like videos and news articles. By sharing selected experiences and exercises, this contribution aims to offer examples and inspiration for educators teaching ecosystem services, fostering improved teaching practices and student engagement.

Keywords: Ecosystem services, Environmental education, Hands-on Exercises, Interdisciplinary learning, Curriculum development

7. Teaching ecosystem services to an interdisciplinary and critical student population

First authors(s): Alexander van Oudenhoven

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The role of and framing of the ecosystem services concept has changed substantially over time. Dealing with these changes is particularly challenging in higher education, especially when courses are to be repeated yearly in a fixed curriculum. As one of the many themes in sustainability sciences, the concept evolves continuously, continues to receive criticism and



actually deals with a topic bigger than itself: human–nature relations and the multiple values involved. Here, I would like to share how I have dealt with challenges related to a changing concept in higher education. I will do so in the context of a dedicated BSc course on the topic Ecosystem Services and a MSc course on the science–policy interface of biodiversity, both at Leiden University.

The BSc course is structured along the fairly traditional DPSIR–based ‘cascade model’, widely used to conceptualize and analyse ecosystem services. In the MSc course, the concept is the topic of one week, embedded in a much broader framework and assignment. Here, it is up to the students to use it, depending on the context and whether they find it appropriate for addressing their research challenge.

Several recurring issues have emerged when teaching on ecosystem services. First, it is crucial to embed this teaching in the wider context of the multiple values of nature. Also, when students have different backgrounds, their perspectives on the concept differs wildly prior to teaching them. Also, embedding the concept explicitly in the science–policy interface makes it more tangible to students, beyond merely a concept on paper. Finally, I would argue that repeatedly teaching on ecosystem services forces the teacher to continuously rethink and critically evaluate the very concept. This is something I hope every scholar can experience every now and then.

Keywords: science–policy interface, IPBES, values, ecosystem services, education

BOOK OF ABSTRACTS

- I. SESSION DESCRIPTION
- II. SESSION PROGRAM

I. SESSION DESCRIPTION

ID: O4

Why would I work with others? Motivations for collaboration at landscape level

Hosts:

	Name	Organisation	E-mail
Host:	Francis Turkelboom	INBO	francis.turkelboom@inbo.be
Co-host(s):	Mario Torralba Nicolas Dendoncker Louise Vercruysse Enrica Garau David Stella	VU Amsterdam Université de Namur INBO;Universidad de Almería; CzechGlobe – Global Change Research Institute of the Czech Academy of Sciences (GCRI)	m.torralbaviorreta@vu.nl nicolas.dendoncker@unamur.be louise.vercruysse@inbo.be egarau@ual.es stella.d@czechglobe.cz

Abstract:

□ Multifunctional regions with a high landscape quality often receive attention from policy makers and the wider public for their rich biodiversity and their opportunities for natural resources use, tourism, regional products and other societal benefits. The necessity to better include the needs of local actors becomes more recognized, but this can be challenging as their perspectives, stakes and values are often very diverse and sometimes contradicting. Therefore, managing multifunctional landscapes involves the negotiation of trade-offs between multiple objectives and diverse values. The success of transformative change at landscape level depends to a large extent on actors' motivations and their capacity to create coalitions and work together on the landscape level.

Goals and objectives of the session:

The goal of this interactive session is to experience and reflect on conducive conditions that motivate stakeholders to collaborate at landscape level. Via a role play participants will experience the challenges of working together for a local common good. We will use a virtual placed-based case, but which is inspired on existing protected landscapes. The stakeholders of this case have



different needs and different levels of power, and have some conflicting land-uses. The frictions will revolve around agriculture, nature, recreation and water management. Due to interdependency, the actors will have to find a way to collaborate, but this will require transdisciplinary bridge-building and social skills. The participants will reflect on their experiences from the role play and from their own work. At the end, we will link these experiences to the findings of an exhaustive literature search on this topic. The goal of this creative session is to experience and reflect on conducive conditions that motivate stakeholders to collaborate at landscape level. Via a role play participants will experience the challenges of working together for a local common good. We will use a virtual placed-based case, but which is inspired on existing protected landscapes. The stakeholders of this case have different needs and different levels of power, and have some conflicting land-uses. The frictions will revolve around agriculture, nature, recreation and water management. Due to interdependency, the actors will have to find a way to collaborate, but this will require transdisciplinary bridge building and social skills. The participants will reflect on their experiences from the role play and from their own work. At the end, we will link these experiences to the findings of an exhaustive literature search on this topic.

Planned output / Deliverables:

1) Increased awareness about the challenges and opportunities for stakeholder collaboration at landscape level, 2) Networking with interested people, 3) Potential collaboration via empirical case studies.

Session format:

Role play, presentation, plenary discussion.

This session is an interactive session. Everybody interested in the session topic is cordially invited to join! Participation of people with a policy or practice background are specially invited, as this will add an additional reality-dimension to the session. The session will be interactive, so willingness to participate in the role play is required. However, facilitators will make the session low-threshold, informal and fun.

II. SESSION PROGRAM

Room: Expert Street 4

Date of session: 20th of November 2024

Time of session: 11:00–12:30

BOOK OF ABSTRACTS

- I. SESSION DESCRIPTION
- II. SESSION PROGRAM

I. SESSION DESCRIPTION

ID: O5

Communities of practice – how to make them truly transformative?

Hosts:

	Name	Organisation	E-mail
Host:	Inge Liekens Mieke Siebers	VITO FSD	Inge.lieken@vito.be
Co-host(s):	Dieter Cuypers Joeri Nau	VITO VITO	Dieter.cuypers@vito.be Joeri.naus@vito.be

Abstract:

Transformative change. The term is heard everywhere, but what does it mean? And how can you integrate it in your networks? A lot of countries have national networks or communities of practice on ecosystem services science, nature restoration, and biodiversity conservation. But although important to share knowledge with peers, a lot of them lack participants outside the specific science, missing valuable practices in other fields. This session aims to let the participants explore what transformative change is about and how to bring this within your networks Central to our discussion will be an in-depth examination of the EU Horizon SELINA project's "communities of practice," utilizing the metaphor of mycelium to illuminate pathways towards transformative action. Through a dynamic eye-opener workshop , we will search together for the best ways to make communities more transformative and translate knowledge into actionable strategies, fostering the growth of Communities of Practice dedicated to advancing transformative change in ecosystem services.

Goals and objectives of the session:

By combining theoretical insights with practical strategies and fostering collaboration among diverse stakeholders, this session aims to empower participants to become catalysts for transformative change within the ecosystem services domain.



Provide an insight on what transformative change is about

- Showcase why National networks or Communities of Practice can play an important role in initiating transformative change
- Explore together what is needed to foster dialogue and collaboration among researchers, practitioners, and stakeholders committed to advancing transformative change.

Specific objectives:

- Explore key concepts and theories underpinning transformative change
- Identify barriers and challenges hindering transformative change efforts within communities of practice and strategies for overcoming them.
- Let participants taste of an eye-opener workshop to learn from each other and translate lessons to actions in their respective contexts.
- Facilitate interactive discussions and knowledge-sharing sessions to foster cross-disciplinary collaboration and learning.

Planned output / Deliverables:

- Understanding transformative change
- Framework for establishing and nurturing Communities of Practice focused on transformative change
- Compilation of workshop outputs, including action plans, resource guides, and collaborative initiatives

Session format:

1. Introduction (15 minutes): Overview of session objectives and structure.
2. Presentations (75 minutes):
 - a. What is Transformative change about?
 - b. Mycelium Metaphor: Navigating Pathways to Transformation
 - c. Communities of practice and their possible role in transformative change
3. Workshop (45 minutes):
 - a. Breakout Groups: Small group discussions and activities.
 - b. Knowledge Sharing: Reporting back and synthesizing insights.
 - c. Action Planning: Identifying next steps and collaborative opportunities.



4. Closing Remarks (15 minutes): Reflections on key takeaways and future directions.

II. SESSION PROGRAM

Room: Expert Street 9

Date of session: 20th of November 2024

Time of session: 13:30 – 15:30

BOOK OF ABSTRACTS

- I. SESSION DESCRIPTION
- II. SESSION PROGRAM

I. SESSION DESCRIPTION

ID: O6

Communicating nature's benefits in protected areas – from theory to practice

Hosts:

	Name	Organisation	E-mail
Host:	Irene Bouwma	Wageningen Environmental Research – WUR	irene.bouwma@wur.nl
Co-host(s):	Theo van der Sluis	Wageningen Environmental Research – WUR	theo.vandersluis@wur.nl

Abstract:

Nature is more than species and habitats; it provides numerous benefits to society. The importance of natural areas in safeguarding biodiversity, but also in supplying a range of provisioning, regulating and cultural services, is widely acknowledged. While the idea of nature benefits (ecosystem services) is firmly embraced in scientific research and policy development, challenges remain at the implementation level. The majority of professionals involved in natural area management struggle to assess the benefits of their sites and communicate these to stakeholders. The majority of communication on nature areas in Western Europe is still focused on the biodiversity benefits while communication of the nature benefits of protected areas might ensure additional support. To help bridge the gap between the scientific knowledge and daily implementation the Erasmus+ project “Nature Benefits: from Theory to Practice (TUNE IT)” has started. Practitioners are exchanging experiences on how to communicate nature benefits to stakeholders. During this workshop we will provide you with practical insights in how to communicate nature benefits of protected areas to stakeholders. After an introduction and some indoor exercises, we will take you to a nature area near the conference center where you will experience first-hand the do and don't of communicating nature benefits during an excursion.



Goals and objectives of the session:

Provide participants with insight of how you can communicate the values of a protected area by offering them a theoretical background information and let them discuss and create communication approaches.

Planned output / Deliverables:

Powerpoint from session

Training exercises

Possibly a short movie of the excursion (if feasible)

Session format:

One-and a half hour training class/Workshop (half an hour presentations and interactive session, 1 hour work in small groups)

II. SESSION PROGRAM

Room: Expert Street 9

Date of session: 21st of November 2024

Time of session: 11:00 – 12:30

BOOK OF ABSTRACTS

- I. SESSION DESCRIPTION
- II. SESSION PROGRAM

I. SESSION DESCRIPTION

ID: 07

Transformative change; Building Public Private Partnerships

Hosts:

	Name	Organisation	E-mail
Host:	Pauline Buffing David Grim Esmee Kooijman Mieke Siebers	NL Ministry of Agriculture, Fisheries, Food Security and Nature Foundation for Sustainable Development	p.k.buffing@minlnv.nl d.c.grim@minlnv.nl e.d.kooijman@minlnv.nl mieke.siebers@fsd.nl


Speakers:

PPS project

- Pauline Buffing, NL Ministry of Agriculture, Fisheries, Food Security and Nature, Department Science Knowledge and Innovation (SKI)
- Haki Pamuk, WUR
- Miel Hooydonk, Wageningen Academy
- Ioanna Biris, Nature Desks
- David Grim, NL Ministry of Agriculture, Fisheries, Food Security and Nature, Collective Nature inclusive

Abstract:

This session aims to bridge the gap between research and practical application by exploring the potential for transformative change through public-private partnerships (PPPs). With an emphasis on interdisciplinary collaboration, we will identify the barriers that scientists face in moving beyond siloed research and into practical implementation. The session will feature presentations on best practices for PPPs, highlighting the importance of applied knowledge and transdisciplinary research for societal impact. Participants will engage in discussions to uncover opportunities and



challenges related to PPPs, fostering inspiration and collaboration among researchers, policymakers, NGOs and private sector representatives.

Goals and objectives of the session:

- Inspire collaboration in public–private partnerships (PPPs) with a focus on the process and content.
- Encourage scientists to extend their focus beyond fundamental research and connect with practical applications.
- Identify barriers to effective PPP collaboration and develop strategies to overcome these challenges.
- To understand how to design effective instruments for facilitating PPPs and ensuring real–world impact.

Planned output / Deliverables:

- A list of scientists (with their research areas) interested in PPP collaboration, which can serve as a basis for a matchmaking event.
- A compilation of the top 10 barriers to PPP collaborations identified during the session.
- Insights and inspiration for researchers regarding the opportunities presented by PPP collaborations.

Session format:

The session will consist of two main parts:

- 90–Minute Session (11:00–12:30)
 - 5 min: Arrival
 - 5 min: Welcome and introduction
 - 40 min: 5 Pitches: Different perspectives on PPP`s; stories from practice
 - 35 min: Round table discussion: “What challenges do you face?” / What is needed to lower these barriers / “How can you make an impact with your research?”
 - 5 min: short wrap–up and explanation marketplace
- Follow up at Marketplace (13:30–15:00)

An open session where participants can engage with the co–hosts and speakers and vote on the top barriers and opportunities for Building Public Private Partnerships for Transformative Change.

Relevance for Scientists:

As environmental scientists face increasing pressure to address complex global challenges, the need for collaborative approaches that extend beyond traditional research boundaries has never been more critical. This session provides a unique opportunity for scientists to engage directly



with representatives from the public, private and third sector and learn how their research can be translated into practical applications. By attending, participants will gain insights into successful PPPs and understand the specific barriers hindering collaboration. This knowledge will empower researchers to create impactful partnerships that can lead to innovative solutions in environmental sustainability, ultimately enhancing their research's relevance and applicability in real-world contexts.



II. SESSION PROGRAM

Room: Expert Street 5

Date of session: 20th of November 2024

Time of session: 11:00 – 12:30

Follow up at Marketplace (13:30–15:00)