BOOK OF ABSTRACTS

This Book of Abstracts provides a comprehensive overview of the session content and is structured into three main sections:

I. Session Description – an introduction to each session, including its objectives and expected outputs
II. Session Program – a detailed schedule for each session, including speakers and timing
III. List of Abstracts – a complete compilation of all accepted abstracts

I. SESSION DESCRIPTION

ID: T2a

Integrating co-benefits into the evaluation of nature-based solutions to support ecological restoration

Hosts:

	Name	Organisation	E-mail
Host (s):	Uta Schirpke	Eurac Research	uta.schirpke@eurac.edu
Co-host(s):	Alberto González-García Aida Gonzalez Ramil	Université Grenoble Alpes Eurac Research	alberto.gonzalez-garcia@univ-grenoble-alpes.fr Aida.GonzalezRamil@eurac.edu

Abstract:

The UN Decade on Ecosystem Restoration has catalyzed global efforts to reverse environmental degradation. This is reflected in policy instruments such as the EU Nature Restoration Law, which mandates the restoration of all ecosystems in need by 2050, and the Kunming-Montreal Global Biodiversity Framework, which targets the restoration of 30% of degraded ecosystems. Within this context, Nature-based Solutions (NbS) have emerged as a promising approach to effectively promote ecosystem creation, restoration, and enhancement, with direct implications for biodiversity conservation. However, despite growing interest, empirical understanding of the capacity of NbS to co-generate benefits for human well-being remains limited. Specifically, there is a need for systematic analysis on how co-benefits, generated through the provision and enhancement of ecosystem services, can be strategically planned, governed, and equitably distributed. This necessitates insights into the typology of co-benefits, the identification of both intended and unintended beneficiaries, and the allocation of benefits across diverse societal groups. In this session, we therefore will address the following key questions:

1. How can we comprehensively assess the co-benefits and trade-offs of NbS in restoration projects, including their distribution across beneficiaries?
2. What tools, methods, and indicators best capture the diverse values of ecosystem services for effective integration of NbS into planning and governance?
3. How can the ecosystem services framework be operationalized to navigate trade-offs, address implementation barriers, and inform decision-making across diverse contexts?

We invite scientists and practitioners from diverse disciplines to submit conceptual, methodological, or empirical contributions. We especially welcome submissions that address the session's key questions across a variety of socio-ecological systems and scales. Contributions could, for example, present novel methods for assessing co-benefits, analyze the distributional effects of NbS in specific case studies, or explore synergies and trade-offs in restoration projects. Studies employing interdisciplinary and transdisciplinary approaches are highly encouraged.

Goals and objectives of the session:

This session aims bringing together scientists and practitioners to discuss and identify the opportunities and challenges of the concept of ecosystem services to support the implementation of nature-based solutions in the context of ecological restoration efforts.

Planned output / Deliverables:

The session will be the basis for a common paper with interested participants, which will be further developed after the conference.

Session format:

The session will be a mixture of presentations and group discussions.

Related to ESP Working Group:

TWG 2 – Biodiversity & Ecosystem services

II. SESSION PROGRAM

Room: C2
Date of session: Tuesday, 19 May 2026
Time of session: 11:00 – 12:30

Timetable speakers:

Time	First name	Surname	Organization	Title of presentation
11:00	Introduction			
11:10	Uta	Schirpke	Eurac Research	Nature-based solutions for optimizing biodiversity and ecosystem services
11:20	Tatiana	Minayeva	Care for Ecosystems	Ecosystem services evaluation in nature-based climate projects
11:30	Katarzyna	Fagiewicz	Adam Mickiewicz University	Restoration of post-mining areas as a means to achieve climate change adaptation: Brudzew Commune case study (Poland)
11:40	Clara	Villegas-Palacio	Universidad Nacional de Colombia, Sede Medellín	Mapping the Complexity of Mangrove Socio-Ecological Systems: A Causal Loop Analysis of Coastal Protection in the Colombian Pacific
11:50	Zeynep	Sergi Marim	Zeynep Şergi Marım	Perception of Ecosystem Services Provided by Nature-Based Solutions (Nbs) to Address Tourism-Related Challenges in Coastal Cities: Aveiro (Pt) And Seferihisar (Tr)
12:00	Focus group discussion			

Lunch break: 12:30-14:00

14:00	Alberto	González-García	CNRS/IRD	Operationalizing the Nature Restoration Regulation beyond protected area boundaries through nature-based solutions
14:10	Jan	Macháč	Jan Evangelista Purkyně University in Ústí nad Labem	Evaluating Co-benefits of Environmentally-Technical Areas for Agricultural Restoration: A Modified Cost–Benefit Analysis Based on Ecosystem Services
14:20	Rianne	van Duinen	ACTeon	Scaling Nature-Based Solutions in the Atlantic–Arctic: A Framework for ecosystem and socio-economic impact
14:30	Vytautas	Narusevicius	Lithuanian Ornithological Society	Nature-based solutions and challenges for the remote rural areas' biodiversity

				enhancement: examples from LIFE habitat restoration projects
14:40	Hugo	Deléglise	Université Grenoble Alpes, IRD, CNRS, Grenoble INP, IGE (UMR5001)	Balancing Urban Greening Co-Benefits under Multiple Constraints through Spatial Optimization
14:50	Novelia	Triana	Nagasaki University	Determinants community involvement in a forest carbon sequestration initiative: A study case in Indonesia
15:00	Focus group discussion			

III. ABSTRACTS

The first author is the presenting author unless indicated otherwise

1. Nature-based solutions for optimizing biodiversity and ecosystem services

First author: Uta Schirpke
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The recent adoption of the EU Nature Restoration Law sets ambitious targets for reversing biodiversity loss and enhancing ecosystem resilience, yet its implementation faces significant knowledge gaps. One critical gap concerns the potential of Nature-based Solutions (NbS) to deliver multiple benefits to human well-being beyond ecological restoration. Addressing this gap, the EVESNAT project investigates how NbS can support both biodiversity conservation and ecosystem service provision in Alpine social-ecological systems. Focusing on three different case study sites across the European Alps, EVESNAT employs a participatory approach to co-develop spatially explicit NbS scenarios tailored to the specific local contexts. These scenarios aim to tackle pressing issues identified by local stakeholders such as biodiversity enhancement, climate change mitigation, and the strengthening of community resilience and autonomy. To evaluate the effectiveness of potential NbS interventions, the project adopts an integrative framework that quantifies and compares key ecosystem services, including provisioning (food, timber, water), regulating (climate control, hazard mitigation), and cultural services (recreation, aesthetic experiences). It also maps the spatial distribution of potential beneficiaries, considering socio-demographic differences, to evaluate synergies and trade-offs among ecosystem services and biodiversity co-benefits. The findings will provide empirical evidence on how NbS can optimize ecological and social outcomes under restoration policies, offering actionable insights for adaptive governance and management.

Keywords: EU Nature Restoration Law, co-benefits, nature-bases solutions, participatory approach, beneficiaries

2. Ecosystem services evaluation in nature-based climate projects

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Nature-based solutions as climate projects are assessed using methodologies that use criteria relatively easy to monetise, such as the climate change mitigation effect. The benefits of the project to local communities or broader society, including biodiversity benefits is considered in carbon projects as added value granted to the investor as bonuses. This approach is preventing the monetisation of gains in social resilience and biodiversity maintenance. The absence of a robust methodology that enables reliable

reporting is due to high uncertainty in related parameters.
We analysed several case studies in which an attempt was made to introduce ecosystem services (ES) assessment as a methodology for quantifying the benefits of development avoidance. That included two projects on avoidance implemented in Alberta, Canada and the Russian Arctic within a partnership between Wetlands International and Shell in 2009-2013; one project on avoidance implemented in the West Siberian protected area Numto in 2013-2015. The algorithm used in the projects named above is proposed for evaluating climate projects on peatland restoration currently under implementation by Wetlands International, Care for Ecosystems, and partners in Mongolia and Peru.
The workflow is based on the ES evaluation cascade method. This includes the development of a landcover map, in which land classes are assigned numeric characteristics of ecosystem functions related to biodiversity, water, and carbon balance. That is followed by stakeholder analysis aimed at identifying groups of stakeholders that utilise the ecosystem functions and the level of dependence on them. As a result of this analysis, each land class not only receives a value for the number of biophysical parameters but also a rank of demand for ecosystem functions, which indicates the value of ES.
The paper discusses the trade-offs between simplification and the needs of a robust and practical assessment tool.

Keywords: peatland, restoration, climate, project, assessment

3. Restoration of post-mining areas as a means to achieve climate change adaptation: Brudzew Commune case study (Poland)

First author: Katarzyna Fagiewicz
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Post-mining landscapes pose significant challenges for local development, but they also offer substantial opportunities to support climate change adaptation and mitigation when strategically integrated into spatial planning. This work presents a policy-oriented assessment framework based on the ecosystem services concept, designed to support local authorities in evaluating how post-mining land reclamation can contribute to climate objectives.
The framework operationalises ecosystem services in a planning context through a set of simple, transparent indicators aligned with the CICES v5.1 classification and relevant to climate change adaptation and mitigation. It focuses on regulating and provisioning services linked to carbon sequestration, renewable energy production, temperature regulation, water retention, and flood control. The approach relies exclusively on publicly available spatial, environmental, and planning data, ensuring its applicability in routine local planning processes such as reclamation plans and local development plans.
The method was applied to the Brudzew Commune (Eastern Wielkopolska, Poland), a post-lignite mining area undergoing large-scale reclamation. Ecosystem service provision was assessed for two land-use configurations: immediately after mining cessation (“terra nova”) and a future scenario reflecting planned reclamation measures. Spatial analyses were conducted using GIS-based land-use data, satellite-derived surface temperature data, and technical documentation of water reservoirs and renewable energy installations.
The results demonstrate that reclamation has a significant impact on ecosystem services relevant to local climate policy. Water-oriented reclamation substantially increased hydrological regulation, with landscape water retention rising from 0.6 to 127.0 million m^3 and flood retention capacity reaching 5.6 million m^3. Local climate regulation improved through increased evaporation and a measurable cooling effect. Mitigation benefits were notably enhanced by the introduction of a large photovoltaic installation, which enabled renewable energy production of over 74,000 MWh annually and reduced CO_2 and particulate emissions. In contrast, carbon sequestration increased only marginally due to limited changes in forest and grassland cover.
The study demonstrates that ecosystem services–based indicators can effectively translate reclamation outcomes into climate-relevant information for spatial planning and policy-making, supporting evidence-based decision-making in post-mining regions.

Keywords: Ecosystem services assessment, Post-mining land reclamation, Local climate policy, Spatial planning and governance

4. Mapping the Complexity of Mangrove Socio-Ecological Systems: A Causal Loop Analysis of Coastal Protection in the Colombian Pacific

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The reciprocal relationship between ecological systems and human well-being has been widely recognized. In the last decade, Nature's Contributions to People (NCP) have been identified as the nexus between ecological and social systems. Forests provide a crucial package of NCPs, but they have been strongly threatened by deforestation, and mangroves are no exception. Mangroves offer significant contributions to human well-being, including coastal protection, carbon storage, biodiversity support, nursery grounds, and cultural importance. In Colombia, the main challenges for mangrove conservation include illegal logging, land conversion for agriculture and aquaculture, insufficient enforcement of environmental regulations, and the impacts of climate change, such as sea-level rise and extreme weather events. In this research, we analyze the determinants of coastal protection provided by mangrove forests in the Colombian Pacific (Punta Soldado, Colombia) from a systemic perspective, conceptualized under the socio-ecological systems approach. This approach allows us to map and understand the dynamic complexity of mangrove forest socio-ecological systems, considering key components such as biophysical characteristics, economic activities, governance, social context, cultural systems, and stakeholder participation. This systemic analysis constitutes a relevant tool for guiding territorial planning in the challenging environmental conditions of the Global South, considering balancing and reinforcing loops within mangrove socio-ecological systems. Our main contribution is the visualization, analysis, and understanding of the full picture of key variables and driving forces in causal loop diagrams related to coastal protection and other nature's contributions to people provided by mangrove forest.

Keywords: socio-ecological system, causal loop diagram, mangrove forest, complexity, nature contributions to people

5. Perception of Ecosystem Services Provided by Nature-Based Solutions (Nbs) to Address Tourism-Related Challenges in Coastal Cities: Aveiro (Pt) And Seferihisar (Tr)

First author: Zeynep Şergi Marım
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Tourism facilitates the economic growth of coastal areas while also increasing pressures and vulnerability of such areas. Seasonal increases in visitor numbers lead to various problems, including inadequate infrastructure, excessive water use, waste management problems, ecosystem degradation, and deterioration of cultural heritage. While Nature-Based Solutions (NBS) are recognized as solutions to many fundamental urban challenges, they have not been well explored in terms of tourism pressures. In urban areas, NBS implementations often prioritize factors such as time, cost, and performance. NBS implementation offers multiple benefits by reducing tourism pressures and simultaneously increasing tourism attractiveness. This objective of this study is to assess the stakeholders' perception on ecosystem services provided by Nature-Based Solutions (NBS) to mitigate tourism-related pressures in coastal cities. This study presents a methodological approach to examine the role of ecosystem services provided by NBS in mitigating tourism-related pressures. This provides cities with the opportunity to identify NBS options that can help address the prevailing problems in their communities. The data obtained will enable the identification of the most effective NBS to address tourism pressures experienced by local communities.

Keywords: Nature-based solutions, sustainable tourism, coastal settlements, participatory approach, perception-based analysis

6. Operationalizing the Nature Restoration Regulation beyond protected area boundaries throug nature-based solutions

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Global conservation strategies, including the European Union's Nature Restoration Regulation, increasingly demand extending restoration efforts beyond protected area boundaries to reconnect isolated ecosystems. However, implementing these landscape-scale interventions involves complex trade-offs between maximizing biophysical effectiveness and ensuring social legitimacy. We operationalized this challenge in the Grenoble region of the French Alps using a novel gradient analysis framework to assess the continuity of 12 ecosystem services across protected area interfaces. We compared a 'Technical' restoration scenario, designed to repair ecological discontinuities based on spatial diagnostics, against a 'Participatory' scenario co-designed with local stakeholders. Our results reveal a remarkable spatial leverage effect: while both scenarios physically modified approximately 14.8% of the landscape, predominantly through a shared, large-scale forest adaptation strategy, they enhanced connectivity-dependent services across nearly 90% of the territory. Despite this shared baseline, critical divergences emerged in the management of the agricultural matrix. The Technical scenario proved superior in repairing functional structure, successfully smoothing 46% of degraded border gradients compared to 26% in the Participatory scenario. However, it allocated over 99% of its non-forest intervention effort to agricultural diversification, a strategy stakeholders ranked as the most difficult to implement due to socio-economic lock-ins. Conversely, stakeholders prioritized socially viable actions, such as river restoration, which offered lower resistance but missed key connectivity bottlenecks. We conclude that the biophysical potential for restoration is high but socially constrained. Overcoming the implementation gap does not require expanding the total restoration footprint, but rather optimizing spatial configuration. Successful implementation depends on using technical diagnostics not as rigid prescriptions, but as tools to align existing sectoral funds (particularly in agriculture, urban and forestry) toward high-leverage interventions. This iterative approach is essential to transform protected areas from isolated refuges into interconnected nodes within a multifunctional landscape.

Keywords: Nature contributions to people, Ecosystem service gradients, Nature Restoration Regulation, Protected area interfaces, Implementation gap

7. Evaluating Co-benefits of Environmentally-Technical Areas for Agricultural Restoration: A Modified Cost–Benefit Analysis Based on Ecosystem Services

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Nature-based solutions (NbS) are increasingly promoted as key instruments for ecosystem restoration, climate adaptation, and sustainable land management. In agricultural landscapes, measures aimed at reducing soil erosion and enhancing landscape resilience represent an important category of NbS. These measures often take the form of environmentally and technically optimized spatial configurations of farmland. Their primary objective is to support sustainable agricultural production and reduce environmental risks. At the same time, they generate multiple additional benefits that extend beyond production-oriented goals. These co-benefits include improvements in biodiversity, water retention, landscape structure, and aesthetic values. Despite their relevance, such co-benefits are rarely systematically assessed or integrated into economic evaluation frameworks used for decision-making. This contribution presents a proposal for a modified cost–benefit analysis (CBA) designed to comprehensively evaluate the societal impacts of environmentally-technical areas (ETAs) implemented within agricultural land optimization schemes. The approach builds on the ecosystem services framework to identify, structure, and assess a broad spectrum of benefits and costs. Unlike conventional CBA approaches, the proposed framework explicitly addresses varying levels of aggregation and differentiates between benefits that can be monetized and those that remain non-monetary but are nevertheless

essential for informed governance.
The methodology combines bio-physical indicators with economic valuation techniques tailored to individual ecosystem services, allowing flexibility depending on spatial scale, data availability, and policy context. At aggregated levels, the analysis focuses on key monetizable benefits, while site-specific applications enable a more detailed inclusion of additional ecosystem services and local co-benefits. The resulting net present value reflects the overall societal contribution of NbS-based land-use optimization rather than narrow financial returns.
By operationalizing ecosystem services within a modified CBA framework, this approach supports more transparent assessment of co-benefits and trade-offs, improves communication with stakeholders, and provides decision-relevant evidence for planning and governance of NbS in agricultural restoration contexts.

Keywords: Ecosystem services, Nature-based solutions, Co-benefits, Cost-Benefit analysis, Agricultural landscape restoration

8. Scaling Nature-Based Solutions in the Atlantic–Arctic: A Framework for ecosystem and socio-economic impact

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Nature-based solutions are increasingly promoted as cost-effective pathways to restore ecosystems and enhance climate resilience. Yet, a persistent challenge remains: translating locally tested NBS into scalable interventions that generate broader benefits and contribute and support policy objectives at regional, national or EU-level. Drawing on the EU-funded A-AAGORA project, this contribution presents the application of a structured, ex-ante assessment framework (including impacts on ecosystem services) designed to assess the upscaling potential of NBS and expected economic impacts.

The framework combines environmental suitability with socio-economic factors to evaluate where impacts can be scaled and the benefits that upscaling may deliver. It is applied to three demonstration sites across the Atlantic–Arctic, a region of exceptional ecological productivity that provides critical ecosystem services but is increasingly vulnerable to climate change and cumulative human pressures, which threaten kelp forests, seagrass meadows, and sandy coastlines, with cascading effects on biodiversity and human well-being. The solutions analyzed include: (1) Enhancing coastal erosion resilience through advanced monitoring and community engagement in Ireland; (2) Restoring kelp forests by removing sea urchins in Norway; and (3) Promoting climate mitigation via seagrass restoration coupled with port decarbonization in Portugal.

By evaluating impacts on ecosystem services, the upscaling analysis shows that the three solutions offer significant potential for wider deployment across the Atlantic-Arctic region, highlighting their relevance well beyond the initial demonstration sites. Although uncertainties remain, the findings clearly suggest that the benefits of large-scale NBS implementation are substantial and can outweigh the costs, emphasizing their strategic value for both environmental sustainability and the blue economy. The analysis is particularly pertinent for accelerating efforts to reverse biodiversity loss and expand ecosystem restoration, central objectives of the Nature Restoration Regulation which mandates EU Member States to develop national restoration plans to comply with ambitious, binding targets.

Keywords: Nature-Based Solutions; Ecosystem Restoration; Upscaling Potential; Ecosystem Services; Ex-ante Assessment Framework

9. Nature-based solutions and challenges for the remote rural areas' biodiversity enhancement: examples from LIFE habitat restoration projects

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The presentation draws on two case studies examining the outcomes and activities of LIFE projects (LIFE LWfG CLIMATE and LIFE21-NAT-LT-LIFEfarms for Birds) implemented in Lithuania and partner countries, which focus on the restoration and management of breeding and stopover habitats for bird species of European Union conservation importance. Nature-based solutions, defined by the IUCN as actions that address societal challenges through the conservation, sustainable management, and restoration of ecosystems, were applied to create and maintain suitable habitat conditions for rare geese and wader species in wet meadow ecosystems. These habitats are located in relatively remote rural areas that are complicated to manage or use for sustainable farming, yet are of critical importance for the conservation of rare species. The evaluation of the effects of complex management practices on selected ecosystem services demonstrates that the examined cases represent commendable and replicable examples of win-win outcomes, balancing the interests of businesses and local farmers with the maintenance of ecosystem health and biodiversity. The results achieved to date, as well as the challenges encountered during project implementation, highlight the need for further discussion on the opportunities and limitations of the ecosystem services concept in supporting nature-based solutions within the context of ecological restoration.

Keywords: ecosystem services, nature-based solutions, habitat restoration, bird species, LIFE

10. Balancing Urban Greening Co-Benefits under Multiple Constraints through Spatial Optimization

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In urban contexts, Nature-based Solutions such as urban greening offer strong potential to mitigate climate-related hazards while delivering multiple ecosystem service benefits. However, these co-benefits are rarely assessed in a systematic way, and spatially explicit socio-ecological frameworks remain rare in urban planning practice.

This research focuses on Grenoble-Alpes Métropole (France), a dense Alpine urban area where geographical setting and urban form exacerbate combined pressures related to heat stress, flood risk, and social inequalities. We present a spatial prioritization framework co-constructed with Grenoble-Alpes Métropole to support greening strategies aiming to increase tree canopy cover from 18% to 30% by 2030.

First, the framework mobilizes heterogeneous datasets to represent five priority factors capturing major co-benefits of urban greening and their links to key urban ecosystem services: (i) urban temperature patterns related to climate regulation, (ii) surface permeability linked to stormwater regulation, (iii) vegetation connectivity supporting urban biodiversity, (iv) social vulnerability to heat exposure, and (v) usability, reflecting accessibility and the potential number of beneficiaries.

Second, these interacting factors are jointly considered through multi-criteria optimization methods to explore synergies and trade-offs among co-benefits. Using data science approaches (e.g., mixed-integer linear programming), the optimization process produces balanced and optimal greening scenarios while explicitly accounting for operational constraints, such as limited budgets and equity requirements.

Third, the framework is developed through an interdisciplinary and transdisciplinary co-production process involving researchers from environmental and data science together with local practitioners in urban planning and climate adaptation. By involving stakeholders throughout the project definition, the process produces spatial prioritization maps that are aligned with planning realities and trusted by end users.

This work illustrates how urban restoration planning can be operationalized to move beyond opportunistic greening practices and inform equitable, multi-objective, and data-driven planning and governance, and provides a transferable example for similar approaches in other urban contexts.

Keywords: Urban ecosystem services, Urban greening, Spatial prioritization, Multi-criteria optimization, Co-production

11. Determinants community involvement in a forest carbon sequestration initiative: A study case in Indonesia

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Community involvement is a crucial component of climate mitigation strategy at the local level. This article explores the relationship between forest carbon sequestration projects, associated co-benefit and community participation and elucidate how local communities as beneficiaries place value to sustain co-benefits. We conducted survey of individuals who are in living near forest restoration area in rural municipalities in central Kalimantan, Indonesia. The survey revealed that project implementation provides both direct and indirect co-benefits to local communities. Our findings indicate that the intention to participate in the project is driven by the support generated in capacity building and communities' awareness. Moreover, communities acquired more in terms of capacity building, involvement in decision-making, and local relevance than in livelihood improvements. Furthermore, the project's management and program design promote positive attitudes increase the likelihood of active community engagement in implementation. In the other hand, the communities . Therefore, researchers and project developers should consider the cognitive and contextual needs of local communities and adopt strategies that are better suited to local conditions when promoting carbon sequestration and forest restoration initiatives.

Keywords: Co-benefits, project characteristics, forest carbon credit, regression analysis