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: T14b | T17b

How to achieve "no net loss" and "net gain" targets for urban nature? The role of ecosystem accounting and other emerging tools at multiple scales | Advancing urban ecosystem accounting: co-developing a roadmap to bridge research, policy, and practice

Hosts:

	Name:	Organisation:	E-mail:
Hosts:	Chiara Cortinovis	University of Trento	chiara.cortinovis@unitn.it
	Javier Babí Almenar	Politecnico di Milano	javier.babialmenar@polimi.it
Co-hosts:	Balint Czucz	Norwegian Institute for Nature Research (NINA)	balint.czucz@nina.no
	Claudio Petucco	Luxembourg Institute of Science & Technology (LIST)	claudio.petucco@list.lu
	Davide Geneletti	University of Trento	davide.geneletti@unitn.it
	Peter Lacoere	HoGent	peter.lacoere@hogent.be
	Roy Remme	Leiden University	r.p.remme@cml.leidenuniv.nl
	Giulia Capotorti	Sapienza University of Rome	giulia.capotorti@uniroma1.it
	David N. Barton	Norwegian Institute for Nature Research (NINA)	david.barton@nina.no
	Sylvie Clappe	Norwegian Institute for Nature Research (NINA)	sylvie.clappe@nina.no
	Marius Bellingen	Federal Statistical Office of Germany (Destatis)	marius.bellingen@destatis.de

Abstract:

This merged session (T14b | T17b) brings together the discussion on how "no net loss" and "net gain" targets for urban nature can be operationalized (through multiple methods) with a dedicated focus on ongoing efforts to advance and standardize urban ecosystem accounting across research, policy, and practice.

Across Europe, a wide range of "no net loss" and "net gain" targets for urban nature are being advanced in international and national policies. Among the most prominent are the targets for tree canopy cover and green spaces in urban ecosystems defined in art. 8 of the EU Nature Restoration Regulation. Other well-known examples include England's Biodiversity Net Gain requirement, mandatory since 2024 under the Environment Act 2021 (amending the Town and Country Planning Act 1990),

as well as the “no net land take” objective set out in the Roadmap to a Resource Efficient Europe and the “no net soil sealing” ambition under the EU Soil Mission.

Achieving these targets requires robust methods and decision-support tools that can guide their integration into spatial planning processes and actions across multiple decision-making levels, from site-specific interventions to entire urban regions. Such tools must respond to the diversity of European urban contexts—characterized by varying socio-ecological-technological conditions, governance systems, and planning traditions—while enabling consistent and comparable outputs, such as datasets, maps, certificates, and reports.

Urban ecosystem accounting, framed as a thematic account under the System of Environmental-Economic Accounting – Ecosystem Accounting (SEEA-EA), offers a promising pathway to inform local decision-making while ensuring alignment with a standardized international statistical framework. Moving beyond ad-hoc ecosystem mapping and assessment, standardized urban ecosystem accounts could support the monitoring of “no net loss” and “net gain” targets, track progress over time, and enable benchmarking and aggregation from local to national and European scales. This is supported by the recent amendment to the EU environmental-economic accounting regulation that introduced mandatory ecosystem accounts for urban areas. However, their application still faces conceptual, methodological, and operational challenges. The absence of an agreed urban-specific framework, combined with the potentially divergent policy uses that ecosystem accounts may serve, risks generating fragmented implementations that hinder comparability, lesson learning, and mainstreaming.

Alongside ecosystem accounting, a variety of complementary methods and tools are being developed to support the implementation of “no net loss” and “net gain” policies in urban areas. Some, such as life cycle assessment and life cycle costing, are being innovatively extended to urban systems and combined with ecosystem services approaches. Others are explicitly designed for urban policy support, including Oslo’s Blue-Green Factor tool and Flanders’ BetonMeter, which respectively guide developers in meeting nature targets and help authorities monitor progress towards reducing soil sealing.

Focusing on urban applications, the session will examine:

- The operationalization of “no net loss” and “net gain” targets for urban nature across scales, with a focus on emergent methods and tools. It will discuss their strengths and limitations, explore opportunities for their integration, and reflect on how such tools can affect the feasibility and inform the implementation of ambitious targets in European cities.

- The advancing of a coherent and policy-relevant urban ecosystem accounting framework, reflecting on how it could inform targets for urban nature, but also discussing strengths and limitations of existing conceptual and methodological approaches being tested across European cities.

Goals and objectives of the session:

- This merged session combines a more general exploration of innovative tools for achieving “no net loss” and “net gain” targets for urban nature (T14b) with a dedicated focus on efforts to advance and standardize thematic urban ecosystem accounting across research, policy, and practice (T17b).

- The overall aim of this session is to present, discuss, and co-develop novel methods, tools, and frameworks that can support planning and policy actions to deliver “no net loss” and “net gain” targets in urban areas. The session is open to contributions addressing multiple spatial levels, from site-specific interventions to entire urban regions. It welcomes both research-oriented and practitioner-oriented studies, including work developed collaboratively among researchers, practitioners, and public institutions.

- The session also aims to foster a shared understanding of thematic urban ecosystem accounting under the SEEA-EA standard and its application in supporting policy-relevant urban nature targets, while addressing conceptual, methodological, and operational challenges.

In practical terms, the session aims to:

- Bring together researchers, public officers, and practitioners engaged in delivering “no net loss” and “net gain” targets, as well as those involved in developing and implementing urban ecosystem accounts, to exchange perspectives, experiences, and practical solutions.
- Explore opportunities for integrating multiple tools, approaches, and data sources to support monitoring, scenario analysis, and reporting of “no net loss” and “net gain” outcomes.
- Initiate dialogue and co-develop pathways for a coherent, standardized framework for urban ecosystem accounting that can inform local, regional, and national policy while remaining flexible to context-specific targets.

Of particular interest to this session are contributions focused on the following themes:

- Tools purposely developed to guide local actors in the implementation of “no net loss” and “net gain” targets within specific urban contexts, including approaches that factor-in the value of ecosystem services.
- Approaches for the prioritization of interventions and the identification of suitable compensation areas.
- Methods for monitoring the achievement of “not net loss” and “net gain” strategies at the city, regional, national, and international level.
- Applications of urban ecosystem accounts to support “no net loss” and “net gain” targets at multiple scales.
- Challenges and bottlenecks in applying urban ecosystem accounts, including diverse stakeholder needs, reporting requirements, and gaps in existing conceptual, methodological, or operational approaches.
- Innovative approaches to advance urban ecosystem accounting, including actionable recommendations for improving consistency, comparability, and usability across scales.
- Digital data pipelines and tools (GIS, remote sensing, IoT, digital twins, AI-assisted decision support) that scale urban nature monitoring and scenario analysis.

We are especially interested to hear from the speakers and to discuss:

- The role of ecosystem condition and ecosystem services assessments in the proposed tools and in existing applications.
- The integration of the results in cross-scale reporting mechanisms.
- Possible combinations of several tools to inform “not net loss” and “net gain” targets and to monitor trends in urban nature.
- Methods to address uncertainty, additionality, cumulative impacts, leakage, spillover and telecoupled effects, and permanence over long time horizons.
- Validation of the proposed approaches through local data.

Planned output / Deliverables:

The session is expected to generate the following outputs:

- A summary paper synthesizing key insights on tools to inform “not net loss” and “net gain” targets for urban nature, prepared for submission to a peer-reviewed journal.
- Identification of innovative methods, tools, and gaps, while bringing together ESP members from diverse sectors to support the prospective ESP urban ecosystem accounting sub-group.
- Identification of an initial list of opportunities for collaboration among attendees beyond the ESP working subgroup, such as pilot projects, joint publications, science-for-policy dialogues on urban ecosystem accounting. The long-term aim is to start building a strong science–policy–practice network on this topic.
- Contributions focused on urban ecosystem accounting are invited to contribute to the Special Issue of the journal Ecosystem Services titled “Urban ecosystem accounting under the SEEA-EA framework: advancing concepts and applications” (submission deadline: September 30, 2026)

Session format:

This Standard session with presentations followed by a discussion.

Related to ESP Working Group:

TWG 14 – Application of ES in Planning & Management

II. SESSION PROGRAM

Room: **B1**
Date of session: **Wednesday 20, May 2026**
Time of session: **09:00 – 12:30**

Timetable speakers:

Time	First name	Surname	Organization	Title of presentation
09:00 – 09:06	*Session chairs and co-chairs*			*Introduction to the session*
09:06 – 09:18	Roy	Remme	Leiden University	Navigating the tools landscape for informing and monitoring urban greening strategies and nature plans
09:18 – 09:30	Dagmar	Haase	Humboldt University Berlin; Helmholtz Centre for Environmental Research (UFZ)	Is there no gain without loss? Accepting ambivalence as the best way to encourage tree diversity in European cities
09:30 – 09:42	Bernadeta	Baroková	Charles University, Faculty of Social Sciences	The implementation variety of urban tree offsetting policy: The case of the Czech Republic
09:42 – 09:54	Andrea	Benedini	Politecnico di Milano	From a blue-green infrastructure strategy to building permits: The multi-ecosystemic factor for “net gain” delivery in Varese, Italy
09:54 – 10:06	Chiara	Parretta	University of Trento	The role of private green spaces in urban greening plans: Evidence from Italy
10:06 – 10:18	Cornelia	Solheim	Norwegian University of Life Sciences	From concepts to practice: Nature-positive terminology and policy alignment in urban property development in Norway
10:18 – 10:30	Ilkwon	Kim	Gwangju Research Institute, South Korea	Strategies for enhancing urban biotope maps: Integrating ecosystem service assessment and no net loss principles for regional environmental management
10:30 – 11:00	*Coffee break*			
11:00 – 11:12	Ralf-Uwe	Syrbe	Leibniz Institute of Ecological Urban and Regional Development (IOER)	Monitoring the recreation-relevant green spaces in cities of Germany
11:12 – 11:24	Lidia	Favaretto	University of Milano-Bicocca, Department of Biotechnology and Biosciences	Supporting biodiversity-sensitive urban regeneration plans through Life Cycle Assessment: A case study in Milan, Italy
11:24 – 11:36	Mayra Alejandra	Zurbaran Nucci	European Commission - Joint Research Centre	Air filtration in urban ecosystems: Sustainability thresholds to guide ecological restoration
11:36 – 11:48	Emmi	Nieminen	City of Tampere	Pioneering urban Ecosystem Accounting in the city of Tampere: Nature’s value in policy and planning
11:48 – 12:00	Javier	Babí Almenar	Politecnico di Milano	An application of thematic urban ecosystem accounts in Western Balkan Countries to inform urban greening
12:00 – 12:12	Giulia	Capotorti	Sapienza University of Rome	Shaping urban Ecosystem Accounting in Italy: Towards coherent and scalable approaches

12:12 – 12:24	Maria	Korkou	Norwegian Institute of Nature Research (NINA)	A data-driven approach to align urban Ecosystem Accounting indicators with municipal policy targets and planning metrics
12:24 – 12:45		*All participants*		*Final discussion*

III. ABSTRACTS

The first author is the presenting author unless indicated otherwise

1. Navigating the tools landscape for informing and monitoring urban greening strategies and nature plans

***First author*:** Roy Remme
***Other author(s)*:** Nick Paling
***Affiliation*:** Leiden University
***Contact*:** r.p.remme@cml.leidenuniv.nl

Europe's cities are facing challenges to protect, maintain, restore, and improve their nature and green space, but a broad and diverse set of tools has been developed to support planners and policy makers to tackle them. To aid urban decision makers, we developed a suite of materials that help navigate the existing tool landscape. The primary product is a handbook that maps out 59 of these tools (software, methods, and modelling approaches), presenting approaches from simple dashboards to advanced spatial models, to plan, monitor, and expand urban green space. Tools were evaluated by experts for ease of use, cost, data needs, and policy relevance, then grouped into five clusters to guide users. The tools are clustered into tools that (1) help with benchmarking based on indicators, (2) help explore and understand challenges, (3) are developed to support specific policies or projects, (4) provide multi-purpose spatial information, and (5) models that are specialized focus on particular challenges (e.g., air quality or ecological connectivity). Factsheets provide overviews for each tool based on the assessed criteria and information. Real-life case studies show how cities across Europe are already using these tools to cool streets, boost biodiversity, and improve public health. Additionally, a 'living' online tool repository and an online navigation tool were developed to assist researchers and planners alike in searching and updating available tools. With EU policies like the Biodiversity Strategy for 2030 and Nature Restoration Regulation in place, this set of materials gives decision-makers the digital edge they need to green cities faster and smarter.

Keywords: Tools, models, repository, urban ecosystem services, urban biodiversity

2. Is there no gain without loss? Accepting ambivalence as the best way to encourage tree diversity in European cities

***First author*:** Dagmar Haase
***Other author(s)*:** Diana Dushkova
***Affiliation*:** Humboldt University Berlin and Helmholtz Centre for Environmental Research UFZ
***Contact*:** dagmar.haase@geo.hu-berlin.de

Urban trees are recognised worldwide as one of the most sustainable and effective nature-based solutions to combat the effects of climate change and improve the quality of life for city dwellers. These solutions include the following: the trees cool the air, absorb pollutants and dampen noise. In addition to their function as a natural hazard mitigation measure, trees in urban areas offer aesthetic benefits, including the enhancement of visual appeal and the promotion of mental well-being. Nevertheless, the relationship between street/park trees and urban society is characterised by significant ambivalence with regard to pollen emissions and allergies. Furthermore, the clearance of space for new housing, road extensions, or parking facilities is widely accepted by large sections of urban society. Furthermore, climate change poses a significant threat to urban trees, which are vulnerable to drought and increased pest infestation. Urban planners and community partnerships have already developed a range of strategies—from more expert-led approaches to participatory co-design and actions—to maintain, increase, and diversify tree cover. Furthermore, the creation of new habitats has resulted in competition for space in urban areas, where every square centimetre is contested. Utilising case studies from Central and Eastern Europe, in conjunction with examples from Northern America and Asia, this contribution elucidates the multifaceted relationship between humans and nature with regard to urban trees. It is evident that acceptance of this ambivalence is pivotal in the

conservation and maintenance of urban biodiversity. This can be achieved through the involvement of various stakeholders, including citizens.

Keywords: Urban trees as Nature-based solutions · Human-nature relationship · Climate Change · Tree felling · Biodiversity and design · Co-creation · Ambivalence

3. The Implementation Variety of Urban Tree Offsetting Policy: The Case of the Czech Republic

***First author*:** Bernadeta Baroková
***Other author(s)*:** Eliška Vejchodská
***Affiliation*:** Faculty of Social Sciences, Charles University
***Contact*:** bernadeta.barokova@fsv.cuni.cz

No net loss (NNL) policies can address negative impacts of urbanisation and land development – societal transformations that often compromise natural ecosystems and biodiversity. However, NNL polices are often criticised for not achieving their intended goals. The real impact of NNL policies highly relates to the nuances of their design and implementation. In this context, environmental street-level bureaucrats play a crucial role in environmental governance as key policy implementers. Our case study explores the Czech nature protection law, with a focus on its regulatory provisions for safeguarding urban tree canopy, including the offsetting mechanisms to compensate for tree loss. We explore the limitations and systemic challenges of applying these protections in practice. We aim to understand how the policy design affects the practical implementation of the policy. The research questions encompass the following: In what ways do street-level bureaucrats use the discretion afforded by policy design to adapt measures according to their own perception of what is reasonable? What strategies do street-level bureaucrats employ to remedy the gaps in the legislation? Do street-level bureaucrats working in different jurisdictions take different approaches, or are their approaches similar? What arguments do they offer for deviating from the intentions of the policy designers? We base our analysis on the Institutional Analysis and Development framework as the analytical lens zooming in on the action arena of street-level bureaucrats implementing the policy. We draw on qualitative interviews besides policy document analysis as data sources to uncover not only formal, but also informal rules-in-use employed by street-level bureaucrats. The findings demonstrate the following: administrative, institutional, financial and legislative challenges, land inaccessibility in urban areas, issues with monitoring and long-term sustainability of offsets, fragmentation and time pressure, as well as limited participation of public. The results can inform policymakers and practitioners on the ground and inform future policies of urban tree protection.

Keywords: No net loss policies, Urban tree canopy, Institutional Analysis and Development framework, Street-level bureaucrats, Czechia

4. From a Blue-Green Infrastructure Strategy to Building Permits: the Multi-Ecosystemic Factor for “Net Gain” Delivery in Varese, Italy

***First author*:** Andrea Benedini
***Other author(s)*:** Silvia Ronchi, Beatrice Mosso, Andrea Arcidiacono
***Affiliation*:** Politecnico di Milano
***Contact*:** andrea.benedini@polimi.it

Across Europe, “no net loss/net gain” targets for urban biodiversity increasingly depend on whether spatial planning can steer the cumulative effects of land-use change across private development. Blue–green factor (BGF) tools translate these targets into project-level performance requirements, but they are often applied as sectoral measures and remain weakly connected to municipal blue-green infrastructure (BGI) strategies and ecosystem services (ES) delivery. This study develops a methodology to adopt the Multi-Ecosystemic Factor (FEM) for Varese (Lombardy, Italy), building on established BGF approaches, as part of the municipal plan’s regulatory toolkit, making the citywide BGI strategy actionable at parcel scale.

FEM is designed as a performance-based standard aligned with zoning rules, BGI provisions, and building-permit typologies. It evaluates the ES contribution of plot-scale transformations by scoring proposed design measures through a catalogue of nature-based solutions (NbS), each assigned a performance value representing overall ES delivery. Project performance is calculated by area-weighting selected NbS, and compliance is achieved when the resulting score meets a minimum threshold. Thresholds are differentiated by urban fabric and calibrated through simulations of feasible surface “portfolios” consistent with morphological constraints and ecological performance objectives. Implementation combines mandatory

compliance for high-impact interventions (new construction; demolition and reconstruction) with a voluntary pathway for lighter transformations supported by incentives.

The study delivers: (i) a typology-and-weight catalogue linking NbS to ES delivery; (ii) urban fabric-specific thresholds balancing ambition and feasibility across heterogeneous morphologies; and (iii) a tiered scheme with stricter requirements in plan-designated BGI priority areas and an incentive tier rewarding voluntary implementation. FEM is operationalised through a standardised calculator generating comparable parcel-level outputs and transparent compliance reports. Overall, FEM operationalises "no net loss/net gain" ambitions within municipal planning by mainstreaming an explicit ES rationale into routine permitting. It offers a transferable methodology for cities to translate BGI strategies into parcel-scale requirements.

Keywords: blue–green factor, ecosystem services, zoning and building permits, no net loss / net gain targets; biodiversity enhancement

5. The role of private green spaces in urban greening plans: Evidence from Italy

***First author*:** Chiara Parretta
***Other author(s)*:** Chiara Cortinovis, Davide Geneletti
***Affiliation*:** University of Trento (Italy)
Contact: chiara.parretta@unitn.it

Urban nature is increasingly recognized as essential for biodiversity conservation, climate adaptation, and ecosystem services (ES) provision in cities. The EU Biodiversity Strategy for 2030 calls on cities to develop Urban Greening Plans (UGPs), while the EU Nature Restoration Regulation sets targets for no net loss and increasing national urban green space and tree canopy cover, making both public and private green spaces relevant. Recent studies have assessed UGPs in terms of governance, citizen participation, biodiversity inclusion, and alignment with EU regulations, highlighting their potential to foster greening interventions and contribute to ecological networks. However, there is no systematic evidence on how private green spaces are incorporated into greening strategies.

This study investigates how private green spaces are addressed in UGPs by focusing on (i) objectives, strategies, and actions formulated for private green spaces and (ii) data and indicators used to define baselines, set targets, and monitor implementation. We conducted a directed qualitative content analysis of 20 Italian UGPs, examining how private green spaces are integrated across different planning dimensions.

Here we show that Italian UGPs display heterogeneity in how private green spaces are addressed, as some plans classify and quantify private green through typologies, indicators, spatial data, and set specific actions, while others include it only indirectly through general actions. These findings reveal that, although private green spaces are increasingly acknowledged in research as contributors to ES provision, they often lack clear objectives, targeted measures, or monitoring. Results highlight the need to better structure the role of private green within planning instruments to support ecological connectivity and contribute to national restoration targets. By highlighting the fragmented inclusion of private green spaces in UGPs, this study reveals a structural gap in current planning approaches and underscores the need to rethink how private and public green are jointly considered within urban planning.

Keywords: urban greening plans; private green spaces; ecosystem services; EU Nature Restoration Regulation

6. From Concepts to Practice: Nature-Positive Terminology and Policy Alignment in Urban Property Development in Norway

***First author*:** Cornelia Solheim
***Affiliation*:** Norwegian University of Life Sciences
***Contact*:** cornelia.solheim@nmbu.no

Ambitious targets for "no net loss" and "net gain" of urban nature are increasingly reflected in international and national strategies, along with the development of various outcome assessment methods. However, in Norway, prevailing concepts and methodologies are primarily designed for large-scale developments in non-urban areas, rather than for urban property projects on smaller, often grey, sites. Operationalizing these targets at the urban property level therefore remains a significant challenge. This study examines how "nature-positive" concepts and related terminology are defined,

understood, and applied in key governance documents for The Norwegian Directorate of Public Construction and Property, a major public developer and property manager.

Through a systematic review of recent policy documents, guidelines, and action plans, this study analyzes the degree to which current frameworks provide property developers with coherent and actionable guidance for integrating nature-positive objectives into individual building projects and ongoing property management. Preliminary findings indicate considerable variability and ambiguity in the use of core concepts such as “nature-positivity,” “no net loss,” and “net gain,” with limited linkage to measurable indicators or standardized tools – such as ecosystem accounting – at the property scale. Existing policy instruments often stress broad ambitions, but provide insufficient detail for project-level implementation, reporting, and monitoring.

To address these gaps, this ongoing research will further explore how social, ecological, and technological factors interact to influence the implementation of nature-positive objectives within state-led building projects and property management. By applying the social-ecological-technological systems (SETS) framework, this work seeks to identify drivers, barriers, and opportunities for operationalizing “no net loss” and “net gain” targets in ways that are both context-sensitive and scalable. This property-focused perspective contributes to the emerging discourse on equipping developers and property managers to achieve measurable biodiversity gains within and across diverse European urban contexts.

Keywords: Nature-positive development, biodiversity, property-level implementation, urban ecosystem accounting, social-ecological-technological systems (SETS)

7. Strategies for enhancing urban biotope maps: Integrating ecosystem service assessment and no net loss principles for regional environmental management

First author: Ilkwon Kim
Affiliation: Gwangju Research Institute, South Korea
Contact: scruble@naver.com

Abstract: While many cities currently produce urban biotope maps, they encounter significant limitations when attempting to utilize these maps in decision-making processes beyond basic ecological inventorying. This study proposes strategies for enhancing assessment precision and implementing the No Net Loss (NNL) principle for ecosystem services (ES) in Gwangju Metropolitan City, South Korea, to maximize the map's policy utility.

The research was conducted in three primary stages. First, this study explored methodologies for advancing the production of urban biotope maps through a comparative scenario analysis, integrating ES assessment results directly into biotope grading versus using them as supplementary indicators. Second, by introducing NNL concepts of ecological resource management in alignment with biotope grades, a system was established to quantitatively evaluate the loss of ecological resource values based on the ES impacts of development projects. Specifically, benchmarking the German Impact Mitigation Regulation, an offset mechanism was designed to ensure the maintenance of equivalent ecological value when high-priority biotopes (Grades 1 and 2) are compromised. Third, following the mitigation hierarchy (Avoid-Minimize-Offset), the study developed strategies to link the offset system with biodiversity enhancement projects and examined the feasibility of institutional mechanisms, such as the restoration of degraded public lands and the introduction of mitigation banking. This research is significant in providing a concrete roadmap for transforming urban biotope maps from simple status inventories into practical policy instruments for the conservation of ecosystem service values.

Keywords: Ecosystem service assessment, no net loss, biotope maps, impact assessment, policy framework

8. Monitoring the recreation-relevant green spaces in cities of Germany

First author: Ralf-Uwe Syrbe
Other author(s): Karsten Grunewald, Lisa Eichler
Affiliation: Leibniz Institute of Ecological Urban and Regional Development (IOER)
Contact: r.syrbe@ioer.de

Recreation-relevant green spaces in cities are valuable for well-being, as they enable leisure activities, provide space for recreation and contribute to maintaining health. In addition to parks and gardens, other types of green and open spaces can fulfil this role as well. In order to maintain the supply of urban green spaces and strengthen their ecosystem services, parameters for measurement and monitoring are required and discussed here.

With the project 'Monitoring the indicator "green space supply" and updating the national ecosystem service indicator "accessibility of public green spaces" in cities', funded by the Federal Agency for Nature Conservation (BfN), the existing indicators were reviewed in terms of their informative value, adapted to the currently available data situation and the calculation methodology was further developed. The current calculation results for the following indicators are presented here:

1. Share of recreation-relevant green spaces (green share for short): proportion of recreation-relevant green spaces in the administrative urban area or in the city centres;

2. Supply of recreation-relevant green spaces (green supply for short): percentage of the urban population with adequate recreation-relevant green space equal or more than 6m² / person in the immediate neighbourhood (until 300m);

3. Accessibility of recreationally relevant green spaces (green accessibility for short): percentage of the urban population that has access to a recreation-relevant green space of a defined minimum size in the immediate neighbourhood (until 300m).

Between 2019 and 2021, the recreation-relevant green spaces in German cities remained largely constant. The proportion of these green spaces in administrative urban areas is 42.9%, respective 10.3% in urban centres. Around 70% of the urban population is provided with at least 6 m² of green space per person within 300 m. In 2021, around 83% of the urban population can reach recreation-relevant green spaces within this distance and use them for local recreation.

Keywords: Ecosystem service, Urban nature, Urban planning, Nearby recreation, Green infrastructure

9. Supporting biodiversity-sensitive urban regeneration plans through Life Cycle Assessment: A case study in Milan, Italy

***First author*:** Lidia Favaretto
***Other author(s)*:** Benedetto Rugani, Chiara Catalano, Paolo Biella, Carlo Calfapietra, Massimo Labra, Werther Guidi Nissim
***Affiliation*:** University of Milano-Bicocca, Department of Biotechnology and Biosciences
***Contact*:** lidia.favaretto@gmail.com

Nature-based solutions (NbS) offer effective means to address urban challenges arising from population growth and climate change. Thanks to thoughtful NbS planning, cities can become a source of solutions to these challenges, while also meeting Europe's urban nature targets. Among various evaluation tools, life cycle assessment (LCA) goes beyond the primary scope of NbS (i.e. the provision of Ecosystem Services, ES), and focuses on quantifying the environmental impacts generated over the entire life cycle of the NbS. LCA can thus be used to identify impact leakages and hotspots in the design phase, supporting planners in steering projects toward "net-gain" objectives.

This study confirms the methodological potential, as anticipated by the literature, of integrating LCA and ES to promote sustainable NbS implementation in urban planning. It specifically aims to evaluate trade-offs across all life-cycle stages of an urban regeneration system, expressing beneficial support for biodiversity within the LCA framework.

The area under study is a university square in Milan-Bicocca, Italy, recently transformed into an intensive green roof that covers an underground indoor space of the university. By merging LCA and ES approaches, it was possible to highlight some of the detrimental and beneficial impacts of this NbS. The standard LCA building assessment modules were expanded to include a module of ES provided throughout the lifespan. Beyond directly combinable ES, such as CO2 storage by trees, a novel compatible methodology was developed to quantify the ES of support to biodiversity, with a focus on pollinators. This allowed for the valorisation of plant species selection in the planning process. Midpoint and endpoint impact assessments were combined to reveal the construction phases and processes that most influence sustainability outcomes. This hotspot analysis highlighted a potential alternative scenario that could reduce the overall detrimental impacts.

Keywords: Urban sustainability, Green Roofs, Life Cycle Assessment, Ecosystem Services, Green Infrastructures, Nature-based Solutions

10. Air filtration in urban ecosystems: sustainability thresholds to guide ecological restoration

First author: Mayra Zurbaran Nucci
Other author(s): Sara Vallecillo, Javier Babi Almenar
Affiliation: European Commission - Joint Research Centre
Contact: mayra.zurbaran-nucci@ec.europa.eu

The ecosystem service of air filtration, as defined in the SEEA-EA, refers to the contributions of ecosystems to the filtering of air-borne pollutants through the deposition, uptake, fixing and storage of pollutants by ecosystem components, particularly plants, that mitigate the harmful effects of pollution. Among air-borne pollutants, the filtration of PM_{10} via dry deposition is a mandatory ecosystem service to be reported under the Regulation 2024/3024 on European environmental-economic accounts.

This study proposes integrating critical thresholds for human health into PM_{10} dry deposition estimates, for supporting the prioritization of restoration efforts. To operationalize this approach, we adopt the World Health Organization PM_{10} concentration threshold of 15 $\mu g/m^3$, above which air quality becomes detrimental to human health. Incorporating this threshold into modelling of ecosystem-mediated PM_{10} filtration allows us to identify where ecosystems regulate PM_{10} sustainably (below threshold) and where they fail to meet health requirements (above threshold), indicating an ecosystem service deficit or excess of PM_{10} concentration.

Results of analysis in Italy for 2021 show that 57% of the service flow provided in urban areas is insufficient to ensure safe levels of PM_{10} concentration for human health. As this analysis is spatially explicit, this helps to identify areas where restoration efforts may be required. As set out in the Nature Restoration Regulation (Art.8) and the Global Biodiversity Framework (Target 12), such restoration should materialize in a net gain of nature. For this service, net gains should translate into significant increases in leaf area, to ensure restoration delivers positive contributions to human health.

Our study illustrates how ecosystem service accounts, when combined with sustainability thresholds, can support the spatial targeting of ecosystem restoration from a practical implementation.

Keywords: Air filtration, SEEA EA, policy, ecosystem services accounts, air filtration

11. Pioneering Urban Ecosystem Accounting in the City of Tampere: Nature's Value in Policy and Planning

***First author*:** Emmi Nieminen
***Other author(s)*:** Tin-Yu, Lai, Pinja-Liina, Jalkanen, Kaisa, Mustajärvi, Leena, Kopperoinen
Affiliation: City of Tampere
***Contact*:** emmi.nieminen@tampere.fi

Urban growth and climate change challenge cities to maintain ecosystem services vital for well-being, biodiversity, and resilience. Ecosystem accounting offers a systematic approach to quantify these services and integrate them into local land-use planning.

The population of the City of Tampere in Finland is growing rapidly, which poses challenges for sustainable urban growth. Thus, Tampere has pioneered urban ecosystem accounting since 2021, systematically measuring ecosystem extent and economic value in collaboration with Finnish Environment Institute SYKE, following the UN SEEA EA framework. The pilot studies present results and methodological developments aimed at strengthening evidence-based urban planning.

Pilots show green infrastructure delivers substantial annual benefits: stormwater regulation 45 million euros and recreation 149 million euros. Ongoing work focuses on developing monetary valuation for urban cooling using the InVEST Urban Cooling model, with results are expected in 2026. Findings demonstrate that investing in nature is economically beneficial, as benefits far exceed the costs of improving city's biodiversity.

Ecosystem accounting provides crucial information for strengthening the evidence base for integrating nature-based solutions into urban planning and climate adaptation strategies. It highlights how ecosystem accounting can make natural capital visible in economic terms, support scenario analysis, and inform sustainable land-use decisions.

Tampere has now a good knowledge base of the amount of green infrastructure and the most important ecosystem services it provides. The next important step is to utilize this information in decision-making so that natural capital and its benefits are given sufficient consideration in land-use planning. Tampere is currently looking for the best possible ways to do this so that it can continue to provide its residents with an environment that promotes well-being, health, and safety.

Keywords: Urban ecosystem accounting, ecosystem services, natural capital, urban planning

12. An application of thematic urban ecosystem accounts in Western Balkan Countries to inform urban greening

First author: Javier Babí Almenar
Other author(s): Claudia Romelli, Saša Čegar, Kejt Dhrami, Matjaz Hribar, Vesna Janković Milić, Sonja Jovanović, Milena Lipovina-Bozovic, Renato Casagrandi
Affiliation: Department of Electronics, Information and Bioengineering, Politecnico di Milano
Contact: javier.babialmenar@polimi.it

Urban ecological health is increasingly prioritized within European Union policies, as evidenced by the EU Biodiversity Strategy 2030, the Nature Restoration Regulation, and the amendment to the Regulation on Environmental-Economic Accounts. These policies call for ambitious urban greening initiatives, including emerging "no net loss" and "net gain" targets for soil sealing and green infrastructure, to improve citizens' quality of life and urban biodiversity. Monitoring these processes requires standardized, spatially explicit evidence. This study explores the utility of the System of Environmental-Economic Accounting–Ecosystem Accounting (SEEA-EA) framework for developing thematic urban ecosystem accounts to track ecological degradation and evaluate progress toward urban greening initiatives in the Western Balkans. We constructed pilot national accounts for all Western Balkan countries for 2018, complemented by local accounts for representative municipalities (Kranj, Rijeka, Niš, Podgorica, Tirana). The accounts quantify ecosystem extent, key condition variables (imperviousness, green space, tree cover, and PM_{10} concentration), and the ecosystem service of air filtration. Results were benchmarked nationally against EU/EFTA/UK countries and locally against Italian municipalities. The analysis reveals that urban ecosystems in the Western Balkans exist on a continuum with those of other European countries but exhibit a distinct, more homogeneous profile shaped by geography, climate, and policy legacies. The accounts successfully identify specific degradation hotspots (e.g., high soil sealing) and spatial capacity for ecosystem service delivery. The study thus demonstrates the practical value and transferability of the SEEA-EA framework in the region, proving its readiness to support environmental monitoring and policy alignment on the path toward EU integration.

Keywords: urban ecosystem accounts; ecosystem condition; ecosystem services; urban sustainability; SEEA-EA

13. Shaping urban Ecosystem Accounting in Italy: Towards coherent and scalable approaches

First author: Francesca Assennato
Other author(s): Giulia Capotorti, Francesca Chiocchini, Raffaella Chiocchini, Alessandra Ferrara, Stefano Mugnoli, Michele Munafò
Presenting author: Giulia Capotorti
Affiliation: Italian Institute for Environmental Protection and Research, Rome, Italy
Contact: francesca.assennato@isprambiente.it

An official inter-institutional working group has been established in Italy for the implementation of Ecosystem Accounting under SEEA. The WG brings together key technical/scientific institutions, relevant government departments, and experts from Academia. As for urban ecosystems, besides operating at the national level, the WG also provides methodological guidance to support sub-national scale accounting across different metropolitan areas and municipal contexts.
Main challenges being faced concern the operational alignment with concurrent European policies, especially the Nature Restoration Regulation and the Soil Monitoring and Resilience Directive. Key issues include defining a coherent territorial frame for urban systems across governance levels, harmonizing ecosystem typologies, effectively involving local administrations and strengthening citizen awareness and policy uptake.
In response, the WG collected nation-wide geospatial and statistical datasets useful for different ecosystem type accountings, including the thematic urban one. For this latter, operational guidelines are being delineated that concern i) the development of a coherent conceptual framework, ii) delimitation of urban areas according to administrative, functional, and morphological criteria at proper spatial scales, iii) detailed ecosystem-based classifications within urban areas (covering artificial surfaces, urban green spaces, agricultural areas, semi- natural ecosystems, and water bodies), and iv) definition and calculation of indicators for ecosystem condition and services, including any useful additional indicators beyond those required at EU level. Current efforts focus on developing modular, scalable spatial frameworks and testing them through pilot applications, supported by structured dialogue with local authorities. Despite this progress, important gaps still affect the need for alternative definitions of urban systems that better capture functional and socio-ecological dynamics and replicability to support monitoring, comparison and reporting over time. To advance a coherent yet flexible framework, we

recommend co-developing a shared typification of urban contexts as ecosystems, able to integrate green spaces quality and condition, alongside quantity, and explicitly accounting for ecological connectivity.

Keywords: multilevel approach; interdisciplinarity; operationalization

14. A Data-Driven Approach to Align Urban Ecosystem Accounting indicators with municipal policy targets and planning metrics

***First author*:** Maria Korkou
***Other author(s)*:** David N. Barton
***Affiliation*:** Norwegian Institute of Nature Research (NINA)
***Contact*:** maria.korkou@nina.no

The Blue-Green Factor (BGF) quantifies vegetated and water-based urban surfaces and structures. BGF is used by Oslo Municipality Planning and Building Agency to encourage new developments to design for biodiversity, stormwater management, and liveability. The BGF is used as a minimum performance indicator required to obtain a building permit. It is computed as a weighted sum of criteria representing blue-green landcover area and structures. It is computed on a case-by-case basis. How well do BGF-related policy incentives perform over time? A challenge for urban ecosystem accounting is that the ecosystem extent and condition metrics mandated at the national scale do not align with those routinely used in land use planning at the municipal level. Periodic accounting of BGF surfaces and structures requires a data-driven approach based on remote sensing and automated workflows. Mapping specific BGF structures across the Oslo built-up area proved challenging. Freely available satellite images through Copernicus Sentinel lacked sufficient resolution to detect small blue and green patches.
This study demonstrates a methodology to compute BGF areas and structural conditions for all properties in the administrative boundary. The BGF criteria computed on a periodic basis can form the basis of a “thematic account” targeting policy- and planning relevant indicators.

The limitation in the spatial resolution of Copernicus data was addressed by using high-resolution aerial photos (orthophotos) with RGB (true colour) and near-infrared (NIR) bands to identify BGF criteria in small patches (< 10 m² pixel). A systematic, non-random sampling approach was applied because the aim is to capture the spatial distribution of specific BGF structures that are sparsely scattered across Oslo’s built-up area. Random sampling would have resulted in insufficient coverage of small BGF elements. Using a non-random approach improves consistency and coverage across the study area, making it spatially representative and suitable for mapping. Some BGF criteria – e.g. green walls, grassy drainage channels (wadis) - are undetectable even with orthophotos, meaning that BGF scores computed for a property are incomplete/conservative. The remote sensing-based BGF calculation is a benchmark that can be validated and corrected by property owners, in the context of using it as a benchmark for different policy instruments. The RS data-driven method is the basis for policy-relevant thematic urban ecosystem accounts. It can be a future update of Oslo’s existing “green accounts” which only address changes in vegetation. The BGF baseline calculation can support other policy instruments - work is ongoing on a blue-green labeling of urban properties, inspired by energy efficiency labelling schemes. The combination of satellite imagery and orthphotos, with owner-initiated groundtruthing, is promising to classify small blue and green structures needed for urban ecosystem accounting. The classification result shows the potential of supporting city-wide planning and policy evaluation using targeted “thematic” urban ecosystem accounts.