BOOK OF 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
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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-mediterrean 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

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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 authors(s): Chiara Cortinovis
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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

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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-mediterrean cities

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Many euro-mediterrean 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

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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.

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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.

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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

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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