BOOK OF ABSTRACT

I. SESSION DESCRIPTION

ID: B10a

Urban Ecosystem Services: dynamics, complexities and challenges for sustainable urban development

	Title	Name	Organisation	E-mail
Host:		Luis Inostroza	Ruhr-Universität Bochum	luis.inostroza@rub.de
Co-host(s):		Nadja Kabisch	Humboldt Universität	nadja.kabisch@geo.hu-berlin.de

Abstract:

The overwhelming, exponential and somehow dramatic emergence of urbanization as a global phenomenon with all related challenges during the 21st century has placed the urban ecosystems at the core of human civilization's future. Together with marine ecosystems, the urban ecosystem is one of the largest habitats of our planet. Yet, little is known about its fundamental processes, complexity, dynamics and how they affect humans, other species – i.e. biodiversity, and ecosystems. Tailored scientific knowledge across disciplines from ecology to human health and well-being is necessary for a resilient and sustainable future urban development. An inter- and transdisciplinary urban science can provide the empirical base for a wise policy making to sustainable urban planning. Such attempts can greatly profit from the large body of knowledge produced in the ecosystem services (ES) science, which has been linking natural and social sciences for a couple of decades. Indeed, urban ES research has exponentially increased during the last years. Today, urban scholars are looking at ES theory and methods in the search for concepts, methods and applicable tools to support urban planning, management and governance towards sustainable urban development.

Urban ES research is experiencing a similar epistemological process than Urban Ecology, which went from a smooth transformation from the "ecology in cities" towards the "ecology of cities" to arrive at the "ecology for cities". In the case of urban ES research, we have observed a path from the ES research applied "in" cities, towards increasing understandings of the ES "of" cities. Indeed, production and consumption, demand and supply of ES find their vortex of

interactions in the urban environment, where their reciprocal linkages are not only spatiotemporally explicit but also highly complex, non-linear, determined by the large existence of built and social capital. While such complex interactions existing in the urban ecosystems make the future of cities mostly unpredictable, therefore challenging scientific approaches, such urban future can be invented and implemented through urban planning measures (Batty 2018).

To advance in the framing of the ES science to be applied and useful in urban planning, theoretical as well as methodological advances are needed. To date, most of urban ES research has been based on "green" aspects of cities, which does only partly reflect the existing natural capital in urban environments. However, ES are the result of complex, non-linear interactions between natural, social, individual and built capital strongly characterized by spatiotemporal process present in urban ecosystems. Urban ES research requires to heavily include aspects of built and social capital, for what theoretical and methodological/operational approaches that consider cities as socio-ecological systems are yet to be developed.

References

Batty, M., 2018. Inventing Future Cities. Mit Press.

Goals and objectives of the session:

This session focuses on inter and transdisciplinary research on urban ecosystem services. The goal is to frame a broad set of contributions looking at three dimensions of the urban ES research:

1.- Theoretical approaches to understand, analyze and measure urban ES. Special interest on contributions looking at theoretical bottlenecks to boost the use of ES science in urban studies, including planning, urban form and governance.

2.- Methodological-operational advances. The high complexity and spatiotemporal heterogeneity of the urban ecosystem hinder the measurement and operationalization of the ES framework. We welcome contributions on new innovative methods to measure, analyze and tackle this challenge. We ask authors to contribute with approaches tailored and conceived from a proper urban dimension, rather than only applying existing methods to an urban context. We welcome contributions using spatially explicit approaches and/or looking at indicators to measure and map urban ES. Modelling approaches using system's ecology are encouraged.

3.- Cross fertilization approaches, from urban ES research towards urban planning. The session will receive contributions linking fundamental aspects of urban ecosystems, planning and health, towards an integrated ES science that understand cities as socio-ecological

systems. We welcome contributions linking a) Land use planning and ES; b) Health/well-being and ES.

Planned output / Deliverables:

Depending on the number of good quality contributions, the session will offer the chance to propose a Special Issue in Ecosystem Services.

Related to ESP Working Group/National Network:

Biome working group: BWG 10 – Urban systems

II. SESSION PROGRAM

Date of session: Tuesday, 22 October 2019
Time of session: 10:30 – 12:00 and 16:30 – 18:00

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
10:30-10:45	Luis	Inostroza	Ruhr University Bochum	Introduction to the session
10:45-11:00	Pavel	Cudlín	Palacký University Olomouc	Valuation of urban ecosystem functions and services in relation to biodiversity
11:00-11:15	Roland	Kraemer	Humboldt-Universität zu Berlin	Beyond presence-absence scores: Advancing quality assessment of urban public green space regarding attractiveness and ecological value
11:15-11:30	Nada	Saidi	University of Dundee	Ecosystem Services Bundles in Urban Areas: Planning our Green Spaces for Multiple Benefits
11:30-11:45	Ieva	Misiune	Vilnius University	Demand for urban ecosystem services through the preferences of the stakeholders
11:45-12:00	Žaneta	Kalasová	Medel University Brno	Urban ecosystem services perception: Brno city case study

Time	First name	Surname	Organization	Title of presentation
16:30-16:45	Davide	Longato	University of Trento	How can we integrate ecosystem services in planning decisions? Insights from a meta-analysis of case studies
16:45-17:00	Mario	Balzan	Institute of Applied Sciences MCAST	Developing a strategy for the mainstreaming of nature-based solutions in the planning process of a rapidly growing urban agglomeration
17:00-17:15	Mikaël	Maes	University College London	Mental health and cognitive development responses in London's children shift with exposure to natural habitat type.
17:15-18:00	Nadja & Luis	Kabisch & Inostroza		Final discussion

III. ABSTRACTS

The abstracts appear in alphabetic order based on the last name of the first author. The first author is the presenting author unless indicated otherwise.

1. *Type of submission:* ***Abstract***

B. Biome Working Group sessions: B10a Urban ecosystem services: dynamics, complexities, and challenges for sustainable urban development

Developing a strategy for the mainstreaming of nature-based solutions in the planning process of a rapidly growing urban agglomeration

First author: Judita Tomaskinova

Presenting author: Mario Balzan

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The integration of nature-based solutions into urban planning and decision-making supports societies to deal with urban challenges by enhancing (or preserving) the provision of multiple co-benefits to biodiversity, human well-being and economic development. We analyse the application of nature-based solutions for the promotion of sustainability and resilience to climatic and environmental change in the small island state of Malta. This area is characterised by the highest population density in Europe, a strong growth in tourism, and ongoing urban sprawl.

We present indicators for developing sustainability projections, and outlining the impacts of urbanisation on human well-being. We then evaluate the potential of nature-based solutions to provide ecosystem services, contributing to human well-being within the city, through two case studies. These case studies have been implemented through the creation of a detailed land use land cover map for the urban agglomeration, and biophysical monitoring and expert knowledge is used to analyse the importance of different urban ecosystems in the provision of ecosystem services. In these case studies we map and assess the ecosystem capacity to deliver local climate regulation and recreation ecosystem services.

Our results indicate a strong association of ecosystem service capacity with specific ecosystems. Based on these trends, we present key processes, such as stakeholder

participation and knowledge co-creation and synthesis, which are being used within the ReNature1 Horizon 2020 project to develop the evidence base and for the integration of nature-based solutions into landscape policy and urban planning.

Keywords: ecosystem services, evidence-based planning, green infrastructure, knowledge synthesis, stakeholder participation

2. *Type of submission:* ***Abstract***

B. Biome Working Group sessions: B10a Urban ecosystem services: dynamics, complexities, and challenges for sustainable urban development

Urban ecosystem services perception: Brno city case study

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The growing urban population trend makes higher pressure on city possibilities. Nature existence in cities, and thus urban ecosystem services (UES), is increasingly important. Previous studies show very low knowledge of ecosystem services (ES) in the Czech Republic, therefore the case study in Brno was conducted. The aim of this abstract is to present public's awareness of the cultural ES of urban green areas. Understanding of UES over the last few years has become more important and there is a tendency to implement them into management and decision making towards sustainable urban development.

The main goal was to find out respondents' attitude towards urban green, their perception of cultural contribution or their willingness to pay for benefits from urban green. After excluding irrelevant questionnaires, we obtained 308 questionnaires. For the respondents the most significant were parks and public gardens (65 %), urban green in general (55 %), rivers, streams, pools or parkways were also significant (43 %). These areas are at most used for recreation, walking or rest. The meaning of cultural contribution for the public is especially recreation, maintaining the conditions for the existence of significant flora and fauna species, aesthetic values or cultural diversity. Spiritual or religious values were not evaluated as significant. Only 7 % of the respondents know the term "ecosystem services" and understand it as services

provided by nature. Willingness to pay for UES was 34 % yes and 41 % no. The most frequent reason for their willingness to pay was conservation of UES for next generations.

In conclusion, the public in the city of Brno understand by the term UES at most parks and urban green; these are the most important for them. This is naturally connected to their lifestyle. The potential is the increase of the awareness of the term "ecosystem services".

Keywords: urban ecosystem services, Brno, public's awareness, cultural ecosystem services

3. *Type of submission:* ***Abstract***

B. Biome Working Group sessions: B10a Urban ecosystem services: dynamics, complexities, and challenges for sustainable urban development

Beyond presence-absence scores: Advancing quality assessment of urban public green space regarding attractiveness and ecological value

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The complex nature of urban landscapes remains understudied regarding detailed and differentiated information on the capacity of green spaces to provide ecosystem services and how and which people actually interact with green spaces and make use of its services. In particular, there is little evidence on how the inner structure (e.g. vegetation structure, species composition) and the configuration of green spaces within the urban fabric (interrelationships, context with other urban structure types) is effecting the actual provision of ecosystem services. However, all of them are important aspects to evaluate green space quality. Besides, most studies that assess the quality of urban green spaces focus on presence-absence scores for most of the green space elements, i.e. only take into account weather features such as playgrounds or water bodies are present but do not assess to what extent, hence detailed quantitative and particularly qualitative measures are lacking.

We took the City of Leipzig, one of the fastest growing cities in Germany, as case study to assess the quality of publicly available green space in a detailed and multi-dimensional way.

We set up multiple indicators that describe (a) natural elements, e.g. types and configuration of vegetation or share of water bodies, (b) built elements, e.g. various recreational facilities or path density, and (c) the embeddedness of green spaces within the built, social and natural environment, e.g. neighbouring number of residents, (alternative) nearby green or blue elements or exposure to traffic. In order to allow a better evaluation of green spaces, we use these initial and non-judgemental indicators to develop scores for attractiveness (for residents) on the one hand and for the ecological value on the other hand. Ecological value in this context focusses on the capacity to provide regulating ecosystem services relevant for cities facing impacts of urbanization and climate change and to benefit biodiversity. Both, partially contrary scores should facilitate particularly urban planning to balance trade-offs between usability and ecology and to find untapped potentials in either dimension; to improve green space for residents, for nature, or for both at the same time.

Keywords: urban green space, ecosystem services, green space quality, indicators, spatial assessment

4. *Type of submission:* ***Abstract***

B. Biome Working Group sessions: B10a Urban ecosystem services: dynamics, complexities, and challenges for sustainable urban development

How can we integrate ecosystem services in planning decisions? Insights from a meta-analysis of case studies

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The inclusion of ecosystem services in planning processes and, consequently, in planning instruments is considered essential to promote sustainable land development and management. However, there is a relative lack of reported case studies in which ecosystem services have been used and integrated to support planning decisions. Practices and processes that encourage proper integration of ecosystem services in planning need therefore to be spread among practitioners.

With the aim to explore what practices and approaches are used to integrate ecosystem services in planning, we conducted i) a meta-analysis of existing reviews describing the integration of ecosystem services in planning documents, including urban, spatial and sectoral plans, and ii) an in-depth analysis of published case studies concerning the application of ecosystem services to support real-life planning processes.

The analyses focused of some key aspects of planning, including the level of stakeholder consultation and engagement, the type of planning decision(s) addressed using ecosystem services knowledge, the phase(s) of the planning process affected, the type of ecosystem services analysis and assessment methods used to inform decisions.

The material for the two analyses was selected after a systematic search in the database "Scopus", by using a combination of relevant keywords. The results of the analyses are then described by referring to the key steps of a generalized planning process. This allowed to discuss strengths and limitations related to current practices, and provide recommendations for strengthening the integration of ecosystem service knowledge in planning processes and instruments.

Keywords: ecosystem services, planning, case studies, literature review, meta-analysis

5. *Type of submission:* ***Abstract***

B. Biome Working Group sessions: B10a Urban ecosystem services: dynamics, complexities, and challenges for sustainable urban development

Mental health and cognitive development responses in London's children shift with exposure to natural habitat type.

First author: Mikaël Maes
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Large scale epidemiological studies have established associations between nature, mental health and cognitive performance, but the underlying drivers remain unknown, especially in

children. These have relied almost exclusively on classifying nature as green by using vegetation indices (e.g. NDVI), but few epidemiological studies have assessed how this relationship could vary across different natural habitat types. Here, we analysed total natural space and types of natural habitats for associations with mental health and cognitive performance. We used 6,616 schoolchildren from the SCAMP baseline cohort aged 10 to 13 years at 39 schools across London, United Kingdom. Mental health was assessed through the Strength and Difficulties and KIDSCREEN questionnaire, while cognitive performance was assessed through the executive function composed of three computerised cognitive tests (2014–2015). Types of natural spaces were assessed using high-resolution satellite data, OS MasterMap and LiDAR data in buffers of 250 m around each child's home and school. We show that high levels of managed grassland are associated with improved mental health and cognitive performance during childhood. The association was adjusted for parental occupation, area-level deprivation, gender, age, ethnicity and school type. No association was found between blue space and mental health and cognitive development where 64% of children had no blue space within a buffer of 250 m. Our results show that managed grasslands during childhood are associated with better mental health and cognitive performance, suggesting a potential trade-off in urban planning decisions between mental health benefits while delivering other ecosystem services.

Keywords: mental health, cognitive performance, natural habitat, ecosystem services, urban planning

6. *Type of submission:* ***Abstract***

B. Biome Working Group sessions: B10a Urban ecosystem services: dynamics, complexities, and challenges for sustainable urban development

Demand for urban ecosystem services through the preferences of the stakeholders

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There is a high demand for ecosystem services (ES) in the cities and since urban population is projected to continue to grow there will be an increase in the demand of these services. It is essential, for the policy makers and urban planners to develop a city where the green spaces not only address the ecological priorities and environmental conditions, but also the needs of the users. Previously suggested frameworks for assessment and mapping of ES demand often relies on proxies that indicate expected demand or use of the services. This research, however, applies participatory method and analyses the preferences for ES via survey. Thus, the aim of this study was to assess the demand for urban ES through the perceptions and priorities of the stakeholders in Vilnius city, the capital of Lithuania. Over 450 respondents participated in a representative survey that was conducted in May, 2019. The questionnaire included 12 ES and various socio-demographic data to see the factors that influence different preferences.

Results show that most frequently perceived ES by people were regulating services, and air purification together with microclimate regulation held the greatest importance. The differences, however, emerged between those that live closer to the green zones or spend more time outside. Some challenges to access the green zones also influence the priorities.

Such analyses can help to improve or validate urban ES assessment and mapping frameworks. At the same time to support urban planning and management.

Keywords: urban ecosystem services, demand, priorities, perceptions

7. *Type of submission:* ***Abstract***

B. Biome Working Group sessions: B10a Urban ecosystem services: dynamics, complexities, and challenges for sustainable urban development

Valuation of urban ecosystem functions and services in relation to biodiversity

First author: Pavel Cudlín

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A number of ecosystem services (ES) assessment tools seek to quantify ES in the landscape using simplified biophysical models or ecosystem functions (EF) measurement. The aim of the paper is to present the results of valuation of selected urban ecosystem functions and services in relation to biodiversity in Liberec and Dresden as a basis for subsequent financial valuation of relevant ecosystem services. For a total of 22 functional groups of habitat types, their chosen EF (biomass production, oxygen and evapotranspiration capability, reducing the amount of radiated heat), providing supportive and regulatory ES, were assessed by expert estimation. The evaluation of EF is based on detailed habitat classification by Habitat Valuation Method, consisting of 156 natural (from Habitat Mapping of the Czech Republic) and 38 non-natural types of habitats, classified into 22 functional groups. For the study on the regional scale, the Refined Consolidated Habitat Layer at a scale of 1: 10,000 was used. On a CZ national scale, habitats were mapped in the Combined Habitat Layer at a scale of 1:10,000 - 1: 100,000, where non-natural habitats were taken from the data layers of the Corine LC/Urban Atlas project, applicable also for Dresden. Using GIS analysis, the representation of 194 natural and non-natural habitats was found in each of the Corine LC category and, using 22 functional groups of habitat types, EF values for Corine LC categories were assessed.

Expert estimates are verified at present by methods based on remote sensing data, especially from Sentinel 2. 4-5 imagery reclassifications according to Corine LC will be made during growing period and unit values of functional habitat groups for selected EF will be verified. The databases and approaches used are a part of a broader integrated approach to the assessment of biodiversity and ecosystem services in the landscape.

Keywords: biodiversity, ecosystem services, habitat, Sentinel, urban area

8. *Type of submission:* ***Abstract***

B. Biome Working Group sessions: B10a Urban ecosystem services: dynamics, complexities, and challenges for sustainable urban development

Ecosystem Services Bundles in Urban Areas: Planning our Green Spaces for Multiple Benefits

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The contribution of green spaces to urban sustainability and well-being, through the ecosystem services (ES) they provide, is increasingly recognised by researchers and practitioners alike. However, the lack of an integrated assessment methodology showing the interlinkages between the multiple urban ES, may lead to missed opportunities to act on synergies between ES or to avoid trade-offs. The concept of bundles of ES, i.e. ES consistently associated together, has been useful in uncovering and visualising such interactions – but very few bundle approaches have been designed for urban areas and none include an assessment of the extent to which findings could actually be taken up by planners and managers.

My research aims to provide insight into how a bundle approach can inform decision-making at city scale and involves:

- Designing a bundle approach suited to the specificities of urban areas, including high heterogeneity and non-linearity;
- Implementing it in a case city in partnership with the local Council;
- Providing recommendations based on coupling bundle results with socio-economic data and on analysing current strategies and practices regarding green spaces.

I intend to present results from the first two items above:

- The spatial distributions of urban ecosystem services require careful thinking when selecting statistical analyses for identifying bundles. Commonly used methods are critiqued and a fit-for-purpose methodology is built for the urban context.
- The developed bundle approach is implemented in the City of Edinburgh, at data zone scale (meso scale). The services are selected and assessed in partnership with the Parks department. Results from bundling show different levels of synergies between the studied ES, as well as spatial heterogeneity in the provision of multiple services.

These results are promising for identifying priority areas for greenspace planning and management. Preliminary insights from consideration of deprivation data will be presented to show how bundles could inform decision-making.

Keywords: bundles, urban, mapping, synergies, management