BOOK OF ABSTRACT

I. SESSION DESCRIPTION
II. SESSION PROGRAM
III. ABSTRACTS

I. SESSION DESCRIPTION

ID: B10d

Urban Green Infrastructure: factors shaping urban ecosystem services and disservices

	Title	Name	Organisation	E-mail
Host:	Dr.	Nina Schwarz	University of Twente	n.schwarz@utwente.nl
	Dr.	Joerg Priess	Helmholtz Centre for Environmental Research - UFZ	Joerg.priess@ufz.de
	Dr.	Annegret Haase	Helmholtz Centre for Environmental Research - UFZ	Annegret.haase@ufz.de
Co-host(s):	Prof.	P. Pereira	Mykolas Romeris University	pereiraub@gmail.com
		J. Palliwoda	Helmholtz Centre for Environmental Research - UFZ	julia.palliwoda@ufz.de
		L. Pinto	ESAC - Escola Superior Agrária de Coimbra	lmpinto@esac.pt
	Dr.	S. Jacobs	Instituut voor Natuur- en Bosonderzoek (INBO)	sander.jacobs@inbo.be

Abstract:

Ecosystem services (ES) delivered by urban green and blue infrastructures (UGBI) such as parks, forests and green brownfields can be important for the wellbeing of citizens. However, this relationship between UGBI and ES is not quite as straightforward for at least three reasons. First, UGBI properties such as accessibility, design, previous use, vegetation or size can influence the supply and actual use of these ES. Second, (unintended) ecosystem disservices (EDS) such as smells, allergenic species or disturbing animals go hand in hand with ES provision. The relationship between UGBI and human wellbeing can be ambiguous in the sense

that ES (e.g. a pond or shade) can also be perceived as EDS by other UGBI users. Third, there is a variety of economic, social, political, technological and environmental contextual factors that influence how citizens benefit from specific ES and / or face EDS. These contextual factors moderate the relationship between UGBI and ES / EDS. For instance, urban food production in cities of the Global North can have recreational and educational benefits in addition to food provisioning, while in poorer parts of cities in the Global South, urban food production may contribute substantially to food security. Likewise, housing larvae of mosquitos in a pond can be a mere nuisance or an actual health risk if mosquitoes are vectors for diseases. Not least, high-quality green may contribute to the improvement of recreational quality and wellbeing in urban neighbourhoods but also to increased housing costs and displacement. Despite the increasing body of literature on ES and EDS provided by UGBI, there is a lack of studies that systematically look at socio-economic and green contextual factors at various levels and their interplay with ES and EDS. In this session, we will discuss these factors and how the context influences our understanding of urban ES and EDS. We invite papers that: 1.- present case studies that critically examine contextual factors related to UGBIs and/or their governance, 2.- comparative analyses of different case studies, 3.- papers that discuss the topic from a theoretical viewpoint.

Goals and objectives of the session:

This session has two major objectives. First, it collects case studies from different contexts which critically examine the factors directly or indirectly influencing ES and EDS. Based on these case studies, the second aim is to develop a framework for taking into account such factors when comparing case studies and drawing conclusions from individual cases for ES and EDS management. To achieve these goals, we ask all participants to systematically reflect on factors influencing ES and EDS, both at the level of UGBI and the wider context for their cases /case study comparisons.

Planned output / Deliverables:

Depending on the papers submitted to the session: contributions to a special issue in STOTEN "Greening the city" (editors: Priess, Ferreira, Baro, Jacobs, Langemeyer; deadline Nov 30 2019) and common positioning paper(s).

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: 13:30 – 18:00

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
13:30–13:45	Johannes	Langemeyer	Institute of Environmental Science and Technology (ICTA), Universitat Autónoma de Barcelona	Where to implement green roofs most effectively? ecosystem service–based spatial multi–criteria decision analysis in Barcelona
13:45–14:00	Daria	Sikorska	European Regional Centre for Ecohydrology of the Polish Academy of Sciences / Warsaw University of Life Sciences SGGW, Faculty of Civil and Environmental Engineering	Pollutant removal, cooling benefits and biodiversity of spontaneous vegetation in urban wastelands
14:00–14:15	Dagmar	Haase	Humboldt University Berlin and UFZ Leipzig	How heat waves and drought shape urban green infrastructure and the ecosystem services it is expected to provide – a critical view on nature–based solutions under climate change
14:15–14:30	Julia	Palliwoda	Helmholtz Centre for Environmental Research – UFZ	How does the „Green" in Urban Green Infrastructure shape Ecosystem Services use? – Examples from Leipzig, Germany
14:30–15:00	Joerg Annegret Luis	Priess Haase Pinto	Helmholtz Centre for Environmental Research – UFZ; Helmholtz Centre for Environmental Research – UFZ; ESAC – Escola Superior Agrária de Coimbra	Discussion, summary and wrap up
16:30–16:45	Michaela	Roberts	James Hutton Institute	Contributions of Urban Greenspace to Mental Health
16:45–17:00	Matthew	Mitchell	Institute for Resources, Environment and Sustainability, University of British Columbia	The importance of conserving natural forests in and around cities: analyzing ecosystem

				services for resilience along an urban–rural gradient
17:00–17:15	Lina	Suleiman	Division of Urban and Regional Studies, Department of Urban Planning & Environment, Royal Institute of Technology, Stockholm, Sweden	Challenges and opportunities for mainstreaming Urban Rain Harvesting Systems: A systematic review from a planning perspective
17:15–17:30	Malgorzata	Stępniewska	Adam Mickiewicz University in Poznan, Faculty of Geographical and Geological Sciences, B. Krygowskiego 10, 61–680 Poznan, Poland	Social recognition of ecological benefits from urban green infrastructure: The case of Citadel Park in Poznan, Poland
17:30–17:45	Joerg	Priess	Helmholtz Centre for Environmental Research – UFZ	Current and expected future provision of urban green in Leipzig: which UGIs and for whom?
17:45–18:00	Nina Paolo Julia	Schwarz Pereira Palliwoda	University of Twente; Mykolas Romeris University; Helmholtz Centre for Environmental Research – UFZ	Discussion, summary and wrap up

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: B10d Urban green infrastructure: factors shaping urban ecosystem services and disservices

Challenges and opportunities for mainstreaming Urban Rain Harvesting Systems: A systematic review from a planning perspective

First author: Lina Suleiman

Other author(s): Blal, Adem Esmail

Affiliation: Division of Urban and Regional Studies, Department of Urban Planning & Environment, Royal Institute of Technology, Stockholm, Sweden

Contact: blal@kth.seblal@KTH.se

The necessity to move towards sustainable urban water systems and management practices is widely recognized. Conventional urban water systems and, particularly, piped rainwater drainage systems are exposed to a plethora of socio-environmental pressures. Whereas alternative system solutions are challenging the dominant view of water engineering, offering more circular approaches that mimics water's natural cycle, and promise technical, socioeconomic and environmental benefits. Advocated under different terms (e.g. LID, SUDS, and GI), these solutions are based on principles of "retaining-storing-draining" rainwater. They integrate nature-like facilities designed as open spatial systems, including swales, open canals, green roofs, and bio-retention systems. Here, the term Urban Rain Harvesting Systems (URHS) is used to stress that rainwater is a resource to be harvested for socioeconomic, environmental, and ecological benefits and not wastewater. However, transition towards consolidated URHS is slow. Partly, this is because URHS are sociotechnical systems incorporating interlinked and path-dependent components of technology, institutions, and society, which make socio-technical changes difficult. Building on transition research, we here explore the state-of-the-art in planning and implementation of UHRS worldwide. Through a systematic review, we aim to locate, critically appraise and synthesize evidence on the range of forming factors that facilitate or hinder the transition towards URHS. A keyword search in the Web of Science identified 7002 studies dealing with URHS of which 471 were selected given their relevance for planning and inclusion of social actors and participation processes. The sample was reduces to 140 studies after reading the abstracts. For the analysis, an own

theoretical outline was used based on relevant transition research concluding on formative factors for sociotechnical change. We looked at the role of: Contexts, Actors, Instruments, Purposes, Processes, Outputs/Outcomes, and Impacts. This ongoing systematic review will contribute to a deeper and nuanced understanding of the challenges, opportunities and prospects for mainstreaming URHS in planning.

Keywords: Blue-Green Infrastructures, Sustainable urban water systems, integrated planning and management of urban water

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

B. Biome Working Group sessions: B10d Urban green infrastructure: factors shaping urban ecosystem services and disservices

How heat waves and drought shape urban green infrastructure and the ecosystem services it is expected to provide – a critical view on nature-based solutions under climate change

First author: Dagmar Haase
Affiliation: HU Berlin and UFZ Leipzig, Germany
Contact: dagmar.haase@geo.hu-berlin.de

The basic idea of the contribution is that green nature-based solutions are an extraordinary idea to employ and use nature, natural processes and their outcomes as ecosystem services (ES) to face societal challenges and to make our cities more sustainable. Many well-working examples of implemented nature-based solutions (NBS) already exist across the globe. However, last summer 2018 showed for European cities, and the summers before in both Americas, that waves of hot temperatures and missing rainfall heavily affected urban nature regardless being planted or naturally growing. Water shortage and strong insolation pushed urban ecosystems, especially green infrastructure, in cities to the brink of collapse: trees leafs burned, litter fall started in early summer, trees lost thick branches to minimize their water capacity needed to survive, lawn burned and all ecosystem services we dedicate to urban green spaces were not longer delivered. Birds partly left their local habitats, which lead to an overcrowding of wet habitats such as wetlands and floodplains over months. Urban planners seemed surprisingly overstrained by the situation. This oral paper systematically lists the damages on urban ecosystems and their services that had been occurring during hot ongoing periods and discusses counter strategies by planning but also by local green infrastructure

stewardship that residents can provide. The arguments discussed should enrich the debate on green NBS and the factors shaping the provision of ES in cities making it more robust.

Keywords: Urban ecosystems, heatwave, water shortage, damages on trees, stewardship

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

B. Biome Working Group sessions: B10d Urban green infrastructure: factors shaping urban ecosystem services and disservices

Where to implement green roofs most effectively? ecosystem service-based spatial multi-criteria decision analysis in Barcelona

First author: Johannes Langemeyer
Other author(s): Diego Wedgwood, Timon McPhearson, Francesc Baró, Anders L. Madsen, David Barton
Affiliation: Institute of Environmental Science and Technology (ICTA), Universitat Autónoma de Barcelona, Spain
Contact: johannes.langemeyer@uab.cat

As cities face increasing pressure from densification trends, green roofs represent a valuable source of ecosystem services for residents of compact metropolises where available green space is scarce. However, to date little research has been conducted regarding the holistic benefits of green roofs at a citywide scale, with local policymakers lacking practical guidance to inform expansion of green roofs coverage. The study addresses this issue by developing a spatial multi-criteria screening tool applied in Barcelona, Spain to determine: 1) where green roofs should be prioritized in Barcelona based on expert elicited demand for a wide range of ecosystem services and 2) what type of design would maximize the relative ecosystem service provision of potential green roofs. As inputs to the model, fifteen spatial indicators were selected as proxies for ecosystem service demands (thermal regulation, runoff control, habitat and pollination, food production, recreation, and social cohesion) along with five decision alternatives for green roof design (extensive, semi-intensive, intensive, naturalized, and allotment). These indicators and alternatives were analyzed probabilistically and spatially, then weighted according to feedback from local experts. Results of the assessment indicate that there is high demand across Barcelona for the ecosystem services that green roofs potentially might provide, particularly in dense residential neighborhoods and the industrial south. Experts identified habitat, pollination and thermal regulation as the most needed ES with

runoff control and food production as the least demanded. Naturalized roofs generated the highest potential ecosystem service provision levels for most areas of the city, apart from smaller areas of central Barcelona where intensive rooftops were identified as the preferable green roof design. Overall, the spatial model developed in this study offers a flexible screening based on spatial multi-criteria decision analysis that can be easily adjusted to guide municipal policy in other cities considering the effectiveness of green infrastructure as source of ecosystem services.

Keywords: Cities, Urban, Nature-Based Solutions (NBS), Green-Blue Infrastructure (GBI), Bayesian Belief Networks (BBN), Multi-criteria Decision Analysis (MCDA)

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

B. Biome Working Group sessions: B10d Urban green infrastructure: factors shaping urban ecosystem services and disservices

The importance of conserving natural forests in and around cities: analyzing ecosystem services for resilience along an urban-rural gradient

First author: Matthew Mitchell

Other author(s): Tahia Devisscher, Cecil Konijnendijk

Affiliation: Institute for Resources, Environment and Sustainability, University of British Columbia, Canada

Contact: matthew.mitchell@ubc.ca

Managing urban landscapes is one of the greatest challenges of this century. As cities continue to grow, they become increasingly vulnerable to multiple risks caused by urbanization, loss of natural landscapes and green infrastructure, and climate change interactions. The state of urban ecosystems and the wellbeing of urban dwellers will greatly depend on the way cities anticipate and prepare for rapid change in the next decade. Urban forests have an important role to play in this regard, yet little has been done to measure the effects of urbanization on the multiple, essential ecosystem services these forests provide for urban resilience. Pressure on land in and around cities is increasing, and some cities are struggling to conserve their natural forest and biodiversity in the face of increasing populations and development. In these cities, there is a growing demand to better understand the role of surrounding forests and natural forest fragments in terms of their potential contribution to urban resilience and human wellbeing. This study will show results of research conducted along an urban-rural gradient

in the City of Maple Ridge, Canada, selected due to its very rapid urbanization rate and expansion into surrounding forests. Forest structure, composition, and associated biodiversity and ecosystem services (and disservices) deemed important for urban resilience were evaluated in forest plots along the gradient. Citizens were also engaged along the gradient to evaluate their interaction with the urban forest and perceptions of the benefits these forests provide. Findings will be used by Maple Ridge to inform future land policies, and promote planning decisions that will improve the conservation of the urban forest areas that play a key role in the resilience and sustainability of the city.

Keywords: ecosystem services, urban forests, resilience, urban-rural gradient

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

B. Biome Working Group sessions: B10d Urban green infrastructure: factors shaping urban ecosystem services and disservices

How does the „Green" in Urban Green Infrastructure shape Ecosystem Services use? – Examples from Leipzig, Germany.

First author: Julia Palliwoda
Other author(s): Ellen Banzhaf, Jörg Priess
Affiliation: Helmholtz Centre for Environmental Research - UFZ, Germany
Contact: julia.palliwoda@ufz.de

An increasing number of people is living in cities and thus depend on urban ecosystems and their services such as climate regulation or recreational use. The pressure on remaining open space or urban green infrastructure (UGI) is high due to increasing urbanization and diverse requirements from a diverse urban population. Thus, a good quality and high capacity for ecosystem services (ES) of these green spaces is crucial so they support good quality of life in urban areas. However, there is not enough knowledge about how their characteristics and especially green parameters influence the actual use of cultural ES in UGI. This study assesses the use of cultural and other ES in two types of UGI, namely urban parks and green brownfields with different tree cover, and how parameters like tree canopy and diversity relate to this use in the city of Leipzig. We applied a smartphone-based questionnaire to interview randomly selected visitors (n=1750) on our 36 study sites and recorded their ES use, motivation and their likes and dislikes of the site. Results indicate that tree cover in urban parks can be a predictor for physical activities like walking or doing sports and for used regulating services

such as mediation of noise or shade. Brownfields are also used for cultural ES but are mainly dominated by people that walk their dog there. ES use is not influenced by diversity in this study. We found differences in liked and disliked UGI features between age groups and between sites with different tree cover. Our findings can provide guiding relations between green elements and the ability of UGI to provide diverse (cultural) ES in cities. They can thus enhance and improve the resilient and sustainable design and management of UGI and further development of unused space.

Keywords: Urban green infrastructure, Cultural ecosystem services, Tree canopy, Interviews

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

B. Biome Working Group sessions: B10d Urban green infrastructure: factors shaping urban ecosystem services and disservices

Current and expected future provision of urban green in Leipzig: which UGIs and for whom?

First author: Joerg Priess
Other author(s): Julia, Palliwoda
Affiliation: Helmholtz Centre for Environmental Research – UFZ, Germany
Contact: joerg.priess@ufz.de

The provision of adequate areas of high quality urban green infrastructure (UGI) is a major objective of governments and city administrations, strongly contributing to the wellbeing of urban citizens. Based on numbers of the European Commission of almost 700 functional urban areas (cities), Leipzig's UGI share is half of the EU mean value, resulting in 0.1 ha UGI per capita, though with a high recreation potential. The Commission's reference scenario suggests minor increases in per capita UGI areas, but strong decreases in recreation potential until 2040. Local data sources reveal additional aspects and partly contrasting trends. Two factors increase current UGI provision in Leipzig. First, within the city limits large areas of riverine forests add to the UGIs managed by the city administration. Second, almost 10.000 urban brown fields, of which de facto 1/3 are used as UGIs, are complementing urban parks and forests. Thus, our results suggest a higher per capita UGI availability and recreation potentials than reported in the European study. However, about half a decade ago population trends in Leipzig turned from declining to strongly increasing. While established urban parks and forests mostly remain unchanged, the availability of green urban brownfields is decreasing fast, due

to construction activities, and only minor areas are converted to official UGIs. Currently, the mostly unregulated use of brownfields comprises mainly mobile activities and is dominated by dog walkers, 2/3 of whom are male persons. While official trends report slightly increasing UGI, the de facto brownfield-based loss of UGI areas is much larger. In addition, users preferring less regulated UGI types increasingly have to use official, more regulated UGIs. Current population trends imply a reduced "buffering" capacity of green brownfields, higher user densities and a higher potential of incompatible UGI uses and users, and risks of displacing less confident UGI users.

Keywords: availability; regulations; urban brownfields; urban green infrastructure - UGI

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

B. Biome Working Group sessions: B10d Urban green infrastructure: factors shaping urban ecosystem services and disservices

Contributions of Urban Greenspace to Mental Health

First author: Michaela Roberts
Other author(s): Alistair McVittie, Katherine N Irvine
Affiliation: James Hutton Institute, United Kingdom
Contact: michaela.roberts@hutton.ac.uk

There is mounting evidence of a positive relationship between greenspace and mental health. As populations become increasingly urbanised the pressure on urban greenspace to provide services linked to improved mental health (e.g. noise reduction, recreation) is growing simultaneously with pressures to develop urban greenspaces. Understanding the contribution of urban greenspace to mental health is therefore important for land use planning. However, not all individuals experience greenspace in the same way, and greenspaces can also provide disservices. Understanding the population experiencing greenspace is therefore important to recognising the services and disservices provided. We investigate the relationship between area of publicly owned greenspace and mental health in urban Scotland, considering the amount of greenspace over three distances from the home (immediate vicinity, 300m, 2km). We find that the relationship between greenspace and mental health is moderated by age. When considering greenspace in the immediate vicinity or 300m, mental health improves with increased greenspace in locations with low proportions of people over 65, but declines in locations with high proportion of people over 65. This may be due to the potential for

greenspace to provide a disservice to the elderly, such as personal safety concerns. However all social groups are predicted to show improvements in mental health related to greenspace area at the 2km scale. This is of importance to greenspace policy, particularly in the UK where government recommendations advise that all individuals should have access to 2ha of greenspace within 300m of their home, in addition to a 20ha site within 2km. When viewed alongside previous studies into greenspace we suggest that further consideration needs to be taken of the quality and features of greenspace, and greenspace management should take account of the characteristics of the population to which they cater, to promote delivery of ecosystem services, rather than disservices.

Keywords: Greenspace, Urban Ecosystems, Mental Health, Wellbeing, Scotland

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

B. Biome Working Group sessions: B10d Urban green infrastructure: factors shaping urban ecosystem services and disservices

Pollutant removal, cooling benefits and biodiversity of spontaneous vegetation in urban wastelands

First author: Daria Sikorska
Other author(s): Piotr Sikorski, Arkadiusz Przybysz, Wojciech Ciężkowski, Jarosław Chormański
Affiliation: European Regional Centre for Ecohydrology of the Polish Academy of Sciences / Warsaw University of Life Sciences SGGW, Faculty of Civil and Environmental Engineering, Poland
Contact: d.sikorska@erce.unesco.lodz.pl

Urban wastelands, also referred to as vacant lots, brownfields or informal green spaces are all different types of neglected areas in the cityscape whose final purpose has not been destined yet. Due to the abandonment, natural succession processes takes place and many of those areas unintentionally become substitutes of parks and informal places for recreation in areas bereft of other forms of green. Despite being often critically perceived by the public as unmanaged and untidy they still play an important role in cities providing numerous ecosystem services to the city dwellers. We have performed an extensive empirical study in 20 sites preselected by the Municipality of Warsaw (Poland) which are currently vacant lots but can be potentially incorporated into the city's green infrastructure system. We assessed qualitatively and quantitatively the role of spontaneous vegetation in air purification process, water storage,

biodiversity and cooling benefits. We used Unoperated Aerial Vehicles (drones) equipped with multispectral and thermal cameras for vegetation mapping and assessment and cooling benefits, we also conducted PM 2.5 and PM 10 content analysis washed off from the surface of the vegetation, to test the ability of spontaneous vegetation to absorb pollutants. The benefits derived from the investigated areas were comparable or even higher than from the typical urban green spaces while generating at the same time minimal maintenance costs. Significant variation in cooling benefits and pollutant removal were found depending on vegetation density, the succession level and habitat type. The urban wastelands were found to be promising areas for expanding city's green system and spontaneous vegetation was proved to considerably improve the air and temperature in the city.

Keywords: GBI, urban green, ecosystem services, UAV, vegetation mapping

9. *Type of submission:* ***Abstract***

B. Biome Working Group sessions: B10d Urban green infrastructure: factors shaping urban ecosystem services and disservices

Social recognition of ecological benefits from urban green infrastructure: The case of Citadel Park in Poznan, Poland

First author: Małgorzata Stępniewska
Affiliation: Adam Mickiewicz University in Poznan, Faculty of Geographical and Geological Sciences, B. Krygowskiego 10, 61-680 Poznan, Poland
Contact: mka.stepniewska@gmail.com

It is widely documented that urban green infrastructure can provide a broad bundle of regulating ecosystem services. It is interesting to recognize to what extent they are perceived by the dwellers as improving their quality of life.

The case study analyses the Citadel Park located in the city of Poznan, in central-western Poland. The park was establish in its present form between 1963-1970, on the site the former fort. It is Poznan's largest park, occupying about 100 hectares in the very heart of the city. Not only is the Citadel Park of the heritage site and popular recreational spot, it is also a place of great natural value. Among others, the park is a part of Natura 2000 site (PLH300005) protecting winter dormitories of bats.

The study should answer for following questions: (1) How do the citizens use the park? (2) What ecological benefits from the Citadel Park do citizens prefer? (3) What is the citizens opinion on the main threats to ecological benefits? (4) What are the citizens preferences for future Citadel Park development?

To fulfil the objectives listed above, face-to-face interviews with a sample of 178 visitors of the Citadel Park were carried out in May 2019. The results are currently being processed and will be presented during the conference. In the author's opinion the results may help to better weight the synergies and trade-offs between different management options and to tie the users' needs and desires with preserving the integrity and ecological stability of the whole urban system. Many of the findings could be interesting for other cities standing in front of a challenge to integrate the social and ecological aspects and make the management decisions that comprehensively capture the relation between urban green infrastructure and human well-being.

Keywords: regulating ecosystem services, social perception, urban areas