Maria Ignatieva, Diana Dushkova, Charles Nilon, Dagmar Haase, Sonja Knapp & Nina Bittorf (eds.)

BOOK OF ABSTRACTS

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Integrating Biodiversity in Urban Planning and Design Processes

28-30 November 2022, Leipzig, Germany

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INTRODUCTION

The 7th Conference of the International Network Urban Biodiversity and Design (URBIO) with the theme ”Integrating Biodiversity in Urban Planning and Design Processes” was held at the Helmholtz Centre for Environmental Research – UFZ Leipzig, Germany, from 28th to 30th November 2022. The conference was organised by UFZ, the Humboldt University Berlin, the University of Missouri and the University of Western Australia and sponsored by KOMIPO (South Korea). 122 individuals from 24 countries participated in the conference.

These proceedings comprise 62 abstracts of oral presentations and eight posters. The abstracts went through the editing process organised by the Conference Organising Committee: Prof. Dr Maria Ignatieva, Prof. Dr. Charles Nilon, Dr. Diana Dushkova, Prof. Dr. Dagmar Haase and Dr. Sonja Knapp with the help of Nina Bittorf and Prof. Dr. Norbert Müller – the founder of URBIO network and honorary URBIO member.

ACKNOWLEDGMENTS

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We also thank the organisers and leaders of the excursions on the 30th November 2022 in Leipzig: Constantin Suppee and Marcus Drappatz (Office of Green Space and Water, City of Leipzig); Ellen Banzhaf (UFZ); Anika Schmidt (UFZ); Lucie Moeller (UFZ); Christine Heinichen and Marie Romer (Ökolöwe – Umweltbung Leipzig e.V., NGO).

PROGRAMME

Day 1: Monday 28th November 2022

8:30-9:00	**REGISTRATION AND MORNING COFFEE**	
9:00-9:20	**Opening ceremony: warm greetings from the hosts – UFZ Leipzig (Bernd Hansjürgens and Diana Dushkova) and HU Berlin (Dagmar Haase), URBIO Committee (Maria Ignatieva and Charles Nilon), City of Leipzig (Constantin Suppee)**	
9:20-10:35	**KEYNOTES**	
9:20-9:45	A review on the work of urban biodiversity networks in Germany – from national to international activities	**Norbert Müller, Peter Werner**
9:45-10:10	Urban trees under climate change: Challenge and/or solution for both biodiversity and society?	**Dagmar Haase**
10:10-10:35	Future of URBIO Movement. Challenges and Opportunities	**Maria Ignatieva, Charles Nilon**
10:35-11:00	**COFFEE BREAK**	
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2	Incorporating community voices to extend the ecosystem services framework for park planning in marginalised urban environments	**Dayle Shand**
3	Integrating biodiversity into urban school grounds through transdisciplinary curriculum design	**Shari Wilson**
4	Exploring the hidden meaning of biodiversity in Canberra as a designed national capital	**Fahimeh Mofrad**
5	Seasonal variation in preference for green roof vegetation	**Petra Thorpert, Åsa Ode Sang**
6	A conceptual approach to investigate the socio-ecological significance of urban green spaces across spatial and structural gradients	**Sophie Arzberger**, Yannik Hecher, Stefanie Burger, Vera Knill, Birgit Probst, Michael Suda, Peter Annighöfer, Monika Egerer
7	The TUM Urban Green Infrastructure Research Training Group: applying social-ecological-technological frameworks to integrate biodiversity into urban fabrics	**Zbigniew Grabowski** on behalf of the TUM UGI RTG
8	Integrating biodiversity in health clinics: the valuation of ecosystem services and disservices of health clinic gardens in South Africa	Marlize Muller, **Nanamhla Gwedla**, Sarel Cilliers, Christi Niesing, Petra Bester*
9	Balancing environmental and socioeconomic benefits in green infrastructure projects: exploring enabling conditions for urban biodiversity conservation	**Javiera Chinga**, Maureen Murúa, Stefan Gelcich*
10	Beautiful vs. useful: plant diversity and related ecosystem services of allotment gardens in Berlin	**Dara Gaeva***
12:15-12:30	***Discussion***	
12:30-13:30	**LUNCH (at UFZ KUBUS)**	
13:30-14:00	**SESSION 2: Ecological restoration and urban biodiversity** ***Chair: Charles Nilon***	
1	Towards carbon neutrality and ESG management of a power plant area – an ecological restoration project by Korea Midland Power Co. Ltd	**Chongsu Lee**
2	Indicator communities for wildlife conservation in heterogeneous urban areas	**Heather Sander**

3	Restoration of urban ecological axis and degraded area in Gwangyang City, South Korea	**Hyunsim Park**
4	Design modules and technique-package based approach to urban biodiversity. Case study of Suwon City, South Korea	**Youngkeun Song, Namchoon Kim**
14:00-14:15	***Discussion***	
14:15-14:30	The post-2020 Global Biodiversity Framework, its urban ecosystem target, the Plan of Action for cities and subnational governments and the associated opportunities and needs for technical and scientific assessments and cooperation	**Oliver Hillel***
14:30-15:00	**SESSION 3: Integrative green infrastructure planning and urban biodiversity** ***Chair: Kristine Engelmann Jensen***	
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2	Urban green infrastructure planning and design that encourage co-management and increase benefits	**Christina Breed, Tania du Plessis**
3	A decision support tool for planning multifunctional integrative green infrastructure	**Peta Brom**, Kristine Engemann
4	Benefits and barriers of urban green infrastructure from the perspective of local communities in Tshwane, South Africa	**Maya Pasgaard**
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15:15-16:20	**SESSION 4: Urban wildlife biodiversity: mechanisms of increasing biodiversity in urban areas, protection, and conservation strategies** ***Chair: Sonja Knapp***	
1	Mammalian functional trait responses to anthropogenic and environmental factors across the contiguous USA	**Christine Brodsky,** Katherine C.B. Weiss, Austin M. Green, Fabiola Iannarilli, Jacquelyn Tleimat, Sarah Fritts, Daniel J. Herrera, M. Caitlin Fisher-Reid, Justin A. Compton, Diana J.R. Lafferty, Maximilian L. Allen
2	UEII – moving forward in providing citywide ecosystem integrity data for urban management and planning	**Ian MacGregor-Fors***
3	Do varying urban built form configurations differentially impact avian richness in urban green spaces?	**Morgan Rogers**
4	How to collect turtles in an anthropic environment? An accessible trapping method to overcome urban barriers	**Sabine B. Rocha**, Carlos Eduardo V. Grou, Carlos Rouco
5	Effects of water level fluctuation and urbanization on soil fauna in the riparian zone of a regulated river	**Fengping Yang***
6	How urban factors are shaping mammal diversity in European cities: a case study in Freiburg, Germany	**Marufa Sultana**, Marius Huber, Carolina Golisch, Geva Peerenboom, Ilse Storch
7	Preferred habitat of *Corvus frugilegus* invading the urban environment and the core management areas tracked by citizen science	**Jiweon Yun**, Wonhyeop Shin, Jihwan Kim, Dohee Kim, Youngkeun Song
8	Species differences in temporal response to urbanization alters predator-prey and human overlap in northern Utah	**Austin Green**
9	Comparative assessment of urban protected areas: methods to reveal ecosystem and cultural value	**Vitaly Kryukov**, Elena Golubeva*
10	How state-led environmental policy affects urban protected areas: a model of pa4d ramifications	**Vitaly Kryukov*** Poster pitch

11	"I converted an old wheelie bin into a water butt" – exploring citizens' motivations and barriers to implementing action to enhance biodiversity and ecosystem services in urban domestic gardens	**Gina Cavan**, Carly Fletcher, Fraser Baker, Konstantinos Tzoulas, Claire L. Smith*
12	Birds in the hood: The importance of urban trees and forest fragments for bird conservation	**Mark Hostetler**, Ryan Buron, Natali Pegg*
16:20-16:30	***Discussion***	
16:30-17:00	**AFTERNOON TEA / COFFEE BREAK**	
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1	Interactions of functional traits with native status and ecosystem novelty explain the establishment of plant species within urban ecosystems: evidence from Berlin, Germany	**Sonja Knapp**, Moritz von der Lippe, Ingo Kowarik
2	Designing urban biodiversity: case studies of alternative lawns in Sweden	**Maria Ignatieva, John Green**
3	Punching above their weight, the role of small green spaces for biodiversity in cities	**Kevin Vega**, Anouk-Lisa Taucher, Christoph Kueffer, Johan Six
4	Smart green city, Gangjin – convergence of urban ecological planning and design techniques	**Ki Sook Park**
5	Low resource availability drives feeding niche partitioning between wild bees and honeybees in a European city	**Joan Casanelles Abella**
6	Biotic homogenization of residential yard vegetation with contrasting management	**Josep Padullés Cubino**, Jeannine Cavender-Bares, Peter M. Groffman, Meghan L. Avolio, Anika R. Bratt, Sharon J. Hall, Kelli L. Larson, Susannah B. Lerman, Desiree L. Narango, Christopher Neill, Tara L.E. Trammell, Megan M. Wheeler, Sarah E. Hobbie
7	Vegetation composition in an ephemeral urban stream in central Texas: value for use in green infrastructure	**Jeffrey T. Hutchinson**
8	Ecological function of urban green spaces based on a high spatial resolution dataset and its implication to the management	**Sokyoung Yi,** Wonhyeop Shin, Youngkeun Song
9	The ECOLOPES plant-animal-soil community model	**Victoria Culshaw**, Jens Joschinski, Isabelle Boulangeat, Carsten Buchmann, Alexandre Changenet, Maya Guéguen, Thomas E. Hauck, Marta Pianta, Enrica Roccotiello, Michael Schloter, Wolfgang Weisser, Anne Mimet
10	Creating urban wildflower meadows using species from threatened native plant communities	**Katherine Horsfall**, Stephen J. Livesley, John Delpratt, Lee Harrison, Nicholas S.G. Williams
11	Restored urban roadside vegetation offers opportunities for climate regulation and enhancement of resources for urban flower-visitors	**Sandra Rojas-Botero,** Simon Dietzel, Johannes Kollmann
17:50-18:10	***Discussion***	
18:10-20:30	**ICE BREAKER (at UFZ KUBUS)**	

Day 2: Tuesday 29th November 2022

8:30-9:00	**REGISTRATION AND MORNING COFFEE**	
9:00-9:15	**Wrap-up of Day 1 and Introduction to Day 2** ***Maria Ignatieva, Diana Dushkova***	
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2	Experiences with the practical application of the Animal-Aided Design method in urban development – a first evaluation of problems and potentials in the implementation of actions	**Thomas E. Hauck**, Wolfgang W. Weisser, Qingyu Liang, Christine Jakoby, Ariane Mutzel
3	Integrating ecological modelling in a 3D CAD system for urban planning and for regenerative urban ecosystems	**Verena Vogler**, Shany Barath, Victoria Culshaw, Luis Fraguada, Jens Joschinski, Anne Mimet, Surayyn Selvan*
4	Urban Nature in integrated city planning – how do we support municipal practice in Germany?	**Rieke Hansen, Lena Enderich**
5	Attitudes of citizens towards wild native flower floral mat as a landscape element in Japanese urban community gardens	**Mariia Ermilova**, Mitsunari Terada*
6	Astro-turfing the city: exploring the environmental impact and social drivers of artificial lawns	**Mark A. Goddard**, Katherine C.R. Baldock, Jessica C. Fisher, Robert Francis, Rachel Gaulton, Robert Lavin, Miranda T. Prendergast-Miller, Marc Redmile-Gordon, Hannah Shaw
7	The ideas of hybridity in urban landscapes: Looking at native and non-native biodiversity components through the research of honeybees in Western Australia	**Yuqi Yang***
8	Translating ecological knowledge for urban developers through Biodiversity Sensitive Urban Design (BSUD)	**Holly Kirk,** Casey Visintin, Georgia Garrard, Sarah Bekessy*
9	Emergence of heterogenous urban landscape and its effects on the biodiversity of wetlands: a case study of three cities in China	**Yuandong Hu**, Tianyi Chen, Congcong Zhao*
10:10-10:25	***Discussion***	
10:25-10:45	**COFFEE BREAK**	
10:45-11:40	**SESSION 7: Nature-based solutions and their multiple co-benefits linked to biodiversity aspects** ***Chair: Julius Knopp***	
1	Urban woodland as a mitigation solution for the impact of urbanisation on biodiversity and ecosystem services in a tropical mega-city (Thailand)	**Phakhawat Thaweepworadej**
2	Listening to the community: implications of cultural and social values on governing meaningful urban nature-based solutions – an Australian perspective	**Veljko Prodanovic**, Niloufar Naserisafavi, Taylor Coyne, Kefeng Zhang, Maria de Lourdes Melo Zurita*
3	Design and management of nature-based solutions in urban plays settings: for co-existence between children and biodiversity	**Marcus Hedblom,** Fredrika Mårtensson, Björn Wiström, Åsa Ode-Sang, Anna Litsmark
4	Indigenous knowledge in green infrastructure, ethics for restorative design and care: a typological approach	**Claudia Tomateo**, Zbigniew Grabowski

5	Nature-based solutions: how to mitigate urban flood risks and conserve biodiversity through co-participatory processes – case study Jacareí/sp, Brazil	**Ana Letícia Bragança Rodrigues Gonçalves**, Wilson Cabral de Sousa Júnior, José Caléia Castro, João Vitor Mariano Ribeiro, Carolina Cassiano Ferreira, Andréa Castelo Branco Brasileiro*
6	Meaningful monitoring: supporting urban green space planning through remote sensing	**Thilo Wellmann**, Dagmar Haase, Angela Lausch
7	Restoring urban ecosystem functions using "nature-based solutions" – products and approaches: a case study from a Brazilian south-eastern region	**Alexandre Marco da Silva**, Lucas Hubacek Tsuchiya, Matheus Marinho Munhos, Maria Lucia, Pereira Antunes, Florence Rezende Leite, Fabiola Bergamasco da Silva Marcondes Palinkas
8	Impact of urban landscape on storm water runoff and quality within a small river in Moscow city	**Sergey Chalov**
9	Derivation of passive technologies of smart farm design	**Donghwa Shon,** Yejin Lee, Hanna Joo, Nahyang Byun, Jieun Lee*. **Poster pitch***
11:40-11:55	***Discussion***	
11:55-12:55	**SESSION 8: Challenges and opportunities of urban biodiversity (e.g., ongoing climate change, the impact of the COVID-19 pandemic, other societal challenges)** ***Chair: Marcus Hedblom***	
1	Personal green spaces during the pandemic – a study of people's attitudes and motivations towards urban home gardens during the COVID-19 pandemic in Bangalore, India	**Varsha Bhaskaran**, Charles H. Nilon
2	The pandemic has changed some of our attitudes and habits concerning outdoor activities and access to urban greenery. Results from a case study in Uppsala, Sweden	Tuula Eriksson**,** **Fredrik Eriksson***
3	Coastal conurbation expansion threatens foredune persistence: opportunities for the re-connection of cities and citizens with remnant ecosystems	**Moisés A. Aguilera**, María Gracia González
4	What influences shifts in urban nature site visitation during COVID-19? A case study in Tel Aviv-Yafo, Israel	**Michelle Talal***
5	Conceptual design of orientation values for urban green in Germany	**Arne Kunkel, Peter Blum**
6	COVID-19 pandemic in Moscow: rethinking the role of nature for urban design, sustainability and resilience	**Anastasia Konstantinova*, Diana Dushkova**
7	Restoration of Satoyama and biodiversity conservation through citizens' activities in the urban area of Kyoto City	**Katsue Fukamachi***
8	Land use and biocultural diversity in the scenic area of Arashiyama in Kyoto, Japan	**Wen Wang,** Katsue Fukamachi*
9	100KTREEs	**Rolf Wilting***
10	Access and management of green areas during the COVID-19 pandemic: socio-ecological gaps in society and participation in conservation	**Yuta Uchiyama,** Ryo Kohsaka*
11	Environmental and social impacts of the COVID-19 pandemic and the role of urban green infrastructure for city recovery (case of Almaty, Republic of Kazakhstan)	**Zarina Kuriyeva,** Elena Golubeva*
12:55-13:10	***Discussion***	
13:10-14:00	**LUNCH (at UFZ KUBUS)**	

14:00-15:00	**SESSION 9: Special session of the UFZ "Resilient cities platform": Blue-green infrastructures and nature-based solutions for resilient cities** ***Chairs: Dieter Rink, Ellen Banzhaf***	
1	Structural biodiversity in Leipzig and its impact on multiple ecosystem services	**Ellen Banzhaf,** Sebastian Elze
2	From landscape design to biodiversity-led design: insights from the Paris Region	**Marc Barra,** Gwendoline Grandin
3	Political-legal challenges of the blue-green transformation of urban water infrastructure	**Frank Hüesker**, Moritz Reese, Lucie Möller
4	Residents' perception of green façades – key for urban resilience or just "nice to have"?	**Raphael Karutz**, Heinrich Zozmann, Uwe Schlink*
5	High resolution mapping of urban green space composition, quality and accessibility. A case study of Aarhus, Denmark	**Julius Knopp,** Gregor Levin
6	Co-creation of nature-based solutions in urban and natural areas towards sustainable development and resilience: results from RECONECT project	**Diana Dushkova, Christian Kuhlicke**
	Discussion	
15:00-16:00	**PODIUM DISCUSSION: Researching and co-designing green cities – setup, experiences and challenges of UGBI interdisciplinary and transdisciplinary research at UFZ** ***Moderation: Annegret Haase***	
	Diana Dushkova, Christiane Heinichen, Sonja Knapp, Anika Schmidt, Constantin Suppee	
	Discussion	
16:00-16:20	**COFFEE BREAK and POSTER SESSION**	
1	Challenging the sustainability of urban beekeeping using evidence from Swiss cities	**Joan Casanelles Abella**
2	Getting to know the urban biodiversity of the metropolitan region of São Paulo (Brazil): data from an education project	**Yuri Tavares Rocha,** Patrícia do Prado Oliveira
3	Comparison of butterfly diversity between traditional and new residential areas in Satoyama landscape	**Yue Yuan**, Wen Wang, Shozo Shibata, Katsue Fukamachi
4	The effects of human development, environmental factors, and a major highway on mammalian community composition in the Wasatch Mountains of northern Utah, USA	**Austin Green**
5	Derivation of passive technologies of smart farm design	**Donghwa Shon**, Yejin Lee, Hanna Joo, Nahyang Byun, Jieun Lee*
6	How state-led environmental policy affects urban protected areas: a model of pa4d ramifications	**Vitaly Kryukov***
7	Illegal captive breeding of continental chelonians: an ethnoherpetological approach to understand this activity in Brazil	Priscila Silva Gomes, Carlos Eduardo Vargas Grou, **Sabine Borges da Rocha**, Fabricio Hiroiuki Oda, Marcos Vinicius Rodrigues
8	UFZ green roof research	**Lucie Moeller**
16:20-17:00	**URBIO Advisory Board Meeting**	
17:00-17:30	***Closing remarks (Maria Ignatieva, Charles Nilon)*** ***Day 3: Excursions. Organisational issues (Diana Dushkova)***	

Note:
* – online participation

First name, last name (bold) – presenter

Day 3: Wednesday 30th November 2022

9:00-10:30	**EXCURSION 1: Leipzig City Centre (Johanna Park): Promoting urban biodiversity and citizen participation in urban greening** *Organised by Constantin Suppee & Markus Drappatz, Office of Green Space and Water, City of Leipzig* Offering important ecosystem services, green infrastructure has a great significance for a high quality of live in the city. The focus of the excursion lies on the diverse ecosystem services offered by green spaces and their associated management against the background of a rapidly growing city. Among other things, the projects focusing on citizen engagement/civic commitment to promote urban greenery ("Aktion Baumstarke Stadt") and the measures implemented in the park to promote biodiversity will be presented.
9:00-11:00	**EXCURSION 2: Typical residential structures including new renaturing programmes by the Leipzig city council** *Organised by Ellen Banzhaf, Department of Urban and Environmental Sociology, UFZ* A walk through the residential suburban structure (see garden city movement by Ebenezer Howard) of the 1920s and 1930s, taking a glimpse at residential buildings of the turn of the 19th century to understand the needs for the garden city concept. Close by, a renaturation project run by the city council will be demonstrated, as well as the so-called Parkbogen Ost, a new public green corridor under construction. From there, we will walk through the accessible part of the allotment garden area and show further advancements of inner development in Leipzig.
11:00-12:30	**EXCURSION 3 in the Eastern part of the city (as follow-up of Excursion 2 but can be joined also separately): New green spaces in the former working-class district of Leipzig East** *Organised by Anika Schmidt, Department of Urban and Environmental Sociology, UFZ* Leipzig's Inner East is a densely built and inhabited urban area which has undergone a dynamic urban development in the recent decades, from shrinkage and decay to upgrading and regeneration. New parks were created where once were industrial sites and railroads. During this excursion we will visit a variety of these green spaces and hear about their different history, design and current use (e.g. multifunctional retention park) and their embedding into a larger municipal masterplan on urban green.
11:00-12:30	**EXCURSION 4: Leipzig South (Connewitz district). Green walls for Leipzig: "Kletterfix" project** *Organised by Christine Heinichen & Marie Romer, Ökolöwe – Umweltbund Leipzig e.V. (NGO)* During our walk through a neighbourhood in the south of Leipzig you will discover the variety of green facades as part of the green urban infrastructure. You will learn more about the potential of climbing plants for cities, especially in times of climate change and the decline of biodiversity.
11:00-12:00	**EXCURSION 5: UFZ Leipzig – The UFZ green roof research** *Organised by Lucie Moeller, UFZ* Green roofs are promising blue-green infrastructures, because they can absorb water and cool the environment through evapotranspiration, store water and release it to the sewer system in a delayed manner, thus enabling smart stormwater management, serving as sinks for CO_2 and particulate matter. In addition, they serve as places for all-around biodiversity – for both plants and animals. The multifunctionality of green roofs is undisputed, however, it is necessary to explore in more detail which of the green roof types is the best option for each problem. During this excursion to the green roof installed on the roof of the UFZ building, we will discuss current questions about the optimized effect of green roofs in urban areas, with a focus on upgrading urban green roofs for rain and grey water management as well as improving the inner-city climate and support biodiversity.

Abstracts

KEYNOTES

A REVIEW ON THE WORK OF URBAN BIODIVERSITY NETWORKS IN GERMANY – FROM NATIONAL TO INTERNATIONAL ACTIVITIES

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We will give a short overview on the background and development of the urban biodiversity networks in Germany since 1970, to document their work and learn for future activities.

The first network called “Biotope mapping in urban areas” was founded by Herbert Sukopp (Berlin) and the Federal Agency for Nature Conservation in connection with the first comprehensive urban ecology studies in Berlin. The aim was to establish standardised methods for the investigation of urban biodiversity, obtain comparable results on the national level and exchange information for sustainable development and management in urban areas. From 1979 to 2005 this network held 21 meetings in different German cities and one meeting in Vienna. The 22nd and last meeting was held in Jena in 2004 in co-operation with the working group “Urban Ecology” of the Ecological Society of Germany, Austria, and Switzerland. At this meeting, with the main theme “Biodiversity in Urban Areas – Foundations and Examples for the Implementation of the Convention on Biological Diversity in Urban Areas”, two major decisions were taken. Firstly, to put the network on a new footing, and secondly, to organise a similar conference at international level. Since more than 222 cities and towns had carried out biotope mappings for their municipal areas by the year 2000, the interest in the network meetings decreased significantly. Therefore in 2005 the network merged to form CONTUREC (Competence Network Urban Ecology) to link local research and activities both on urban biodiversity and urban ecology. From 2006 to 2011 CONTUREC organised several national conferences, published their results in its own book series and sent out a newsletter with information to local projects and current international research. Both national networks were driven by an active group of scientists closely linked to each other, as well as by financial support from the Federal Agency for Nature Conservation and the respective state authorities.

With financial support by the German Ministry of the Environment the network organized in 2008 in Erfurt the first international conference “Urban Biodiversity and Design”. The results were brought to the following up 9th Conference of the Parties (COP) in Bonn (Germany) and underlined the urgent need to create a dedicated cross-cutting theme within the Convention on Biological Diversity (CBD). On this occasion the international network URBIO was founded to promote urban biodiversity and design through a continuing dialogue with the CBD. This network organized prior to the COP meetings international conferences and exchanged over a newsletter and website the state of the art of urban biodiversity research and its application. In total, from 2008 until today, seven conferences and three workshops were hold and their results published in a book (2008) and in special issues in international journals. To support local authorities, the network members have developed several tools, e.g. the City Biodiversity Index, the URBIO Index and the Cities and Biodiversity Outlook.

Using the experiences of the three mentioned networks we will describe the conditions of a successful co-operation between scientists and local authorities resp. policy, between science and implementation and national and international networking to support local activities on urban biodiversity.

Keywords: conferences, Convention on Biological Diversity, network biotope mapping in urban areas, CONTUREC, URBIO, website, workshops

URBAN TREES UNDER CLIMATE CHANGE: CHALLENGE AND/OR SOLUTION FOR BOTH BIODIVERSITY AND SOCIETY?

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Trees are one of the most important elements of green infrastructure in cities. Climate change is specifically affecting urban tree canopies in many European cities. Trees are experiencing negative impacts from the increase in heat waves and droughts, both of which begin, in some cases, early in the year and continue through the growing season. Current studies on the regionalization of climate change indicate that important water reservoirs such as soil and tree canopies have been drying out for years/decades, and these impacts can be observed in various parts of Europe. Trees react to stress as they age through mechanisms such as crown defoliation, early wilting, shedding of branches and, ultimately, lowered resistance to pests. As a result, massive tree death, both in park trees and street trees, can be observed in many cities. The present study provides a current inventory of street tree damage caused by heat and drought in the city of Leipzig, Germany, in 2020 and 2021, a short time after the extreme dry years 2018 and 2019. The field maps focus on different age groups of dominant urban street tree taxa such as *Quercus, Tilia, Aesculus, Platanus, Fraxinus* and *Acer* along a periurban-urban gradient. The results are clear: significant damage was found in all tree species. Older trees and newly planted trees are most likely to die as a result of extreme conditions, while younger trees with narrow trunks and crowns that have not yet expanded cope better with both heat and drought. Four out of five mapped street trees showed recognizable damage, indicating severe impacts of climate change on important elements of green infrastructure in cities. In addition, a bundle of ecosystem services provided by native but also heat-adapted taxa has been quantified using the iTree modelling environment. These results add new facts to the discussion about future urban canopies under climate change: Whereas native tree species are not able to deliver ecosystem services due to their high damage and death rates, heat-adapted novel taxa deliver significantly lower amounts of pollutant fixation or carbon storage, for example. Also, tree shading and thus air cooling is lower when planting heat robust street tree assemblages. Urban forestry needs to deal with these results and the presentation presents pros and cons of both an adaptation strategy and a strategy that relies on prevailing tree taxa and improved water storage/irrigation in the city.

Keywords: urban trees, climate change, drought, challenge, solution, biodiversity, society

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FUTURE OF URBIO MOVEMENT. CHALLENGES AND OPPORTUNITIES

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The URban BIOdiversity and Design Network (URBIO) was formed in 2008 as an open worldwide scientific network for education and research to promote the implementation of the UN Convention on Biological Diversity (CBD) in urban areas. URBIO is a group of researchers and scientists united by the idea of investigating urban biodiversity in cities and using ecologically based design and planning as a tool for improving biodiversity and connecting humans to nature in cities. A strong connection to the Convention on Biological Diversity (CBD) is one of the key features of URBIO. URBIO organizes an international conference every two years, publishes books and articles on urban biodiversity, urban planning, and design, and facilitates connections among members on research projects, exchanges of ideas, and case studies on successful implementation of urban biodiversity projects. There have been six international conferences (in Germany, Japan, India, South Korea, Panama, and South Africa), and an online webinar 2021 “Urban biodiversity and design in a time of pandemics” identified recent challenges related to the post-pandemic world and highlighted gaps in the existing research on urban biodiversity.

The link between urban biodiversity and design and planning strategies has been particularly emphasized as an important future direction of URBIO. The research on urban biodiversity and design is still mostly concentrated in Europe, North America, Australia, and New Zealand. There is also a strong school of urban ecologists in South Africa and Japan. However, there is a growing interest in the participation in URBIO from scientists, design practitioners, and governmental authorities from Asia, South America, the Middle East, and Africa. The future of URBIO is seen in increasing the role of the younger generation of researchers and practitioners, reinforcing URBIO’s involvement in the activity of the Convention on Biological Diversity and encouraging transdisciplinary research on urban biodiversity by involving urban citizens and decision-makers.

Keywords: URBIO, urban biodiversity, urban planning and design

Abstracts

Session 1

Integration of biodiversity in urban planning, green infrastructure and landscape design projects

INCORPORATING COMMUNITY VOICES TO EXTEND THE ECOSYSTEM SERVICES FRAMEWORK FOR PARK PLANNING IN MARGINALISED URBAN ENVIRONMENTS

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The similarities between environmental justice (EJ) and ecosystem services (ES) are evident in the anthropocentric vals central to each concept. However, there are also contradictory positionalities between the two. While both are concerned with human well-being supported by the environment, their fundamental difference lies in the ES tendency towards the marketisation of the natural environment, which is argued by EJ proponents to further deepen inequalities. Moreover, the ES framework evolved in the Northern Hemisphere, within developed and economically advanced contexts, quite different from the developing context of the Global South. Thus, in addition to the economic impetus of the ES framework, questions emerge related to the appropriateness of adopting the framework, unchallenged, within the various contexts of the Global South.

In South Africa specifically, many people directly utilise the earth's natural resources, driven by a myriad of human-nature relationships. There are also unique conceptualisations of the value of nature, especially within the built environment. It is argued that to promote more just urban environments, the planning and design of local community parks should be driven by nature-based placemaking. However, to be truly representative of the local communities using urban parks, the views and perceptions held by these role-players, related to the value of nature, must be incorporated. The ES framework is thus seen as a potential foundation for the planning of such places, provided it is adapted and extended to the local context.

This paper aims to illustrate the findings from a qualitative, ethnographic research project focused on understanding the value placed on urban nature, in the form of local community parks, from the perspective of local urban communities in the City of Tshwane (CoT), South Africa. Despite the many challenges faced by marginalised urban communities in the CoT, parks are valued for their social, ecological and place-making characteristics. From the narratives about the lived experiences of the local park network, emergent informants for the extension of the ES framework, within a specific context, materialise. These perceptions can assist local designers and municipal departments in providing more effective nearby nature places to urban communities.

Keywords: ecosystem services, environmental justice, community perspectives, urban parks, urban ecology

INTEGRATING BIODIVERSITY INTO URBAN SCHOOL GROUNDS THROUGH TRANSDISCIPLINARY CURRICULUM DESIGN

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As a teaching ecologist and doctoral candidate in Educational Sustainability, I work with science teachers who want to use place-based learning in their classes. Place-based learning ties ecological concepts to "real world" situations where students can act to help solve wicked problems like biodiversity. After surveying middle and high school teachers, I decided to create a curriculum, the Schoolyard Biodiversity Community (Schoobio), to provide transdisciplinary activities culminating in students envisioning their ideal ecological schoolyard and advocating for it with their school and community leaders. The curriculum is global in scope, with the goal being increasingly biodiverse school grounds and, by extension, more biodiverse public spaces throughout neighbourhoods. It also aims to increase understanding of different cultures present in cities through activities exploring human-nature interaction through the experience of cultural traditions and how they could be reflected on school grounds. The method used to develop the curriculum is Universal Design for Learning, which is similar to universal design in landscape architecture in that it provides many ways to participate in the activities regardless of ability or preferred learning style. Instructional strategies encourage opening the classroom to urban planners and landscape architects to learn best practices from those professions. Students lead the way in integrating nature into the built environment that is their school and school grounds, restoring biodiversity to their neighbourhoods through activities designed from their point of view. The Schoobio tools help students 3-D model their current and ideal future school grounds, resulting in presentations to school and community leaders that have more impact than typical PowerPoint presentations alone. By involving school landscaping staff as well as professionals outside the school, student plans are rooted in the real world of school policies, budgets, and need for shared use of the school grounds. Teachers using the curriculum report that students have increased their capacity for using data and mapping to inform their understanding of biodiversity and how its loss affects not just the urban environment but also human health and appreciation of nature for its intrinsic value. Schoobio is ready to be scaled up and used by more cities and schools to increase biodiversity.

Keywords: biodiversity, school grounds, transdisciplinary curriculum, urban school design

Acknowledgments: The Kansas Department of Wildlife, Parks, and Tourism partially funded the early stages of this project.

EXPLORING THE HIDDEN MEANING OF BIODIVERSITY IN CANBERRA AS A DESIGNED NATIONAL CAPITAL

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Canberra, the national capital of Australia, was designed in 1912 by Walter Burley Griffin and Marion Mahoney Griffin based on a landscape vision. It was constructed on a grassland plain, respecting its original landform and bushlands (native forest). Therefore, the native biodiversity in Canberra attaches to symbolic values. The urban forest in Canberra, however, contains a significant area of exotic trees that have been planted since the establishment of the city in the early 20th century. A mixture of native plants, remnant bushlands, and exotic evergreen and deciduous trees within the urban footprint make Canberra's urban landscape character. This research explores how the urban landscape of Canberra has been shaped based on the different meanings and benefits of biodiversity throughout time. We discuss the unique biodiversity meaning in the context of Canberra as the national capital of Australia and the challenges for the conservation of biodiversity in urban planning. The use of exotic plants in the first decade of Canberra's development was a necessary action to provide enough canopy cover. However, the urban biodiversity planning and governance in Canberra have shifted towards the use of more native species within urban green spaces since the 1960s. We found out that despite the symbolic role of native trees and bushlands in Canberra as the national capital of Australia, the exotic trees play an important role in representing Canberra's character. This dual nature (native biodiversity and urban biodiversity), however, added complexity to green infrastructure planning and the governance of Canberra's green spaces which decreases the chance of comprehensive planning.

Keywords: native biodiversity, native forest, urban forest, green infrastructure, Canberra

SEASONAL VARIATION IN PREFERENCE FOR GREEN ROOF VEGETATION

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Green roofs have been promoted as features to improve the amount of urban vegetation, primarily in the dense city where space for other types of vegetation is limited. Green roofs could contribute with multiple ecosystem services that are beneficial to human health and well-being, however this is depending on the specific design of the roofs. Several health benefits are linked to the environmental appraisal of the vegetation of the green roof. In this study we wanted to explore the effects of different types of green roof vegetation as well as seasonal variations on visual aesthetical experiences as well as perceived biodiversity. An on-line photo elicitation survey was carried out using standardised photographs for a selection of different green roofs in Malmö, Sweden, during three different seasons. In the survey members of the general public were asked to evaluate different aesthetic qualities, estimate biodiversity and stress reducing capacity for each photograph.

The results from the study will inform the green roof management about perceptions linked to ecosystem services of different types of green roofs and give an understanding that this varies with season.

Keywords: urban biodiversity, aesthetic, ecosystem services

Acknowledgments: This research was funded by the Swedish Research Council for Sustainable Development (Formas) through grant Nr 2019-00654 to Ishi Buffam, entitled “In it for the long-term: How does the provision of ecosystem services from green roofs change as the ecosystems age?”

A CONCEPTUAL APPROACH TO INVESTIGATE THE SOCIO-ECOLOGICAL SIGNIFICANCE OF URBAN GREEN SPACES ACROSS SPATIAL AND STRUCTURAL GRADIENTS

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Urban green spaces help support local climate change mitigation by providing valuable ecosystem services such as temperature regulation, noise reduction and habitat provisioning for urban wildlife. In addition to their biophysical-climatic effects as well as their ecological effects, urban green spaces (UGS) can also improve the physical and mental well-being of urban residents by offering space for relaxation, recreation and socializing. Although the socio-ecological significance of UGS is moving more and more into the focus of urban planning, little is understood of the health-promoting influence of UGS across different spatial and structural gradients. Which green structures are particularly responsible for the positive climatic and well-being effects of UGS? How does the UGS size influence the perceived well-being effects? Our research on various UGS in Munich, Germany, aims to describe the relationship between the structural diversity of UGS, their plant species composition, the microclimate and human well-being. We predict that even small UGS can have positive biophysical-climatic, ecological and human health effects. Furthermore, we hypothesize that many well distributed, small UGS can have a higher socio-ecological effect on an urban environment compared to a few large ones. Here we present our interdisciplinary approach that combines qualitative social science with quantitative natural sciences to investigate 60 differently-sized UGS within the city of Munich. This includes: (i) a detailed structural analysis of the selected UGS using terrestrial mobile laser scanning; (ii) biodiversity and microclimatic monitoring within and outside the UGS; (iii) surveys and interviews on the health effects and the social significance of UGS; and (iv) citizen science approaches to source locations of important UGS in the city. The findings will provide key information for city planning on how UGS can be designed, protected and developed to improve urban climate and to create spaces for city dwellers to meet and relax.

Keywords: urban green spaces, structure complexity, ecosystem services, microclimate, public health

Acknowledgments: The project is funded by the Bavarian State Ministries for the Environment and Consumer Protection (StMUV) and Health and Care (StMGP).

THE TUM URBAN GREEN INFRASTRUCTURE RESEARCH TRAINING GROUP: APPLYING SOCIAL-ECOLOGICAL-TECHNOLOGICAL FRAMEWORKS TO INTEGRATE BIODIVERSITY INTO URBAN FABRICS

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Urban green infrastructure knits together ecological systems with engineered infrastructures to achieve socially negotiated goals. Existing approaches to understanding cities as socio-ecological systems have thus evolved to explicitly consider technologies within the built environment, characterizing cities as complex urban social-ecological-technological systems (SETS). Within these complex systems urban green infrastructure (UGI) provides vital urban ecosystem services. As recent global comparative work has shown, many cities have started explicitly planning for and implementing UGI programs as part of their core infrastructure systems to address linked challenges of climate change, biodiversity loss, and equitable access to green spaces and alternative transit. These social goals exist alongside and occasionally in conflict with existing infrastructures and planning priorities. Integrating green elements and biodiversity into existing urban fabrics thus requires new knowledge and design tools whose application often requires transformations in urban governance. To meet these challenges, the TUM Urban Green Infrastructure Research Training Group of over 54 interdisciplinary researchers is working towards a novel synthetic framework to provide for project level, thematic, cross cutting, and decision-making integration of multi-faceted and transdisciplinary knowledge around UGI. This includes the investigation of the role of governance in creating existing and future urban green infrastructure, sustainable transit, building energy, and urban drainage systems, how UGI is experienced and valued by different residents, its ecological functions and processes and relationships with biodiversity. In this talk we present our approach towards this integration through an elaborated SETS-UGI conceptual framework coupled with a knowledge-to-action plan in order to provide policy support for transformative governance, develop design tools that allow for green element integration at multiple spatial and temporal scales, and facilitate broader public outreach and education on UGI.

Keywords: urban green infrastructure, urban social-ecological-technological systems (SETS)

INTEGRATING BIODIVERSITY IN HEALTH CLINICS: THE VALUATION OF ECOSYSTEM SERVICES AND DISSERVICES OF HEALTH CLINIC GARDENS IN SOUTH AFRICA

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Humans have a natural connection with nature and contact with nature is essential for human well-being. These experiences with nature can be enhanced by the presence of ecosystem services (ESs) and may be compromised by ecosystem disservices (ESDs). Gardens are versatile ecosystems that can provide connections with nature and protect biodiversity. Ecosystem services valuation and ecosystem disservices assessments, and biodiversity in community gardens, such as health clinic gardens, are crucial to help policy makers advocate for and decide on their development, maintenance, and environmental preservation. Therefore, this study sought to evaluate the ESs and assess the ESDs of 32 health clinic gardens in the Dr Kenneth Kaunda District Municipality, North-West Province, and the Frances Baard District Municipality, Northern Cape Province, South Africa. To do this, an ecological survey was conducted, and existing ES valuing techniques were used to determine the actual ecological, economic, social and cultural values of health clinic gardens in terms of the provisioning, regulating, cultural and supporting ESs and ESDs in these gardens. The actual values of selected ESs were determined using market values. Key results indicate that provisioning ESs were the most valuable in health clinic gardens, as evidenced by the number of potential food (13.7 ± 6.13) and medicinal plants (17.4 ± 6.54), followed by supporting ESs that enhance habitat diversity (2.4 ± 1.83), while regulating and cultural ESs were valued the least. Common potential food species included *Portulaca oleracea*, *Prunus persica*, and *Urochloa mosambicensis*, while common potential medicinal plants included *Cynodon dactylon* and *Conyza bonariensis*. The market value of vegetables and fruit produced (ZAR) was valuated at 1653.81 ZAR (277.7 ± 421.17). At least five different bird species were found in at least three health clinic gardens, respectively, and at least 14 bird nests encountered in at least three health clinic gardens, respectively. The most common bird encountered was the *Passer domesticus*, encountered in 27 gardens. Approximately 18 plant species were identified to cause allergies, including *Pennisetum clandestinum*, and six species were identified to overhang buildings with the potential to cause accidents. The rich plant biodiversity in health clinic gardens positions them as ideal ecosystems that even the most vulnerable members of society can benefit from, and the presence of ESDs should not deter their establishment, maintenance, and preservation.

Keywords: ecosystem disservices, ecosystem services, health clinic gardens, valuation

BALANCING ENVIRONMENTAL AND SOCIOECONOMIC BENEFITS IN GREEN INFRASTRUCTURE PROJECTS: EXPLORING ENABLING CONDITONS FOR URBAN BIODIVERSITY CONSERVATION

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Green Infrastructure (GI) is an urban planning strategy that aims to integrate environmental and socioeconomic benefits. However, the implementation of these projects tends to prioritize socioeconomic over environmental interest. In this context, understanding how environmental functions may generate enabling conditions for social benefits is crucial to generate designs that improve users' acceptance and engagement with conservation-based GI projects. Particularly, understanding users' perceptions and sociodemographic determinants may inform about their acceptance of conservation initiatives. In this work values and beliefs of users of green areas from central Chile were described and associated with the acceptance of the most common conservation-based GI projects found in public discourse. For doing so, online focus groups were performed to identify benefits associated with green areas, landscape attributes associated with such benefits, beliefs about native biodiversity and climate change, and common conservation-based GI projects in public discourse. To study how users' perceptions related to conservation-based GI projects in public discourse, face-to-face surveys were performed in parks of different cities in central Chile. Three conservation-based GI projects were identified: the inclusion of native plants, the inclusion of exclusive zones for native biodiversity conservation, and the inclusion of zones for native pollinator conservation. The three initiatives were associated with different aspects of users' perceptions. First, the acceptance of the inclusion of native flora was almost exclusively associated with beliefs about climate change. Second, the acceptance of exclusive zones for native biodiversity conservation was associated mostly with the importance of landscape attributes (e.g., plant density and functional diversity). Third, the acceptance of native pollinator conservation initiatives was associated with both, landscape attributes (order and presence of natural processes) and beliefs about native flora. None of the pro-conservation attitudes were related to familiarity/knowledge of native plants and pollinators, but all of them were associated with at least one belief about climate change. Overall, our results suggest that the acceptance of conservation-based GI projects may depend on the nature of the projects: in projects where user's acceptance depends on landscape attributes, local studies should be done to understand how landscape design may balance both, environmental and social benefits.

Keywords: green infrastructure, pro-conservation attitudes, user's perceptions, biodiversity conservation

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BEAUTIFUL VS. USEFUL: PLANT DIVERSITY AND RELATED ECOSYSTEM SERVICES OF ALLOTMENT GARDENS IN BERLIN (GERMANY)

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Habitat degradation, destruction and fragmentation due to an agriculture intensification, urbanisation and reduced plant biodiversity leads to decline in pollinators. In this paper we investigated the plant diversity conservation potential of allotment gardens. Additionally, we highlighted the potential role of allotment gardens in supplying city dwellers with food. We assessed plant species diversity in allotments across Berlin and their possible effects on ecosystem services, such as creating habitat for pollinators, food production and cultural services.

We identified plants for ten allotment plots included in the study. The plant diversity negatively associated with plot management intensity.

Our results show that urban green spaces can support pollinators, given the high diversity of melliferous plants, but that this capacity is strongly affected by local plot management; more than half of the identified plants in allotment gardens are multifunctional: ornamental and melliferous or food, medicinal and melliferous.

Also, our survey shows, that allotment gardens have an important function for the urban biodiversity (385 counted species, among them 26 native), which is associated with the support of different types of ecosystem services such as cultural, provisioning and supporting services.

We acknowledge that allotment gardens in Berlin also play an important role in food production and the increase in the variety of types of vegetables consumed (in total, 76 species) But there are some differences between plot management which should be further investigated.

We propose to increase the multifunctionality of allotment gardens by increasing the phytodiversity and affordable greening of gardening practices. Some improvement suggestions consist of reducing the frequency of mowing the lawn and cutting hedges and the inclusion of flowering honey plants in these zones. Recommendations on the selection of plant species useful for insects and having two or more functions are also provided.

Keywords: allotment gardens, ecosystem services, plant diversity, Berlin

Abstracts

Session 2

Ecological restoration and urban biodiversity

TOWARDS CARBON NEUTRALITY AND ESG MANAGEMENT OF A POWER PLANT AREA – AN ECOLOGICAL RESTORATION PROJECT BY KOREA MIDLAND POWER CO. LTD

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With the arrival of the climate crisis, efforts to reduce carbon emissions have now become a real economic problem. Accordingly, many countries reach hard to absorb as much carbon dioxide as they emit to achieve carbon neutrality and make up for the actual emissions until they reach absolute zero. Accordingly, the importance of environmental, social and governance (ESG) management is also emerging, and for this purpose, a method of converting renewable energy and a system for eco-friendly reduction of emission sources causing environmental problems are being practiced. In addition, carbon-emitting power plants are being shut down one by one due to the activation of these policies, and efforts to return the coast and ecosystem near the power plant to a nature-friendly environment are being implemented in Korea. Since the demolition of the thermal power plant in Seocheon, Korea, Korea Midland Power (KOMIPO) has replaced it with an ultra-super critical (USC) power plant that can reduce greenhouse gas emissions and increase efficiency. Through this, the restored coastline is expected to provide a comfortable recreation area for people and a new habitat for wildlife and plants. Moreover, the restoration of the marine ecosystem is expected to create blue carbon by absorbing carbon dioxide. In addition, it is expected to bring us massive reduction of greenhouse gas compared to green carbon, which currently relies on forestry.

Keywords: carbon neutrality, ESG management, ecosystem restoration, power plant

INDICATOR COMMUNITIES FOR WILDLIFE CONSERVATION IN HETEROGENEOUS URBAN AREAS

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Cities offer opportunities for wildlife conservation given the high proportion of species occurring in them and relative hostility of surrounding landscapes in many contexts (e.g., intensive agriculture). Such conservation, however, is challenging by heterogeneity in urban species distributions, habitat requirements, and landscape composition. We sought to support urban conservation by designing and testing an approach to planning urban habitat management focused on specific urban environments and their associated wildlife communities. Our approach identifies conservation zones within cities, indicator communities for each zone, and key habitat requirements for each community. These habitat relationships are used to design zone-specific habitat management.

We demonstrate our approach in the Iowa City-Cedar Rapids area of Iowa, USA, using songbirds. We classified survey sites into urban conservation zones using k-means clustering based on vegetation and impervious cover and identified songbird indicator communities for zones using Dufrene-Legendre indicator species analysis and field-collected data. Using binomial N-mixture models, we identified relationships between indicator communities and habitat attributes and used these relationships to construct conservation zone-specific habitat management strategies. We predicted impacts of these management strategies on the richness and abundance of songbirds from different groups using landscapes simulated to represent vegetation and land-cover change under conservation zone-specific management. We compared these impacts to the predicted impacts of management strategies implemented uniformly across the study area based on habitat models for the entire study-area community.

We identified five urban conservation zones and indicator communities consisting of 6 – 11 species. Indicator community models included different covariates and relationships with richness and abundance, indicating clear differences in the habitat requirements of bird communities among zones. Habitat management focused on indicator community habitat requirements in each conservation zone was predicted to outperform the full community-based approach in its impacts on the richness and abundance of most songbird groups.

These results suggest that our approach could facilitate urban conservation planning targeted to specific urban conservation zones that could effectively support urban species in different environments within cities, enhancing the diversity and richness of species city-wide.

Keywords: urban wildlife conservation, birds, habitat management, landscape heterogeneity

Acknowledgments: We would like to acknowledge the assistance of numerous student research assistants, particularly Jason McCurdy, Brandon Casswell, Jamie Tigges, and Jonah Alderson, who helped conduct surveys related to this work. This research was funded by grants from Iowa Audubon and the Centre for Global and Environmental Research.

RESTORATION OF URBAN ECOLOGICAL AXIS AND DEGRADED AREA IN GWANGYANG CITY, SOUTH KOREA

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Due to urbanization, the demolishing of urban ecology, soil and water pollution, and topography damage caused by illegal cultivation are occurring. Therefore, it is necessary to restore the ecological axis in cities that have been damaged and disconnected due to the current demolishing of the ecological axis and illegal cultivation. Gwangyang, South Korea, is an ecological area containing high ecological diversity where endangered species live such as *Lutra lutra*, *Prionailurus bengalensis*, and *Falco tinnunculus,* etc. In addition, it is necessary to respond to AQI (Air Quality Index) by expanding forests and creating wind roads, especially in fine dust and ozone management areas. Accordingly, the goal is to (1) create a space to restore biological habitats for species that meet the conditions of their territory, spawn, food, and cover, and (2) to restore the central part of the target area to an ecological forest which creates various habitats for species such as small animals and insects. In the case of the central ecological forest, it will be divided into (1) the “core zone” where the biological species protection campaign will take place through participation in biological species habitat and observation monitoring, (2) the “buffer zone” that protects the core and leads the food chain, and (3) the cooperative zone where residents can rest. As a result, by restoring these vegetation areas and urban forests, we can expect to control the microclimate of the city, increase the recreation and communication of residents, and escalate biodiversity.

Keywords: ecosystem restoration, biodiversity, urban ecology

DESIGN MODULES AND TECHNIQUE-PACKAGE BASED APPROACH TO URBAN BIODIVERSITY. CASE STUDY OF SUWON CITY, SOUTH KOREA

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Urban biodiversity is still one of the challenging goals in most cities of Korea, and thereby requires consistent R&D projects. Here we will introduce the current issues and the techniques for responding to the challenges, based on the preliminary results from national urban ecosystem projects. Urban bird nest observations by citizens clearly showed the spatio-temporal change in habitat use of various urban birds (*Parus minor, Dendrocopos major,* etc.), at both natural and artificial types of nests. This will be helpful for urban biodiversity decision makers to decide what kind of bird nests are needed and where they can be introduced. Thousands of datasets including pictures and locations provided by citizens during the winter seasons clarified the movement patterns of rooks (*Corvus frugilegus*) in various types of urban spaces, which is useful to the species management by municipal governments. Our effort is not just limited to the monitoring, but also focused on developing practical techniques to solve the current issues. Responding to the vulnerability of the urban ecosystem, we proposed up-to-date types of diverse urban avian nests and bug houses, ecological corridors of urban amphibians, urban forest and wetland biotope modules, and multi-functional plant bases. This study will show how to design these kinds of practical products and how they work. By applying these design modules as a technique-package to many urban spaces of Suwon City, the test-bed city of our R&D projects, we could expect not only to improve urban biodiversity but also to provide better ecosystem services to the citizens.

Keywords: bird nest, ecological corridor, green infrastructure, citizen science, urban habitat

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Abstracts

Session 3

Integrative green infrastructure planning and urban biodiversity

IMPLICATIONS OF UNDEFINED OWNERSHIP IN THE MANAGEMENT OF GREEN INFRASTRUCTURE IN THE CITY OF TSHWANE, SOUTH AFRICA

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This presentation addresses the issues of usage, ownership, and co-management of green infrastructure in Tshwane. The green and grey infrastructures are owned by the city and are "supposed" to be guided by spatial policy frameworks, but the reality reflects otherwise. Conflicts of "undefined" ownership and management have resulted in the use of green spaces for informal and illegal activities, with consequences such as land degradation, loss of livelihoods and biodiversity, and socio-ecological imbalances. There seems to be a gap in the planning and management of green spaces between the existing policy framework used by the city officials and the use of those spaces by the community. To explore this gap, we analysed eight policy frameworks related to green urban planning and development through a desk study review. We interviewed 15 key informants in related departments in the city and administered 200 survey questionnaires among residents. We found that the selected policy frameworks do not spell out green infrastructure implementation and management stages, nor do they keep up with the city's intense demographic development. The perception of green spaces as extra land that can be developed for residential and commercial uses, including informal, illegal uses puts the green spaces at future risk. In particular, the indiscriminate conversion of green spaces causes a disconnection among various land uses, flooding risk, and stresses on urban edges, thereby reducing the multiple potential benefits of the city's urban green infrastructure. Through an interdisciplinary approach, this research project seeks to provide a common ground for all the stakeholders: the policymakers, developers, and the community in the planning, co-development, and co-management of green infrastructure. This effort aims to decrease the risk and consequences, increase benefits, and upscale the opportunities for green infrastructure in Tshwane and other cities in sub-Saharan Africa. Therefore, towards achieving "research to action" in this project, we would like to open a discussion on a workable ownership and partnership model that could maximise benefits and address informalities and other challenges of urban green infrastructure under pressure.

Keywords: green infrastructure, governance, ownership, urban planning and development, Tshwane, South Africa

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URBAN GREEN INFRASTRUCTURE PLANNING AND DESIGN THAT ENCOURAGE CO-MANAGEMENT AND INCREASE BENEFITS

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Urban green infrastructure planning and design are often neglected in Global South cities. The City of Tshwane currently guides "green" planning through high-level spatial frameworks, but the urban reality does not resemble these framework visions after nearly two decades. Our study aimed to establish strategies and guidelines on how urban planning can improve and protect existing green infrastructure to supply more ecosystem functions and services for both ecological and socio-economic benefits in Tshwane. Action research was conducted through three landscape design studio engagements on two case-study sites during 2021 – 2022. The studios engaged 4th-year design students, city officials, community representatives and private consultants. The action research was supported by a literature and spatial framework review, and 15 interviews with local planning officials. We found that an apparent lack of ownership of vast undeveloped municipal green spaces resulted in illegal activities that degrade the ecological integrity of green spaces and produce safety and well-being concerns. Where community members informally adopted or used these green spaces there are no means to effectively manage bad practices or legitimize positive interventions. The failure of the public sector to react to the current challenges seems largely due to inadequate city capacity and management models. Another major challenge identified was the effective integration of green spaces into future development. Existing good practice guidelines are regularly not implemented due to silos in decision-making and a lack of actionable outcomes at different stages of the development process. From the two case studies, we illustrate how planning and design initiatives could become catalysts for community co-management and increased social and ecological benefits. From a management perspective, we propose key planning guidelines with collaboration points to co-create a unified green spatial planning vision that is inclusive of city officials, private developers, the community and designers. In this session, rather than proposing that we have all the answers, we present the conundrums to the audience to stimulate ideas towards alternative solutions.

Keywords: green infrastructure, planning, design, co-management, Global South

Acknowledgments: The research is conducted as part of the Integrative Green Infrastructure (GRIP) project, funded by the Danish Fellowship Centre. We acknowledge the collaboration of students from the University of Pretoria, the Department of Architecture, private consultants, and public sector officials from the City of Tshwane in the design studios and research-related workshops.

A DECISION SUPPORT TOOL FOR PLANNING MULTIFUNCTIONAL INTEGRATIVE GREEN INFRASTRUCTURE

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Rapidly expanding urban areas in developing economies are presented with social, climatic, and ecological challenges in the design of health-promoting cities, particularly in low- and middle-income countries. Unplanned urban expansion in South Africa (SA) has been occurring at the expense of public green space. Consequently, biodiversity and connectivity are being lost to intensive land transformation and encroachment on natural areas. It is therefore time to rethink urban development towards greater inclusion of green infrastructure (GI) planning in the urban expansion process. Using remote sensing technology to map GI benefits provides a top-down approach towards addressing the challenges associated with rapid urbanisation. This session presents a technocratic method that aims to integrate climate-change mitigation benefits, biodiversity benefits and socio-economic gains into a city's ecological fabric in order to identify priority areas for GI enhancement. Remote sensing and big data are used in this project to analyse spatial patterns of overlapping GI multifunctional benefits (or the deficits thereof) at a citywide scale. We present a decision-support tool to assess and prioritise areas for GI development within the City of Tshwane. We invite the audience to discuss if multifunctional benefits can be realised despite the complexities of the real world.

Keywords: green infrastructure, planning, biodiversity, multifunctional benefits, City of Tshwane, South Africa

BENEFITS AND BARRIERS OF URBAN GREEN INFRASTRUCTURE FROM THE PERSPECTIVE OF LOCAL COMMUNITIES IN TSHWANE, SOUTH AFRICA

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In this presentation, we address how local communities use, perceive, and engage with larger areas of connected green infrastructure in cities, and importantly, what hinders a positive relation and interaction between urban residents and their nearby pockets of nature. In the City of Tshwane, South Africa, as elsewhere, larger urban green areas are often referred to as “parks” or “open green spaces”, while being neither adequately maintained nor accessible to the level indicated by these terms. In order to unfold and illustrate the multiple potential benefits and barriers for local communities related to their urban green infrastructure, we draw on a community survey among 200 residents, key informant interviews, and a photovoice study.

Our main findings show that from the perspective of residents living near urban green areas, a complex combination of risks stands in the way of realizing the many nature values and potential benefits expressed by the community. Safety risks, pollution, limited physical accessibility, and conflicting ownership – all connected to past-to-present injustices and limited resources in planning and management – interact to hinder a positive relation between people and their surrounding nature and the benefits it could provide, including recreation and physical and spiritual well-being.

In our broader research project, we apply an interdisciplinary and interactive research mindset by engaging local communities, city officials and private sector partners in the co-development of approaches to strengthen urban green infrastructure planning, and our collaborative approach is met by great willingness across all parties, while also revealing unforeseen challenges. Questions remain concerning the contextualization and actionability of our research-based outcomes toward long-lasting, sustainable co-management of urban green infrastructure in cities like Tshwane and beyond.

Keywords: urban green infrastructure planning, City of Tshwane, South Africa

Abstracts

Session 4

Urban wildlife biodiversity: mechanisms of increasing biodiversity in urban areas, protection, and conservation strategies

MAMMALIAN FUNCTIONAL TRAIT RESPONSES TO ANTHROPOGENIC AND ENVIRONMENTAL FACTORS ACROSS THE CONTIGUOUS USA

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Ongoing urbanization and land transformation drive profound changes in ecosystems worldwide, with wildlife responding in myriad ways. Particularly, functional homogenization of wildlife communities due to widespread anthropogenic changes may reduce biodiversity and urban ecosystem resilience. However, there are benefits of urbanization (e.g., increased resources and survival) for some mammal species, likely supported by corresponding traits that facilitate the exploitation of human-dominated environments. Using data collected simultaneously from 107 sites throughout the contiguous United States, we explored how anthropogenic development, agricultural development, and environmental factors affected mammalian functional diversity (i.e., richness, evenness, and divergence of effect traits) and mean species' traits at two spatial scales. Although we predicted that urbanization would lead to mammal community functional homogenization, we found that anthropogenic development was positively associated with all three functional metrics at both scales, while environmental variables (i.e., primary productivity, temperature) had weaker associations. Sampling locations with greater anthropogenic development also correlated with mammal species with smaller average home ranges, smaller average body sizes, and decreased mean rates of carnivory and scavenging. Identifying the effects of anthropogenic development on ecosystem functioning, as mediated by species' traits, is crucial as urban landscapes continue to expand globally.

Keywords: diversity, functional, homogenization, traits, urbanization

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UEII – MOVING FORWARD IN PROVIDING CITYWIDE ECOSYSTEM INTEGRITY DATA FOR URBAN MANAGEMENT AND PLANNING

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In this talk, I will present the Urban Ecosystem Integrity Index (UEII), which is a novel and customizable procedure that allows the quantification of the integrity of urban ecosystems. In summary, the UEII takes city-wide data from the physical and biological dimensions of cities that are contrasted with systems of reference. The first UEII was calculated for the city of Xalapa (Mexico) and showed to be highly informative and accurate. Currently, it is being calculated for a boreal city (Lahti, Finland) and no drawbacks have been detected. Empirical results show that, with its intrinsic limitations of scale and quality of information, the UEII showed to be a flexible and easy-to-calculate tool to evaluate ecosystem integrity for cities, allowing for comparisons between or among cities, as well as the sectors/regions within cities. If the UEII is calculated and interpreted properly, it could become a useful tool for decision making and resource allocation at a city level. Further research is aiming to include the social dimension to the UEII, or at least ways to incorporate the social aspect of cities in its assessment.

Keywords: Urban Ecosystem Integrity Index

DO VARYING URBAN BUILT FORM CONFIGURATIONS DIFFERENTIALLY IMPACT AVIAN RICHNESS IN URBAN GREEN SPACES?

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Urban biodiversity plays an important role in ecological processes and ecosystem services within cities, making conservation a priority in many municipal sustainability plans. Urban green spaces (UGS) have been a key strategy for conservation by providing habitat for wildlife, including avian communities. While the ecological attributes necessary to enhance the habitability of UGS for avian communities are relatively well known, an understanding of how variation in the surrounding urban matrix influences avian richness outcomes in these spaces, is less understood. As new urban areas continue to develop and UGS become increasingly important habitat areas, urban designers and planners will need a better understanding of the ways in which urban built form patterns at the matrix-level influence avian biodiversity outcomes at the site-level in UGS. To that end, this study investigates the influence of four urban built form matrix-level variables and six UGS site-level variables on total avian richness and avian richness by foraging guild using generalized linear model methods in 22 UGS. This analysis was conducted using high resolution land cover data, building LiDAR data, and twenty years of bird occurrence data from the eBird community science program in well-surveyed UGS in Los Angeles, California. Several urban built form variables were found to improve model prediction for carnivores, insectivores, and omnivore foraging guilds, but were not strong predictors of richness patterns on their own. In addition, some of the urban built form variables had positive associations to avian richness outcomes for certain foraging guilds, demonstrating that urban built form configurations may have differentiated impacts on avian richness outcomes. The size of the UGS was the best predictor of richness patterns across all groups, confirming previous findings. The results of this study suggest that the most important factor in avian richness in UGS is the size of the area, but that urban built form plays a role too and improves avian richness model prediction.

Keywords: urban biodiversity, urban built form, eBird, urban green space, urban matrix

HOW TO COLLECT TURTLES IN AN ANTHROPIC ENVIRONMENT? AN ACCESSIBLE TRAPPING METHOD TO OVERCOME URBAN BARRIERS

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There are different trapping methods for freshwater turtles, such as funnel traps, basking traps, manual capture, and nets. However, in urban environments, they are limited, mainly in developing countries like Brazil. Some of these barriers are, for example, the bad conditions of water bodies (polluted), usually silted, and the fact that devices are at risk of theft. Hence, to overcome these obstacles, we adapted a technique of *Hookless trot line,* and created a novel one that we named *Hookless fishing,* similar to traditional fishing but without causing any injury to the turtles. The device is composed of a baited clip tied to a fishing line around three-five meters long, and with a float attached. The opposite end of the line is tied to a branch next to the operator. As soon as the trap moves, the clip is brought close to the operator and the animal is captured by a dip net. To analyse the effectiveness and potential advantages of this method we compared the results with those obtained by two other techniques commonly used in freshwater turtle studies (funnel trap and manual capture). Fieldwork was conducted between August and November 2021 in lakes of four areas in Maringá city, Paraná, Brazil. Each area was sampled seven times and all trapping methods were simultaneously used for 4 h on each day sampled. A total of 195 captures occurred, with funnel trap being the method that captured the most turtles (n = 94; 48%), followed by *Hookless fishing* with 83 turtles captured (42.5%). The manual capture was responsible for a small portion of captures (n = 18; 9.2%). As an advantage, staying close to the device reduces the risk of theft and allows easy re-baiting whenever necessary. Furthermore, it increases the trapability, since it is possible to trap many individuals on the same day using one device. Regarding cautions, it is important to remain in silence, use light-coloured clothes, and avoid sudden movements (to avoid spooking the turtles). Therefore, we conclude that in urban areas *Hookless fishing* is a good trapping method since it is efficient, cheap, easy to use and transport, and only requires one operator to work.

Keywords: Brazil, freshwater turtle, no injury, novel, trap

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EFFECTS OF WATER LEVEL FLUCTUATION AND URBANIZATION ON SOIL FAUNA IN THE RIPARIAN ZONE OF A REGULATED RIVER

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As a typical seasonal wetland ecosystem, the riparian zone plays an important role in maintaining biodiversity. Soil fauna acts in nutrient cycling, biological control, pollination and decomposition of organic matter. However, little knowledge has been obtained about the soil fauna in the riparian zones. As the city most affected by the construction of Three Gorges Dam, the riparian zones of Chongqing city have been heavily affected by both the water level fluctuation and urban environmental changes. Therefore, the study selects Chongqing as case study city and aims to obtain knowledge about the effects of rapid urbanization and the water level change on soil animal community characteristics. Accordingly, in this study the riparian zones along the Yangtze river and Jialing river in the urban areas of Chongqing city are selected as the study area. We investigated the diversity and distribution of riparian soil fauna along an elevational gradient and determined the major factors structuring the soil animal communities. Results show that a total of 4966 species of soil fauna were captured in autumn and spring, belonging to five phyla, 30 orders and 87 families. Among them, the dominant groups were *Trachelipidae, Formicidae, Chironomidae* and *Onychiuridae*. The diversity of soil fauna is significantly different in different elevations and was the lowest in the lower part of the riparian zone. It was found that scavenging was the main feeding habit of soil macrofauna and soil meso-micro fauna, while herbivory was the main feeding habit of soil meso-micro fauna. The soil fauna was affected by soil organic matter, moisture content, total nitrogen, moisture content and available phosphorus, which indicated that the water level fluctuation impairs the soil physicochemical property and had a significant effect on the soil fauna community. The results will provide a scientific basis for accurate assessment of soil health status in the riparian zone of urban areas. Furthermore, the study also offers theoretical support for ecological restoration and landscape management of riparian zones in urban areas under multiple disturbances.

Keywords: soil fauna, community characteristics, flooding duration, environmental factors, soil physicochemical property

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HOW URBAN FACTORS ARE SHAPING MAMMAL DIVERSITY IN EUROPEAN CITIES: A CASE STUDY IN FREIBURG, GERMANY

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Europe is one of the leading regions with a growing interest in bringing back the wilderness in cities. Here, a barrier exists concerning the poor documentation of wildlife species (except birds) in many cities in this region. Given this fact, we focused on mammals and documented species occurrences across urban areas by applying the wildlife camera trapping method in Freiburg, a medium-sized city in Germany. From this, we assessed how mammal diversity at the sampling sites was related to different human-induced factors and habitat connectivity across urban areas of this city. Our results showed the occurrence of 12 mammal species, among which generalist species (e.g., stone marten and red fox) were the most common in urban areas. These generalist species usually benefited from functional habitat connectivity, whereas some other species, e.g., roe deer and wild boar, were related to surrounding vegetation cover. Besides, our investigation indicated the usual negative effect of the proximity of roads alongside built-up proportions on overall mammal richness. These findings provide evidence of generalist species effect in mammals along the increasing gradient of urbanisation in one of the European cities, which is considered a model of sustainable cities globally. It, in turn, indicates the necessity to explore further whether and how habitat connectivity can be improved to benefit mammal species diversity across urban areas and to strengthen wildlife-inclusive city planning.

Keywords: urbanisation, habitat connectivity, wildlife, camera trapping

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PREFERRED HABITAT OF *CORVUS FRUGILEGUS* INVADING THE URBAN ENVIRONMENT AND THE CORE MANAGEMENT AREAS TRACKED BY CITIZEN SCIENCE

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In Suwon, South Korea, the appearance of *Corvus frugilegus* (rook) in the urban areas started from November 2016. To solve this problem, a laser deterrent method is currently being conducted. However, in the case of avian species, they share a vast range of movement making it difficult to manage and investigate their preferred habitats and the related treatment in order to deter them from the urban area. Hence, in this study citizen science and SDM (Species Distribution Method) were utilized to overcome geographical hindrance in order to track rook's sample data and its preferred habitat.

In this study, a total of 6,314 location data of the rooks were collected through citizen science data in Suwon, and 5,214 were extracted by examining photos that were found to be inappropriate. As a result, the leftovers within the boundaries in Suwon were counted and 4,523 points were utilized overall. The data was acquired from December 2020 to March 2021, and in order to minimize repetitive data within a certain area, data acquired within 20 minutes at the same point were removed. MaxENT and GeoDa were utilized based on the sample data collected through citizen science data in order to derive out core management areas.

MaxENT results showed that the relative contributions rate of the top three environmental variables for rooks in the time zone after sunset (18:00 ~ 08:00) was: Euclidean distance from 6th ~ 20th floors (20.7%), 1st level of Biotope category (19.4%), DEM (19%) and Euclidean distance from utility pole (14.5%). Based on citizen GeoDa, spatial auto-correlation analysis was conducted for specific town units in Suwon. As a result, the area adjacent to Maetan 3-dong and 4-dong turned out to be suitable as a target area for rook extermination.

Suwon is now currently practicing the laser deterrent method based on the results derived in the study and the actual appearance rate of rook has decreased. However, in order to establish a more detailed plan to eradicate the rook, it is necessary to derive specific results and analyse the interrelationship of the prediction of the appearance of the rook using advanced independent variables such as illumination and noise.

Keywords: laser deterrent, Species Distribution Model (SDM), urban ecology

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SPECIES DIFFERENCES IN TEMPORAL RESPONSE TO URBANIZATION ALTERS PREDATOR-PREY AND HUMAN OVERLAP IN NORTHERN UTAH

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Wildlife is under continuous pressure to adapt to new environments as more land area is converted for human use and human populations continue to concentrate in suburban and urban areas. This is especially the case for terrestrial mammals, which are forced to navigate these habitat matrices on foot. One way in which mammals may occupy urbanized landscapes is by altering their temporal activity behaviour. Typically, studies have found that mammals increase their nocturnal activity within urbanized environments to avoid overlap with humans. However, to date, the majority of studies on this topic have focused on single species, and studying whether this trend holds across an entire community has important ecological implications. Specifically, understanding how differences in species temporal activity response alters predator-prey dynamics and sympatric interspecies competition can provide insight into urban wildlife community assembly and provide a mechanistic understanding of species co-occurrence within these systems. In this study, we used data from a community science camera trapping project in northern Utah to elucidate how human influence alters the temporal activity behaviour of five medium- to large-sized mammals and how differences in species response affect predator-prey, human, and sympatric competitor temporal niche overlap. We found community-wide changes in activity across study sites, with increases in late night and midday activity and decreases in crepuscular activity within the more-urbanized sites. However, species-specific behavioural changes varied, and these changes resulted in reduced overlap, especially between coyotes (*Canis latrans*) and their potential prey species. These results provide information on how human influence may alter community assembly and species-species interactions within a wildland urban interface.

Keywords: wildlife, species, urbanization, predator-prey, behavioural change

COMPARATIVE ASSESSMENT OF URBAN PROTECTED AREAS: METHODS TO REVEAL ECOSYSTEM AND CULTURAL VALUE

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At present, the urban environment is under growing tensions between various stakeholders due to multidimensional urbanization issues. Widely known classifications of ecosystem services encompass cultural services as one of the compounds of total value. The core ecosystem and social services of six urban protected areas (UPAs) in Moscow and Saint-Petersburg have been assessed separately due to significant contradictions between these compounds. A comparison blueprint comprises three main blocks: institutional value I (evaluated according to zoning and respective prohibitions established by legislation), ecosystem value E (evaluated according to ability to provide ecosystem services and deterioration level of landscapes), cultural value C (evaluated according to zoning, prohibitions on human activities and the results of a conducted survey). Moreover, a general evaluation of vulnerability dynamics of the UPAs' network in Moscow has revealed the significant drop in ability to provide ecosystem services (indexes of optimum habitat shape and fragmentation have increased by 3.2 – 5.1 times). After NDVI analysis of Landsat imageries and Global Forest Change data, it has been identified that green infrastructure (GI) and tree cover in PAs of both cities are rather stable, while GI reducing is widespread in the central urban cores (by 1.6 – 1.8 times since 1990) and the former Moscow green belt (by 1.1 times). Cultural value prevails over ecosystem value in two UPAs. Only one exceptional PA (Pike Lake reserve in Saint-Petersburg) has the significant dominance of ecosystem value (E-C = +8.4; possible values vary from -20 to 20). A significant gap between urban planning and actual ecosystem value has been revealed. Prohibitions that are insufficient for ecosystem protection are widespread in the riparian forests and meadows of Setun and Ochakovka river valleys, as well as in watershed forests occupied mostly by lindens and oaks. Excessive prohibitions discounting intensive land-use and high recreation value are much less common. Despite increasing ecosystem vulnerability, the social demands should not be neglected, as total prohibitions of human activities are impossible in the contemporary megapolises. The devised set of methods to assess the dualistic nature of UPAs may be implemented in various cities and countries, especially operated by state-led systems of spatial planning.

Keywords: green infrastructure, protected areas, ecosystem services, urban ecology, urban planning

"I CONVERTED AN OLD WHEELIE BIN INTO A WATER BUTT" – EXPLORING CITIZENS' MOTIVATIONS AND BARRIERS TO IMPLEMENTING ACTION TO ENHANCE BIODIVERSITY AND ECOSYSTEM SERVICES IN URBAN DOMESTIC GARDENS

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Urban domestic gardens are an important component of cities. They comprise around 20 – 40% of the land area and provide green spaces that offer habitat, landscape connectivity, and a wide range of ecosystem services. Management and maintenance of urban domestic gardens is subject to limited planning regulation and largely a result of individual landowners' preferences, which can influence the biodiversity present as well as the provision of ecosystem services. Engagement of citizens is therefore especially important to fulfil goals of protection and enhancement of green space and biodiversity within urban domestic gardens.

This paper presents the outcomes of a co-produced project at the science-policy-practice interface that aimed to improve understanding of domestic gardens in a large city and the ecosystem services they provide, to support green infrastructure planning. This required close connections with citizens, with the aim to increase green space and enhance biodiversity in domestic gardens.

Through co-development and deployment of the "My Back Yard" citizen science online survey tool, we captured quantitative data from > 1000 citizens about garden land surfaces in Manchester, UK. This citizen science database was verified and extended through high-resolution imagery, then applied to quantify and map climate regulation services. On completion of the survey, citizens received feedback on their results and guidance on ways to improve their garden to enhance ecosystem services and biodiversity. Respondents could then pledge their support to take positive environmental actions e.g. plant a tree, store rain water. A follow-up survey was undertaken one year later to find out which actions citizens had completed, as well as their motivations and barriers to achieving these.

Results demonstrate that for citizens who pledged to implement an action, completion rates were high, varying between 84.5% to 94.8%, depending upon the specific pledge (e.g. reduce risk of flooding or drought) and associated actions (e.g. take up paving, store rain water). Thematic analysis of survey responses reveals several common motivations and barriers for implementing actions. Discussion focuses upon the uptake of action by citizens to provide recommendations for engagement and implications for promoting sustainable behaviours. The online survey tool and results are transferable to other cities and demonstrate how citizen science can provide the basis for shared learning to enhance urban green space, biodiversity, and climate resilience.

Keywords: urban domestic gardens, green infrastructure, citizen science, climate resilience, green infrastructure planning

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BIRDS IN THE HOOD: THE IMPORTANCE OF URBAN TREES AND FOREST FRAGMENTS FOR BIRD CONSERVATION

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Although cities mostly contain fragmented habitats and decreased vegetation, urban design and management can provide bird habitat for a wide variety of species, even for species that are not considered “urban birds”. In particular, the conservation of residential trees and small, urban forest patches could offer habitat for birds during the breeding, migration, and winter season. Our objectives were to determine 1) which migrating species primarily use urban forest fragments versus adjacent residential areas during migration and winter season; 2) whether three reported interior-forest specialists, pileated woodpeckers (*Dryocopus pileatus*), summer tanagers (*Piranga rubra*), and northern parulas (*Setophaga americana*), could breed in older residential neighbourhoods; and 3) which habitat parameters were correlated with the presence of a particular species. We conducted avian point/transect counts and assessed habitat characteristics in residential neighbourhoods and in nearby urban forest patches in Gainesville, Florida. The migration/winter survey results found that over 50 migrant species utilize residential and urban forest patches as stopover and winter habitat. Some migrating birds that typically forage under the canopy significantly preferred urban forest fragments whereas canopy-foraging birds used both forest fragments and residential neighbourhoods equally. The main vegetation difference between forest fragments and residential areas was that forest fragments had more vertical height structure. The breeding survey results showed that all three interior-forest species did occur in residential neighbourhoods, with each species occurring more often in areas that had increased tree canopy cover, tree snags, and presence of nearby forest fragments. In particular, each species occurred most frequently in yards that were “near-wild” compared to yards that were “manicured” or “semi-manicured”. The results indicate that planning policies that encourage the protection of tree canopy, promotion of “near wild” portions of yards, and conservation of small forest patches can increase the diversity of birds that utilize urban areas.

Keywords: breeding birds, migrating birds, forest fragments, tree canopy, urban planning

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Abstracts

Session 5

Challenges and opportunities of urban plant biodiversity

INTERACTIONS OF FUNCTIONAL TRAITS WITH NATIVE STATUS AND ECOSYSTEM NOVELTY EXPLAIN THE ESTABLISHMENT OF PLANT SPECIES WITHIN URBAN ECOSYSTEMS: EVIDENCE FROM BERLIN, GERMANY

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A key challenge in urban biodiversity conservation is to understand the drivers that govern the population establishment of different groups of species in different urban ecosystems. Here, we ask whether and to what extent vascular plant species establishment (i.e., the ability to establish self-sustaining populations within a certain time span) is driven by interactions of species functional traits, native status, and the type of ecosystem species occur in, with types of ecosystems distinguished by their degree of ecosystem novelty. To answer this question, we use a dataset of 1,178 vascular plant species occurring in Berlin, Germany, that originally had been compiled to substantiate the Berlin Red List of endangered plant species. This dataset classifies native and non-native species into casual and established species based on a minimum of 25 years of expert observation. Whether a species is established or casual is distinguished among four broad types of ecosystems: natural remnant, hybrid, novel immature, and novel mature ecosystems. Moreover, we classify species into those native to Berlin and non-native species (split into archaeophytes and neophytes), and link species to selected functional traits and indicator values. By applying ordinal regression within a Bayesian framework, we show that traits are key drivers of these establishment processes and that the traits that drive species establishment differ across types of ecosystems. While across traits, more established species are present in natural remnants, low canopy height, annual life span, and late end of flowering specifically promote establishment in novel immature ecosystems. In hybrid ecosystems, low canopy height and reproduction by seeds are beneficial traits, with the latter promoting establishment in novel mature ecosystems, too. Traits were less important in predicting species establishment in native as compared to non-native species. All types of ecosystems add to urban biodiversity, and trait analyses refine our knowledge on how they can be supported in doing so on the long term. This can help in sharpening conservation measures.

Keywords: biodiversity conservation, functional traits, novel ecosystems, population establishment, urban land use

Acknowledgments: We thank Marina Golivets and Ingolf Kühn at the Helmholtz-Centre for Environmental Research – UFZ for methodological advice. We thank all those who created the dataset of 1,178 vascular plant species used here.

DESIGNING URBAN BIODIVERSITY: CASE STUDIES OF ALTERNATIVE LAWNS IN SWEDEN

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One of the practical outcomes of the transdisciplinary project "Lawns as an ecological and cultural phenomenon. Searching for sustainable lawns in Sweden" was designing and establishing demonstration sites on the University Campus of the Swedish University of Agricultural Sciences. Demonstration sites were designed as open and accessible experimental research amenities aimed at encouraging communal and educational activities to see sustainable design in action. Biodiversity was the main concept driver behind the design of different types of lawn alternatives. Four different types were implemented in 2016. The choice of plant species was mainly inspired by an acceptance and appreciation of Nordic "meager nature" and the use of only native species. During five seasons we watched the dynamic of designed plant communities. Plant community compositions have changed every season and some plants have not survived or have decreased in numbers, while other plants have won the competition and increased their presence. Weather patterns and microclimatic conditions were the most influential parameters at the beginning of the development of meadow plant communities. However, it is quite difficult to predict the direction of the succession because of unpredictable natural forces in combination with weather patterns, soil moisture, the quality of original seeds, and the competition between species and fauna's population activities. The central position of experimental sites within Ultuna Campus provided a good educational and research opportunity for students, researchers, and citizens. They had a chance to see the development of different types of meadows and learn about how to design biodiverse and sustainable lawn alternatives. Our research also confirmed the hypothesis that biodiverse alternative plantings would be better understood by the public when plantings employ appropriate design frameworks and the right management and maintenance plans.

Keywords: urban biodiversity, alternative lawns, demonstration sites, Sweden

PUNCHING ABOVE THEIR WEIGHT, THE ROLE OF SMALL GREEN SPACES FOR BIODIVERSITY IN CITIES

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Cities are dynamic living ecosystems in which human actions directly intertwine with natural processes – mutating, promoting or impeding them. The plants that occur within cities often seem to exist only at our will: we plant and sow, mow and trim the greenery of our urban spaces. However, in reality many species are succeeding in making urban green spaces their own. For these species, seed dispersal, pollination, colonization, and competition are still major drivers of diversity, evolution, and biogeography in cities. We believe that with the right design, species selection, and promotion, we can work with rather than against these "wild" natural processes to help make cities sites of biodiversity conservation. Our work explores this interplay between human action and biologically driven patterns in urban wildflowers and pollinators in Zurich. We conducted a vegetation survey across 7 km^2 of the city, identifying both sown and spontaneous wildflower species in public green spaces. We identified the ecological patterns associated with isolation and patch size in determining the biodiversity of even tiny green "islands" spread throughout a sea of concrete. We identified the major role small green spaces play in increasing urban beta-diversity, the minimum-benefit distances between small green spaces, and those whose ability to self-disperse make them ideal candidates for further promotion. While cities represent a system in constant flux due to rapid human actions, they also present an opportunity to directly engage with and influence the system's key shapers and drivers. Working with a local citizen science network, we have run two projects: 1) *Wo Samen fallen* which highlighted the self-dispersing flower species which emerge in our gardens/balconies of their own volition, and 2) *B^3*: *Bienen, Baumscheiben und Bestäubung* which revealed the importance of the distribution of small green spaces for supporting wild pollinators. In doing so, we brought volunteers into dialogue about wildflowers in cities, their pollination, the role of design in ecological connectivity, and the perception of wilderness in a city.

Keywords: urban biodiversity, connectivity, citizen science, wildflowers, spontaneous vegetation, small green patches, ecological design.

SMART GREEN CITY, GANGJIN – CONVERGENCE OF URBAN ECOLOGICAL PLANNING AND DESIGN TECHNIQUES

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The Smart Green City Project is a convergence of urban planning and design technologies in the complex city models that comply with the principles of sustainability and carbon neutral strategies supported by the integrated ICT-based operation management smart system. The project applies various model cases based on the existing condition of the community and residents' opinions. Moreover, the project is intended to establish a systematic network amongst the cases and experiences. By verifying efficiency through regional application and establishing a new planning model, the planning model for each business type has been diversified, standardized, and spread through 25 cities in Korea. The Ministry of Environment expects about 3,000 jobs (construction and management stages) to be created through 25 smart green cities and that the 25 cities will play a role in the city's green transformation, and IoT based smart facilities are expected to reduce 27,000 tons of greenhouse gas annually. Smart Green City has a "comprehensive-leading type" that combines three or more environmental projects for the green transformation of the city as well as a "problem-solving type" that combines two or more environmental projects to solve local customized climate and environmental problems. Among them, Gangjin is one of the "comprehensive – leading type" which is expected to connect fragmented green spaces to revitalize residents' life-friendly spaces.

Keywords: carbon neutrality, smart green city, ecosystem restoration, IoT

LOW RESOURCE AVAILABILITY DRIVES FEEDING NICHE PARTITIONING BETWEEN WILD BEES AND HONEYBEES IN A EUROPEAN CITY

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Cities are socio-ecological systems that filter and select species, thus establishing unique species assemblages and biotic interactions. Urban ecosystems can host richer wild bee communities than highly intensified agricultural areas, specifically in resource-rich urban green spaces such as allotment and family gardens. At the same time, urban beekeeping has boomed in many European cities, raising concerns that the fast addition of a large number of managed bees could deplete the existing floral resources, triggering competition between wild bees and honeybees. Here, we studied the interplay between resource availability and the number of honeybees at local and landscape scales and how this relationship influences wild bee diversity. We collected wild bees and honeybees in a pollination experiment using four standardized plant species with distinct floral morphologies. We performed the experiment in 23 urban gardens in the city of Zurich (Switzerland), distributed along gradients of urban and local management intensity, and measured functional traits related to resource use. At each site, we quantified the feeding niche partitioning (calculated as the average distance in the multidimensional trait space) between the wild bee community and the honeybee population. By using multilevel Structural Equation Models (SEM), we tested direct and indirect effects of resource availability, urban beekeeping and wild bees on the community niche partitioning. We found an increase in feeding niche partitioning with increasing wild bee species richness. Moreover, feeding niche partitioning tended to increase in experimental sites with lower resource availability at the landscape scale, which had lower abundances of honeybees. However, beekeeping intensity at the local and landscape scale did not directly influence community niche partitioning or wild bee species richness. In addition, wild bee species richness was positively influenced by local resource availability, while local honeybee abundance was positively affected by landscape resource availability. Overall, these results suggest that direct competition for resources was not a main driver of the wild bee community. Due to the key role of resource availability in maintaining a diverse bee community, our study encourages cities to monitor floral resources to better manage urban beekeeping and help support urban pollinators.

Keywords: urban ecosystems, wild bee communities, honeybees, Zurich, Switzerland

BIOTIC HOMOGENIZATION OF RESIDENTIAL YARD VEGETATION WITH CONTRASTING MANAGEMENT

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Similar human preferences and management practices in private yards across environmentally heterogeneous regions might lead to the selection of plant species with similar attributes and induce urban biotic homogenization. We investigated yard plant diversity and composition in yards with management practices in six cities of the U.S. We tested whether yard management results in more homogeneous taxonomical, phylogenetic, and functional plant assemblages than the natural areas they replace or than relatively unmanaged areas at the residential-wildland interface ("interstitial" areas). Based on fertilizer input frequency and landscaping style, we grouped yards into high-input lawns, low-input lawns, and wildlife-certified yards. We defined homogenization as decreased variance in α-diversity and decreased average β-diversity in yards when compared to natural and interstitial areas. We found that all residential yard types were functionally more homogeneous for both α- and β-diversity than the natural and interstitial areas regardless of their management. However, wildlife-certified yards were functionally more similar to natural areas than lawn-dominated yard types. All yard types were also more homogeneous in phylogenetic α-diversity compared to natural and interstitial areas, but more heterogenous in taxonomic α-diversity (i.e., yards had a more variable number of species than natural and interstitial areas). Our findings underscore the ecological importance of gardening practices that both support biodiversity and create residential plant communities that are functionally heterogeneous.

Keywords: beta-diversity, biodiversity facets, private landscapes, plant diversity, wildlife certified yards

Acknowledgments: We are grateful to all the homeowners who allowed us to sample vegetation diversity in their yards. In Baltimore, we thank Laura Templeton for leading and coordinating the filed sampling, and for cleaning up the data. For sampling in Boston, we thank the Massachusetts Department of Conservation and Recreation and Mass Audubon for permission to sample in natural and interstitial areas, and Roberta Lombardi, Margot McIlveen, Pamela Polloni, Meghan Shave and Michael Whittemore for field assistance. In Los Angeles, we thank Noortje Grijseels for leading and coordinating the field sampling, and cleaning up the data; Nathaly Rodriguez, Cedric Lee, Kyle Gunther, Eleanor Arkin and Nathaly Rodriguez for field assistance and plant identification; and UCLA/La Kretz Center for California Conservation Science, National Park Service, Los Angeles City Department of Recreation and Parks, the Audubon Center, Mountains Recreation and Conservation Authority, Palos Verdes Peninsula Conservancy for permission to sample natural and interstitial sites. For sampling in Miami, we thank Miami-Dade County Parks, Florida State Parks and Pine Ridge Sanctuary for permission to sample natural and interstitial areas; and Martha Zapata, Sara Nelson, Sebastian Ruiz, and Alex Lamoreaux for field assistance. For sampling in Minneapolis-St. Paul, we thank the Minnesota Department of Natural Resources, the Nature Conservancy, Three Rivers Park District, the cities of Brooklyn Park, Eden Prairie, and Arden Hills, and Ramsey County Parks and Recreation for permission to sample natural and interstitial areas; and Chris Buyarski, Sophia Hahn, Ben Huber, Hannah Stellrecht, Kyle TePoel, Sara Nelson and Hannah Weisner for field assistance. For sampling in Phoenix, we thank Darin Jenke, Erik Nelson, Hannah Heavenrich, Alyssa Bailey, Caitlin Ribeiro, Christal Beauclaire-Reyes, Matthew Minjares, Randy Fulford, Amy Smeester, Manas Subberaman, Jack Oberhaus, and Laura Steger. We thank Mary Phillips and Erin Sweeney from National Wildlife Federation in accessing Wildlife Certified© yards.

VEGETATION COMPOSITION IN AN EPHEMERAL URBAN STREAM IN CENTRAL TEXAS: VALUE FOR USE IN GREEN INFRASTRUCTURE

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Globally, it is predicted that many perennial streams and mid-order rivers will become ephemeral with increasing water extraction and climate change. The Central Texas corridor from Austin to San Antonio represents one of the fastest growing regions in the United States. Ephemeral streams and isolated pools within the stream channel are common in sub-humid central Texas but have received little attention. Gaining an understanding of the dominant native vegetation present in an ephemeral stream and pools from a subtropical subhumid area of central Texas will provide a current record of plant diversity and composition within an urban greenway for future conservation efforts and document native plants suitable for planting in green infrastructures. The plants in the ephemeral stream experience long term droughts and flash floods. In this study, it was expected that a greater number of wetland species would be present in the pools compared to the ephemeral stream channel. However, the plant species were similar between the ephemeral stream and pools indicating that microhabitats exist in both allowing the occurrence of upland, facultative, and wetland plant species. Species in the ephemeral stream and pools consisted of a mix of upland, riparian, and wetland species with a total of 114 species documented in the upper section of Leon Creek. Ten plant species were dominant with a mean coverage of > 3% and no difference ($P = 0.402$) observed for dominant species in the ephemeral stream and pools. Perennial graminoids and forbs were significantly greater ($P < 0.001$) in coverage compared to trees, shrubs, vines, and ferns. Shrub and tree cover was rare accounting for < 0.3% coverage. Native species coverage was significantly greater ($P < 0.001$) compared to non-native species in the ephemeral stream and pools. *Panicum virgatum* had greater ($P < 0.05$) coverage at > 20% in both the ephemeral stream and pools compared to all other plant species. Multiple functional groups of native plants were documented in this study that warrant evaluation for use in green infrastructures in similar geographical regions to improve ground and surface water quality and increase ecosystem services.

Keywords: ephemeral streams, greenway, vegetation, green infrastructure, Texas

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ECOLOGICAL FUNCTION OF URBAN GREEN SPACES BASED ON A HIGH SPATIAL RESOLUTION DATASET AND ITS IMPLICATION TO THE MANAGEMENT

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The evaluation of ecological functions in urban spaces is essential in maintaining the quality of urban ecosystems and quality of life. Trees are an exceedingly important component in such ecosystems considering their role, and hence must be properly investigated. However, acquisition of individual tree information in the field has been challenging due to its intensiveness in time and labor. The emerge of LiDAR (Light Detection and Ranging) and hyper-spectral imaging, and their fused usage has enhanced efficiency in tree investigation, and thereby led to more accurate evaluation of ecosystem services. Accordingly, this study focuses on using the fusion of LiDAR and hyperspectral imaging derived high-resolution data to extract more detailed information on park trees in Uiwang, South Korea, and through this, evaluate their ecological functions more precisely.

The ecological functions to be evaluated are carbon storage and canopy condition. Carbon storage can be estimated through the fusion of airborne and slam LiDAR, because each of them differs in the information they acquire. The airborne LiDAR data of Uiwang were acquired in leaf-off and leaf-on seasons, Slam LiDAR data on each park were acquired and fused with airborne LiDAR data for extraction of more detailed tree information. Canopy condition on the other hand, can be evaluated through hyperspectral imagery. By extracting vegetation vitality, water stress, photosynthesis functions according to the types of spectroscopic index, canopy condition is to be evaluated within the parks of Uiwang. The individual tree information derived from high-resolution data will be averaged by park. Then it will go through clustering analysis, which can analyse the relationship between clusters by forming unknown clusters based on similarity and analysing the characteristics of formed clusters.

This study focuses not only on the method to evaluate the ecosystem functions from high-resolution data, but the categorization of the parks as a cluster by evaluated ecological function. By comparing the factors of the clustered parks, it is expected to contribute to the systematic planning and management of the parks.

Keywords: LiDAR, hyperspectral imaging, ecological function, urban green space, cluster analysis

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THE ECOLOPES PLANT-ANIMAL-SOIL COMMUNITY MODEL

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Urbanization is a major contributor to natural habitat loss. Urban areas are extreme habitats in comparison to their natural counterparts, including non-natural soils, frequent drought and flood risk, and human disturbances. Yet, a well-planned architecture can also provide rich habitat for microbes, plants and animals alike, allowing for human-nature interactions that increase human wellbeing and the quality of life in the city. In the EU-project ECOLOPES, we propose a radical change for city development: instead of minimizing the negative impact of urbanization on nature, we aim at urbanization to be planned and designed such that nature – including humans – can co-inhabit the city. A cornerstone of our approach is a computational design workflow, in which the interaction of architecture with plants, animals and microbes is incorporated into the evaluation of an architectural design.

We develop an ecological model which incorporates a spatially and temporally explicit simulation of plant, animal and microbe communities. Using existing code from FATE-HD and Buchmann's allometric home range formation model, we develop a functional group-based plant-animal-soil model in which plant succession is affected by architecture, soil and herbivory; animal home ranges are affected by architecture, soil and plant resources; and soil develops depending on animal and plant activity. Furthermore, the immigration of animals and plants depends on their occurrence on a regional scale. Our model simulates community succession on microhabitat scale (1 m^2), and includes microenvironmental parameters such as shading as well as management plans, thus making it applicable to an urban context.

We envision that our ecological model and its integration into ECOLOPES will transform architectural design and increase the quality of life for humans, microbes, plants and animals alike.

Keywords: plant-soil-animal interactions, urban ecological modelling, trait-based functional groups, allometric equations, community structure

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CREATING URBAN WILDFLOWER MEADOWS USING SPECIES FROM THREATENED NATIVE PLANT COMMUNITIES

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Using species from the critically endangered temperate grasslands and grassy eucalypt woodlands of south-east Australia we are able to create urban wildflower meadows that can improve urban biodiversity and people's exposure to nature. However, government agencies and public land managers need convincing that such meadows can be implemented and managed within constrained budgets to deliver genuine biodiversity gains. Directly sowing the seeds of native grass and forb species is a low-cost approach that offers the potential to deliver biodiverse meadow communities with fewer gaps for weed invasion as compared to tube stock planting. Adapting the direct-seeding methods typically used in Australian grassland restoration to an urban context requires amelioration of edaphic challenges, such as soil contamination, high weed-seed loads and soil nutrient enrichment. One low-cost solution could be to use nutrient-poor substrates as surface treatments to receive the seed and enable germination whilst reducing competition from weed species that are common in urban landscapes.

We conducted a replicated experiment using two depths of sharp sand and site soils across 54 experimental plots in a public park in the City of Melbourne. Each plot was sown with 27 grass and wildflower species and data collection enabled comparisons between species establishment and weed management requirements on the different sand depths. The sowing demonstrated the potential of sharp sand to reduce maintenance inputs by up to 76%, whilst allowing the establishment of a diverse indigenous understorey. Sown in Autumn 2020, the meadow featured good cover of native understorey species one year after sowing and the use of sand as a surface treatment reduced weed emergence and labour requirements during the critical first year of establishment. This project demonstrates the potential for wildflower meadows to re-establish species from threatened plant communities in south-east Australia's cities and towns, to improve the native biodiversity of the urban realm. Of the three threatened species sown, all three established at the site, demonstrating the potential of a biodiversity sensitive landscape design action with potential to be integrated into parks, streetscapes, and new developments across south-east Australia.

Keywords: grassland, rehabilitation, meadows, threatened species, biodiversity

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RESTORED URBAN ROADSIDE VEGETATION OFFERS OPPORTUNITIES FOR CLIMATE REGULATION AND ENHANCEMENT OF RESOURCES FOR URBAN FLOWER-VISITORS

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Increasing urbanization negatively affects biodiversity and ecosystem services, while urban green infrastructure is a suitable nature-based solution that benefits humans, increases climate change adaptation, and integrates biodiversity into urban systems. Thus, we aim to study the ecological functioning and potential of small patches of restored grasslands in urban road verges for climate adaptation and biodiversity fostering. Along a gradient of urbanization in the city of Munich, Germany, 50 patches of native grassland species were established at roadsides based on ecological criteria and managed with a single cut per year. After two years, we assessed functions related to regulatory ecosystem services, i.e., microclimate at the surface level and water infiltration capacity. We compared them with those offered by typical road verge lawns ("controls"). Additionally, the offer of floral resources for pollinators, as well as the visiting insects, were quantified and compared. In parallel, mesocosm experiments simulating climate change scenarios evaluated their functionality under climate change. With the establishment of taxonomically and functionally diverse grasslands, we found that surface temperature decreases compared to lawns and sealed surfaces. The structural complexity of the patches explains this decreasing effect. The water infiltration rate was highly variable and not significantly different between lawns and recently restored grasslands. Furthermore, restored roadside vegetation offers more flower resources, which translates into a larger abundance of flower-visiting insects, e.g., generalist and specialist wild bees. Moreover, the flowering patches seem to compensate for the effects of urbanization on urban pollinators. Our mesocosm experiment revealed that the multifunctionality of road verge grasslands is mainly affected by reduced precipitation under climate change. At the same time, the composition of functional types is crucial for maintaining ecosystem functionality in a warmer world. Even though restoring and adjusting the management of urban grasslands increases alternatives for developing climate-resilient cities and pollinator-friendly greenspaces within urban green infrastructure, some expected positive effects might not be noticeable in the short term. Thus, monitoring the ecological performance is necessary to properly assess benefits, needed adaptations in design, and potential arising trade-offs.

Keywords: climate change adaptation, functional diversity, pollinators, multifunctionality, urban grasslands

Acknowledgments: Students developing projects in the frame of this project and technical staff at the department contributed to data collection and pre-processing. TUMmesa staff supported the monitoring of climate change experiments.

Abstracts

Session 6

Methodological approaches to implement biodiversity in design and planning

A SCALABLE REMOTE SENSING MODEL FOR URBAN FOREST HEALTH INVENTORY

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Urban trees mitigate heat, clean air and water, and provide residents with an improvement in general well-being. However, trees are threatened by climate change, disease, invasive species, and land-use change. Today, most urban tree inventories rely on time-intensive visual assessments deployed unevenly and are generally expensive to execute. The County of Los Angeles, California, USA, manages at least 800,000 public trees, with inventory costs using traditional methods exceeding $5 million (USD). Currently, no department within the county has a cost-effective or efficient way to know where and when to plant or manage trees, and this is quite common among local governance structures around the world. The County of Los Angeles has teamed up with the University of California Los Angeles to identify the best approach to tree species identification and health assessment to help ease the burden of manually managing local tree stocks.

The ability to inventory urban trees using remote sensing will provide the County with a faster, cheaper, and more efficient way to measure and monitor trees throughout the region. In our model, we overlap the GPS location of street trees with multisource remote sensing imagery (NIR,R,G imagery, imaging spectroscopy, and discrete-return LiDAR point clouds) and use deep learning algorithms (fully convolutional neural networks) to develop critical tree metrics: family, genus, and species identification, canopy area and height, mortality, and health. Our scalable remote sensing model also identifies

1. Trees vulnerable to changing climate (native/non-native);
2. Trees vulnerable to drought (mortality);
3. Trees vulnerable to natural disasters (fire, tree fall); and
4. Tree assessment of vulnerable populations (seniors, low-income, and immigrant communities).

Application of our model gives scientists, urban foresters, and stakeholders the technical know-how to update urban forest inventories and retrieve critical tree health assessments to deploy their management resources more effectively.

Keywords: remote sensing, deep learning, urban forest, planning and management, health assessment

EXPERIENCES WITH THE PRACTICAL APPLICATION OF THE ANIMAL-AIDED DESIGN METHOD IN URBAN DEVELOPMENT – A FIRST EVALUATION OF PROBLEMS AND POTENTIALS IN THE IMPLEMENTATION OF ACTIONS

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Animal-Aided Design (AAD) is an approach that makes animals an integral part of the urban design process. AAD takes the needs of other organisms seriously and carefully plans for their food, shelter, and other needs, focusing on the requirements of individual species and trying to integrate their needs into landscape architectural and urban design. At the beginning of the design process, humans choose target species to become stakeholders in the design process (Fig. 1). There are many ways to select these target species, in cooperation with the human stakeholders of the planning process, including the developer, client and authorities. Once target species have been selected, designers must become familiar with their life cycles and requirements, which have been prepared in the form of species portraits with data relevant to planning by biologists (Fig. 2). Taking the needs of the animal seriously allows us to view the building project through the eyes of an animal. Designing with the life-cycle of an animal implies that the designer has the creative challenge to find solutions that meet the requirement of both the animal and the human, ideally in a synergic manner. For the designer, the requirements of animals not just set constraints for the design, but also open novel possibilities. By designing for both humans and wildlife, the designer also has the task to define the future co-habitation between humans and animals. AAD has been applied to several planning projects in recent years by the interdisciplinary planning firm Studio Animal-Aided Design (animal-aideddesign.de). In our article we will systematically analyse the problems and potentials in applying the AAD method in real planning projects along the different steps in the planning processes.

For this purpose, we consider the different scale levels (district, neighbourhood, object) and planning procedures (urban planning, object planning), the different disciplinary topics and approaches (urban planning, open space planning, architecture, landscape architecture, green space maintenance) and the different goals of the clients (investors, municipalities, housing cooperatives, etc.).

Keywords: Animal-Aided Design, target species, building process, biodiversity vs. style and values in architecture

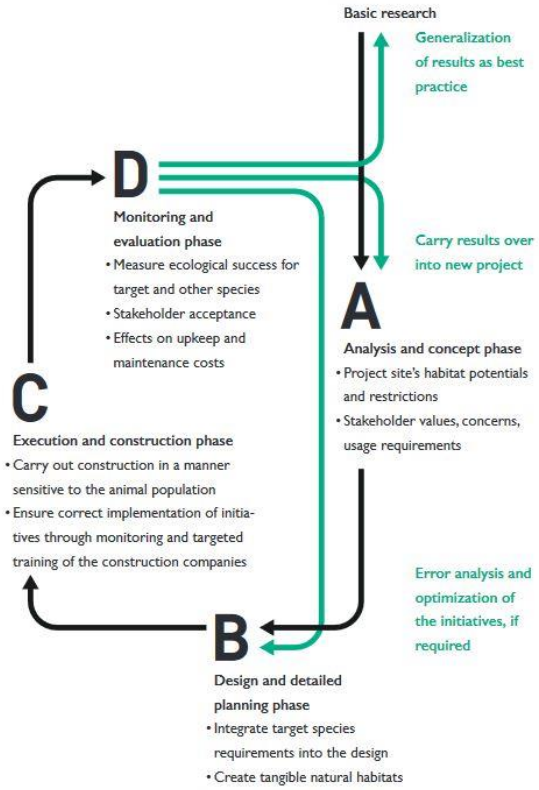

Fig. 1 Methodological approach – AAD planning cycle (AAD, Sophie Jahnke)

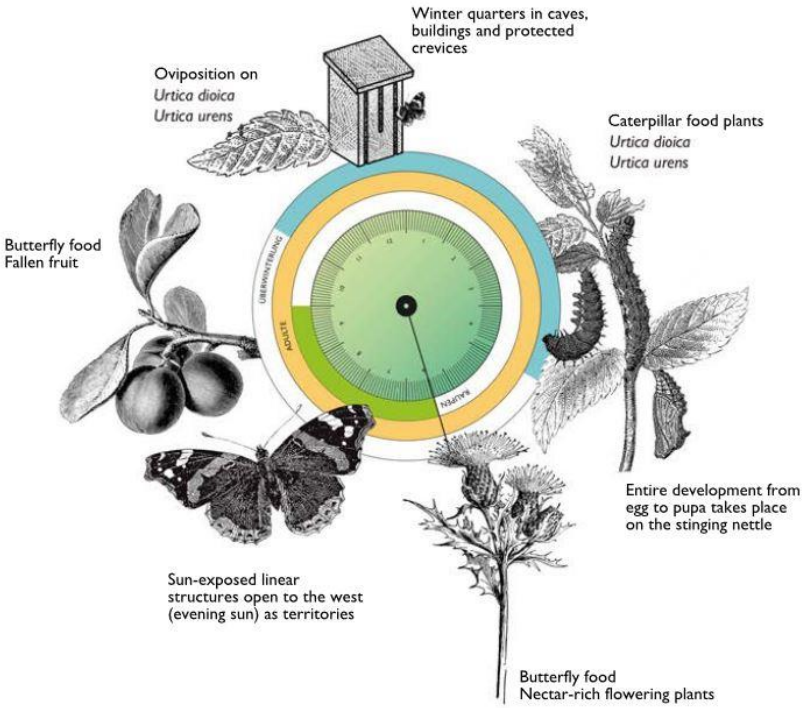

Fig. 2 Life cycle *Vanessa atlanta*, red admiral (AAD, Qinygu Liang)

INTEGRATING ECOLOGICAL MODELLING IN A 3D CAD SYSTEM FOR URBAN PLANNING AND FOR REGENERATIVE URBAN ECOSYSTEMS

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Human-induced climate change, pollution, urban heat islands and densification are having a drastic impact on metropolitan biodiversity, human health, and quality of life in our cities. Therefore, governments, municipalities and stakeholders are to develop new legal frameworks and regeneration strategies aimed at a greener and more diverse urban development. Such an approach asks for the consideration of the urban ecosystem, the architectural design, and the stakeholders in a unified process, requesting a more sustainable, resilient and holistic planning strategy. However, there is a knowledge gap between the form of a building envelope and its performance as an operational and integrated part of the urban ecosystem. The ECOLOPES project investigates which architectural form promotes biodiversity, biomass, and ecological performance in our cities. In contrast to conventional design approaches, where only human stakeholders define the necessities for urban development, ECOLOPES takes up a radical approach to regenerative urban ecosystem design by interestingly and holistically considering non-human (microbiota, plants, animals) stakeholders also. In this context, the paper presents a computational design framework which integrates an Ecological Model, developed by ecologists, as a key component within a 3D CAD system. Open geo-referenced datasets are used as input to simulate plant growth and the distribution of animals based on digital 3D models of building envelope design to a) gain knowledge about the correlations between ecological and architectural parameters, and b) to make this information available for design decision support. Our results demonstrate a successful integration of the developed Ecological Model in Grasshopper, a visual algorithm editor for Rhino, a standard 3D CAD software in AEC. As a parametric modelling tool, Grasshopper can manipulate geometry to generate multiple design solutions informed and analysed by the Ecological Model. The Ecological Model provides variables to define architectural and ecological performance indicators that facilitate multi-objective optimisation processes in Grasshopper to find the most appropriate design solution. In summary, ecological modelling has become an intrinsic part of a parametric and data/information-driven design process that considers the requirements of multiple species. The developed system is non-deterministic as it constantly generates knowledge which can be used for more effective design-decision support.

Keywords: ecological modelling in design, data-driven urban design, multi-species design, parametric modelling, computational design.

Acknowledgements: The ECOLOPES project has received funding from the European Union Horizon 2020 research and innovation programme FET Open under grant agreement No. 964414.

URBAN NATURE IN INTEGRATED CITY PLANNING – HOW DO WE SUPPORT MUNICIPAL PRACTICE IN GERMANY?

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The climate crisis and global biodiversity loss require novel approaches to urban planning as well as to green space design and management. New concepts related to urban nature such as green infrastructure, urban ecosystem services or nature-based solutions emphasize the value of natural elements in cities. Related knowledge products such as reports, guidance documents or digital apps developed by research, professional organizations or NGOs are usually envisioned to have a real-life impact and improve actual urban planning.

The on-going research project "Urban green infrastructure concretized – sample solutions and recommendations for action" identified about 80 research projects, 60 guidance documents and 25 digital data bases and toolboxes (from 2017 – 2021, mostly in German) that are supposed to inspire municipalities and other stakeholders to plan for and implement urban green infrastructure. However, for practitioners it is almost impossible to review and absorb the plethora of information. In addition, barriers for more ambitious and ecologically oriented urban greening are persistent such as lack of resources and personnel, thinking in silos, economically-driven decision-making or lack of political support.

Using Germany as example, we will first discuss the general challenges and opportunities of integrating natural elements in urban planning. We will build on experiences and discussion with stakeholders from the ongoing development of a digital Toolbox for urban green infrastructure planning, designed to support German municipalities in promoting urban biodiversity together with other benefits of urban nature. We will introduce three issues for more integrated planning with urban nature: (1) overcoming silos with green infrastructure planning, (2) co-governance as an avenue for integrating the diversity of urban stakeholders, and (3) transforming the built city with urban renewal projects. Finally, we will present how the Toolbox is conceptualized and supposed to support municipal planning in overcoming barriers. The Toolbox will include a "knowledge and tools" component that will provide brief information and point to selected guides on different dimensions of green infrastructure planning. The other component contains "good practice examples" that showcase what can be done to promote urban green infrastructure and how processes for doing so can be designed in an effective and novel ways, i.e. by creating new kinds of alliances or funding sources.

Keywords: urban nature, urban planning, urban green infrastructure, ecosystem services, nature-based solutions, co-creation, Germany

ATTITUDES OF CITIZENS TOWARDS WILD NATIVE FLOWER FLORAL MAT AS A LANDSCAPE ELEMENT IN JAPANESE URBAN COMMUNITY GARDENS

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In this paper we draw attention to the cross-section of two sustainable practices: 1) using perennial native herbs and flowers in urban greening, 2) community gardening in two case studies, where wildflowers were planted and grown in community gardens in Japan. We investigate the cases in terms of land managers' approach to assigning the role to native flowers in their gardens, flowers cultivation and perception in the landscape.

Planting occurred in 2017 as a result of a university-community collaboration project. The authors continuously observed and updated the gardens with local citizens throughout four years up to 2020. The data consists of two transcribed interviews of garden managers and numerous memos of casual conversations with the garden participants, as well as participatory observation.

To implement native flowers, we used a product of Nakada Nursery Co ltd., a so-called floral mat consisting of about 50 native species, blooming from spring to autumn. The implementation of native flowers in the community garden landscape allowed to research attitudes towards them in a qualitative manner.

Results: aged women show more interest in the native flowers compared to males and younger individuals. First, the garden manager and landowner were pleased with the floral mat, the flowers were blooming "unexpectedly, like gifts". In this privately-owned garden wildflowers were carefully cultivated and researched by the members, leading to increase in their knowledge.

After the implementation of wildflowers in the second garden by a female manager, another co-manager, male, said that he prefers "proper" flowers instead of wildflowers. Over four years this garden went through dramatic changes that led to the removal of native plants. Managers shared, that the garden's goal is to protect the area from littering and the small size makes native flowers look ineffective compared to horticultural species. It suggests that the use of native flowers may be difficult to implement in the small-scale landscape projects in Japanese neighbourhood settings. Factors like exposure of land to the public and an affiliation of managers with a certain culture may strongly affect the attitudes towards growing wildflowers.

This research investigates Japanese landscape beauty preferences and discusses implementing wildflower vegetation on the small, neighbourhood scale.

Keywords: community garden, wildflowers, native species, landscape perception, Japanese culture

Acknowledgments: We want to acknowledge the Iwase Neighbourhood Association for its support while doing this research.

ASTRO-TURFING THE CITY: EXPLORING THE ENVIRONMENTAL IMPACT AND SOCIAL DRIVERS OF ARTIFICIAL LAWNS

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Lawns are a major land cover in urban ecosystems, particularly in the Global North, where they can cover over 20% of urban area (Hedblom et al. 2017). Although the creation and maintenance of lawns can have harmful ecological impacts (e.g. through chemical application), they do provide a range of beneficial ecosystem services, especially relative to impermeable hard surfaces. In addition to cultural services such as recreation, lawns can mitigate flooding through rainwater infiltration, sequester carbon, moderate urban heat island effects, and provide habitat for biodiversity. Given these benefits, the current trend for replacing living lawns with artificial alternatives warrants urgent attention (Francis 2018). A growing desire for low-maintenance gardens and public green spaces has seen a rapid uptake in the installation of artificial lawns constructed from synthetic polymers (plastics). However, the scale of the uptake remains unquantified and the impacts on the provision of ecosystem services unknown. Here we present the results of an exploratory study that addressed the following research questions:

(1) Can remote sensing techniques be used to assess the current distribution of artificial grass, rate of expansion and loss of previous habitat?
(2) How do soil properties and soil health differ between artificial and living lawns?
(3) How does the provision of ecosystem services differ between artificial and living lawns (e.g., surface temperature, carbon storage, infiltration, pollutant retention)?
(4) What are the social drivers behind the installation of artificial lawns, and what are their maintenance requirements and societal impacts?

Preliminary results suggest that multispectral satellite data can be used to distinguish artificial grass from natural vegetation. Soil samples, clippings and field measurements were taken from private gardens and a local authority managed highways site in Newcastle upon Tyne, UK. Analyses of these data revealed differences in soil properties and ecosystem service provision between artificial lawns and natural surfaces. An online survey of householders who have installed artificial grass in the north-east of England is currently in progress and will help us to identify optimal strategies to help facilitate the transition towards more sustainable gardening practices.

Keywords: urban ecology, urban ecosystem services, remote sensing, synthetic grass, social drivers

Acknowledgments: This work was funded by the Northumbria University Application Seed Funding Scheme and a NERC Research Experience Placement. We thank Paul Hannon at Artificial Grass North-East for assistance with sampling and finding participants for the online survey. Sevi Modestou provided invaluable support with laboratory analyses. Finally, we thank Newcastle City Council and all householders who granted us permission to collect survey data.

THE IDEAS OF HYBRIDITY IN URBAN LANDSCAPES: LOOKING AT NATIVE AND NON-NATIVE BIODIVERSITY COMPONENTS THROUGH THE RESEARCH OF HONEY BEES IN WESTERN AUSTRALIA

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Australia has a high floristic richness and endemicity. More than 80% of its plant and animal species are endemic, with about 90% of vascular plants being endemic. The initial reason for using non-native plants in Australia's landscapes is mainly due to the absence of European native crops for European settlers for reasons of both taste and sentiment. Native biodiversity has been deeply affected by continuing land clearing, introduction of non-native species, further causing the environmental weeds invasion (more than 3,000 species since 1788), and climate change. In Australia, both honey bees and native bees play vital roles in providing ecosystem services to different types of landscapes by ensuring stable pollination for agriculture and other plant communities.

This debate and attitudes towards native vs non-native species have been carried on from the time of European settlement till now in Australia. This study seeks to understand the differences between "native landscape" and "urban landscape" in the eyes of landscape practitioners from Western Australia, and the grounds behind such discrepancies. It also aims to further explore the feasibility of keeping "hybrid" landscapes in Western Australia, focusing on both plant species and bee species.

This study conducts in-depth interviews with 15 landscape practitioners in Western Australia to collect their perceptions on "nature", "wilderness", and "urban biodiversity" in the context of Western Australia, as well as their views and applications on the use of native and exotic species in urban landscapes practices. This study also uses the interview results from 15 beekeepers. Perceptions on "honeybee and native pollinator competition", the importance of beekeeping for the public (targeting on human-nature relationship), pollinations and perspectives on exotic plants (targeting on the ecological values) are discussed, in order to support the argument.

Keywords: hybridity in urban landscapes, honeybee, native bees, Western Australia

TRANSLATING ECOLOGICAL KNOWLEDGE FOR URBAN DEVELOPERS THROUGH BIODIVERSITY SENSITIVE URBAN DESIGN (BSUD)

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Biodiverse cities are healthy cities, but how do we include provisions for nature in urban planning? Providing people with every-day access to biodiversity has multiple economic, health and wellbeing benefits, but creating space for nature in towns and cities can be complicated. Designing for biodiversity from the beginning of the urban development process helps ensure that key requirements for nature can be included synergistically while meeting other development needs. The Biodiversity Sensitive Urban Design (BSUD) framework provides a method for improving the inclusion of ecological knowledge within urban design. BSUD provides a set of five key principles to help developers and planners create urban areas that bring net benefit to both people and nature. The flexible framework can be applied across different development types and helps to translate ecological needs into urban design actions.

We are working with a range of industry partners to understand how the BSUD framework can best be mainstreamed into the urban development process. This work involves effective communication of ecological theory to the range of professions who collaborate on a development: e.g. developers, builders, urban planners and other local government officials. Co-creation of biodiversity objectives for a site could result in greater inclusion of biodiversity in the design of developments and improved uptake of BSUD recommendations.

To understand how this process facilitates a better apprehension of how biodiversity objectives align with those of a development we used online surveys to collect data before and after urban development professionals took part in stakeholder engagement workshops. Using a mixed effects modelling approach, we are able to show changes in understanding of, and attitude towards, urban biodiversity conservation. We explore ways to improve the potential success of this type of stakeholder engagement, particularly focussing on improving communication between urban ecologists, designers and planners.

Keywords: urban ecology, urban planning, social science, biodiversity conservation

Acknowledgments: This work is supported by a grant from The Ian Potter Foundation.

EMERGENCE OF HETEROGENOUS URBAN LANDSCAPE AND ITS EFFECTS ON THE BIODIERSITY OF WETLANDS: A CASE STUDY OF THREE CITIES IN CHINA

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This paper discusses the most common ecosystem types and urban green infrastructure – urban wetland. According to the current research results on urban wetland biodiversity, urban wetland type and patch structure are the key driving factors of biodiversity. However, the underlying ecological mechanism of the biodiversity-wetland relationship in highly urbanized areas is still unclear, especially the impact of urban wetland landscape heterogeneity on biodiversity. In this study, we investigated the effects of heterogeneous landscape formation on urban wetland biodiversity in northeast and central China. The results show that the rapid urbanization in China in recent years has led to drastic changes in land use patterns, which is the key driver of urban wetland ecosystem changes. The biodiversity of urban wetland is closely related to the composition of surrounding land use types. The protection and restoration of urban wetlands need to adjust the composition of surrounding land use types at different scales, and the first step is to increase the proportion of ecological restoration land. This paper provides new insights into the mechanisms and coping strategies of urbanization on biodiversity and provides scientific support for the view of maintaining and restoring urban wetlands to protect biodiversity.

Keywords: urban wetlands, land use patterns, habitat fragmentation, biodiversity, response and adaptation

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Abstracts

Session 7

Nature-based solutions and their multiple co-benefits linked to biodiversity aspects

URBAN WOODLAND AS A MITIGATION SOLUTION FOR THE IMPACT OF URBANISATION ON BIODIVERSITY AND ECOSYSTEM SERVICES IN A TROPICAL MEGA-CITY (THAILAND)

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The world is rapidly urbanising – contributing to massive loss of biodiversity and its associated ecosystem services. There is growing interest in increasing urban woodland to mitigate urbanisation's impact on biodiversity and improve the quality of urban environment. However, understanding is limited of how the magnitude of these benefits varies along the urbanisation gradient, and with woodland characteristics. This is especially true in the tropical regions which are projected to experience some of the highest urbanisation rates whilst also supporting most of the globe's biodiversity. We explore these questions using Bangkok (Thailand) as a Southeast Asian case-study of a rapidly urbanising tropical mega-city. We used random stratification to select 150 1-km cells across the urbanisation gradient. Tree and bird surveys were conducted at two locations within each cell; one at the centre of each randomly selected cell to represent typical conditions at that urbanisation level and another at the largest wooded patch within each cell to quantify the potential benefits of retaining woodland in urban landscapes. We estimated the contribution of urban trees to carbon storage, human food production (biomass of trees providing fruits for people), and economic value (assessed by regulations regarding the use of trees as collateral for financial loans). Our results indicated that retaining woodlands can moderate adverse impacts of urbanisation on avian species richness and human food production of urban trees and enhance tree species richness and their economic value, especially in highly urbanised locations – suggesting benefits of woodland retention increase as urbanisation intensifies. Lack of strong positive relationships between tree species richness and most of our focal ecosystem services (including supporting avian biodiversity) suggests that urban planners should pay attention to both biodiversity and ecosystem services as promoting one of them will not automatically gain in the other. Woodlands visited by fewer people support greatest avian biodiversity, whilst woodland size, tree species richness, and tree biomass only increase species richness of forest-dependent birds. Turnover in avian community composition between paired survey locations is mainly influenced by proximity of the randomised survey location to the nearest woodland suggesting wooded patches should be well distributed across the urban landscape to minimise effects of habitat isolation.

Keywords: nature-based solution, habitat restoration, habitat configuration, urban birds, food security

Acknowledgments: We thank Philip D. Round and (the late) Sontaya Manawattana for help with bird identification, Thaya Janjitikul and Wichai Aiyakool for help with tree identification, and (the late) Manit Jompang for information on the tree collateral scheme.

LISTENING TO THE COMMUNITY: IMPLICATIONS OF CULTURAL AND SOCIAL VALUES ON GOVERNING MEANINGFUL URBAN NATURE-BASED SOLUTIONS – AN AUSTRALIAN PERSPECTIVE

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The needs and expectations of communities towards their urban natural environments often vary, hence landscape management strategies can often be prone to fail in the absence of social and cultural considerations. It is incumbent on policymakers to investigate and attempt to reconcile diverse community perceptions toward the natural and built environment for more equitable governance. This is of particular interest when planning and managing nature-based solutions (NBS) for urban biodiversity protection. We have considered the challenge to understand human values, perceptions and behaviour in a multi-layered urban ecosystem that includes waterways, NBS, green open spaces, and built environment. This work investigated human perceptions and behaviour around a public urban park next to the Georges River in Sydney, Australia, utilising a proxy-based approach and a mixed-method comprising of community surveys, behavioural mapping, and semi-structured interviews with the local government officials. The results showed that while users perceive the significance of the urban blue-green environment differently, naturalistic (ecological), humanistic (recreational) and utilitarian (well-being) values are dominant. Green, public spaces are highly valued for recreational purposes, but there is a strong sense of environmental care in the community, with a high level of water literacy. It was observed that local NBS systems primarily designed for water management can address some users' important values (e.g., naturalistic), however, NBS systems may lack further delivery of humanistic and utilitarian values due to the poor integration with recreational and cultural spaces. It was also the case around Georges River, where low prominence of cultural features was observed, in favour of biodiversity elements (open water, greenery, local fauna, etc.). While the local government does show desire to adapt NBS practices to the local communities, there is a lack of expertise and guidance on such matters, as well as a disconnection between local ecosystem managers and communities. We concluded that NBS development around Georges River and other urban ecosystems should incorporate socio-cultural considerations and community values, finding a context-specific balance between biodiversity elements and community needs. The gaps between users' beliefs and behaviour do not greatly challenge governance, provided that the decision-makers utilise these gaps for optimising management actions.

Keywords: urban planning, blue-green ecosystem, urban biodiversity, public perception, co-benefits

Acknowledgments: We acknowledge the support from the Georges Riverkeeper organisation through a student project partnership with the University of New South Wales (UNSW), Sydney. We also acknowledge all the unnamed survey, interview, and behavioural mapping participants.

DESIGN AND MANAGEMENT OF NATURE-BASED SOLUTIONS IN URBAN PLAYS SETTINGS: FOR CO-EXISTENCE BETWEEN CHILDREN AND BIODIVERSITY

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Most children today live in urbanised settings in which the possibility to experience biodiversity is low. Yet, experiencing nature and other species increases children's health, wellbeing, learning abilities and the understanding of nature values. The aim of this study is to explore the possibilities (and limitations) of a co-existence between children and other species in nature-based play settings. We especially focus on the design and management by further developing the concept of play-biotopes. Play-biotopes are based on landscape ecology theories, where structures in the morphology of landscapes at different scales and the content of flora and fauna can support children's interplay with a piece of land. By observing children's behaviours (3 – 7 years) in an outdoor landscape lab (Alnarp in southern Sweden) we found that children of younger ages focus on minor affordances (e.g. branches, specific climbing trees, snails) in the landscape. We further co-created the landscape by micro managing the landscape laboratory (e.g. provide better climbing branches) between children's visits and observed changes. We here provided a number of different play-biotopes identified during developmental work in a landscape laboratory. We finalise by presenting and discussing these in relation to other types of tools and concepts used in environmental surveillance and the mapping and evaluation of children's outdoor environments.

Keywords: nature-based solutions, nature experience, play-biotopes, children outdoor environment, co-creation

INDIGENOUS KNOWLEDGE IN GREEN INFRASTRUCTURE, ETHICS FOR RESTORATIVE DESIGN AND CARE: A TYPOLOGICAL APPROACH

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Green Infrastructure (GI) has emerged as a predominant approach for designing and implementing diverse landscape intervention focused on delivering specific biophysical functions – such as stormwater runoff – or other forms of social utility such as improving aesthetics. GI interventions act within planning regimes built on the patriarchal mastery of nature, the domination of Mother Earth, and ecologically extractive economic systems; ultimately rooted in colonial ideas of property. If GI does not include indigenous' reciprocal relationships with land and their inseparable cosmos-visions, GI interventions will remain complicit with the dispossession, extraction, and oppression of indigenous lands, bodies, and knowledges. Here we argue there remains a need to grounding GI concepts in the inseparability of social relations and ethical engagements to land and more than human life, which in turn makes space for ideas of restorative, reciprocal, and relational design. By examining recent reviews of how the GI concept is employed globally, we identify the dominant framings of GI as an extractivist and techno-managerial approach – one that uses nature as infrastructure through the design and implementation of prototypes for stormwater runoff, heat mitigation and water quality, many of which fail to address humans' need for deep relationships with land and more than human life (e.g. relations of care) and justice beyond its geographical distribution. Then, by drawing upon numerous examples of indigenous people's ethical engagements with land that result from grounded cosmos-visions, governance systems, and dynamics of care, we provide examples of restorative design, just reparations, and decision-making processes, all of which fundamentally question colonial ideas of property. Drawing upon these global examples, we develop a Conceptual Ethical Framework for Indigenous Landscapes to responsibly understand Indigenous Knowledge (IK) in the context of GI, operationalized in a typological set. This framework provides a pathway for a non-authoritarian, non-dominating, and non-exploitative GI typological approach; allowing practitioners to bridge the architecture, urban design, and landscape architecture disciplines by focusing on fostering deep reciprocal relationships between land, humans, and more-than-humans. Through this framework, we aim to lay out a platform for decolonized just futures, and for the reconstitution, and revitalization of regenerative biocultural territorialities and resurgent forms of indigenous land governance, planning, and design.

Keywords: green infrastructure, indigenous knowledge, typologies, decolonization, indigenous justice

NATURE-BASED SOLUTIONS: HOW TO MITIGATE URBAN FLOOD RISKS AND CONSERVE BIODIVERSITY THROUGH THE CO-PARTICIPATORY PROCESSES – CASE STUDY JACAREÍ/SP, BRAZIL

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The present work provides the approaches of Nature-Based Solutions (NBS) as an alternative to avoid and mitigate flooding in cities susceptible to hydrometeorological risk. The main aim is to demonstrate how multilevel participatory actions can help create and implement in a practical way the co-benefits of NBS for socioeconomic and biodiversity aspects. Modern cities experience an apparent antagonism between the implementation of grey infrastructure as a cheap and efficient solution to reduce flood risks in cities, and NBS as a response, not only to reduce flood risks, but as an effective method, capable to generating urban infrastructure based on landscape planning and environmentally sustainable. It is argued that the NBS method is technically and economically more appropriate because it uses a combination of natural drainage and engineering strategies, and especially the participation of different stakeholders that structure the city. However, the NBS approach still faces sociocultural resistance, especially in countries like Brazil. The work has been applied on the case of Rio Comprido Basin in Jacareí/SP and its connection with the Ecological Corridor project. It was carried out through: i) comparative analysis of drainage models (Grey and NBS); ii) mapping and analysis of the watershed, drainage systems and flooding of the study area; iii) analysis and contextualization of NBS strategies presented by RECONECT; iv) identification, selection and engagement of stakeholders – a crucial methodological process adapted to the Brazilian reality. Preliminary results suggest that with the engagement of stakeholders it is possible to elaborate a wide list of potential solutions for the case study and the contribution to the Landscape Planning of the Municipality of Jacareí and the implementation of the Ecological Corridor and compliance with environmental legislation referring to areas of environmental preservation. On the other hand, the study showed that stakeholders can effectively contribute to the project NBS in the future.

Keywords: flood mitigation, hydrometeorological risk, nature-based solutions, co-benefits, stakeholders

Acknowledgments: Aeronautics Institute of Technology (ITA); National Council for Scientific and Technological Development (CNPq); RECONECT.

MEANINGFUL MONITORING: SUPPORTING URBAN GREEN SPACE PLANNING THROUGH REMOTE SENSING

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Remote sensing is a tool for cost-effective environmental analysis, providing spatio-temporal continuous monitoring data. It has potential to actively inform planning in cities and can provide valuable evidence in different stages along the policy cycle. When positioned in an interdisciplinary context, its information could serve as connector between professions and stakeholders in urban planning and management. We therefore analysed articles along the interface of remote sensing, ecology and planning regarding the degree of integration between the three disciplines and how the studies contribute to different stages of urban policy making on green spaces and biodiversity (Wellmann et al., 2020). We found that only 12% of the papers integrated ecology, remote sensing and planning while 24% of the papers used specific methods from one discipline only. Further, the vast majority of papers are contributing to the knowledge base. In turn, few papers are relevant for other planning phases like visioning, design or community involvement. To overcome these issues, we suggest three features for monitoring approaches seeking to contribute to applied urban green planning and explain them along a study (Wellmann et al., 2020):

- Go with the flow of the policy cycle: Design studies that are not only valuable as an information baseline but also in later stages of the policy cycle.
- Set into context: Social and ecological indicators need to be set in relation to each other.
- Open up information barriers: Web-apps and information dashboards can bring evidence to scientists, stakeholders and beyond.

Taking such routes remote sensing could become more vital for creating connections in green space and related biodiversity planning processes in cities.

Keywords: remote sensing, monitoring, decision support systems

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RESTORING URBAN ECOSYSTEM FUNCTIONS USING "NATURE-BASED SOLUTIONS" – PRODUCTS AND APPROACHES: A CASE STUDY FROM A BRAZILIAN SOUTHEASTERN REGION

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Urbanization is a process that brings several kinds of benefits but also prints several kinds of modifications. One aspect that chiefly suffers with such modification is the ecological aspect, in various manners. The focus of our study is the Sorocaba Municipality, which is the main municipality of the Sorocaba Metropolitan Region, Sao Paulo State, Brazil. Sorocaba municipality has 470 km^2 and 695,000 inhabitants (in 2021) – 85% living in the urban region. Historically Sorocaba consolidated its industrial aptness, but the environmental characteristics have been severely changed, usually degraded. The original vegetation was significantly suppressed, and the soil and water resources were polluted. Hence, it is a place that urgently demands actions and projects to restore at least part of the ecosystem functions, especially in the urbanized region. One way of re-establishing the ecological functions is to engineer solutions that favour the restoration of ecosystem processes. Hence, our goal has been to develop a set of solutions fundamented in the concept of "nature-based solutions", dedicated to restoring the problems above related. So, we have focused on the initiatives: (i) developing a product devoted to simultaneously mitigate the soil erosion and control the establishment of weeds (product named here as bioblanket), (ii) developing appropriate models of ecological roofs to retain part of the rainwater, alleviate the indoor temperature, favour the colonization of the roof by plants and permit the presence of animals, notably insects, and (iii) to engineer pieces made with pervious concrete for two kinds of applications: (iiia) use in streams and creeks to induce a partial accumulation of sediment and permit the colonization by pioneer plant species, (iiib) create pieces and ways of incentivisation of use pervious concrete in sidewalks and others public places. As a whole, we have been getting interesting results in terms of find ideal materials for manufacturing the bioblanket, as well as the shape and materials for the green roofs (based in the local features such as climate, available materials in commercial places, and costs), and to find the ideal proportion of the elements necessary for manufacturing a concrete with reliable resistance and adequate porosity.

Keywords: adaptation to climatic changes, biophilism, ecological restoration of urban sites, green-blue technologies

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IMPACT OF URBAN LANDSCAPE ON STORM WATER RUNOFF AND QUALITY WITHIN a SMALL RIVER OF MOSCOW CITY

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In 2020 and 2021 the city of Moscow, Russia, has experienced two historical rainfall events that is caused major flooding of small rivers. Based on long-term observation datasets from the surrounding weather stations, regional mesoscale COSMO-CLM climate model results, and a detailed hydrological and water quality monitoring data collected in 2019 – 2021, we performed pioneer climate change and urbanization impact assessment on flooding hazard and water quality of case study urban Setun river located entirely in Moscow. A statistically significant rise of moderate extremity indices and absence of significant trends for the most extreme indices was revealed for the 1966 – 2020 period. The combined impact of climate change and increased urbanization is highly non-linear and results in as much as a four-fold increase in extreme floods and a shift of water regime features which lead to the formation of specific seasonal flow patterns. The rainstorm flood wave catchment response, involving the infiltrated and hillslope-routed fractions of rainfall, is accounted as 6 – 11 hours, which is more than twice rapid as compared to the non-urbanized nearby catchments. The behaviour of four types of chemicals in the river water during rainstorms was identified, as well as main differences compared to the spring freshet period revealed. Based on the obtained results we conclude that the lack of research focused on the combined impacts of climate change and urbanization on flooding and water quality in the Moscow urban area is a key problem in water management advances.

Keywords: urban landscape, Moscow, water management, hydrological response

Abstracts

Session 8

Challenges and opportunities of urban biodiversity (e.g., ongoing climate change, the impact of the COVID-19 pandemic, other societal challenges)

PERSONAL GREEN SPACES DURING THE PANDEMIC – A STUDY OF PEOPLE'S ATTITUDES AND MOTIVATIONS TOWARDS URBAN HOME GARDENS DURING THE COVID-19 PANDEMIC IN BANGALORE, INDIA

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The COVID-19 pandemic has brought about unprecedented changes in a short span of time in many walks of life and people's living. Being in a lockdown, especially in urban areas, has led to changes in the way people perceive nature around them and within their homes. Scholarship provides limited urban ecological investigations in the cities of the Global South and even fewer from Indian cities. To begin to address this gap, in this exploratory study, we looked at how people perceived the changes they experienced in their home gardens and in the nature around their neighbourhood due to the lockdown in the Indian City of Bangalore. Data was collected by interviewing thirty home garden owners in the city over a period of two months between June and July 2021. We recorded various perceptions and motivations by the garden owners regarding the changes in nature around them and within their gardens during the lockdown. These perceptions were then grouped into four major themes as follows:

a) The perceived changes in nature around the participants' neighbourhood,
b) Changes in their gardens and gardening practices,
c) Personal changes associated with home gardens by the participants and their family members,
d) Challenges and concerns about the future of the domestic green space.

Participants had some similar and a few diverse perceptions for the above themes. A common observation was that most respondents felt, the lockdown had led to an increase in their curiosity and observation towards nature. Some respondents highlighted that their enthusiasm towards gardening had increased. Some participants also recognised the importance of home gardens as a safe outdoor space where they can enjoy nature. However, there were a few respondents who mentioned that they did not observe any imminent changes in the nature around them, due to the lockdown. While the lockdown has implications on a global scale, further research is needed to assess the changes at local scale to understand the impacts on people and nature.

Keywords: people's attitudes and motivations, urban home gardens, COVID-19, Bangalore, India

THE PANDEMIC HAS CHANGED SOME OF OUR ATTITUDES AND HABITS CONCERNING OUTDOOR ACTIVITIES AND ACCESS TO URBAN GREENERY. RESULTS FROM A CASE STUDY IN UPPSALA, SWEDEN

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This research is based on the results of the High Intensive Densification project (2019 – 2021) in Uppsala, Sweden. The aim was to evaluate how the ongoing pandemic (Coronavirus 19) impacted peoples' outdoor activities, attitudes and habits towards green spaces. We interviewed 80 people in two Uppsala neighbourhoods. The interviews were done in March, April, May, and June outdoors with people of different ages, genders and ethnicity. Despite the pandemic, people were willing to talk to us and shared a lot of their experiences and thoughts of life during the pandemic. 62 of the interviewed citizens had a strong opinion that the pandemic situation had a strong impact on their needs and habits and their access to nature and green spaces. Half of the interviews were performed in the nearby shopping centres and the other half in the nearby popular green areas. The results of this study confirmed that the pandemic impacted people's lifestyle and their attitudes toward nature and urban green spaces. Much more people (compared to pre-pandemic) are concerned about the densification of the city and as a result the loss of the green areas in the urban environment with negative consequences on health and lifestyle. The results from the interviews show also that many people have discovered how humans are vulnerable and sensitive to pandemic situations. People started to appreciate nature much more than before the pandemic. Urban dwellers clearly expressed the need for more green spaces in our cities.

Keywords: densification, people's attitudes toward nature and urban green spaces, pandemic

COASTAL CONURBATION EXPANSION THREATENS FOREDUNE PERSISTENCE: OPPORTUNITIES FOR RE-CONNECTION OF CITIES AND CITIZENS WITH REMNANT ECOSYSTEMS

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Coastal urbanization is provoking habitat loss and fragmentation, challenging the integration of nature into the urban neighbourhood and to achieve a human–nature balance. Remnant habitats in urban areas can be especially prone to degradation by human activities at short time scales, and poor planning during urban expansion can erode their spatial and functional connectivity. Foredunes in particular are threatened significantly by coastal urban infrastructure expansion, by bulldozing them and/or by interrupting their continuity across the shoreline, and also by associated artificial light pollution. Few urban plans are aiming to tied people living in cities to dune habitat, and thus to preserve the services they supply to cities. Concurrently, there is still scarce information about how urban processes modify remnant habitat extent and spatial connectivity in coastal urban settings. Using an expanding coastal conurbation located in north-central Chile (~ 29°S) as model system, we investigated the rate of coastal foredune loss and spatial fragmentation due to urban expansion, and the change in the type of spatial connectivity, i.e. with other natural habitats vs. with urban infrastructure. Based on detailed map analyses, we estimated changes in foredune habitat extent and fragmentation and their shared border with other habitats and built infrastructure during two-time intervals, 2010 – 2015 and 2015 – 2020. Spatial distribution of the intensity of light pollution present on foredunes was also mapped along the coastal conurbation. We found a persistent decline in foredune area and increase in their connectivity with urban hard infrastructure. Urban wetlands and parallel dunes also experienced persistent area loss and change in connectivity. Light pollution was intense in the foredune-beach ecotone, suggesting significant effects on floral and faunal components. Given the rapid erosion of connectivity of natural habitats, it will be critical to build more effective protection policies aiming to conserve the network of urban remnant habitats, their boundaries or ecotones and improving natural corridors in urban settings. Re-connection of people with nature through participative engagement in local rehabilitation plans can also aid to improve citizens' livelihood and to build more sustainable coastal cities in the future.

Keywords: coastal landscapes, conurbation, connectivity, dunes, urban corridors

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WHAT INFLUENCES SHIFTS IN URBAN NATURE SITE VISITATION DURING COVID-19? A CASE STUDY IN TEL AVIV-YAFO, ISRAEL

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Urban nature sites are crucial places for the promotion of human health and well-being during the COVID-19 pandemic, but there are few interdisciplinary studies that simultaneously investigate the impact of a range of social and environmental factors on potential shifts in urban nature site visitation. We sought to do this by analysing both geospatial data of the amenities and environmental features of urban nature sites with a web-based survey of urban nature site visitation in Tel Aviv-Yafo, Israel. We found that 53% of the surveyed participants decreased visitation during the pandemic, while 26% increased visitation, 21% had no change, and only 1.7% were first-time visitors of urban nature sites. We developed a multiple linear regression model for shifts in visitation frequency during the pandemic, and found that a relative increase in visitation was positively associated with higher ratings of the physical and mental health contribution of the urban nature sites, higher nature maintenance and accessibility ratings, and visiting with a spouse, but negatively associated with variables such as car transportation, visit length, shrub habitat, age, and visiting alone or for romantic dates. Our results suggest that the perceived health benefits and accessibility of urban nature sites could be key in motivating visitation during the pandemic more than the specific environmental features or amenities of these sites. Given the on-going threats of the pandemic and other environmental crises, it is imperative to continue supporting the creation, maintenance, and monitoring of urban nature sites for not only urban ecosystems and biodiversity, but also so that they can contribute to the health of all urban residents.

Keywords: urban nature, outdoor recreation, COVID-19, greenspace accessibility, health and well-being

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CONCEPTUAL DESIGN OF ORIENTATION VALUES FOR URBAN GREEN IN GERMANY

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Urban development is challenged in many forms, e.g. densification of the built environment, climate crisis, pandemics and loss of biodiversity. Urban green spaces and trees offer beneficial ecosystem services essential for urban dwellers and can address these issues as a nature-based solution. In planning practice, indicators and orientation values help as quantitative standards to safeguard urban green infrastructure (UGI) functions. Furthermore, such orientation values serve as an argumentation aid for decision-making processes. Mostly, existing indicators and orientation values for urban green are recreation-oriented and lack the consideration of new requirements of urban development, such as climate crisis and global biodiversity loss.

To update existing indicators and orientation values, literature research and interviews with representatives from the planning administration of several German cities and further experts were performed in the on-going research project “Capturing, protecting, developing urban nature: orientation values and parameters for public green spaces”. A participatory research design allowed consultation with the experts for open space planning, landscape architecture, and nature conservation as well as stakeholders of UGI-related administration. As a result, a conceptual design of a multi-set of indicators and matching orientation values was developed, complementing biodiversity, climate adaptation and environmental justice with recreational function. Using the case of Germany as an example, we will discuss the design of indicators and orientation values for urban green infrastructure with a strong focus on application: (1) safeguarding the capacity to contribute to city-wide services of urban green, criteria for each green (e.g. park) element were defined. (2) Further, it was decided to only consider public green for reasons of regulation. In order to yet consider non-public elements of urban green infrastructure, (3) the inclusion of area-wide urban structure types improves the model and ensures that the function of urban green space for the city as a whole remains in focus.

The conceptual design of indicators and orientation values aims to implement a reliable and applicable model that describes the quantitative and qualitative characteristics of UGI.

Keywords: urban green spaces, urban green infrastructure, urban trees, orientation values, indicators

COVID-19 PANDEMIC IN MOSCOW: RETHINKING THE ROLE OF NATURE FOR URBAN DESIGN, SUSTAINABILITY AND RESILIENCE

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The COVID-19 pandemic has affected many areas of human life, including human-nature interaction and use of urban green spaces (UGS) providing multiple ecosystem services being valuable for human health and well-being. The post-pandemic challenge is not only to preserve the remaining nature in the city but to ensure that all citizen groups have equal access to UGS. Our research aims to:

a) identify the factors attracting visitors to UGS (its value, perception, types of relationships, etc.) to explore how existing UGS catered to the citizens' needs during COVID-19 and
b) assess which landscape design is needed to address these challenges.

A comprehensive study was conducted in Moscow (Russia), using an online questionnaire survey during the first wave of the COVID-19 pandemic (April – July 2020). It was continued with observations of additional limiting measures in UGS, a content analysis of documents and interviews, and an analysis of UGS accessibility using GIS mapping. Our results revealed that citizens value urban nature mostly for the possibility to breath fresh air and enjoy nature and for stress reduction. At the same time, access to UGS in Moscow is unequal across urban districts, corresponding with their social and economic characteristics. The respondents proposed pocket parks and gardens, shady places, native vegetation and street plantings as important for the future development of UGS. This highlights the need to facilitate the integration of UGS of various designs and sizes within and around Moscow into urban development so that all residents have access to UGS during a crisis such as COVID-19. It also underlines the importance of rethinking planning and design standards, including contemporary features and elements. The proposed implications go beyond a simple interpretation of urban planning policy as a tool for pro-economic development or pro-environmental sustainability to a more nuanced assessment of decision-making that responds to the needs of a diverse urban society and multifunctionality of UGS.

Keywords: green infrastructure, urban green space, human-nature relations, COVID-19 pandemic, green recovery in a (post) COVID world

RESTORATION OF SATOYAMA AND BIODIVERSITY CONSERVATION THROUGH CITIZENS' ACTIVITIES IN THE URBAN AREA OF KYOTO CITY

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Yoshida-yama (approx. 14 ha), located in Kyoto City, is a small hilly area isolated northeast of the urban area at an elevation of approximately 100 m above sea level that extends to the precincts of Yoshida Shrine and other areas. As an urban satoyama that supports the lives of local residents, it has been used for resources such as firewood and firewood bushes and is a popular place for cherry blossom viewing in spring, autumn foliage viewing in fall, and matsutake mushroom picking. In 2010, a citizen's organization involving local residents, shrines, businesses, universities, and other diverse entities began activities to restore the abandoned satoyama. Specifically, the activities include supplemental cutting and replanting to promote the renewal of dominant species such as konara oak, the main tree species in the satoyama. They are also working to revitalize the satoyama as a famous site for yamazakura (mountain cherry), to maintain shrubs and forest floor plants such as mochitsutsuji (azalea) so that they receive sufficient light, and to maintain the area around walking trails. The Kyoto Wood Stove Association and local Boy Scouts have joined the project to use the wood from the maintenance as firewood, and programs are now being planned to provide environmental education for children. Through these activities, the appeal and value of Mt. Yoshida as a place of worship, a place for the sustainable use of local resources, a place to enjoy the seasonal satoyama scenery, and a place to view the surrounding townscape and traditional events are being reevaluated. In this report, we examine the role of Yoshida-yama, an urban satoyama, in the preservation of biodiversity, based on an understanding of its vegetation and the characteristics of citizens' activities.

Keywords: satoyama, biodiversity, nature restoration, citizens' activities, Kyoto

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LAND USE AND BIOCULTURAL DIVERSITY IN THE SCENIC AREA OF ARASHIYAMA IN KYOTO, JAPAN

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The Arashiyama area has been a representative urban and suburban scenic area of Kyoto, the ancient capital of Japan. Arashiyama became a villa area for aristocrats in the Heian period (794 – 1185) and has been designated as a national scenic beauty spot since the 1920s. The formation of Arashiyama's unique landscape is said to have given rise to and developed various cultures while benefiting from biodiversity. To continue to preserve the landscape of Arashiyama, it is considered necessary to conserve the biocultural diversity of the area and identify its challenges. In this study, to characterize the biodiversity of Arashiyama, the vegetation community status of Arashiyama was determined using land use maps and vegetation maps. To identify the characteristics of cultural diversity, interviews and fieldworks were conducted with residents (commercial operators / general residents, former residents / migrants) to understand the actual situation of traditional Arashiyama events and related natural resource use. Then, to understand the cultural landscape that people felt was unique to Arashiyama elements were ascertained. As a result, the Arashiyama area contains not only natural landscapes such as forests, rivers, parks, and bamboo forests, but also many cultural landscape elements related to the lives and beliefs of residents, such as shrines and temples, residential areas and shopping streets. However, with urbanization, tourism, and the aging of the population, forests are becoming degraded, and farmland abandoned, and the procurement of natural resources to maintain traditional events is becoming an issue.

Keywords: biocultural diversity, landscape, land use, traditional culture, Arashiyama

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100KTREES

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Most of us live in cities, even though cities are not the healthiest places due to poor air quality, noisy surroundings and lack of recreational spaces. Many cities have few green areas and consist of too much "concrete jungle" which makes for a harsh environment for all living species. With the changing climate, the weather is expected to become more extreme. This phenomenon known as the urban heat islands, which will be even more profound, with heatwaves expected to increase three to ten-fold by 2080[1] depending on the climate scenario. A way of tackling all these issues, is to plant more trees within the urban fabric – a well-recognised and relatively cheap and efficient measure for cities to adapt to future climatic challenges.

In view of this, the ambition of 100KTREEs is to make cities a better and healthier place to live by encouraging municipalities to plant more trees and to optimise the impact of tree planting. The team will support cities by mapping the existing trees and by showing a solid business case for planting new trees, as well as attracting third party sponsorship to make it happen. We need to plant trees now to allow our children to enjoy their shade in 20 years' time.

100KTREEs will develop a mapping and modelling toolbox to optimise the planting of trees and to monitor the health of the trees, based on Copernicus and in-situ data. By assigning monetary value to the key attributes of a tree, e.g., pollution absorption, cooling effect, noise abatement, flood risk reduction and increased biodiversity, a number of business cases will be developed for our two partner cities, Copenhagen and Sofia. Such business cases will also be used to attract third party financing. By means of a crowd science app we will engage with citizens and create awareness of the wonders of trees, also extending to improved life quality and mental health impacts.

Keywords: cities, planting trees, mapping and modelling toolbox

[1] https://www.adapt2climate.be/wp-content/uploads/2020/09/SECLIM-BE-2020_FinalReport.pdf

ACCESS AND MANAGEMENT OF GREEN AREAS DURING THE COVID-19 PANDEMIC: SOCIO-ECOLOGICAL GAPS IN SOCIETY AND PARTICIPATION IN CONSERVATION

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Green areas supply various ecosystem services based on biodiversity. In the context of Monsoon Asian cities, Satoyama landscapes composed of different types of land use categories such as residential area and paddy fields provide ecosystem services which largely depend on biodiversity. During the COVID-19 pandemic, citizens were not able to access green areas as before. The negative impacts of the restriction on green area access were detected in the mental and physical health of citizens and communities. Existing studies identified the status of green area access in the different regions of the world. In those studies, the influence of socio-economic status and environmental factors were analysed. For example, citizens with higher household income tended to visit green areas during the COVID-19 state of emergency in Japan. Existence of forestlands near residential areas could facilitate visiting the forestlands. In this new circumstance, it seems that socio-ecological gaps in society in terms of acknowledgement of ecosystem services are becoming wider. If citizens with certain socio-economic status are paying attention to ecosystem services and the others are not, urban ecosystem and biodiversity conservation is more challenging. To identify such situation, we conducted a survey in a Japanese prefecture as a case study. In concrete terms, we analysed the relationships between socio-economic status and environmental factors as well as awareness of citizens and their motivations for conservation activities. In our previous studies on green area access, we identified impacts of socio-ecological gaps on green area access. In the process of the analysis, citizens' groups based on socio-economic status and environmental factors were detected. This study uses the groups to analyse their different awareness of and motivations for conservation activities. It reveals that each group has different characteristics in terms of participation in conservation. Although several groups were similarly active in the activities, their motivations for the participations and knowledge on rare species differ among the groups. Based on the results of this study, efficient and effective communication methods can be developed to facilitate their participation in conservation and to avoid miscommunications among them. The collaborations between citizens with different backgrounds are essential for sustainable biodiversity conservation and urban environmental management.

Keywords: green area, socio-ecological gap, participatory management, rare species, Satoyama

ENVIRONMENTAL AND SOCIAL IMPACTS OF THE COVID-19 PANDEMIC AND THE ROLE OF URBAN GREEN INFRASTRUCTURE FOR CITY RECOVERY IN ALMATY, REPUBLIC OF KAZAKHSTAN

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The present study focuses on the social and environmental situation in the city of Almaty of the Republic of Kazakhstan in terms of the COVID-19 pandemic. The rapid march of the coronavirus infection has brought considerable global attention to the issue. Over the short term, the coronavirus infection has caused considerable damage to the socio-economic development of all states. But at the same time, the pandemic has led to a change in the environmental situation in the world. Consideration of the socio-ecological situation during the pandemic made it possible to identify its consequences for the population, attitudes towards environmental problems and the role of the city's green infrastructure. As a result of the study, it was revealed that the improvement of the environmental situation during the pandemic was of a short-term nature: a decrease in the concentrations of the main pollutants was observed in the spring-summer period, which was due to the introduction of quarantine measures, the implementation of the gasification project for the private sector and public transport. In the following months, there was a gradual return to "pre-COVID" values, which was associated with an increase in the energy consumption of citizens as a result of the active use of gadgets, which increased the consumption of fuel burned. In addition, the pandemic caused a deterioration in the socio-economic development of the city: overall mortality increased by 14%; GRP decreased due to the suspension of production activities; the unemployment rate rose by 0.1%. As a result of a sociological survey, the authors found that the pandemic increased the interest of citizens in the environmental situation, and also increased the degree of littering in the city as a whole (due to an increase in the amount of medical waste of classes B and C, as well as an increase in packaging waste as a result of the widespread distribution of delivery services) but also in urban parks that were in high demand during the quarantine period, which caused an increase in the anthropogenic load on the green frame of the city.

Keywords: COVID-19 pandemic, coronavirus infection, environmental and social impacts, atmospheric air, medical waste

Abstracts

Session 9

Special session of UFZ “Resilient Cities Platform”: Blue-green infrastructures and nature-based solutions for resilient cities

SPECIAL SESSION ON BLUE-GREEN INFRASTRUCTURES AND NATURE-BASED SOLUTIONS FOR RESILIENT CITIES

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The protection and promotion of biodiversity have been on the public and political agenda in cities for years. Blue-green infrastructure (BGI) and related nature-based solutions (NBS) can and must make a decisive contribution to this crucial issue. Beyond, they contribute to making cities more resilient, and cope with climate change, such as sponge city concepts or retention areas for flood protection, or green spaces and forests for microclimate regulation and heat stress. Quite different approaches and concepts are being pursued in cities. This session will use examples to show how these goals can be achieved. A focus will also be on highlighting conflicting goals, trade-offs and dilemmas.

By providing the insights from the "Transformations towards resilient cities" Platform Project PP 6.4, this session will bring together different approaches for a better understanding of the benefits of BGI in urban areas. Structural biodiversity supports the benefits we can extract from BGI for urban ecosystem services through meadows, scrubland, and trees. As green spaces are important components of BGI, their composition, quality and accessibility are essential for a better quality of life for urban residents. A rather recent approach to make cities greener is to develop more green façades for houses. It is important to understand residents' perception of such a BGI instrument to figure out their support for such a greening strategy. Insights from Paris demonstrate how to achieve a biodiversity-led design. NBS for urban water infrastructure can increase resilience to extreme events in urban neighbourhoods, demonstrating a variety of co-creation strategies and transdisciplinary partnership for NBS design in urban and non-urban spaces.

Keywords: blue-green infrastructures, urban resilience, nature-based solutions, ecosystem services, benefits, transdisciplinary approach.

STRUCTURAL BIODIVERSITY IN LEIPZIG AND ITS IMPACT ON MULTIPLE ECOSYSTEM SERVICES

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To safeguard the well-being of urban dwellers, it is vital to restore, protect and enhance urban green infrastructures (UGI), their related ecosystem services (ES) and the associated benefits for a large number of inhabitants. This study maps and monitors land cover between 2012 and 2018 in the fast-growing German city of Leipzig. We pay special attention to UGI by delineating structural biodiversity for both time steps regarding lawn and meadow, shrubs and young trees (< 5 m), and increments in mature trees (> 5 m). The location, quantity and coverage of urban trees are important factors to help estimate the enhanced environmental quality – such as cooling, shading, carbon sink, etc. – provided by ES in residential areas. For this reason, we undertake a distinct tree cover monitoring by height differentiation to derive a site-specific knowledge on the structure of tree height and their crowns.

As a result, we illustrate variations in the provision of ES and render visible disparities in the accessibility of UGI in Leipzig. By analysing the number and stands of trees and their respective height development in detailed increments, the study confirms that intensive management is successfully rejuvenating the urban forest, but also that foliage in this forest is suffering from drought. The mapping procedure reveals a high spatial and temporal variation in the rates of carbon storage. This is also the case for the provision of recreation areas which has an impact on the equitable distribution of ES to Leipzig's inhabitants.

This study is related to the journal publication by Elze and Banzhaf, *UFUG*, 2022; doi.org/10.1016/j.ufug.2022.127616

Keywords: urban green infrastructures, structural biodiversity, ecosystem services, benefits, Leipzig

FROM LANDSCAPE DESIGN TO BIODIVERSITY-LED DESIGN: INSIGHTS FROM THE PARIS REGION

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In urban areas, nature-based solutions (NBS) are often confused with traditional landscape design with the assumption that NBS will automatically support biodiversity conservation goals by virtue of being green (Connop et al., 2019). Many NBS projects actually refer to urban “greenery” and focus on a few aspects (aesthetics, stormwater management) rather than an integrated approach based on science in ecology. In France, this kind of greening developed under the influence of formal landscaping whose legacy has been a highly controlled ornamental approach to nature focusing mainly on plants and ignoring other species as well as ecological functionality. However, cities are gaining interest in urban ecology and are moving from traditional landscape approaches to more biodiversity-centered approaches of planning and design.

As part of the REGREEN project, this presentation will present several initiatives in the Paris region and in France where biodiversity is addressed through NBS (see further details at https://www.regreen-project.eu/urban-living-lab/paris/).

Keywords: nature-based solutions, biodiversity-led design, ecological functionality, Paris region

POLITICAL-LEGAL CHALLENGES OF THE BLUE-GREEN TRANSFORMATION OF URBAN WATER INFRASTRUCTURE

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Blue-green urban development aims to adapt urban areas to the climate-induced increase in weather extremes, i.e. to increasing heavy rainfall on the one hand and more severe drought on the other. It is recognized among experts that a high level of (urban infrastructural) resilience to these opposing extremes can only be achieved by transforming urban drainage towards a decentralized management of precipitation water according to the model of the "sponge city" or "blue-green urban development". The aim of this presentation is to provide a more detailed picture of what the relevant political-legal framework conditions in Germany are and where the main obstacles to blue-green urban development lie within them. To this end, we first present the BMBF research project "Leipzig Blue-Green" and discuss the results of an actor survey that we conducted in the form of semi-standardized interviews. The survey covers the relevant urban and private actors of the Leipzig model project (Eutritzscher Bahnhof; engl. former heavy goods train station) and representatives of the administration of selected other cities and the higher political levels. The evaluation of the interviews for this paper focuses on the "status quo" (https://www.ufz.de/index.php?en=43948).

Keywords: urban resilience, blue-green transformation, sponge city, urban water infrastructure, political challenges

RESIDENTS' PERCEPTION OF GREEN FAÇADES – KEY FOR URBAN RESILIENCE OR JUST "NICE TO HAVE"?

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Green façades have been discussed widely as part of the urban green infrastructure to improve the resilience of urban systems against heat and other environmental stressors. The sluggish adoption of façade greening in German cities is often justified by the allegedly low acceptance among residents. We investigate the perception of green façades by tenants in greened and conventional buildings in Leipzig, Germany. We find that the overall acceptance of green façades is very high in both groups. The perceived most important positive and negative aspects of façade greening, however, differ: Residents of greened buildings value the effects of in- and outdoor cooling as well as air quality improvements significantly higher than those without green façades, wo rate more general aspects such as aesthetics and climate change mitigation higher. While the latter are worried about high costs of façade greening, this is not conformed by those that already have them installed. They are instead concerned about specific maintenance issues. Our results show that people who already live in greened buildings show particular appreciation for their resilience effects against urban heat and related stressors. Their critique should not be misunderstood as general rejection of green façades, but as valuable input on concrete challenges (see project "Living Walls" at https://www.ufz.de/index.php?en=48592).

Keywords: green façades, urban green infrastructure, resilience, heat, environmental stressors

HIGH RESOLUTION MAPPING OF URBAN GREEN SPACE COMPOSITION, QUALITY AND ACCESSIBILITY. A CASE STUDY OF AARHUS, DENMARK

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The focus of this presentation will be on sub-meter land cover mapping based on publicly available digital orthophoto data, embedded in a semi-automated processing chain with object-based image analysis. Its outcome serves as basis to analyse in more detail the composition of urban green spaces (UGS), and especially adds to the variable of green infrastructure on private grounds. The findings of this study are in line with others in this field, suggesting that private gardens make up a great part of the overall UGS and contribute to the overall vegetation coverage of a given urban region.

As most supranational, national and regional development plans emphasise the accessibility of UGS to residents, our study focuses on the effect of:

1) the scale when using high resolution mapping,
2) how accessibility shapes the distribution of UGS and
3) what quality and compositions different UGS actually provide in terms of structural biodiversity, e.g. the ratio of trees, shrubs and open lawns.

Our study thus assesses whether goals such as UGS per capita and access to UGS of a certain size within a certain distance are met and if one is to consider private gardens, their size and the thus corrected demand of residents for public UGS.

The research is embedded within the EU project REGREEN – Fostering nature-based solutions for smart, green and healthy urban transitions in Europe and China. The proposed framework will be subsequently applied to other urban living labs within the project.

Keywords: high-resolution mapping, urban green space, green and healthy urban transition, Aarhus

CO-CREATION OF NATURE-BASED SOLUTIONS IN URBAN AND NATURAL AREAS TOWARDS SUSTAINABLE DEVELOPMENT AND RESILIENCE: RESULTS FROM RECONECT PROJECT

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Nature-based solutions as part of the blue-green infrastructure (BGI) are based on a number of different principles, including networking, multifunctionality, multiple benefits as outcomes and the possibility of supplementing or (partially) replacing technical infrastructure. From their origin, NBS are also understood as participatory and cooperative planning, in that the broad spectrum of state and non-state actors are actively involved in the planning, co-design and implementation of NBS (known as a process of co-creation) as the essential elements of BGI. These participatory approaches involve various disciplines and interest groups and promote civil society engagement. Various co-creation strategies are presented and analysed, which demonstrate participatory approaches and transdisciplinary partnership for NBS design in urban and non-urban spaces. These were developed and researched against the background of hydro-meteorological risk reduction using nature-based solutions as part of the RECONECT research project (www.reconect.eu). In addition, various aspects, forms of cooperation and co-benefits of co-creation will be shown and discussed, as well as the step-by-step realization of the whole participation procedure to consider the heterogeneity of societies and to generate participation in response to social trends and social challenges. Barriers to the participatory design and implementation of NBS are also critically reflected. The results from the different case regions confirm that co-creation and broad participation makes available the knowledge of residents about their places of residence and helps to identify their needs and promote regional identity.

Keywords: co-creation, nature-based solutions, participatory methods, hydro-meteorological risk, resilience

Acknowledgments: The RECONECT (Regenarating ECOsystems with Nature-based solutions for hydro-meteorological risk rEduCTion) project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 776866.

PODIUM DISCUSSION

RESEARCHING AND CO-DESIGNING GREEN CITIES – SETUP, EXPERIENCES AND CHALLENGES OF UGBI INTERDISCIPLINARY AND TRANSDISCIPLINARY RESEARCH AT UFZ

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Research on urban blue-green infrastructure (UGBI) at the Helmholtz-Centre for Environmental Research – UFZ has a long tradition and includes a large variety of research strands, topics and project settings. It is characterized by a high degree of interdisciplinarity and transdisciplinarity. Interdisciplinarity means a close cooperation between natural and social science disciplines making UGBI research at UFZ extremely comprehensive and broad in terms of approaches and methods used as well as types of outcomes produced. Transdisciplinarity means an in-depth cooperation through participation with policy- and decision-makers as well as stakeholders from different spheres of urban development. In addition to research projects, co-creation approaches as well as real world lab/urban living lab approaches are being applied demonstrating the role of different actors in the green transition of the cities. Research covers different geographical destinations and different spatial scales reaching from local to global providing the opportunity to discover the role of various local backgrounds in identifying context specific solutions appropriate to the locally available resources, knowledge, networks, and institutional frameworks. Here, the city of Leipzig serves as a long-term local living lab where many strands and expertise come together.

With this panel, we offer a moderated podium exchange and discussion on: a) how we research UGBI functions, design, implementation, and management at UFZ using an inter- and transdisciplinary manner, b) why we decided for such an approach, and we share our experiences on the outcomes, benefits and challenges. The discussion will be fuelled by short inputs of four podium participants representing different disciplines, experience and perspectives on UGBI research. Two rounds of exchange will follow the inputs. The first one will be held among the podium participants, the second one will be opened up to the audience.

Podium:

1) Urban biodiversity research perspective – Sonja Knapp, Department of Community Ecology, UFZ
2) Co-designing NBS for urban areas: co-creation and participatory research perspective – Diana Dushkova, Department of Urban and Environmental Sociology, UFZ
3) Urban green and social science perspective – Anika Schmidt, Department of Urban and Environmental Sociology, UFZ
4) Municipality perspective – Constantin Suppee, Office of green space and water, City of Leipzig
5) Citizen and civil society environmental organizations' perspective – Christiane Heinichen, Ökolöwe – Umweltbund Leipzig

Moderation: Annegret Haase

Keywords: transdisciplinary approach, interdisciplinary approach

Abstracts

POSTER SESSION

CHALLENGING THE SUSTAINABILITY OF URBAN BEEKEEPING USING EVIDENCE FROM SWISS CITIES

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Urban beekeeping is booming, heightening awareness of pollinator importance but also raising concerns that its fast growth might exceed existing resources and negatively impact urban biodiversity. To evaluate the magnitude of urban beekeeping growth and its sustainability, we analysed data on beehives and available resources in 14 Swiss cities in 2012 – 2018 and modelled the sustainability of urban beekeeping under different scenarios of available floral resources and existing carrying capacities. We found large increases in hives numbers across all cities from 3139 hives in total in 2012 to 6370 in total in 2018 and observed that available resources are insufficient to maintain present densities of beehives, which currently are unsustainable.

Keywords: urban bee keeping, awareness raising, biodiversity, capacity, sustainability, Switzerland

GETTING TO KNOW THE URBAN BIODIVERSITY OF THE METROPOLITAN REGION OF SÃO PAULO (BRAZIL): DATA FROM AN EDUCATION PROJECT

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The Metropolitan Region of São Paulo (Brazil), with 39 municipalities, is the largest in South America. It presents native fauna and flora that managed to adapt to its transformations and species that were introduced by the cultural, aesthetic and ecological values. Thus, their knowledge is fundamental for planning and management actions. Between 2010 and 2020, fieldwork has been carried out, in urban areas, by students of the Biogeography discipline, from the Bachelor's Degree in Geography/University of São Paulo. Its purpose is to train the observation and identification of animal and plant species found in urban areas and their mapping using tools such as Google Maps/Google Earth/SIGs. The data collected by the students are reviewed, generating a database and mapping of the biodiversity. In the 11 years of the educational project (2010 to 2020), 571 students identified and recorded 266 species of annelids, molluscs, fish, crustaceans, centipedes, millipedes, arachnids, insects, amphibians, reptiles, birds and mammals of the urban fauna of the Metropolitan Region of São Paulo. The largest number of species found was birds, followed by insects, mammals, reptiles, arachnids, amphibians, molluscs, fish, crustaceans, annelids, centipedes and millipedes. Of the total found, 29% of the animal species are exotic, coming from different parts of the world, and 71% are Brazilian species from different parts of Brazil. As for the urban flora, in this educational project, 202 species of trees and palms were identified, distributed in 58 botanical families, and of this total of plant species, 69% are exotic, from various parts of the world, and 31% are species exclusively Brazilian, from various domains, ecosystems and natural regions, including the Atlantic Domain. The six families with the highest number of tree and palm species found were *Leguminosae* (37 species), *Arecaceae* (26), *Moraceae* (14), *Myrtaceae* (14), *Malvaceae* (9) and *Bignoniaceae* (8). A better understanding of urban ecology is essential for efficient wildlife conservation in modern man-made environments. The first step to increase this knowledge is to identify the species of urban fauna and flora and map their location in different urban landscapes.

Keywords: Metropolitan Region of São Paulo (Brazil), urban fauna and flora, urban biodiversity, educational project, urban biogeography

Acknowledgments: To all the students who participated in this educational project and contributed to increasing knowledge about urban biodiversity in the Metropolitan Region of São Paulo, Brazil.

TRADITIONAL WISDOM INSPIRES BIODIVERSITY CONSERVATION IN RESIDENTIAL AREAS IN SHIGA, JAPAN

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Satoyama is a traditional landscape in a suburban and rural area in Japan and considered as an important habitat for species. Nevertheless, due to rapid population growth and economic development, the expansion of residential areas and transformation of lifestyle have posed a great threat to biodiversity. We investigated butterfly diversity and abundance in traditional and new residential areas in Satoyama landscape in Shiga, Japan. We found that butterfly diversity and abundance tended to be higher in traditional residential areas than those in new residential areas. Choice of horticultural plants and the reservation of native vegetation species might be two of the most determining factors for butterfly diversity. Based on our findings, we argue that traditional wisdom plays an important role for conservation. These findings also have important implications for future biodiversity conservation in rural, suburban and even urban areas.

Keywords: Satoyama, butterfly biodiversity, traditional wisdom, conservation, residential area, Japan

Acknowledgments: This research was supported by Research Institute for Humanity and Nature (RIHN: a constituent member of NIHU) Project No. RIHN 14200103.

THE EFFECTS OF HUMAN DEVELOPMENT, ENVIRONMENTAL FACTORS, AND A MAJOR HIGHWAY ON MAMMALIAN COMMUNITY COMPOSITION IN THE WASATCH MOUNTAINS OF NORTHERN UTAH, USA

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Human development and roads threaten wildlife through distinct mechanisms and understanding the influence of these elements can better inform mitigation and conservation strategies. We used camera traps to quantify the effects of major roads, environmental factors, and human development on the mammalian community composition between sites north and south of a major interstate highway in northern Utah, USA. We found no significant differences in species richness nor community similarity across the north-south divide of the highway. Through Bayesian hierarchical modelling, we compare the effects of the distance to the highway, housing and human population density, normalized difference vegetation index (NDVI), and the human footprint index to changes in mammalian community composition and species-specific habitat usage. Community occupancy response, similarity, and species richness were negatively affected by increased housing and human population densities and positively affected by increased NDVI and decreased human footprint, whereas their response to the highway was more inconclusive. We conclude that mammalian community composition in our study area is influenced by both environmental conditions and human development while the effect of the highway was more nuanced, possibly due to the presence of a newly constructed wildlife overpass. Taken together, the lack of differences in species richness and community composition across the highway suggests that is may not currently exacerbate the effects of other anthropogenic sources of habitat fragmentation and highlights the need for additional research into human-wildlife conflict mitigation strategies.

Keywords: highway, mammalian community composition, northern Utah, USA

DERIVATION OF PASSIVE TECHNOLOGIES OF SMART FARM DESIGN

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According to environmental pollution, climate change, and food crisis, smart farms are emerging as a way to achieve self-sufficiency in food and reduce carbon emissions from buildings. However, although a smart farm has several advantages, it has not been spread due to a newly emerged concept. In particular, research on reducing carbon emissions by applying passive technology to smart farm buildings is insufficient. Therefore, this study aims to derive passive technology elements that can be applied to the smart farm. By collecting smart farm cases, four crop growth factors were derived: illuminance, temperature, humidity, and airflow. First, the illuminance factor can be applied to use solar heat and natural light. Second, the temperature factor can be applied to wall greening, awning, and double glazing. Third, the humidity factor can be applied to wall greening and pore covering. Fourth, the air flow factor can be applied to natural ventilation, double skin, and openable windows. This study implies the possibility of reducing the energy load by applying passive technology to the smart farm. However, since there is a limitation in not providing an accurate figure for the actual energy load reduction, it should be supplemented through future research.

Keywords: smart farm, passive technologies, green building, architecture, carbon emissions

HOW STATE-LED ENVIRONMENTAL POLICY AFFECTS URBAN PROTECTED AREAS: A MODEL OF PA4D RAMIFICATIONS

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Adverse transformations of protected areas (PAs) may be reflected in the PADDD conceptual framework: downgrading, downsizing and degazettement. Meanwhile, an urban environment is exposed to significant human impact, specific entanglement of stakeholders' demands and an exceptional variety of land-use conflicts. In this regard, a detailed structure of adverse transformations of two megapolises (Moscow and Saint-Petersburg) has been disclosed: fours type (design of planned and proposed PAs), eight subtypes and 15 levels of possible alterations. Spatial analysis of adverse transformations (PA4D) through QGIS mapping has been conducted on the basis of legislative acts with the attached raster images or coordinates of transformed areas. The imageries from open-source Google Earth Pro since 2005 have been harnessed to assess ecosystems' differentiation in terms of PA4D. Negative transformations have affected about 53.8% of the total area that was ever under protection in Moscow due to the complicated history of legislative changes. Besides, positive transformations (PA4P) are considerably less spread than PA4D. The core contributor to PA4D in Moscow is downgrading, particularly a subtype of partial downgrading (60.3% of PA4D area), which is different from the downgrading of entire PAs. The second most important constituent is related to the low speed of proposed PAS' design (22.8% of PA4D area). At the same time, Saint-Petersburg considerably differs from Moscow – almost all PA4D actions are due to the extremely low speed of the PAs' design (only 15.2% of the total area planned in 2008). Wetlands are considered as biotopes of the highest vulnerability to PA4D, but even remote forests' parts are threatened by easing prohibitions on extensive recreation, primarily construction of permeable pavements. Hence, such almost complete absence of local governance leads to significant ramifications for providing ecosystem services. Although the state-led system of PAs planning and management can report on formal extension of green infrastructure and PAs, in-depth spatial dynamic analysis unveils predominantly negative tendencies. The devised PA4D model may be implemented in the regional and international blueprints of environmental planning to design resilient cities that are able to retain the well-being of citizens. Moreover, the PA4D concept should be used to assess an effectiveness of government entities and need to facilitate a local interest.

Keywords: green infrastructure, urban ecology, urban planning, PADDD, protected areas

ILLEGAL CAPTIVE BREEDING OF CONTINENTAL CHELONIANS: AN ETHNOHERPETOLOGICAL APPROACH TO UNDERSTAND THIS ACTIVITY IN BRAZIL

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Brazil has the richest biodiversity in the world. In this way, many species of the Brazilian fauna are targets of wildlife trafficking, a common cultural practice in Brazilian society. In this study, we used an ethnoherpetological approach to understand the empirical knowledge of Brazilian communities about the capture of wild chelonians to be kept as pets. Our research was guided by two aims:

(1) to analyse the information on turtles delivered by the population to the Centro de Biodiversidade da Usipa – CEBUS, which conducts the fauna rehabilitation program in the municipality of Ipatinga, state of Minas Gerais.
(2) to identify through local and national questionnaires the interrelationships between human populations and continental chelonians.

We analysed reports of turtle delivery to the CEBUS between January 2017 and December 2019. The knowledge of Brazilian communities regarding turtles breeding in captivity was accessed by face-to-face questionnaires with people from Ipatinga (n = 20), and also by online questionnaires applied to people from different parts of Brazil (n = 378). Both of them were implemented between January and March 2021. The CEBUS received 68 turtles of six species in the analysed period, all of them without any legal registration. The most received species was the tortoise *C.carbonarius* (n = 57%), its delivery increased over the years. The same species was the most held in captivity by Ipatinga`s people (43%), in national scale the most captive was *T. dorbigni* (24%). The majority of respondents obtained their turtles through donations (~ 50%). The answer most selected about animal destination in case of disinterest in maintaining them as a pet was to deliver to Environmental Institute and Zoos (~ 50%), and turtle donation was the second most expressed answer (~ 20%). Our results highlight the gap of knowledge about breeding of wild animals in captivity and its impacts in the environment, corroborating the presence of wild animal's illegal trade in Brazil. They also reveal the lack of inspection in the wild animal trade, and the lack of campaigns and actions against the trafficking of fauna aimed at the Brazilian population. Finally, the results refer to social characteristics and cultural issues, a by-product of inadequate economic conditions and the superficiality of social educational measures.

Keywords: animal trade, Brazilian wildlife, traditional knowledge, traffic, turtle

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The Leipzig URBIO 2022 Declaration Leipzig, Germany, November 29, 2022,

Preamble:

This declaration was submitted during the 7th Conference of the International Network Urban Biodiversity and Design (URBIO) with the theme "Integrating Biodiversity in Urban Planning and Design Processes" held at the Helmholtz Centre for Environmental Research – UFZ in Leipzig, Germany, from 28th to 30th November 2022. 122 individuals from 24 countries participated in the conference. The participants presented 62 papers and 8 posters. The conference acknowledged the growth in and understanding of the critical role of biodiversity in our cities and the necessity of its integration with practical applications such as planning and design. The conference highlighted the necessity of interdisciplinary collaboration and the importance of advanced research on urban biodiversity and its implementation into planning, design and management of urban landscapes to promote integrated urban blue-green infrastructure and sustainable and resilient cities.

The importance of urban biodiversity and design:

This 7th URBIO conference continues the tradition from previous URBIO conferences in Erfurt, Nagoya, Mumbai, Incheon, Panama, and Cape Town that addressed cutting-edge research and practice of biodiversity-based management, planning and design. The 2022 conference is particularly relevant because of the new focus of the COP 15 to mainstream biodiversity conservation in cities.

Development associated with urbanization continues to be a leading cause of biodiversity loss in cities. Climate change is an additional and major factor in biodiversity loss. On the other hand, the recent pandemic situation revealed new potentials and opportunities for improving biodiversity in cities and the role of urban nature for human health and well-being.

During the URBIO 2022 conference we discussed the current state of integrating biodiversity into the urban planning and design process. The contributors at the conference demonstrated a wide range of understandings of urban biodiversity, as well as unique local approaches to biodiversity protection and ecological design and management that were implemented in different countries. The approaches included:

- Urban plant and wildlife biodiversity: mechanisms of increasing biodiversity in urban areas, protection, and conservation strategies
- Integration of biodiversity in urban planning, green infrastructure and landscape design projects
- Methodological approaches to implementing biodiversity in design and planning
- Ecological restoration and urban biodiversity
- Nature-based solutions and their multiple co-benefits linked to address biodiversity loss and climate change
- Management of urban green to increase biodiversity and human-positive perception

The work presented at the conference points to new approaches to studying biodiversity in cities and using that information in the co-production of information on conservation, design, and planning with local residents. The work from this conference has promised to address issues raised by the expanded CBD focus on cities.

Challenges for the future:

To address these issues the following tasks and responsibilities are recommended:

- Encouraging interdisciplinary and transdisciplinary research on urban biodiversity by involving urban citizens and decision-makers.
- Increasing the role of the next generation of researchers and planners who will reinforce URBIO's involvement in the activities of the Convention on Biological Diversity – particularly in supporting the implementation of GBF target 12 and the Plan of Action to be endorsed via item 16 B of the COP 15.
- Recognizing urban biodiversity as a complex and specific phenomenon of urban nature that includes native and non-native biota but acknowledging the detrimental effect of invasive alien species.
- Urgent research of all components of urban biodiversity, especially in the global south (along the entire socioeconomic gradient) and other fast-growing regions as well as in countries located in biodiversity hotspots.
- Role of education: expand the incorporation of key concepts from urban ecology, planning, ecological design, and the activities of the Convention on Biological Diversity's work in cities into the university curriculum.
- Reinforce integration of biodiversity and design using ecological planning, design, nature-based solutions, and green-blue infrastructure concepts.
- Collaboration between urban ecologists, planners, geographers, landscape architects, sociologists, and artists. Reach out/supply scientific input to implement platforms such as the GEF-8 (The Global Environment Facility) Cities program (Moving Toward an Equitable, Nature-Positive, Carbon-Neutral, and Pollution-Free World), the WB's (World Bank) Cities4Biodiversity, and the ICLEI (Local Governments for Sustainability) supported Berlin Pact cities as support.
- Participation of URBIO in SBI-4 (Subsidiary Body for Implementation) and the COP 16 in Turkey.

<u>On behalf of URBIO</u>

URBIO Presidents:
Prof. Dr. Maria Ignatieva (Australia) and Prof. Dr. Charles Nilon (USA)

URBIO Conference Organisers:
Prof. Dr. Dagmar Haase, Dr. Diana Dushkova, Dr. Sonja Knapp (all Germany)

Photos (selected; by Diana Dushkova, UFZ, and Maria Ignatieva, UWA)

Figure 1. Participants of the 7th URBIO conference at UFZ, Leipzig

Figure 2. Founder of the URBIO network Norbert Müller (left), URBIO 2022 conference organisers Diana Dushkova and Sonja Knapp (middle) and presidents of URBIO Maria Ignatieva and Charles Nilon (right)

Figure 3. Key-note presentations: Charles Nilon and Maria Ignatieva (left), Dagmar Haase (right)

Figure 4. Ellen Banzhaf (left), Frank Hüesker (right) at the special session 9 of UFZ's Resilient cities platform: Blue-green infrastructures and nature-based solutions for resilient cities

Figure 5. Session presentations: Åsa Ode Sang (left), Zbigniew Grabowski (right)

Figure 6. Session presentations: Shari Wilson (left), Dayle Shand (right)

Figure 7. Session presentations: Thomas Hauck (left), Rieke Hansen and Lena Enderich (right)

Figure 8. Session presentations: Thilo Wellmann (left), Morgan Rogers (right)

Figure 9. Session presentations: Fahimeh Mofrad (left), Austin Green (right)

Figure 10. Session presentations: Arne Kunkel (left), Sergey Chalov (right)

Figure 11. On-line presenters: Fredrik Eriksson (left), Michelle Talal (right)

Figure 12. Ceremony and celebration during the at Ice-breaker. Left: Peter Werner, Diana Dushkova, Fahimeh Mofrad; right: Constantine Suppee, Simon Elliott, other participants of URBIO conference

Figure 13. URBIO 2022 Advisory Board meeting: on-line participants and members

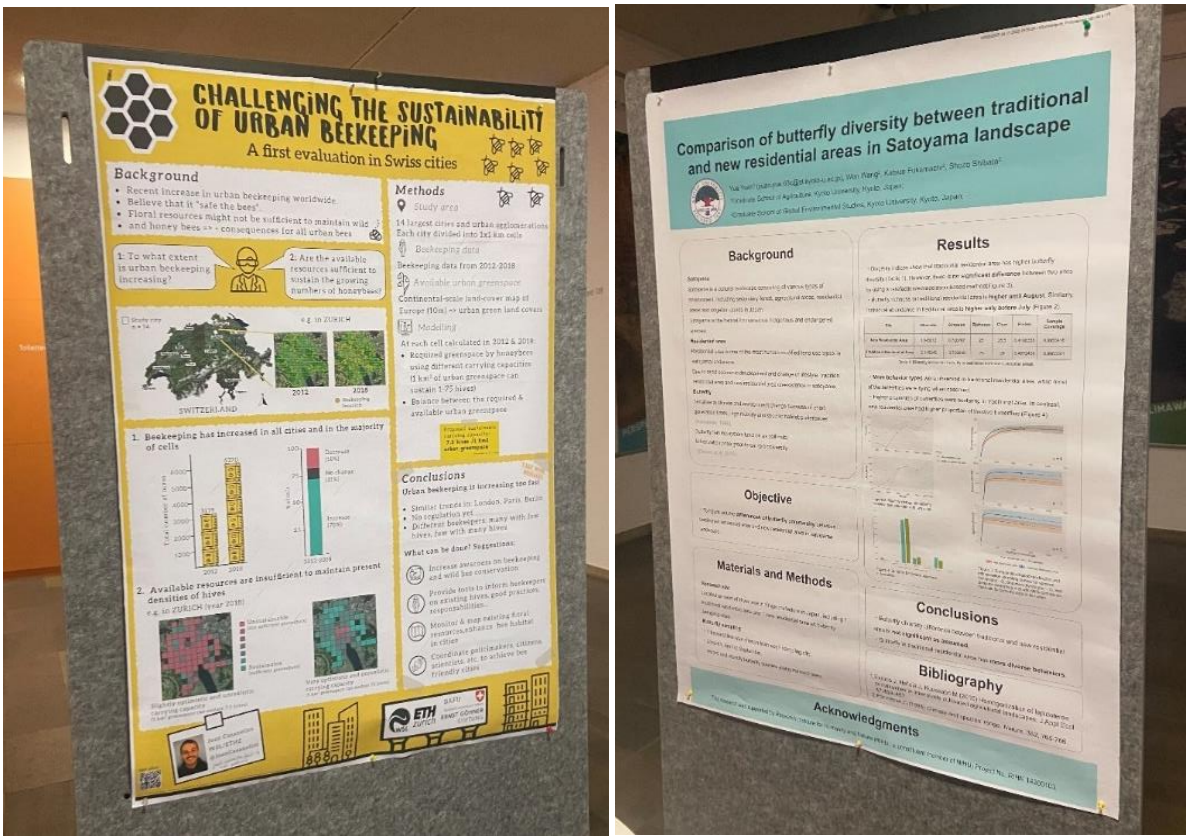

Figure 14. Selected posters by Casanelles 2023, Yuan et al. 2023

Figure 15. Excursion to Johanna Park organised by Constantine Suppee (left)