
# BOOK OF ABSTRACTS



## I. SESSION DESCRIPTION

### ID: B10

Designing healthier cities through understanding demand for urban green and blue spaces, and the context-dependent benefits they provide, with tools and models

### Hosts:

| | Name | Organization | E-mail |
|---|---|---|---|
| Hosts: | Laurence Jones | UK Centre for Ecology and Hydrology | LJ@ceh.ac.uk |
| | Stefano Salata | Izmir Institute of Technology | ssalata1983@gmail.com |
| Co-Hosts: | Silvia Ronchi | Politecnico di Milano | silvia.ronchi@polimi.it |
| | Andrea Arcidiacono | Politecnico di Milano | andrea.arcidiacono@polimi.it |
| | David Fletcher | UK Centre for Ecology and Hydrology | dfletcher@ceh.ac.uk |
| | Luis Inostroza | Ruhr-Universität Bochum | Luis.Inostroza@ruhr-uni-bochum.de |
| | Nadja Kabisch | Technische Universität Berlin (TU) and Humboldt-Universität zu Berlin (HU) | nadja.kabisch@geo.hu-berlin.de |
| | Alice Fitch | UK Centre for Ecology and Hydrology | afitch@ceh.ac.uk |

### Abstract:

Cities are places where multiple challenges can affect citizens' health, safety and well-being. However, good city design can contribute to improving the liveability and quality of life in urban areas. Collaboration between environmental and social scientists and urban planners is essential in reforming traditional approaches to urban design. Many current approaches do not consider the quality of green and blue spaces, their location and the arising inequality in the provision of ecosystem services (ES) and their benefits to well-being.

Urban pressures (e.g. heat, air pollution, noise) are unevenly distributed in space and time, as also is greenspace. The co-location of these two aspects is important in determining the amount of ES that is provided. Further, the amount of ES is also affected by the quality or ecological attributes of greenspace and bluespace – not all greenspace is equal for ES provision. This spatial context is often missing in urban assessments which assume that a patch of trees in one location provides exactly the same amount of service as a similar sized patch of trees in another location.

In addition, access to urban green and blue space, and the associated benefits, are often influenced by socio-economic status. People on lower incomes are typically at higher risk of exposure and lack the means to respond, or adapt, to urbanisation-related pressures. Children are particularly vulnerable and their exposure to these pressures can result in life-long impacts in terms of health and well-being and in socio-economic mobility. The majority of studies which attempt to map demand for ES pick easy metrics, which focus almost exclusively on mapping the pressure - they fail to take account of the aspects discussed above.

This session aims to explore tools and modelling techniques which urban planners and city authorities can use to develop spatial plans which combine greenspace design with social and ecological factors, to improve wellbeing.

## Goals and objectives of the session:

We are interested in showcasing the latest approaches to understand four aspects that are required for nature-based solutions to really meet the needs of urban dwellers and improve liveability of cities. We are particularly interested in sharing experiences, approaches and techniques regarding modelling of ecosystem services and addressing demand aspects for a range of services (such as: air quality improvement, urban heat stress mitigation and reducing the hydraulic vulnerability of the cities through flooding). These four aspects are:

- Improvements in spatial modelling approaches to incorporate local context.
- Understanding demand for NBS in the context of urban pressures, including spatial and temporal variation in pressures.
- Socio-economic aspects of demand, linked to accessibility and equity issues.
- Translation of these aspects into tools and advice for policy makers.

In this session we encourage presentations from those developing models and tools or conducting primary research or modelling approaches to take account of social, cultural and economic factors as well as the quality of green and blue space. The session will start with a brief introduction by the hosts on two aspects: linkages between ES and health, and conceptual understanding of spatial dependence between demand and services provision. After this, there will be a series of short presentations by session participants, approximately 10 minutes each. The session will include time to discuss key issues on the topic, including prioritising NBS solutions which address the discussed issues, and discussing a synthesis paper on the topic.

## Planned output / Deliverables:

A synthesis paper or commentary in a journal paper (e.g. Ecosystem Services, Sustainability)

## Related to ESP Working Group/National Network:

Biome working group: BWG 10 – Urban systems

## II. SESSION PROGRAM

**Date of session:** Wednesday, 9 June 2021

**Time of session:** 11:00 – 17:30

### Timetable speakers

| Time | First name | Surname | Organization | Title of presentation |
|---|---|---|---|---|
| 11:00<br>11:10 | Laurence | Jones | UK Centre for Ecology and Hydrology | Introduction |
| 11:10<br>11:20 | Celina | Stanley | Leibniz Institute of Ecological Urban and Regional Development | A concept for determining the perceived quality of urban green spaces as the basis for a green space planning tool |
| 11:20<br>11:30 | Costance | Brouillet | ETH Zurich | Do we have enough space for walking in times of a Pandemic? |
| 11:30<br>11:40 | Roland | Kraemer | Humboldt-Universität zu Berlin | Parks in context: Advancing citywide spatial quality assessments of urban green spaces using fine-scale indicators |
| 11:40<br>11:50 | Wanggi | Jaung | Duke Kunshan University | Temperature and air pollution reductions by urban green spaces are highly valued in a tropical city-state |
| 11:50<br>12:00 | | | | Discussion |
| 13:30<br>13:40 | Stefano | Salata | Izmir Institute of Technology | Introduction |
| 13:40<br>13:50 | Silvia | Ronchi | DAStU - Politecnico di Milano | Setting Urban design parameters based on Ecosystem Services modelling: an application in Milano city |
| 13:50<br>14:00 | Helena | Duchkova | Global Change Research Institute of CAS, Charles University in Prague | Mismatches in urban microclimate cooling and unequal distribution among beneficiaries, a case study of Prague, Czech Republic |
| 14:00<br>14:10 | Davide | Geneletti | University of Trento | Implementing Nature-based solutions in cities through performance-based urban planning |


| Time | First name | Surname | Organization | Title of presentation |
|---|---|---|---|---|
| 14:10<br>14:20 | Lillia | Sulkarnaeva | University of Tyumen | Assessing, valuing, and mapping ecosystem services at city level: The case of Tyumen (Russia) |
| 14:20<br>14:30 | David | Fletcher | United Kingdom Centre for Ecology & Hydrology | Quantifying the Ecosystem Service of noise mitigation provided by urban woodland, at scale |
| 14:30<br>14:40 | Javier | Babí Almenar | Luxembourg Institute of Science & Technology | Assessing the contribution of urban forest to ecological connectivity and net ecosystem services supply in densifying cities |
| 14:40<br>15:00 | | | | Discussion |
| 15:30<br>15:40 | Luis | Inostroza | Ruhr Universitat, Bochum | Introduction |
| 15:40<br>15:50 | Davide | Longato | University of Trento | Planning Nature-based Solutions in Valletta (Malta) by analyzing citizens' demand, spatial opportunities and policy instruments |
| 15:50<br>16:00 | Claudia | Dworczyk | Leibniz Universität Hannover | Conceptualising demand for ecosystem services – an adapted spatial-structural approach |
| 16:00<br>16:10 | Suzanne | van der Meulen | Wageningen University; Deltares | Changing demands for urban surface water extractions and in situ use functions |
| 16:10<br>16:20 | Ksenia | Marekalova | Lomonosov Moscow State University | Urban ecosystem services in Lipetsk (Russia): mapping, assessment, modeling |
| 16:30<br>16:40 | Yujing | Ma | Vrije Universiteit Amsterdam | Revealing the value of ecosystem services from city parks for nearby residents: a hedonic pricing study in Beijing |
| 16:40<br>16:50 | Carmen | Cantuarias-Villessuzanne | Groupe ESPI2R | The impact of biodiversity and urban ecosystem services in real estate. The case of the region Ile-de-France |
| 16:50<br>17:00 | Michael | Leone | Research Institute Nature and Forest | Uptake of the green infrastructure concept in urban policies and planning: a field study in 4 European cities |
| 17:00<br>17:10 | David Neil | Bird | Joanneum Research | Downscaling of daily Land Surface Temperature (LST) to |

| Time | First name | Surname | Organization | Title of presentation |
|---|---|---|---|---|
| | | | | fine scale (30m x 30m) using a variation of the DisTrad approach that mixes MODIS LST and LANDSAT NDVI data at different spatial frequencies |
| 17:10<br>17:30 | | | | Discussion |

## III. ABSTRACTS

*Abstracts are ordered based on the session program. The first author is the presenting author unless indicated otherwise.*

*1. Type of submission: Abstract*

B. Biome Working Group sessions: B10 - Designing healthier cities through understanding demand for urban green and blue spaces, and the context-dependent benefits they provide, with tools and models

### A concept for determining the perceived quality of urban green spaces as the basis for a green space planning tool

*First author:* Celina Stanley
*Other author(s):* Wolfgang Wende
*Affiliation*: Leibniz Institute of Ecological Urban and Regional Development, Germany
*Contact*: c.stanley@ioer.de

Urban green spaces (UGS) have diverse positive effects on human health. Therefore, UGS are a central starting point for maintaining the well-being of citizens and the quality of life in cities. To meet the growing demand for ecosystem services, the services provided by UGS must be maximized. Recreational services, as part of cultural ecosystem services , are suitable for this purpose, as they are also referred to as the perceived quality of UGS. In order to determine the perceived quality of the UGS, the complex relationship between UGS users demands and UGS supply must be analysed in particular. A rather new approach to do this is the use of relational values. In the presentation, a concept will be introduced that makes it possible to determine the perceived quality of UGS, among other things using relational values. Through the participatory

approach of surveys, user demands are collected and indicators for quality assessment are derived. In this way, quality scores can be calculated for all UGS in a city, even for different user groups. Taking into account user group-specific travel distances, supply areas can be determined. Combining this supply areas with the local resident population, the supply of these user groups with high-quality UGS can be calculated. This allows to identify possible unequal access to UGS and to take measures for compensating the inequalities. This concept is being tested and evaluated in the city of Dresden/Germany. After a survey of UGS planners in selected German cities, a tool will be developed to support the future development and design of UGS considering user demands. In this way, all citizens should get access to high-quality UGS to benefit from their positive health benefits.

*Keywords*: green space planning, green space quality, green space user demand, relational values, urban green spaces

*2. Type of submission: Abstract*

B. Biome Working Group sessions: B10 - Designing healthier cities through understanding demand for urban green and blue spaces, and the context-dependent benefits they provide, with tools and models

## Do we have enough space for walking in times of a Pandemic?

*First author:* Constance Brouillet
*Other author(s):* Marcelo Galleguillos Torres, Adrienne Grêt-Regamey
*Affiliation*: ETH Zurich, Department of civil, environmental and geomatic engineering (D-BAUG), Institute for Spatial and Landscape development (IRL), Chair of Planning of Landscape and Urban Systems (PLUS), Switzerland
*Contact*: cbrouillet@ethz.ch

Recreational walks using neighbourhood open spaces (NOPs) has a direct positive impact on the fitness of its inhabitants and contribute to well-being with psychological benefits such as feelings of belonging and security. However, actual planning tendencies in cities are oriented towards densification that aim to reduce land consumption, putting pressure on NOPs. This study aims to determine if the offer of NOPs for walking activities is enough, considering the population's demand in the canton of Zurich, Switzerland. In addition, we investigate behavioural changes

during the semi-lockdown of the first wave of the COVID-19 pandemic and the influences of those changes on the demand. We also try to specify the key characteristics of the NOPs that foster recreational walking behaviours. Mobility data was obtained thanks to a GPS tracking app used by 3'500 participants during a normal period and during the first wave semi-lockdown. Using one-hectare cells, geospatial data was combined with the mobility data to find the NOPs characteristics that explain best the mobility. Finally, we calculated the offer and demand for recreational walks on NOPs. We observed that during the first wave of the COVID-19 pandemic, more people did recreational walks, on average longer, resulting in an enhance demand of space. We found that the amount of vegetation, the tranquillity, and the landcover heterogeneity are among the most important NOPs characteristics that explain where people recreate. We also could see that pandemic situations foster changes in what people consider important for their recreation walks. These results show that during normal times, the NOPs are already under pressure, particularly in certain areas were the offer is scarce, and the demand has grown because of densification. Considering pandemic times, we show that the pressure increased even more and thus that new considerations need to be taken to plan more resilient cities.

*Keywords*: Neighbourhood Open Spaces (NOPs), COVID-19, recreation demand, GPS tracking, GLM

*3. Type of submission: Abstract*

B. Biome Working Group sessions: B10 - Designing healthier cities through understanding demand for urban green and blue spaces, and the context-dependent benefits they provide, with tools and models

## Parks in context: Advancing citywide spatial quality assessments of urban green spaces using fine-scale indicators

*First author:* Roland Kraemer
*Other author(s):* Nadja Kabisch
*Affiliation*: Humboldt-Universität zu Berlin, Germany
*Contact*: roland.kraemer@hu-berlin.de

Urban green spaces have gained attention due to their increasing relevance to human well-being in the context of challenges related to urbanization and climate change. Detailed, systematic,

citywide assessments of specific urban green space characteristics that help to understand resident interactions with green spaces and respective ecosystem service flows are lacking. We chose the city of Leipzig, one of the fastest growing cities in Germany, as a case study to assess the quality of publicly available green spaces by incorporating spatial context as a key dimension in determining their actual quality. We established 33 indicators that describe (a) natural elements, e.g., the types and configuration of vegetation and the proportion of water bodies; (b) built elements, e.g., various recreational facilities and path density; and (c) the embeddedness of green spaces within the built, social and natural environment (context), e.g., the number of neighboring residents, nearby green or blue elements and exposure to traffic. Based on these indicators, we developed a scoring approach that provides an evaluation of green space quality in terms of their benefit to residents. We identified and discussed spatial gaps and deficits in the quality of green space supply as well as leverage points for making operational improvements at the individual green space level. Our study provides urban planning guidance for identifying untapped potential for ecosystem services provision, e.g., due to usage barriers, and may help to balance the trade-offs between benefits for citizens and ecology and thus improve green spaces for people and nature at the same time.

*Keywords*: ecosystem services, green space quality, Leipzig, potential analysis, spatial assessment

*4. Type of submission: Abstract*

B. Biome Working Group sessions: B10 - Designing healthier cities through understanding demand for urban green and blue spaces, and the context-dependent benefits they provide, with tools and models

## Temperature and air pollution reductions by urban green spaces are highly valued in a tropical city-state

*First author:* Wanggi Jaung
*Other author(s):* L. Roman Carrasco, Shaikh Fairul Edros Bin Shaikh Ahmad, Puay Yok Tan, Daniel Richards
*Affiliation*: Duke Kunshan University, China
*Contact*: wanggi.jaung@dukekunshan.edu.cn

Urban neighborhood green spaces provide ecosystem services important for sustainable and resilient cities. We examine public preferences for these ecosystem services by conducting a discrete choice experiment in Singapore. The results showed that the public preferred the contributions of neighborhood green spaces in reducing temperature (1, 2, or 3°C), reducing air pollution (20 or 40%), and learning in nature. However, they did not prefer noise abatement (10, 20, or 30 dB) and increases of bird, butterfly, and native plant species. Creation of a new neighborhood green space was preferred by people living near parks, but not preferred by those living near nature areas. These results show that diverse public preferences exist for different ecosystem services provided by neighborhood green spaces. In the context of Singapore, the urban heat island effect, to be exacerbated under climate change, and air pollution are perceived to be major environmental problems mitigated by urban vegetation.

*Keywords*: urban green space, ecosystem services, valuation, choice modeling, Singapore

*5. Type of submission: Abstract*

B. Biome Working Group sessions: B10 - Designing healthier cities through understanding demand for urban green and blue spaces, and the context-dependent benefits they provide, with tools and models

## Setting Urban design parameters based on Ecosystem Services modelling. An application in Milano city

*First author:* Silvia Ronchi
*Other author(s):* Stefano Salata, Andrea Arcidiacono
*Affiliation*: DAStU, Politecnico di Milano, Italy
*Contact*: silvia.ronchi@polimi.it

The paper investigates the possibility of setting urban design parameters for Milan's city based on Ecosystem Service assessment and especially on the urban Cooling Capacity (CC). CC is seen as one of the most fundamental urban ES with multiple health benefits. It can model and identify the most suitable land use, and define successful urban design parameters oriented to human well-being. The CC was developed using InVEST Urban Cooling model, while the urban design parameters were measured through GIS analysis (among the many: permeability ration, built-up footprint, tree canopy, building heights). The results of ES modelling were combined with some

Milan' urban districts (13 in total) selected from four main historical planning periods looking at how they were designed, and how the urban design has influenced CC reducing excessive heat in urban neighbourhoods. The historical planning periods include: Beruto's city, late 19th century; Modern city, early 20th century; 60 s-70 s city, late 20th century; and Contemporary city, 21st century. The study aims to measure how urban planning approaches have influenced the urban design and related CC to create a heterogeneous ES delivery scenario. The study's results allowed to define the most significant urban design parameters that produce excellent CC: permeability ratio, the built-up footprint, tree cover, and green areas dimension. This allows integrating ES consideration in Planning process solving one of the key lack that still today limits the adoption of ES into land-use planning and decision-making processes.

*Keywords*: urban cooling, urban planning, urban design parameters, urban heat island, ES assessment

*6. Type of submission: Abstract*

B. Biome Working Group sessions: B10 - Designing healthier cities through understanding demand for urban green and blue spaces, and the context-dependent benefits they provide, with tools and models

## Mismatches in urban microclimate cooling and unequal distribution among beneficiaries, a case study of Prague, Czech Republic

*First author:* Helena Duchková

*Other author(s):* Davina Vačkářová

*Affiliation*: Global Change Research Institute of CAS, Charles University in Prague, Czech Republic

*Contact*: duchkova.h@czechglobe.cz

Urban heat is becoming an increasing problem for many cities, especially during the summer season. Ecosystems can provide a solution to extreme heat as they regulate microclimate via shading and evapotranspiration, hence, they can cool the surrounding environment. However, the available greenery in urban environments is usually just a small fraction compared to build-up land, resulting in urban heat islands, while the pressure on ecosystems is still increasing from the competition with urban development and construction. At the same time, the population in

urban areas has been growing, thus also increasing the demand for ecosystem services such as microclimate regulation. Since the ecosystems are usually not equally distributed across space and among the population, there are only some people benefiting from their services, leaving the others with unsatisfied demand. Moreover, different groups of people have various levels of demand for urban cooling. This contribution aims to present the assessment of urban cooling supply-demand mismatches on the case study of Prague, Czech Republic. We assessed the vegetation cooling via Urban InVEST model and coupled it with demand for cooling, represented by the recommendations on heat exposure. To answer the question of who are the benefiting and disadvantaged people in the city, we also included the socio-demographic variables to capture the needs of different population groups. This enabled to consider the vulnerable population and made the demand side of the assessment more robust. The results indicate the benefiting areas and areas with the unsatisfied demand, which we discuss in the context of environmental equity and land use planning. The outcomes of the research may contribute to a better understanding of ecosystem service needs among different socio-demographic groups and help urban planners, policy- and decision-makers to prioritise the areas for implementation of green measures, hence, leading to better equity among ecosystem service beneficiaries.

*Keywords*: ES supply-demand coupling, urban cooling, vulnerability, spatial mapping, environmental equity

*7. Type of submission: Abstract*

B. Biome Working Group sessions: B10 - Designing healthier cities through understanding demand for urban green and blue spaces, and the context-dependent benefits they provide, with tools and models

## Implementing Nature-based solutions in cities through performance-based urban planning

*First author:* Davide Geneletti
*Other author(s):* Chiara Cortinovis, Maria Susana Orta Ortiz, Jarumi Kato Huerta, Davide Longato, Enzo Falco
*Affiliation*: University of Trento, Italy
*Contact*: davide.geneletti@unitn.it

In performance-based urban planning permitted land use transformations and activities are not necessarily defined ex-ante, but evaluated case-by-case, by considering the expected impacts (or performance") of the proposed intervention. Due to its flexibility, performance-based planning has potential to promote and implement Nature-based Solutions (NbS) in cities. We present and apply a performance-based urban planning approach, grounded in the assessment of ecosystem service (ES) supply and demand. The approach allows to estimate the impacts of proposed urban transformations, and to define for them appropriate and proportionate performances. These performances consist in the deployment of NbS that can offset the negative impacts generated by the urban transformation. Two maps were prepared to support the implementation of the approach. The "integrated ES demand" map summarizes information on the demand for ES in different areas of the city, thus identifying place-based needs and priorities. This information is used to select the most suitable NbS types for each location (e.g, green roofs or permeable surfaces to mitigate run-off). The "combined ES supply" map summarizes information on the current supply of multiple ES and allows estimating the expected negative impacts of the proposed transformation. This information is used to identify the level of performance that the implemented NbS should achieve (e.g, rate of permeable surfaces; size of green roofs), in order to off-set the expected negative impacts. The approach is applied to the city of Trento (Italy), by simulating the implementation of a set of urban transformations included in the current Urban Plan (eg, residential developments; peri-urban mixed developments; brownfield re-development). For each transformation, relevant NbS types and locations are proposed and scenarios are generated at the city scale. We conclude by discussing how ES service assessments can be used to inform technical policy instruments and support the design of NbS in cities.

*Keywords*: ecosystem services supply and demand, urban planning, GIS

*8. Type of submission: Abstract*

B. Biome Working Group sessions: B10 - Designing healthier cities through understanding demand for urban green and blue spaces, and the context-dependent benefits they provide, with tools and models

## Assessing, valuing, and mapping ecosystem services at city level: The case of Tyumen (Russia)

*First author:* Lillia Sulkarnaeva
*Other author(s):* Irina Akhmedova, Natalya Zherebyatieva, Valentina Dobryakova
*Affiliation*: University of Tyumen, Russian Federation
*Contact*: sulkarnaeva1992@mail.ru

A vital role of urban ecosystem services in maintaining sustainable urban development is worldwide recognized. The strategy of the development of the living environment of Russian cities aims to develop a comfortable urban environment, which advances the need for urban ecosystem services assessment and mapping for Russian cities. In this study, we aimed to identify and map ecosystems in the city of Tyumen that could provide ecosystem services. We calculate the demand and supply ratio of ecosystem services with high local significance: "everyday recreation," "cooling effect," and compare the spatial distribution of ecosystem services' demand and supply. To assess the spatial distribution of demand for these ecosystem services, we mapped population density, and supply – we mapped the green and blue infrastructure. For population density, urban green and blue infrastructure mapping, we used ArcGIS PRO software and OpenStreetMap vector layers, which were verified according to the field observations, local statistical data, and city trees register. Comparison analysis showed that the supply in the center of the city is much lower than the demand, and in the suburbs, the supply is higher. The spots with a significant lack of ecosystem services should be considered for implementing green infrastructure sites. This study attempts to assess the ecosystem services of green and blue infrastructure of Tyumen.

*Keywords*: urban ecosystem services, Tyumen, everyday recreation, cooling effect, mapping of demand and supply

*9. Type of submission: Abstract*

B. Biome Working Group sessions: B10 – Designing healthier cities through understanding demand for urban green and blue spaces, and the context-dependent benefits they provide, with tools and models

## Quantifying the Ecosystem Service of noise mitigation provided by urban woodland, at scale

*First author:* David Fletcher

*Other author(s):* Amy Thomas, Laurence Jones,
*Affiliation*: Centre for Ecology & Hydrology, United Kingdom
*Contact*: dfletcher@ceh.ac.uk

Noise pollution is a pervasive pressure in the modern world, intrinsically linked to both urbanisation and transport infrastructure. The World Health Organisation has estimated the health impact as a minimum of one million healthy years of life lost, annually, in Western Europe alone. Woodland can act to mitigate noise through absorbing and scattering the sound, breaking up and redirecting the sound waves, leading to increased atmospheric energy absorption, as well as increased absorption of energy by the ground. For instance, previous research has demonstrated that suitably positioned woodland can have a substantial mitigating effect on traffic noise. However, such studies have rarely quantified this noise mitigation as an ES, particularly in an urban setting where the impacts of noise pollution are most likely to be greatest. The EU Noise Directive (END) recognises the health impacts of noise and requires member states to publish noise maps and noise management action plans every five years, for large urban agglomerations and major transport infrastructure. The methods typically used to create these noise maps do not account for the reduction in noise levels caused by woodland. Currently available ecosystem services approaches to quantifying the mitigating effect of woodland are often simplistic. Here, we propose a new method that uses END noise maps, land cover data, population and building data, landscape permeability and cost-distance techniques to estimate noise mitigation by woodland. This approach allows detailed spatial assessment of the benefits of urban woodland which takes into account which households benefit from noise mitigation, and by how much. The approach can be quantified at whole-city scale. We also present a means of identifying optimal locations for woodland placement, to obtain maximum noise mitigation from new tree-planting projects.

*Keywords*: urban, green-space, trees, woodland, noise

*10. Type of submission: Abstract*

B. Biome Working Group sessions: B10 - Designing healthier cities through understanding demand for urban green and blue spaces, and the context-dependent benefits they provide, with tools and models

3rd ESP EUROPE CONFERENCE Tartu, Estonia 2021 7-10 June
Ecosystem Services Science, Policy and Practice in the face of Global Changes

# Assessing the contribution of urban forest to ecological connectivity and net ecosystem services supply in densifying cities

*First author:* Javier Babí Almenar

*Other author(s):* Chiara Cortinovis, Davide Geneletti, Benedetto Rugani,

*Affiliation*: Institute of Science & Technology, Luxembourg

*Contact*: javier.babialmenar@list.lu

Urban nature-based solutions (NBS), especially urban forests, have become popular among policy makers and built environment professionals for their potential to provide multiple co-benefits and mitigate multiple societal challenges. However, urban NBS assessments usually do not consider: i) environmental impacts of NBS (both, positive and negative) over their entire life cycle; and ii) the influence of the local urban context (e.g. building density) on ES demand and supply. We present a modelling framework that assesses the positive (ES) and negative environmental impacts of urban forests over their entire life cycle. It acknowledges that changes in ES supply and demand over time are dynamic and it works at two levels: foreground (dynamic) and background (steady state). This generates a semi-dynamic modelling framework where local impacts during the operational phase of the NBS intervention are considered dynamically. In contrast, the implementation and end-of-life phases as well as remote impacts are assumed steady state. Moreover, the modelling framework includes an ecological connectivity module, and takes into account the influence of the local context on the ES supply and demand. The modelling framework is tested by evaluating four planning options for the regeneration of a former industrial district in Esch-sur-Alzette (Luxembourg). The options have been developed during a competition held by a public-private consortium. They differ in the amount, density, and spatial arrangement of trees and buildings. The application of our modelling framework allowed to measure the impacts on ES supply and demand due to the compositional and configurational variations of the natural and built features associated to each planning option. In addition, it provided insights on the effects on ecological connectivity at urban and peri-urban levels. The potential and limitations related to the use of our approach to support real-life urban plans is presented and discussed.

*Keywords*: nature-based solutions, system dynamics, biophysical assessment, densification, functional connectivity

3rd ESP EUROPE CONFERENCE Tartu, Estonia 2021 7-10 June
Ecosystem Services Science, Policy and Practice in the face of Global Changes

*11. Type of submission: Abstract*

B. Biome Working Group sessions: B10 - Designing healthier cities through understanding demand for urban green and blue spaces, and the context-dependent benefits they provide, with tools and models

# Planning Nature-based Solutions in Valletta (Malta) by analyzing citizens' demand, spatial opportunities and policy instruments

*First author:* Davide Longato
*Other author(s):* Chiara Cortinovis, Mario Balzan, Davide Geneletti
*Affiliation*: University of Trento, Italy
*Contact*: davide.longato@unitn.it

Nature-based Solutions (NbS) in cities are actions that utilize ecosystem processes of urban green-blue infrastructure to safeguard or enhance the delivery of Ecosystem Services (ES). The analysis of the demand for ES by citizens is a crucial step to identify where and what type of NbS are needed. This research presents a practical approach to identify possible locations for NbS that target existing urban challenges, and to identify policy instruments that may be used to implement them. The case study is represented by the urban area around Valletta, in Malta, the EU country with the highest percentage of built-up areas and population density. First, spatial opportunities for NbS are identified by detecting available open spaces and current planning regulations promoting nature-based interventions (e.g., share of green open space to maintain in development sites, guidance for environmental improving of public spaces, etc.). Second, the demand for ES by citizens is assessed by matching population data and distribution of main urban challenges (i.e., air and noise pollution, stormwater management, high temperatures, and lack of green recreational spaces). Selected ES include noise reduction, air quality regulation, runoff mitigation and flood control, microclimate regulation, and recreation. Third, information about spatial opportunities and ES demand is analysed together with the available policy instruments to prioritize NbS implementation in different target spaces. The results of this study can contribute to a planning strategy for NbS implementation at the city scale, in which available areas are identified and prioritized, and suitable policy instruments are proposed. These instruments are tailored to specific characteristics of the areas, such as size, land tenure, current land use and cover.

*Keywords*: ecosystem service demand, urban planning, urban challenges, green infrastructure, planning regulations

*12. Type of submission: Abstract*

B. Biome Working Group sessions: B10 – Designing healthier cities through understanding demand for urban green and blue spaces, and the context-dependent benefits they provide, with tools and models

## Conceptualising demand for ecosystem services – an adapted spatial-structural approach

*First author:* Claudia Dworczyk

*Other author(s):* Benjamin Burkhard

*Affiliation*: Leibniz Universität Hannover, Institute of Physical Geography and Landscape Ecology, Hannover, Germany

*Contact*: dworczyk@phygeo.uni-hannover.de

People require multiple ecosystem services (ES) to meet their basic needs and to improve or to maintain their quality of life. Natural resources are exploited to meet these needs, threatening biodiversity and increasing pressure on the earth's ecosystems. Cities in particular are characterised by a high demand for ES due to their high population numbers. At the same time, cities are providing few ES themselves due to the strong anthropogenic changes they and their surroundings have been subject to. Comparative analyses can contribute towards relieving some of these pressures by revealing if and where unsustainable use of ES exists and identifying unmet ES demand. The gaps and problems these analyses identify can then be taken into account in sustainable and equitable urban and spatial planning. Spatial-structural approaches can be used to clarify, analyse and visualise the spatial relationships between areas that provide and benefit from ES. However, demand areas are barely considered in existing spatial approaches. This presentation, therefore, introduces an adapted spatial-structural approach for mapping ES demand and aims to improve understanding of the mutual spatial dependencies between the demand for and the supply of ES. This adapted approach spatially relates Service Demand Areas (SDA) to already familiar ES provision and use units, namely Service Provision Areas (SPA), Service Connection Areas (SCA) and Service Benefit Areas (SBA), and can be used to schematically

illustrate, understand and analyse the different forms of demand that emerge. We will demonstrate the benefits of this approach by referencing examples from urban ES contexts.

*Keywords*: service provision area, service benefit area, service connection area, service demand area, ecosystem service mismatches

*13. Type of submission: Abstract*

B. Biome Working Group sessions: B10 - Designing healthier cities through understanding demand for urban green and blue spaces, and the context-dependent benefits they provide, with tools and models

## Changing demands for urban surface water extractions and in situ use functions

*First author:* Suzanne van der Meulen
*Other author(s):* Nora Sutton, Frans van de Ven, Pieter van Oel, Huub Rijnaarts
*Affiliation*: Wageningen University; Deltares, Netherlands
*Contact*: suzanne.vandermeulen@wur.nl

Surface water is an important resource and part of the public space in cities. Sustainable use of these waters contributes to health. For example, aqua thermal energy can replace the use of fossil fuels, and clean surface water supports a healthy lifestyle as it provides ample opportunities for outdoor recreation. A study in two cities in Europe and North America indicates increasing pressure on urban surface water for multiple human use functions (UF's). Sustainable use of urban surface waters requires sound analysis and management of demand and supply of human UFs. Such analysis is missing and needs to include an extended view on current use of urban surface water and a projection on future demand for urban surface water UF's. We present a comprehensive overview of potential UF's, by integrating knowledge from Ecosystem Services and Integrated Urban Water Resources Management literature. In depth-analysis in Toronto, Canada and Amsterdam, The Netherlands, shows that surface water is currently being used for a variety of functions related to nutrition, energy, water regulation, recreation, symbolic use, transportation and floating buildings. Many of these UF's involve in situ use of the water body, rather than water extractions. Interviewed water managers and spatial planners in both cities expect increasing demand for most UF's by 2040. This increase is most prominent for aqua

thermal energy extraction, different types of recreation and urban transportation. Interviewees also identify novel demands, such as climate regulation and reuse of waste products from waterway maintenance. Changing demand is mainly driven by urban growth and redevelopment, climate change and sustainability ambitions; developments that occur in many cities. This study provided a comprehensive overview of UF's, supporting future research on supply and demand. Insight into demand and supply will support prioritization of UF's and function-oriented design and maintenance.

*Keywords*: water demand, urban water resources management, ecosystem services, Toronto, Amsterdam

*14. Type of submission: Abstract*

B. Biome Working Group sessions: B10 - Designing healthier cities through understanding demand for urban green and blue spaces, and the context-dependent benefits they provide, with tools and models

## Urban ecosystem services in Lipetsk (Russia): mapping, assessment, modeling

*First author:* Ksenia Merekalova
*Other author(s):* Alexander Karandeev, Natalia Kopaeva, Natalia Ilinova, Alexander Moiseev, German Titov
*Affiliation*: Lomonosov Moscow State University, Russian Federation
*Contact*: merekalova@yandex.ru

The health and well-being of citizens is directly related to the quality of urban environment, which is determined not only by buildings and infrastructure, but also by the biological and psychological comfort of people, which depends on the natural environment. To make decisions in the field of urban planning policy, objective, reliable and scalable information about the value of urban areas is required. The study of urban landscapes in the context of their provision of ecosystem services makes it possible to identify territories with the highest and lowest potential for the production of various ecosystem services, territories, which require conservation and protection, and territories for which certain planning decisions are needed. The current research is aimed at studying the ecosystem services of urban landscapes in the city of Lipetsk (Russia) in order to develop approaches to their modeling for subsequent implementation in the

environmental management. At the first stage we created a map of urban geosystems of the city based on the concept of geographical systems and approaches to urban morphology. The classification of satellite images of the territory made it possible to calculate the composition of different landcover classes in each contour. A quantitative assessment of the climate-regulating function at the local level was carried out in the InVEST program and the contribution of various geosystems to the regulation of the patterns of climatic variables and heat mitigation was estimated. Air quality assessment was carried out based on field measurements of alkaline-acid conditions and dust content in the snow cover. We also evaluated the recreational service of urban landscapes based on the analysis of green infrastructure availability and the attractiveness of various recreational facilities for citizens.

*Keywords*: urban geosystems, urban ecosystem services, heat mitigation, air quality, recreational services

*15. Type of submission: Abstract*

B. Biome Working Group sessions: B10 - Designing healthier cities through understanding demand for urban green and blue spaces, and the context-dependent benefits they provide, with tools and models

## Revealing the value of ecosystem services from city parks for nearby residents: a hedonic pricing study in Beijing

*First author:* Yujing Ma
*Other author(s):* Eric Koomen, Zhifang Wang
*Affiliation*: Vrije Universiteit Amsterdam, Netherlands
*Contact*: myjingjingxx@hotmail.com

Urban parks and public open spaces play an important role in improving the quality of life for city dwellers by offering many different ecosystem services. As the type and magnitude of these services differs between parks, the benefits citizens derive from them are likely to differ too. We assume that the appreciation for these services is reflected in the citizen's willingness to pay for residential property near the parks and apply an economic valuation approach to assess the contribution of different park characteristics that can be associated with the ecosystem services they deliver. We have set up a hedonic pricing study relying on an extensive database of

residential property transactions for the six central districts of Beijing relating to the past 10 years. The characteristics of the parks are inferred from a social media platform that allows users to exchange quality of life experiences. The results of this study are helpful for urban planners and designers to better understand resident's preferences for urban green spaces and may help them to optimize park characteristics and thus the well-being of local residents.

*Keywords*: ecosystem services valuation, hedonic pricing, urban park, green space

*16. Type of submission: Abstract*

B. Biome Working Group sessions: B10 - Designing healthier cities through understanding demand for urban green and blue spaces, and the context-dependent benefits they provide, with tools and models

## The impact of biodiversity and urban ecosystem services in real estate. The case of the region Ile-de-France

*First author:* Carmen Cantuarias Villessuzanne
*Other author(s):* Jeffrey Blain, Radmila Pineau
*Affiliation*: Groupe ESPI, Paris, France
*Contact*: c.cantuarias@groupe-espi.fr

Our research project aims at raising awareness about the value of biodiversity and urban ecosystem services (UES) for the French real estate market, in the private residential housing. Public perception of the environmental risks rose sharply over the last decade. What is the perception of biodiversity and UES in the real estate market? The French Observatory of Sustainable Real Estate analyzed the priorities of employees and companies. The issue of biodiversity was considered as important as water and human rights, but well below energy, business ethics, corporate social responsibility, risk management policy, territorial development, mobility, or comfort. Using GIS data and economic evaluation, by hedonic price methods, we assess the isolated contribution of the explanatory variables of biodiversity and UES on the price of real estate. We analyze the variation of the value for three urban ecosystem services (IDEFESE Project, 2019)—flood control, proximity to green spaces and refreshment—on the price of real estate when a property changes ownership. Our modeling and mapping focus on the price of transaction (€/m2) at the communal scale from 2014 to 2019. The main variables are internal

characteristics of housing (area, kind of housing, heating), external characteristics (accessibility and infrastructure, economic, social, and physical environment such as air pollution, noise), and biodiversity indicators and urban ecosystem services for the Ile-de-France region. Moreover, we compare environmental values on the enhancement of green spaces, and their impact on residential choices. These studies are very useful for real estate developers, because they enable them to promote green spaces, and municipalities to become more attractive.

*Keywords*: urban ecosystem services, sustainable real estate, urban biodiversity perception, hedonic price, environmental values

*17. Type of submission: Abstract*

B. Biome Working Group sessions: B10 - Designing healthier cities through understanding demand for urban green and blue spaces, and the context-dependent benefits they provide, with tools and models

## Uptake of the green infrastructure concept in urban policies and planning: a field study in 4 European cities

*First author:* Michael Leone
*Other author(s):* Ieva Misiune, Luís Valença Pinto, Julia Palliwoda, Raïsa Carmen, Sander Jacobs, Jörg A. Priess
*Affiliation*: Research Institute Nature and Forest (INBO), Belgium
*Contact*: michael.leone@inbo.be

With the prospects of urban population continuing to grow and demands for more liveable, healthy and resilient cities, green infrastructure increasingly emerged over the last decade as a strategy within the EU to improve the quality of life in urban areas as it can deliver ecological, socio-cultural and economic benefits. To reach the EU's political ambitions, it is vital that the local scale applies the same concept. To plan green infrastructure that provides desirable benefits it is essential to integrate local values – including environmental justice values – and sustainability targets. We investigate how the green infrastructure concept is taken up in policies relevant for urban green space and which values shape green infrastructure in these policies. A document analysis was conducted in four European cities. Additionally, interviews were conducted to investigate which interactions municipalities have with other agencies – as possible ways for the

green infrastructure concept to circulate – that may influence urban green space policies. While the concept can be found in every case study, it's uptake and interpretation differs. We discuss (1) the presence of other environmental concepts which influences the uptake, (2) the moldability of the green infrastructure concept, leading to different interpretations, and (3) the requirement of driving forces that incentivize the concepts' (re-)use in order to make it recognized and shared.

*Keywords*: urban green infrastructure, multifunctionality, environmental justice, urban green space policies, policy analysis

*18. Type of submission: Abstract*

B. Biome Working Group sessions: B10 – Designing healthier cities through understanding demand for urban green and blue spaces, and the context-dependent benefits they provide, with tools and models

## Downscaling of daily Land Surface Temperature (LST) to fine scale (30m x 30m) using a variation of the DisTrad approach that mixes MODIS LST and LANDSAT NDVI data at different spatial frequencies

*First author:* David Nail Bird
*Affiliation*: Joanneum Research Forschungsgesellschaft mbH, LIFE – Institute for Climate, Energy and Society, Austria
*Contact*: neil.bird@joanneum.at

Land Surface Temperature (LST), a remotely sensed estimate of temperature, is available free of charge, at 30m x 30m from LANDSAT every 16 days, and at 1000m x 1000m from MODIS four times daily. A problem in the data collection is the presence of clouds, which means that there may be very few useful LANDSAT based fine scale LST images for a specific site. However, the coarseness of the MODIS data makes it not very useful for studies of the impact of specific ecosystem services (ES). A variation of the DisTrad downscaling method will be presented that mixes a high spatial frequency ES, vegetation, represented by the normalised differential vegetation index (NDVI) from LANDSAT with lower spatial frequency background LST from MODIS in different spatial bands (spatial spectral composition) to provide find scale LST. The method has the potential to provide find scale LST four times daily on any day of the year. As an auxiliary output of the method, the effectiveness of the ES at various daily temperatures can be

demonstrated and the spatial “blurring” of the impact of ES can be estimated. Finally, with LST estimates distributed regularly throughout the year, one can create a transfer function to convert LST to air temperature if required. Examples will be shown from the ongoing REGREEN H2020 Project.

*Keywords*: urban heat estimation, land surface temperature, cooling by vegetation, spatial frequency analysis