# BOOK OF ABSTRACT



## I. SESSION DESCRIPTION

ID: B10b

Nature-based Solutions for enhancing urban sustainability and ecosystem services



| | Title | Name | Organisation | E-mail |
|---|---|---|---|---|
| Host: | Dr. | Roy Remme | Natural Capital Project, Stanford University, USA | royremme@stanford.edu |
| Co-host(s): | | Clara Veerkamp | Netherlands Environmental Assessment Agency (PBL), The Netherlands | clara.veerkamp@pbl.nl |
| | Dr. | Hongxiao Liu | Natural Capital Project, Chinese Academy of Sciences, China | michellewinter@126.com |
| | Dr. | Léa Tardieu | CIRED, France | tardieu@centre-cired.fr |



Abstract:

Urban green and blue infrastructure and the solutions they provide (i.e. through natural capital and ecosystem services) are increasingly recognized for their potential to help tackling many urban sustainability issues. Several policy bodies and initiatives have promoted the integration of urban nature-based solutions (NbS) in future policy and planning for sustainable cities around the world (e.g. SDG11, WHO, New Urban Agenda, ICLEI, EU Green Infrastructure Strategy). However, scientific evidence on the contribution of NbS to address urban sustainability challenges are largely scattered, which might hamper the future implementation and management of such solutions.

Climate change, human health issues and loss of biodiversity are sustainablity issues cities around the world are facing. Climate change is a multifaceted challenge,including threats such as increasing heat stress, changes in the local water cycle (i.e. flooding and droughts), and consequences of sea level rise in coastal zones. NbS can contribute to creating climate resilient cities and to reduce risks.Urbanization is leading to more a more sedentary and unhealthy

population. Many cities are looking for pathways to address a range of health issues. A body of literature had shown that nature can bring multiple health benefits from enhancing NbS, cognitive development, good thermal confort, stress relief, blood pressure control and increasing physical activity, through multiple pathways.

Rapid urban growth creates a challenge for global commitments to conserve biodiversity. Biodiversity is under pressure in expanding cities, where (semi-)natural habitats are making place for buildings and infrastructure. At the same time, nature in and near cities is crucial for maintaining global biodiversity and flow of different ecosystem services. Presentations are sought that showcasing examples of different cities using inspiring tools and applications that directly support city planning and policy towards sustainable futures cities. The presented strategies to tackle climate change, human health and biodiversity challenges with Nbs will be further discussed in an interactive debate, involving participants and audience, to address bottlenecks and opportunities for applying NbS in different urban contexts.

## Goals and objectives of the session:

This session will explore the roles that nature-based solutions can play to tackle urban sustainability issues. Multifaceted approaches that address multiple ecosystem services will be presented, addressing co-benefits of sustainability strategies. The focus of the session will be on NbS in relation to three major themes:

1) climate resilience
2) human health
3) urban biodiversity

This session will facilitate a multidimensional debate on the role of nature-based solutions in complex urban challenges.

## Planned output / Deliverables:

No specific planned outputs and deliverables.

## Related to ESP Working Group/National Network:

Biome working group: BWG 10 - Urban systems

## II. SESSION PROGRAM

**Date of session:** Thursday, 24 October 2019
**Time of session:** 10:30 – 12:00

### Timetable speakers

| Time | First name | Surname | Organization | Title of presentation |
|---|---|---|---|---|
| 10:30–10:40 | Roy | Remme | Stanford University, USA | Nature-based solutions for enhancing urban sustainability and ecosystem services – session introduction |
| 10:40–10:50 | Helena<br>Tomáš | Duchkova<br>Bad'ura | CzechGlobe, Czech Republic | Benefits and costs of nature-based solutions: two case studies from Prague<br>Using choice experiment to value preferences to support use of nature based solutions for adaptation for climate change in Prague |
| 10:50–11:00 | Davide | Geneletti | University of Trento, Italy | Nature-based solutions for urban vacant lots: a sustainable strategy? |
| 11:00–11:10 | Chris | Nootenboom | Natural Capital Project, University of Minnesota, USA | Standardized assessment of ecosystem services provided by green infrastructure in US cities |
| 11:10–11:20 | Katja | Schmidt | University of Potsdam, Germany | Greening courtyards for climate adaptation and co-benefits in Potsdam, Germany |
| 11:20–11:30 | David | Fletcher | Centre for Ecology & Hydrology, UK | Assessing benefits of urban green and blue space in cities from four continents: Asia, Latin America, Africa, Europe |
| 11:30–12:00 | Interactive debate and wrap up | | | |

## III. ABSTRACTS

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

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

B. Biome Working Group sessions: B10b Nature-based solutions for enhancing sustainability and urban ecosystem services

### Using choice experiment to value preferences to support use of nature based solutions for adaptation for climate change in Prague

*First author:* Tomas Badura

*Other author(s):* Eliska, Lorencova, Silvia, Ferrini, Dava Vačkářů

*Affiliation*: Global Change Research Institute of the Czech Academy of Sciences (CzechGlobe), Czech Republic

*Contact*: badura.t@czechglobe.cz

This paper presents a choice experiment that values residential preferences for policy concerning increase in usage of a range of nature based solutions (NBS) for climate adaptation in the capital of Czech Republic, Prague. The valuation study provides a rare focus on a full range of common NBS rather than on specific type of NBS present in other studies and provides an analysis of preferences for a city wide policy in a major European city. The policy change was described by three characteristics: where the NBS would be dominantly implemented; how diverse in terms of species composition they would be; and how much such policy would cost the respondents. Our results suggest that majority of our sample strongly supports a move from status quo and is willing to pay for an increased of use of NBS in their city. Respondents prefer measures that are either implemented mostly in public spaces (e.g. trees, flower and grass strips, permeable green measures) or policy that are evenly implemented also on public buildings (includes also green roofs and facades). Policy that implements NBS dominantly on public buildings was less preferred, however such policy showed high level of preference heterogeneity. Respondents preferred higher species composition of the measures, but with a decreasing rate. Analyzing the sources of the preference heterogeneity we see that people's experience of heatwaves has tendency to increase their WTP for a change from status quo, as does university education. The paper also provides welfare analysis of a range of policy scenarios involving different combination of the attributes of the policy change; and provides overview of sample's opinions about climate chance policies in general. Results of this study

will be used by city administration, on which request it was designed, to further inform climate change adaptation in Prague.

*Keywords*: choice experiment, non-market valuation, nature based solutions, climate change adaptation

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

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## Nature-based solutions for urban vacant lots: a sustainable strategy?

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

An emerging problem in some cities, in Europe but also elsewhere, is the presence of land parcels with building rights that are not developed, due to the on-going crisis of the building sector, or other economic reasons. Irrespective of their conditions, and the market situation, these vacant lots often maintain their development rights through time, because revoking them can be legislative (or politically) challenging. As a result, these areas are left idle for long periods of time, and are often abandoned and unkempt. Nature-based solutions (NbS) can offer a way out of this problem, provided that their implementation can prove to be flexible and reversible (e.g. to accommodate future shifts in housing market), cost-effective, and beneficial to people (communities, administrators, land owners) and nature.

In this study we empirically analysed the potential impacts of implementing a range of different NbS in the vacant lots of a city in northern Italy, by assessing the expected ecosystem services for different groups of beneficiaries, and the cost for executing and maintaining NbS over different time horizons (5, 10, 20+ years). To this purpose, we considered five broad categories of NbS (rain gardens, Kyoto forests, recreational areas, allotment gardens, habitat for wildlife), and simulate their implementation in the lots that are currently vacant, despite having development rights. Potential NbS were allocated to the different lots according to the suitability of the site (e.g., by looking at morphology, size, etc) and the demand for that "solution" (e.g., by considering population density and classes, proximity to existing parks or

allotment gardens, imperviousness rate, etc.). The resulting scenarios of future implementation of NbS were assessed against the expected costs (including taxation associated to development rights), and used to draw conclusions about the overall role that NbS can play for revitalising vacant lots in cities.

*Keywords*: Urban ecosystem services, urban planning, cost effectiveness, green infrastructures

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

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## Benefits and costs of nature-based solutions: two case studies from Prague

*First author:* Eva Horváthová

*Other author(s):* Duchková, Helena, Baďura, Tomáš, Grammatikopoulou, Ioanna, Vačkářů, Dava

*Presenting author:* Helena Duchkova

*Affiliation*: Global Change Research Institute of the Czech Academy of Sciences (CzechGlobe), Czech Republic

*Contact*: horvathova.e@czechglobe.cz

Well-designed Nature based solutions (NBS) can yield several benefits including air quality regulation, noise reduction, recreational opportunities while it also may mitigate some climate change risks such as heat waves. In some cases, however, NBS can lead to disservices such as an increase in pollen or can rise carbon emissions, while also posing significant and fixed and operational costs. Careful design based on understanding of relative costs and benefits of NBS is hence of significant importance.

Many cities have incorporated NBS as a key concept in the adaptation strategy to climate change. In this article we assess costs and benefits of two implemented urban NBS in Prague. First, we assess benefits and costs of trees planted in a downtown street in Prague. In this case, we compare costs and benefits of two approaches: normal tree planting and planting with root structure systems. Root structure systems prevent paving from being pushed up, ducts from being destroyed and while at the same time having capacity to store and regulate stormwater. Next, we evaluate vegetation strips in a city. We focus mainly on green tramways

and compare cost and benefits of different types of vegetation planted in green tramways. The focus on these two case studies is useful as they are very common NBS in other cities.

To assess importance and effects of different types of NBS, we employ a database on urban NBS which is introduced in the study, too. In this database we gather bio-physical as well as monetary data on benefits of urban NBS.

Our work supports the evaluation of cost-effectiveness of NBS in urban environment and provides methodological insights into the evaluation of benefits and costs of two common NBS measures. The study results can assist urban landscape planning in Prague and other cities.

*Keywords*: urban adaptation; nature-based solutions; benefits; Prague

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

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## Assessing benefits of urban green and blue space in cities from four continents: Asia, Latin America, Africa, Europe

*First author:* Laurence Jones
*Other author(s):* Patrick Likongwe, Sosten Chiotha, Gilbert Nduwayezu, Dwijen Mallick, Nasir Uddin, Atiq Rahman, Polina Golovatina
*Presenting author:* David Fletcher
*Affiliation*: Centre for Ecology & Hydrology, United Kingdom
*Contact*: lj@ceh.ac.uk

The benefits of urban green and blue space are widely discussed, but rarely quantified. Where they are quantified, they tend to use generic value transfer, and do not take into account how green or blue space might perform differently under local conditions or in different contexts. Although assessments increasingly consider the demand for services, this frequently confuses the spatial pattern of pressure with a wider understanding of where the beneficiaries are located and who will benefit most.

We conduct an assessment of urban natural capital in selected cities from four continents with contrasting climate, political and social context, and size. The assessment takes into account spatial patterns in the socio-economic demand for ecosystem services and develops metrics which reflect that local context. The following ecosystem services were assessed: flooding regulation, hazard regulation, air pollution removal, urban heat island mitigation, noise mitigation and recreation/access. It uses locally-relevant data and response functions to calculate the benefit from each of these, for each case study city.

The desired endpoint is to create a summary for local policy makers in each city that clearly describes the benefits that green and blue space in their city provides. The aim is that with a better understanding of the benefits, this will inform future management of this resource.

*Keywords*: Nature Based Solutions, social equity, green and blue space, cities, green infrastructure

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

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## Standardized assessment of ecosystem services provided by green infrastructure in US cities

*First author:* Eric Lonsdorf
*Other author(s):* Chris Nootenboom, Ben Janke, Brian Horgan
*Presenting author:* Chris Nootenboom
*Affiliation*: University of Minnesota and Natural Capital Project, United States of America
*Contact*: eric.lonsdorf@gmail.com, lons0011@umn.edu

Increases in urban population will exert development pressure to convert existing green spaces to built-up areas with greater housing or commercial capacity. Yet, the precise impact of urban nature on people is uncertain. In order to achieve the UN's SDG goals, the complex interactions of urban planning with ecosystem service supply and human well-being are uncertain. Developing standardized approaches to quantifying the supply of ecosystem services in urban areas would facilitate their integration into urban planning decisions around green infrastructure. We used the Natural Capital Project's latest software, Urban InVEST, to

explore how changes in the amount and configuration of green infrastructure affects the supply of urban cooling, runoff retention and urban pollination in several cities in the United States. We also developed a related tool to help standardize assessing effects of land use change on the supply of urban ecosystem services. The tool samples existing land use patterns within each city and creates six urban typologies that were representative of the urban land use patterns: a golf course, a natural area, a city park, a suburban residential development, an urban residential development, and an industrial area. Then, the tool applies these typologies to user-defined locations within the city and runs each of urban ES models under each potential land-use change scenario. Together, these standard approaches enable a user to explore how increases or decreases in green space might affect the supply and distribution of ecosystem services in cities across the United States or other urban areas with comparable data.

*Keywords*: urban ecosystem services, green infrastructure, natural capital

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

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## Greening courtyards for climate adaptation and co-benefits in Potsdam, Germany

*First author:* Katja Schmidt
*Other author(s):* Ariane Walz
*Affiliation*: University of Potsdam, Germany
*Contact*: schmikat@uni-potsdam.de

Urban green infrastructure (UGI) is increasingly being promoted as a measure to mitigate urban heat stress caused by the heat island effect and climate change impacts. However, evidence of the effectiveness of UGI to moderate heat stress is mostly lacking. This is a serious challenge for urban planners who have the responsibility of navigating their cities towards a sustainable future while being constrained by financial and spatial factors. In this contribution, we examine the effectiveness of green structures to increase thermal comfort in four courtyards with similar building structure but varying green structures in Potsdam, Germany. Our work will highlight important co-benefits that green structures offer in an urban setting. We will present first results of a measuring campaign that will take place in July and August 2019. Specifically, we aim to show how green infrastructure (1) affects human health through

thermal comfort, while it has the potential to also affect (2) human well-being, (3) biodiversity, and (4) carbon storage. The case study area is located in a socially deprived neighborhood in the south-east of Potsdam, where additional benefits of green infrastructure are of particular importance. Our findings aim to increase our understanding of the regulating effects of different green infrastructure settings as well as their co-benefits.

*Keywords*: urban green infrastructure, regulating services, climate adaptation