BOOK OF ABSTRACTS

I. SESSION DESCRIPTION

ID: B10a

Assessing health and well-being ecosystem service benefits from Nature-Based Solutions across urban/peri-urban landscapes

Hosts:

	Name	Organisation	E-mail
Host:	Peter Roebeling	University of Aveiro	peter.roebeling@ua.pt
Co-host(s):	Carlotta Quagliolo Luis Inostroza Luis Magalhães-Filho Myriam Lopes Rita Mendonça Fábio Matos	University of Aveiro Mendel University in Brno	carlotta.quagliolo@ua.pt luis.inostroza@mendelu.cz

Abstract:

Global change, including climate change, population growth and economic development, presents urgent challenges to socio-ecological systems worldwide. In particular cities need to deal with global change-related challenges, such as urban heating and air pollution, flooding and water pollution, biodiversity losses and ecosystem degradation, and sprawl, gentrification and real-estate devaluation, among others. These challenges impact on economic activities, human health and well-being and, hence, global change adaptation is crucial for cities of the future. There is increasing evidence that nature-based solutions (NBS) and strategies across urban/periurban landscapes, can provide effective solutions to these multiple challenges. The underpinning principle of NBS is the operationalization of the ecosystem services concept – providing multiple ecosystem services and benefits that contribute to human health and underpin well-being – hence not only mitigating but also adapting to global change challenges. Albeit the Final Report of the Horizon 2020 Expert Group on 'Nature-Based Solutions & Re-Naturing Cities'

of the European Commission provides overwhelming evidence of the positive impacts of NBS on human health and well-being, evidence is mostly partial (i.e., focused on one or few ecosystem services), short-term (i.e., focused on direct impacts) and specific (i.e., focused on single solutions). Hence, there is a need for integrated approaches that allow for the assessment of multiple human health and well-being ecosystem service benefits provided by NBS across urban and peri-urban landscapes using a broad value approach as the one proposed by the IPBES value assessment. In this session we welcome contributions developing such integrated approaches, discussing associated methodological issues, and/or applying these approaches in actual case studies.

Goals and objectives of the session:

Researchers are invited to present their latest findings about approaches for assessing human health and well-being ecosystem service benefits provided by NBS across urban and peri-urban landscapes. This session aims to facilitate an interactive discussion where participants can exchange their diverse experiences about integrated NBS assessments.

Planned output / Deliverables:

Special Issue in Ecosystem Services.

Session format:

Between 1 and 1½ hours 10-minute pitches/presentations

II. SESSION PROGRAM

Room: Expert Street 3

Date of session: 18th of November 2024
Time of session: 14:00 – 15:30 & 16:00 – 17:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
14:00 – 14:05		Session organizers		Introduction to session
14:05 – 14:17	Luke	Brander	Leibniz University Hannover	Environmental degradation and mental health: A global analysis of societal costs

Time	First name	Surname	Organization	Title of presentation
14:17 – 14:29	Silvia	Ronchi	Politecnico di Milano	Governance mixes for sustainable peri-urban landscapes: insights from a survey on policy instruments
14:29 – 14:41	Pierre	Chopin	Vrije Universiteit Amsterdam	A conceptual framework to design and assess urban agricultural systems that provide multiple ecosystem services and benefits to society
14:41 – 14:53	Chiara-Charlotte	Iodice	ILS Research gGmbH, Dortmund	A healthier planet for all – green and blue spaces and their benefits for mental health: Co-creation approaches of the GreenME project
14:53 – 15:05	Mareike	Diekmann	Technische Universität Dortmund	Ecosystem Services to protect critical health infrastructure
15:05 – 15:17	Ellen	Hannes	UHasselt	The value of neighborhood greenspace for children using the life satisfaction approach
15:17 – 15:30	All participants			Session discussion (part I)
15:30 – 16:00	Coffee/tea break			

Time	First name	Surname	Organization	Title of presentation
16:00 – 16:12	Peter	Roebeling	University of Aveiro	Health disutility benefits from nature-based solutions for air quality improvement: a case study for Turin (Italy)
16:12 – 16:24	Aisling R. Sealy	Phelan	University of Padova	Economic evaluation of nature-based therapies – A pilot costing analysis and willingness to pay for nature-based rehabilitation of Chronic Obstructive Pulmonary Disease
16:24 – 16:36	Corinna	Patetta	Politecnico di Milano	Assessing ES for human health in the Forestami tree planting

Time	First name	Surname	Organization	Title of presentation
16:36 – 16:48	Carlotta	Quagliolo	University of Aveiro	Cultural ecosystem service benefits assessment of Nature-Based Solutions scenarios: the case of Aveiro (Portugal)
16:48 – 17:00	James	Obeng	University of Jyväskylä	Mapping young people's favorite environments and the association with wellbeing and social inclusion
17:00 – 17:12	Pinar	Pamukcu-Albers	University of Bonn	Quantifying Ecosystem Services in Renatured Floodplains: A Case Study of the Emscher River in Germany
17:12 – 17:22	All participants			Session discussion (part II)
17:22 – 17:30	Session organizers			Wrap-up of session, outlook and next steps

III. ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Ecosystem Services to protect critical health infrastructure

First authors(s): Mareike Diekmann

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Humans can benefit directly from nature in terms of health in many ways (e.g. Coutts & Hahn, 2015). In Grün4KRITIS, the next step is being taken to investigate the extent to which green infrastructure can help protect critical infrastructures (CI) in the health sector.

Some facilities in healthcare such as hospitals are identified as CIs. This can be seen from the perspective of the facility as a CI, but also from hosting vulnerable groups of people (BSI Kritis

Regulation; Federal Ministry of Health, 2023). In the event of a crisis, specific healthcare facilities must remain functioning. In the context of climate change, consideration of the potential risk resulting from the hazard, exposure, and vulnerabilities is of fundamental importance for the protection of CIs (IPCC, 2022). Cascading effects are a method used in the field of risk research to illustrate consequences. Based on a scenario, it is shown how the event affects facilities and what further effects a disruption or failure may result in, also considering influences on other CI-sectors (Kruse et al., 2021).

The project framework deals with extreme weather events. The consequences are investigated in a qualitative approach based on findings from previous projects, interviews, and workshops. Scenario-based cascades are developed as part of risk research. Interrupting them by implementing suitable ecosystem services (ES), is one of the main research interests. Furthermore, the protection of CI through green Infrastructure might be introduced as a new ES. In this way, infrastructures shall be better protected against extreme weather events. The investigation is taking place in the Ruhr area in Germany

The contribution will highlight findings on the innovative combination of both research fields and discuss how this can be further deepened. The focus will be on the methodological description of cascading effects and the potential for interruption by ES.

References

BSI-Kritis Regulation of April 22, 2016 (Federal Law Gazette I p. 958), last amended by Article 1 of the Ordinance of November 29, 2023 (Federal Law Gazette 2023 I No. 339)

Federal Ministry of Health (2023): Gesundheitsrisiko Hitze. Available: https://www.bundesgesundheitsministerium.de/themen/praevention/hitze.html, last checked on 24.12.2023.

Coutts, Christopher; Hahn, Micah (2015): Green Infrastructure, Ecosystem Services, and Human Health. In: International journal of environmental research and public health 12 (8), S. 9768-9798. DOI: 10.3390/ijerph120809768.

IPCC (2022): Climate Change 2022 - Impacts, Adaptation and Vulnerability.

Kruse, P.M.; Schmitt, H. C.; Greiving, S. (2021): Systemic criticality-a new assessment concept improving the evidence basis for CI protection. In: Climatic change 165 (1), p. 2. DOI: 10.1007/s10584-021-03019-x

Keywords: critical infrastructure protection, climate adaption, green infrastructure, cascades, interdisciplinary

2. Mapping young people's favorite environments and the association with wellbeing and social inclusion

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The health and wellbeing challenges among young people has heightened in recent times, especially in the face of the multiple crises such as climate change, COVID-19, and precarious labor market. Concurrently, urbanization and technological innovations are affecting the lifestyles of many young people, limiting their outdoor exposure and nature experiences which all bears on their wellbeing. In Finland, young people have reported symptoms of anxiety, depression, loneliness, and social isolation.

Meanwhile, there is increasing research that show that natural environments provide ecosystem services such as improving human health and wellbeing, helping to mitigate air pollution and climate change induced heat and in recent times providing the space for people to relieve stress during the COVID-19 pandemic. Though there are lots of nature in Finland and natural environments are common places for recreation activities, some young people do not consider nature important despite encouragements to go into nature (Rantala & Puhakka, 2020). Those who go into nature usually prefer outdoor recreation at notable distances from their residence and favor more sports-related activities (Fagerholm, 2022; Laatikainen et al., 2017).

To enhance young people's utilization of ecosystem services, more understanding in needed on their nature experiences. As such, we combined the Public Participation Geographic Information Systems (PPGIS) tool with survey questions and asked young people living in Northern Finland to map their favorite environments and activities in those environments and examined how these factors associate with their mental wellbeing, social inclusion, nature relatedness. Results from the study will contribute to developing tailored nature-based interventions for young people and support spatial land use planning.

Keywords: Favorite environment, PPGIS, social inclusion, wellbeing, young people in Finland

3. Quantifying Ecosystem Services in Renatured Floodplains: A Case Study of the Emscher River in Germany

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Renatured floodplains provide critical ecosystem services, including enhanced water filtration, increased biodiversity, and improved flood mitigation. By restoring natural habitats, these areas support wildlife, improve water quality, and offer recreational and aesthetic benefits to local communities. This study utilizes the River Ecosystem Service Index (RESI) method to quantify and compare ecosystem services in renatured floodplains along the Emscher River in Germany. The Emscher River has experienced significant anthropogenic impacts, primarily due to its historical use as a sewage channel and the effects of coal mining activities. Our research makes the ecosystem services of the new floodplains visible and quantifiable. Furthermore, this study tests and potentially adapts the applicability of the RESI method for rivers with relatively small watersheds, and the variable technics on segmentation. The primary results show that the method enables the identification of trade-offs and synergies between individual services, and dependencies on land use, floodplain characteristics, and current nature-based solutions and measures, facilitating the prioritization of actions in flood-prone areas. The RESI method proved useful in supporting decision-making within a watershed approach for restoration planning, despite some inherent challenges and limitations of the methodology itself.

Keywords: Ecosystem services, renaturation, floodplains, nature-based solutions, flood measures.

4. Assessing ES for human health in the Forestami tree planting

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Cities face numerous challenges in the social, urban and environmental context due to densification and the effects of climate change. Among these, the Milan metropolitan area, one

of the densest areas in Europe, deals with challenges such as harmful air quality levels and heat waves that significantly affect the most vulnerable populations.

In this critical context, the Forestami project aims to plant three million trees, proposing an adaptive strategy to activate a sustainable network to increase NBS and improve citizens' quality of life.

Since 2018, 59 interventions have been carried out for almost 58,500 trees and shrubs planted in urban and peri-urban contexts, engaging municipalities and different public and private institutions operating in the territory. These planting activities were investigated in relation to the accessibility maps to open green spaces to evaluate their contribution to the citizens' psychophysical well-being.

This research assesses and quantifies the tree planting activities to communicate the influence and relevance of afforestation projects to decision-makers and disseminate their value to people.

It compared different evaluation methods in four Forestami projects implemented along roadways, in compact industrial urbanisation, between dwelling units and agricultural fields and on the edge of the urbanised. The proposed approach is a MCA, which refers health-related ES with environmental and context-based criteria, proposing a brief discussion on cultural ES through a survey. This interpretation provides a systematic and integrated method highlighting the potential and limitations of the tools and methods available today.

The complexity of the Forestami tree planting and the models applied, therefore, intends to initiate a reflection on the need to implement and develop new ways to enhance the importance of nature in urban spaces, leaning towards an integrated dialogue between planners, designers and decision-makers, also considering the growing market demand by private companies, stakeholders and citizens to quantify plants' ES.

Keywords: #urbanforestry#multicriteriaanalysis#ESculturaldissemination

5. Cultural ecosystem service benefits assessment of Nature-Based Solutions scenarios: the case of Aveiro (Portugal)

First authors(s): Carlotta Quagliolo

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There is growing empirical evidence on the notion that people more connected with urban nature and that engage physical activities in nature, report higher general well-being in terms of happiness, life satisfaction and quality of life. Social and cultural impacts of Nature-Based Solutions (NBS) are directly linked to human health and well-being co-benefits. While there are numerous primary valuation studies assessing cultural ecosystem service (ES) values from urban nature, there are only a few studies that develop spatially-explicit simulation approaches to assess the cultural ES benefits from NBS. Hence, the objective of this study is to develop and apply a spatial environmental-economic approach to assess the cultural ES benefits from NBS for urban global change adaptation. The approach integrates the InVEST Urban Nature Access model (InVEST-UNA) and meta-analytic value function transfer methods (MA-VFT) into a spatially-explicit GIS-based approach. A case study is provided for the city of Aveiro (Portugal), considering green roofs, street trees and urban park NBS scenarios. Results show that albeit existing urban nature access is low, urban green spaces provide important cultural ecosystem service values to residents. The establishment of NBS is expected to provide significant cultural ES benefits, in particular in areas where existing urban nature access is low. Largest cultural ES benefits are observed in higher-income and densely populated areas. Hence, the integrated spatial environmental-economic assessment approach aims to inform urban planners and policymakers regarding decisions on where to invest in NBS in order to achieve the maximum well-being benefits across all urban residents.

Keywords: Urban nature access, Well-being, Spatially-explicit assessment, Nature-based solutions scenarios

6. Health disutility benefits from nature-based solutions for air quality improvement: a case study for Turin (Italy)

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Climate change, population growth and economic development present urgent challenges for cities in the 21st century, leading to residential, industrial and infrastructure development, associated increases in surface sealing and air pollutant emissions, and subsequent consequences for urban heating and air pollution. Air pollution has been associated with cancer, cardio-vascular and respiratory diseases (morbidity) that, in turn, imply resource (medical expenses), opportunity (productivity losses) and disutility (pain and suffering) costs. While morbidity costs associated with resource and opportunity costs are well established, those associated with disutility are less well established. Hence, these challenges impact on human health and well-being and, thus, global change adaptation is crucial for resilient cities of the future. Nature-based solutions (NBS), which provide multiple ecosystem functions, services and values that contribute to human health and well-being, are considered to provide effective solutions to these multiple challenges. The objective of this study is to assess the health disutility benefits from nature-based solutions for air quality improvement, with a case study for green/blue spaces, street trees and green roofs in Turin (Italy). Therefore, an integrated assessment method is developed, combining air quality models (to assess the impacts of NBS on air quality), dose-response functions (to assess the impacts of air quality on morbidity) and value function transfer (to assess the impacts of morbidity on disutility), and using city statistical data (from ISTAT) and randomization of variables (using R). Results show that current disutility costs amount, on average, to ~3,300 Euro/person/year. Disutility benefits from NBS range, on average, between ~300 (green roofs) and ~550 (green/blue spaces) Euro/person/year. Comorbidity increases disutility costs and NBS disutility benefits by up to 5 times. Hence, it is shown that disutility costs from air pollution related morbidity are large and that NBS lead to significant reductions in disutility costs (on average up to -15%).

Keywords: Air pollution, Morbidity, Disutility, Human health, Nature based solutions

7. Governance mixes for sustainable peri-urban landscapes: insights from a survey on policy instruments

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Peri-Urban Landscapes (PULs) are defined as transitional areas that include both natural and anthropic areas. While the unsustainability of these landscapes is well-known and recognized, governing PULs still remains particularly difficult. Habitat fragmentation, biodiversity degradation and urban sprawl are common processes that exacerbate the difficulty of managing PULs sustainability.

The research moves from the assumption that addressing the sustainability challenges of PULs requires a combination of Policy Instruments (PIs) that can respond to different needs and provide effective solutions to various challenges. The rationale behind is that no single PI can effectively address the multifaceted issues of PULs, but a coordinated policy mix is needed to tackle different aspects of sustainability.

An online survey was developed to collect case studies of existing PIs implemented in PULs. Respondents described the selected PIs in terms of objectives, stakeholders' involvement, modes of implementation, and associated barriers. In addition, the survey sought to investigate which combinations of PIs are adopted to tackle specific categories of sustainability challenges.

Data from fifty valid answers were collected and analysed, covering 47 PULs from 26 countries. The analysis revealed the presence of a policy mix approach for addressing sustainability challenges in PULs, suggesting the need for a plurality of PIs to govern the dynamics and complexities of PULs. The results indicate an important role of the regional governance level and a dominating presence of top-down instruments. Moreover, prevalent features and common shortcomings of PIs adopted in PULs emerged, including the prevalence of regulatory approaches, a high dependency on public funds, and a still low level of involvement of citizens in policymaking processes.

Reflecting on the findings and considering the existing literature on governance experimentation, the research suggests governance mixes for PULs as potential approaches to address some of the shortcomings of the analysed policy mixes.

Keywords: policy mix, sustainability challenges, planning, governance

8. Environmental degradation and mental health: A global analysis of societal costs

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Human activities are causing global environmental degradation and there is increasing evidence of consequences for both physical and mental health. Mental disorders have major negative economic impacts in the form of treatment costs, loss of productivity, and impaired wellbeing – collectively described as societal costs. This paper presents the results of an explorative global analysis of the societal costs of mental disorders attributable to projected future changes in climate, air pollution and access to green space. The analysis applies meta-analytic value transfer methods to identify and quantify the key determinants of the prevalence and costs of mental ill health; and to subsequently model future changes in societal costs attributable to environmental degradation. Two regression analyses are used to quantify 1. the rates of mental health disability adjusted life years (DALYs) at a country level; and 2. the cost of mental disorders (USD/DALY) as a function of natural hazards, air pollution, access to green space and other predictor variables. The results provide country level estimates of the monetary value of the costs of mental health disorders attributable to changes in climate hazards, air pollution and access to green space over the period 2020-2050. Globally, the additional annual societal costs of mental disorders due to changes in these environmental factors are estimated to be almost USD 47 billion in 2030 and rising to USD 537 billion in 2050, relative to a baseline scenario in which environmental conditions remain at 2020 levels. The paper serves to provide evidence to motivate policy makers to integrate environmental considerations in policy responses to address mental ill health; and concomitantly to integrate the costs of mental ill health within broader environmental public policy debates.

Keywords: mental health, climate change, air pollution, green space, societal cost

9. The value of neighborhood greenspace for children using the life satisfaction approach

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Across the globe, urbanization is increasing, intensifying the pressure on greenspaces, which affects all its users, including children. This is potentially concerning since exposure to nature enhances children's health and well-being. With regard to well-being, while robust evidence is present on the positive relationship between exposure to nature and well-being of children, currently no monetary valuation of the well-being benefits exists, making them more difficult to appropriately include in public decision-making regarding greenspace development. This study, for the first time, puts a monetary value on neighborhood greenspace exposure for children using the life satisfaction approach (LSA). This approach has been employed for the monetary valuation of environmental goods and issues but has not been extended yet to value the well-being of children. The LSA quantifies the influence of neighborhood greenspace on children's life satisfaction (LS) and compares it to the impact of other determinants of their LS that can be valued in monetary terms. In that way, the LSA calculates the amount of money to offset a change in neighborhood greenspace to keep the child at the same level of LS. As a result, the LSA does not require children or their parents to assign monetary values themselves. Data were gathered from 430 parent-child pairs in 29 different primary schools in Flanders (age range of children 10-12). The monetary value will be determined based on the tradeoff between the impact of the exposure of neighborhood greenspace on children's LS and the impact of working hours of parents and time children spend with their parents on children's LS. This time will be valued using the market replacement cost and opportunity cost method. The results of the study reveal the monetary value of neighborhood greenspace in terms of improvements in children's self-reported LS.

Keywords: Neighborhood greenspace, Life satisfaction, Valuation, Children

10. Economic evaluation of nature-based therapies – A pilot costing analysis and willingness to pay for nature-based rehabilitation of Chronic Obstructive Pulmonary Disease

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As modern and developed societies become increasingly urbanised, digitalised and detached from the natural world, we are increasingly facing problems with regards to poor physical and mental health. At the same time, there is a growing recognition of the potential benefits for human health of interacting with nature. Within this context, nature-based health interventions have been growing in popularity in the western world. Despite increasing scientific evidence on the physical and psychological health benefits of interacting with nature, there remains a lack of knowledge from an economic perspective. Some evidence suggests that these types of interventions could be a cost-effective way of providing public health benefits, however, we lack examples of robust economic evaluations. We address this knowledge gap, undertaking an economic evaluation alongside a randomised control trial testing the effects of nature-based therapy for Chronic Obstructive Pulmonary Disease (COPD) patients. This study evaluates the costs of providing such a therapy, and the value of the benefits experienced by participants. Micro-costing methods were used to undertake an economic evaluation in three ways: (i) costing analysis to identify and where possible value the total costs of the trial, (ii) costing analysis of the costs relevant for evaluating cost-effectiveness of trial, and (iii) an estimation of future "roll out" costs. The benefits of the programme will be assessed using the contingent valuation method, employing a willingness to pay approach. After completing the trial, participants will be asked their marginal willingness to pay for the programme compared to the conventional therapy offer currently available indoors at rehabilitation clinics. This will allow us to assess whether or not this type of therapy is valuable from a patient orientated perspective, and subsequently the estimated value can be compared to the costs of providing the therapy.

Keywords: Economic evaluation, Cost analysis, Nature-based therapy, Nature-based health

11. A conceptual framework to design and assess urban agricultural systems that provide multiple ecosystem services and benefits to society

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Europe's rural and urban areas are facing increasing negative impacts from climate change, biodiversity loss, unsustainable resource use, and a growing disconnect between urban and rural citizens. Throughout Europe's cities, various forms of urban farming, such as gardens, rooftop farming, and vertical farming, have emerged. These could provide impactful responses to these threats through climate regulation, habitat for biodiversity, nutrient cycling, and community cohesion, while also enhancing well-being, economic benefits, and reconnection between rural, peri-urban, and urban areas. Policymakers and practitioners urgently need knowledge about the services, benefits, and risks of urban farming to help them shape policies and legal frameworks that can foster benefits and mitigate risks.

In the Horizon Europe project FOODCITYBOOST (https://foodcityboost.eu/), we collaborate with more than 100 stakeholders from six case studies, using a living lab-based approach to learn from current urban agriculture developments. This is done by representing urban agriculture functions to understand the ecosystem services produced by different types of urban agriculture and exploring the governance and policy factors that drive these functions. Using a participatory process, FOODCITYBOOST proposes a method to redesign urban farming systems, combining design methods inherited from rural agriculture and urban development, foresight analysis to imagine future cities, and assessment tools grounded in ecosystem services assessment. The project will produce an array of knowledge-based decision-support tools, including (i) multi-service assessment tools for urban farming at farm, regional, and EU scales, and (ii) guidance on policy instruments that foster the development of urban farming.

FOODCITYBOOST furthermore brings together expertise in social, land use, environmental, and ecological sciences to expand the knowledge base on urban farming and stimulate the development of a varied landscape of urban farming that optimally fulfills community needs while minimizing negative impacts and risks.

Keywords: Urban agriculture, Ecosystem services, Food system transformation, Urban design, Multi-functionality

12. A healthier planet for all – green and blue spaces and their benefits for mental health: Co-creation approaches of the GreenME project

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In a world characterised by increasing human populations and the negative effects of advancing climate change, human health is increasingly becoming the focus of city and regional planning. Climate change can have a negative impact on people's mental health, but Nature-based solutions (NBS) have proven to be a promising way to tackle the interlinked environmental and social challenges. By integrating natural elements into urban environment, NBS have the potential to unlock a wide range of ecosystem services with a profound impact on human health and well-being. Green and blue spaces such as parks and gardens are becoming increasingly important for health and equity. They not only contribute to recreation and relaxation, but can also improve the mental health and wellbeing of exposed individuals.

This paper is based on a Horizon Europe funded project, GreenMe, which aims to comprehensively assess the benefits of NBS for residents' mental health and well-being in multiple European countries and the U.S. Using a multidisciplinary approach, GreenME aims to reshape our understanding of how contact with nature can promote mental health and to bring a paradigm shift that leads to more sustainable and equitable green and blue spaces, promoting mental health and well-being for all.

In this project, the co-creation method is applied in six European countries and the U.S. to expand our community and create national schemes and guidelines to inform decision makers and empower actors. To achieve this, country representatives are working together to develop country chapters that include a diverse group of 10 to 15 stakeholders, as well as co-creating a methodology for participatory workshops that will be both country-specific and international.

By integrating different perspectives and expertise as part of the co-creation approach, actor-oriented solutions can be developed that promote NBS and equity in our regions to create healthier environments for everyone.

Keywords: Nature-based solutions; Health promotion, Co-creation; Mental health equity