



BOOK OF ABSTRACTS

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I. SESSION DESCRIPTION

ID: T14

Recent advances in green and blue infrastructure ecosystem services and disservices – from rural to urban spaces

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Abstract:

Green and Blue Infrastructures (GBI) are composed of natural and semi-natural landscape elements that are embedded within managed agricultural and urbanized landscapes. GI provides natural habitats to wild species, thereby supporting ecological processes such as e.g., primary productivity, nutrient cycling or biotic interactions and the ecosystem services (ES) capacity depending on them. But at the same time, GBI are also providing many ecosystem services to citizens and society, such as recreation, drinking water, flood protection, etc.



A sustainable management of GBI requires an understanding of the different ecosystem services provided by GBI, the links between their ecological integrity and the capacity to maintain those functions, the socio-economic dynamics where the GBI operate, trade-offs between GBI uses, and the institutions and policies defining landscape planning and prioritisation of conservation targets. The need for resilient and healthy ecosystems, fostering biodiversity and maintaining human well-being is particularly acute in urban contexts where the highest population densities are coinciding with the highest environmental impacts.

Management options to restore and design multifunctional GBI networks are defined by complex interactions and regulatory mechanisms at different governance levels that can only be tackled in a local, place-based and in-depth participatory research approach and citizens involvement.

Regarding citizens involvement, the growth of the digital world has fostered their involvement in the science world, from the collection of data for a large variety of scientific projects, to the co-creation of studies and citizen-led research projects. Citizen Science (CS) has been acknowledged as a valid tool to facilitate data acquisition and processing, to support science-policy-society communication, and to increase scientific literacy and learning. Management options to restore and design multifunctional GBI networks are also defined by complex interactions and regulatory mechanisms at different governance levels that can only be tackled in a local, place-based and in-depth participatory research approach and citizens involvement. The concept of Ecosystem Services (ES) has been less addressed by CS approaches, with recent reviews revealing a near absence of ES in CS studies. This is a rather unexpected observation; thus, this session is also focusing on CS and participatory processes related to ES and ecosystem disservices (EDS) provided by green and blue infrastructures (GBI).

Goals and objectives of the session

Related to the two Biodiversa projects: IMAGINE (<https://imagine.inrae.fr/>) and UrbanGaia (http://urbangaia.eu/ug_proj_about.php).

This session aims to present recent research results regarding GBI, their ecological characteristics, functions and the ecosystem services they deliver in different context, but also to address the policyscapes and stakeholder interactions controlling their management and planning, as well as the integration of citizens interests, preferences and participation regarding GBI, through CS actions. First, it aims to discuss case studies using CS and participatory-based processes for the assessment and mapping of ES and EDS and their outcomes, especially focusing on GBI. Preferably these studies will also contribute to the critical view on the benefits and pitfalls of CS. Second, we seek for studies demonstrating how this knowledge can be operationalized



for planning and managing GBI efficiently. This is key to address social, environmental and economic issues and contribute to achieving United Nations Sustainable Development Goals 3 (good health and well-being), 10 (reduced inequalities), 11 (sustainable cities and communities), 13 (climate action), 15 (life on land) and 17 (partnerships for the goals).

Planned output / Deliverables

The session will contribute to the knowledge of innovative, practical and replicable CS participatory processes in Ecosystem Service research focused on GBI, also contributing to the discussion on the benefits and constrains of CS. Possible integration in a Special issue on the subject is under discussion and dependant on the quality and relevance of the studies presented by the session contributors.

Related to ESP Working Group/National Network

Thematic working group: TWG 14 – Application of ES in Planning & Management

II. SESSION PROGRAM

Date of session: Thursday, 10 June 2021

Time of session: 9:30 – 15:00

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
				Introduction
9:30 9:45	Raïsa	Carmen	Research Institute for Nature and Forest	Keep it real: Selecting realistic sets of urban green space indicators
9:45 10:00	Yaella	Depietri	Israel Institute of Technology and University of Haifa	Reconciling tradeoffs and maximizing synergies in the design and implementation of green, blue, and grey infrastructure in urban areas
10:00 10:15	Daniele	La Rosa	University of Catania	Green Infrastructure for urban cooling: high-resolution scenarios based on urban morphology and environmental predictor model
10:15 10:30	Pramila	Thapa	University of Kassel	Assessment of importance of ecosystem services around



Time	First name	Surname	Organization	Title of presentation
				greenspaces in rural–urban gradient of Bengaluru, India
11:00 11:15	Mario V.	Balzan	Institute of Applied Sciences, College of Arts, Science and Technology	Mapping and assessing ecosystem services to prioritise nature–based solutions in a high–density urban area
11:15 11:30	Jingxia	Wang	Ruhr University Bochum	Harnessing neogeography methods in ecosystem services assessment: A scoping review for the context of green infrastructure planning
11:30 11:45	Fiona	Nevzati	Estonian University of Life Science	The ecosystem services from green infrastructure that support human well–being along an urban–wilderness gradient
11:45 12:00	Philip	Roche	INRAe	Integrative management of green infrastructures multifunctionality, ecosystem integrity and ecosystem services
12:00 12:30	Stien	Heremans	Research Institute for Nature and Forest	Spatial management prioritization in green infrastructure: a landscape–scale approach
13:30 13:45	Marion	Mehring	Institute for Social–Ecological Research, Biodiversity and People	Choosing between agricultural production and biodiversity conservation in rural landscapes: Preferences of local people in North–Western Europe
13:45 14:00	Francis	Turkelboom	Research Institute for Nature and Forest	Social valuation and friction analysis of green infrastructure
14:00 14:15	E. Seda	Arslan	Süleyman Demirel University	Assessing cultural ecosystem services produced by urban green–blue infrastructure using place–based approach
14:15 14:30	Roel	May	Norwegian Institute for Nature Research	Ecosystem service bundles in multifunctional landscapes



Time	First name	Surname	Organization	Title of presentation
14:30				Conclusion & Exchanges
15:00				

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

T. Thematic Working Group sessions: T14 – Recent advances in green and blue infrastructure ecosystem services and disservices. From rural to urban spaces

Keep it real: Selecting realistic sets of urban green space indicators

First author: Raïsa Carmen

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With increasing urbanisation, urban green spaces are expected to be crucial for urban resilience and sustainability, through the delivery of ecological, economic and social benefits. In practice, however, planning, management and evaluation of urban green spaces are rarely structured and evidence-based. This represents a missed opportunity to account for, track and foster the multiple benefits that green spaces are expected to deliver. To gain insight into this gap, this study assesses the availability and uptake of relevant evidence by city governments. Interviews, focus groups and quantitative surveys were applied in four medium-sized European cities: Coimbra (Portugal), Genk (Belgium), Leipzig (Germany), and Vilnius (Lithuania), covering the main governance and climatic gradients in Europe. Using straightforward data exploration and regression, we analyse which ecological, economic and social indicators are typically chosen by cities and why. Together with the city stakeholders, we derived a common set of benefit



categories and key performance indicators which can be adapted to diverse local contexts. We conclude that cities tend to make pragmatic decisions when composing their indicator sets, but nevertheless cover multiple urban green space dimensions. Finally, we explore how indicator choice could be optimised towards a complementary and credible indicator set, taking into account a realistically feasible monitoring effort undertaken by the cities.

Keywords: urban green space, nature's contributions to people, key performance indicator, feasibility, plural values

2. Type of submission: Abstract

T. Thematic Working Group sessions: T14 – Recent advances in green and blue infrastructure ecosystem services and disservices. From rural to urban spaces

Reconciling tradeoffs and maximizing synergies in the design and implementation of green, blue, and grey infrastructure in urban areas

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Green, blue and hybrid infrastructure to improve urban sustainability are gaining popularity amongst policy makers, planners, and citizens. These have proven to be desirable solutions to complement grey infrastructure in cities. However, planners are often faced with new and unique obstacles with these approaches which they did not encounter with the design and implementation traditional infrastructure. Tradeoffs and conflicts can originate from competing planning goals, socio-economic objectives, and divergent cultural values amongst locals and other actors. In this context, synergistic solutions need to be identified. This paper carries out a review of the literature to suggest that synergies amongst competing goals, particularly in urban areas, often originate through the implementation of hybrid approaches, a combination of green, blue, and grey infrastructure, particularly in urban areas. Building on the Social-Ecological-Technological Systems (SETs) framework, a conceptual approach is suggested to improve the



identification tradeoffs and seek for synergies in the design and implementation green, blue, grey or hybrid infrastructure in cities.

Keywords: green infrastructure, nature-based solutions, social-ecological-technological systems, tradeoffs, urban areas

3. Type of submission: Abstract

T. Thematic Working Group sessions: T14 – Recent advances in green and blue infrastructure ecosystem services and disservices. From rural to urban spaces

Green Infrastructure for urban cooling: high-resolution scenarios based on urban morphology and environmental predictor model

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Over the past decades, urbanization processes resulted in built environments characterised by low energy efficiency and a severe lack of green spaces. The latter represent the main providers of ecosystem services in cities and play a relevant role in regulating the local microclimate and in mitigating the urban heat island effects. This chapter addresses the potential effectiveness of urban green infrastructure in increasing the outdoor comfort, by the use of the UMEP (Urban Multi-scale Environmental Predictor) model. The model simulates the spatial variations of 3D radiation fluxes and the mean radiant temperature in complex urban settings, also considering the spatial variations of shadow patterns. The spatial explicit model is implemented with resolution land-use/land cover information is used, as well as vegetation canopy, digital terrain model and urban morphology layers. The case study of the municipality of Acireale (in southern Italy) is tested, as it includes urban contexts with different density, building types and vegetation. Based on the modelling results of the current state (scenario 0), urban greening scenarios for climate change adaptation are proposed and their efficacy is evaluated considering different criteria of economic, physical feasibility as well as the possible integration of the scenarios in urban planning policies.



Keywords: green infrastructure, regulating service, heat island, UMEP

4. Type of submission: Abstract

T. Thematic Working Group sessions: T14 – Recent advances in green and blue infrastructure ecosystem services and disservices. From rural to urban spaces

Assessment of importance of ecosystem services around greenspaces in rural–urban gradient of Bengaluru, India

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Urbanization is a major anthropogenic process with often irreversible impacts on wellbeing of a society. With the increasing trend of urbanization globally, there are ongoing discussions on roles of green infrastructure to solve societal challenges. Though existence of greenspaces mostly decreases with increase of degree of urbanity, and the intensity is even worse in megacities of Global South such as in Bengaluru, Bengaluru is still relatively ‘greener’ than many other cities in the Global South. Tree species in Bengaluru have a specific local purpose and meaning that are shaped by cultural backgrounds and livelihood of the residents. However, dynamics of multiple ecosystem services or disservices (ES/ED) provided by the greenspaces and their synergies or trade-offs along rural–urban gradients are less explored. Using the five most common types of greenspaces in Bengaluru (domestic greenspaces, farm greenspace, street greenspace, platform greenspace and temple greenspace), and considering three tree species that are commonly chosen for its design locally, we carried out a photo-elicitation survey to assess the relative importance of the different greenspaces for ES/ED supply as perceived by the local community. To do so, we used different sets of photographs depicting those greenspaces with different tree species, and surveyed 648 residents from 61 villages across two transects along the rural–urban gradient. We explored the association of perceived importance of ES/ED for the different greenspaces based on socio-demographics factors (e.g. gender, age, caste, migration origin,



income sources, religion and education level) and assessed the potential influence of tree species choice for the greenspace in its importance for the local community. To do so, we employed ordinal regression models. Our results contribute to a better understanding of the use of greenspaces in rural–urban dynamics and inform relevant policies. Understanding the association of the differences in the uses the greenspaces by different groups of people would facilitate inclusive management, policy making and governance of the greenspaces.

Keywords: green infrastructure, mega-city, paper-based questionnaire, photo-elicitation, socio-cultural preferences

5. Type of submission: Abstract

[T. Thematic Working Group sessions: T14 – Recent advances in green and blue infrastructure ecosystem services and disservices. From rural to urban spaces](#)

Mapping and assessing ecosystem services to prioritise nature-based solutions in a high-density urban area

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Regional and national policies increasingly favour the establishment of urban green infrastructure to support biodiversity and ecosystem service capacities, but the effectiveness of these measures is influenced by the management of urban ecosystems and their socio-cultural and economic context. This study maps and assesses urban ecosystem services, and assesses whether access to ecosystems with high ecosystem service capacity is different among communities characterised by different socio-economic conditions in the city of Valletta (Malta) and the surrounding urban area. The study area is the location of a UNESCO World Heritage Sites but is also characterised by high population density and a booming tourism industry leading to rapid high-density urbanisation. The highest ecosystem service capacities were in the urban fringes and the lowest in dense urban cores. However, private gardens and street landscaping had the



highest ecosystem service capacities per unit area. Public gardens had the highest cultural ecosystem service capacities but low regulating ecosystem service capacities. Cultural ecosystem services followed ecosystems depending on the type of use and were less strongly influenced by the measured ecosystem structure variables. Groups with lower educational attainment and employment conditions, and high population density, had reduced proximity to urban ecosystems having high ecosystem service capacities. The relevance of these results to recent urban greening measures within the study area are discussed. Results emerging from this study provide evidence that measures that favour the protection of existing urban gardens or the establishment of new green infrastructure with high regulating ecosystem service capacities, cannot be considered as a replacement of the various non-material benefits obtained from urban ecosystems. Ecosystem assessments can provide the knowledgebase to systematically select nature-based solutions according to the existing spatial distribution and access to urban ecosystems and their services.

Keywords: cultural ecosystem services, green infrastructure, regulating ecosystem services, socio-environmental justice

6. Type of submission: Abstract

[T. Thematic Working Group sessions: T14 – Recent advances in green and blue infrastructure ecosystem services and disservices. From rural to urban spaces](#)

Harnessing neogeography methods in ecosystem services assessment: A scoping review for the context of green infrastructure planning

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Ecosystem services (ES) assessments can provide relevant evidence for green infrastructure (GI) planning in metropolitan regions. However, at what extent ES assessments actually could support



GI planning substantially depends on the undertaken ES assessment approaches and data availability. So far, a magnitude of approaches have been developed for ES assessments, i.e. remote sensing technique for spatial mapping, look-up table for ES indicators calculation, simulated modeling, field measurements, and citizens' option surveys and have been widely used in the past decades. Available methods can be distinguished in user-independent approaches based on science-based indicators and user-dependent approaches that elicit and incorporate people's values and preferences. Both ES assessment approaches face substantial data constraints in terms of temporal and spatial resolution. The recently emerging new techniques in environmental sensing (e.g. mobile sensors) and crowdsourcing geo-information (e.g. volunteered and contributed geographic information methods) arguably provide useful and promising new data sets for assessing ES in metropolitan regions. This contribution aims to evaluate current applications and frontiers in ES assessment with those novel approaches, also termed 'neogeography'. We focus our analysis mainly on three ecosystem services indicators, namely local climate regulation, noise reduction and recreation. These three ES indicators are selected considering they are the most relevant services in urban sphere and have tremendous impacts on human health in metropolitan regions. Our method is a scoping review of literature and relevant documents. Our results not only present available advances and potentials of emerging neogeography approaches (i.e. satellite-derived spatial data, crowdsourced and sensor-based data) for ES assessment, but also embody the ways to incorporate these methodological advances into GI planning. Our preliminary findings contribute to the ongoing efforts to harness new technology and data to support GI planning in metropolitan regions and simultaneously pave the way to participatory citizen science.

Keywords: remote sensing, environmental sensors, crowdsourcing data, big data, citizen science

7. Type of submission: Abstract

[T. Thematic Working Group sessions: T14 – Recent advances in green and blue infrastructure ecosystem services and disservices. From rural to urban spaces](#)

The ecosystem services from green infrastructure that support human well-being along an urban-wilderness gradient



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The latest research has shown the significance of a good mental state, including the aspect of human well-being (HWB), which is an essential factor for a good quality of life, especially in urban areas. Valuing HWB levels using GDP is often being disfavoured in the latest research since the nonmaterial factors significantly influence HWB. Unlike the rest of the ecosystem services, cultural ecosystem services (CES) have been regarded as the most challenging ones for assessment and examination. This is because they take into consideration nonmaterial aspects and socio-ecological beliefs, emotions, and values that are usually associated with an intangible object outcome. These services, such as aesthetic experience and enjoyment, spiritual enrichment, reflection, cultural heritage, sense of place, recreation, and cognitive development, may directly or indirectly contribute to HWB. The primary objective is to develop a conceptual framework for assessing the connection between CES and HWB in the urban-wilderness gradient and green infrastructure context into a theory that will be applied. After respective empirical data has been collected, correlational models in this subject field will be carried. We will deliver preliminary results from self-reported evaluations using online self-participatory mapping questionnaires. Furthermore, interviews, observation, and expert-based methods, and GIS software will be used to assess the connection between CES (as an independent variable) and HWB (as the dependant or outcome variable) in the scope of green infrastructure in the urban-wilderness gradient. The case study areas chosen to observe and map the CES in the urban-rural-wilderness contexts will be in the Tallinn area, Estonia, and follow on from the studies of the Biodiversa IMAGINE project.

Keywords: urban-rural-wilderness context, cultural ecosystem services, quality of life, participatory assessment, Tallinn area

8. Type of submission: Abstract

[T. Thematic Working Group sessions: T14 – Recent advances in green and blue infrastructure ecosystem services and disservices. From rural to urban spaces](#)



Integrative management of green infrastructures multifunctionality, ecosystem integrity and ecosystem services

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Green infrastructures (GI) are composed of natural and semi-natural landscape elements that are in interactions with more heavily managed and/or urbanised areas. Sustainable territorial management of GI requires an understanding of the different functions provided by GI and the links between their ecological integrity and the capacity to maintain those functions. GI provides natural habitats to wild species, thereby supporting ecological processes such as e.g. primary productivity, nutrient cycling or biotic interactions and the ecosystem services (ES) capacity depending on them. We will present the results from the IMAGINE project (2017–2020, BiodivERsA) dedicated to evaluating green infrastructures multi-functionalities, management and policies in rural to urban landscapes. Using a multidisciplinary approach on six case study sites covering a European north–south gradient from the boreal zone to the Mediterranean, the IMAGINE project aimed to assess the multiple functions, ecosystem services and benefits provided by green infrastructure in different contexts. The IMAGINE project implemented an operational framework that allowed us to replicate in 5 countries and 6 case study cases similar analysis regarding both ecological multifunctionalities, societal demands and regulations, resulting in the capacity to define flexible models that can be adapted to the different contexts and stakeholders demands. We will present here the overall approach and some key project results regarding ecosystem integrity, ecosystem services and disservices capacity, frictions in stakeholders' preferences and options. Our results show that the use of an integrated and interdisciplinary approach is essential to support the exploration of barriers, trade-offs and opportunities for the design and management of green infrastructure in diverse urban and rural landscapes.

Keywords: ecosystem services, policy coherence, ecological integrity, multifunctionality, connectivity

9. Type of submission: Abstract

[T. Thematic Working Group sessions: T14 – Recent advances in green and blue infrastructure ecosystem services and disservices. From rural to urban spaces](#)



Spatial management prioritization in green infrastructure: a landscape-scale approach

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The budget for conservation (or restoration) management is limited and this implies that management priorities need to be identified. We present here a novel method for sorting green infrastructure (GI) patches according to their conservation priority at the landscape level. Our approach is based on the spatial overlay of readily available spatial data sets. Thus, it can be easily reproduced on other sites and at different scales. We propose to carry out a prioritisation of GI patches based on two criteria. Firstly, the importance, here defined as the capacity to produce ecosystem services. Secondly, the urgency, here defined as the exposure of different habitat patches to anthropogenic pressures. The combination of these two criteria makes it possible to classify each habitat patch into different priority categories. To assess the capacity for ecosystem services, we used an approach based on the capacity matrix method combined with land use mapping and stakeholder valuation. Urgency was assessed by producing a vulnerability index that takes into account the spatial configuration of GI patches and proximity to sources of pressure such as agriculture and urbanisation. GI patches with a high capacity for ecosystem services combined with high urgency are prioritised for immediate conservation action. For GI patches with a high ES capacity (important) but with a low urgency, conservation actions can be planned on the longer term. The exact management practices have to be based on an in-situ assessment of the local conservation status and of the disturbances that affect the area. If a GI patch has a high emergency, but low importance, it will be managed only if funds are still available. And finally, patches with low importance and low urgency requires no actions. Our approach was tested in four study sites across Western Europe encompassing different social-ecological conditions. We will present the protocol and the results obtained.

Keywords: conservation, prioritization, green infrastructure, ES capacity, degradation risk



10. Type of submission: Abstract

T. Thematic Working Group sessions: T14 – Recent advances in green and blue infrastructure ecosystem services and disservices. From rural to urban spaces

Choosing between agricultural production and biodiversity conservation in rural landscapes: Preferences of local people in North–Western Europe

First author: Marion Mehring

Other author(s): Thomas Fickel, Dieter Mortelmans, Philip Roche, Francis Turkelboom, Diana Hummel

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In Europe, biodiversity is in continuous strong decline. Production–based subsidies have led to an intensification of agriculture negatively affecting biodiversity. However, only a transformation of the social, economic and ecological paradigms of agricultural production could halt biodiversity loss while keeping an agricultural production. The question is how both, agricultural production and biodiversity conservation can be jointly achieved. Presenting case studies from North–Western Europe, namely Germany, Belgium, and France, we address the local people’s perspective and 1) identify the preference between agricultural production or the protection of biodiversity in rural areas, and 2) analyze explaining factors such as rural–urban gradient as well the professional background in the respective fields. Findings from a telephone survey across the European countries show that there is a high consent to protect biodiversity in agricultural landscapes, even among people experienced in agriculture. A rural–urban divide was also not found in the data. If required to make a choice, people clearly prefer biodiversity conservation compared to agricultural use in their local area. The results thus indicate that the situation is more nuanced and complex than an opposition dialectic present it. A more encompassing social–ecological system transformation is needed to ease of the practices changes. We conclude that future endeavor should focus on identifying and overcoming current barriers on how to better integrate biodiversity conservation in current agricultural production and how to support this transition. From a policy perspective, our results add to the wider and controversial discussion on the revision of the EU’s Common Agricultural Policy (CAP). The results clearly show that there is a broad support that biodiversity should play a (more) prominent role



in agricultural production. With this oral contribution we present current research from the BiodivERsA project IMAGINE – Integrative Management of Green Infrastructures Multifunctionality, Ecosystem integrity and Ecosystem Services.

Keywords: agriculture, biodiversity conservation, ecosystem services, perception, rural–urban gradient

11. Type of submission: Abstract

[T. Thematic Working Group sessions: T14 – Recent advances in green and blue infrastructure ecosystem services and disservices. From rural to urban spaces](#)

Social valuation and friction analysis of green infrastructure

First author: Francis Turkelboom

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Green infrastructures (GI) are strategically planned networks of natural and semi-natural areas which are expected to enhance biodiversity and ecosystem services, improve environmental conditions and citizens' health and quality of life. While the expectations are often high, the implementation and use of GI can often result in social frictions between stakeholders because of divergent interests. A better understanding of these (potential) frictions can be instrumental for successful implementation and management of GI. To get a better idea about the possible friction points of GI, we asked stakeholders to assess the desirability of the ecosystem services (called “GI functions” during stakeholder meetings) and physical elements of the GI in six cases around Europe (Be, Fr, No, Ger, Est). For this purpose, we applied a stakeholder analysis and social valuation in a deliberative workshop setting. The number of involved stakeholder groups per GI are generally high (between 10 to 37). The involved stakeholders have very different levels of interest, influence, dependence and faced impact in relation to the GI. Based on the social valuation of GI elements and functions, three clusters can be identified:



- Highly desirable GI elements and functions, included water-related elements and functions, forests and biodiversity, possibilities for soft recreation/education, and maintenance of air and soil quality.
- Moderately desirable and more controversial GI elements and functions included green elements in the landscape such as hedgerows, economic-related activities such as timber production and agriculture, hunting and habitat connectivity.
- Finally, there is a group of undesirable functions (e.g. motorised recreation) and a number of GI-related disservices (such as allergies, pests, invasive species).

These results show that GI are complex socio-ecological systems, which involve many stakeholders who hold (dis)similar values related to the GI elements and functions, and which can potentially lead to frictions. This explains why the management and governance of GI are complex, and require participatory inter-institutional and inter-stakeholder cooperation

Keywords: green infrastructure, social valuation, stakeholders, friction analysis

12. Type of submission: Abstract

[T. Thematic Working Group sessions: T14 – Recent advances in green and blue infrastructure ecosystem services and disservices. From rural to urban spaces](#)

Assessing cultural ecosystem services produced by urban green-blue infrastructure using place-based approach

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The aim of this research is to determine and assess cultural ecosystem services (CES) perceived by residents in urban areas represented by green-blue infrastructures (GBI). A place-based approach will be applied with residents with an online survey in the city of Isparta (Turkey). Residents' perceptions will be mapped using geo-tagged data represented their important places and activities related to CES. This study will be presented the spatial patterns of CES and their relation to the urban GBI using land use/land cover data based on the Urban Street Map (OSM).



CES perception of the residents in the urban GBI will be estimated using Kernel–density estimation tool and hot–spot areas will be defined. In order to identify CES associations with the GBI, quantitative methods will be applied. The result of this study will be shown the producing CES capacity of urban GBI spatially and quantitatively. As a consequence, it can be said that if the place–based data is collected before the planning process, sustainable cities and communities may be possible with creating protection and management strategies for natural and semi–natural elements of landscape represented as GBI.

Keywords: cultural ecosystem services, participatory–based mapping, green infrastructure, blue infrastructure, land cover

13. Type of submission: Abstract

[T. Thematic Working Group sessions: T14 – Recent advances in green and blue infrastructure ecosystem services and disservices. From rural to urban spaces](#)

Ecosystem service bundles in multifunctional landscapes

First author: Roel May

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Management of Ecosystem Services (ES) within Green Infrastructures (GI) requires mapping of ES bundles to visualize synergies and trade–offs which may arise between competing interests. We assessed spatial bundling of the multiple components of the ES delivery chain within different land use and land cover (LULC) types, as well as multifunctional bundling of LULC for ES types. The capacity matrix approach was used to assess ES capacity of each LULC based on experts' knowledge. ES supply was calculated by integrating the variation in naturalness and connectivity of green patches with ES capacity. From this, accessibility to green patches gives a measure of the potential use of ES, or ES flow. Finally, ES flow was weighed by the perceived relative importance of ES rendering the ES value. Collective stakeholder perceptions were surveyed using an Analytical Hierarchy Process, to measure the amount of ES that can be provided or potentially



used by society, particular stakeholder groups or individuals in a certain region. For each of the ES delivery chain components, ES bundles (across LULC) or co-located LULC clusters (across ES) were identified and visualized using hierarchical k-means clustering combined with Principle Component Analysis. In addition, the overall coherence / differentiation among policy plans for managing ES within GI was visualized in a similar fashion. This assessment was done to elucidate how policy plans may hamper, provide synergies for, or enhance the management of bundles of ES and LULC within GI. Both spatial and multifunctional assessments allow for integrated insight into where management should be prioritized in terms of LULC to obtain specific ES bundles, and what would be gained within co-located LULC in terms of ES delivery. The bundle assessment was done for the entire ES delivery chain, and exemplified for GI within the urban-rural landscapes of Trondheim (NO) and Scarpe-Escout (FR).

Keywords: ecosystem service delivery chain, multifunctionality, green infrastructure, integrated management