BRAIN-be (BELGIAN RESEARCH ACTION THROUGH INTERDISCIPLINARY NETWORKS) - BIODIVERSA

URBANGAIA

CONTRACT - BR/175/A1/URBANGAIA-BE

FINAL REPORT

30/11/2020

Promotors
António Dinis Ferreira (Research Centre for Natural Resources, Environment and Society (CERNAS), Polytechnic Institute of Coimbra, Escola Superior Agrária de Coimbra, Bencanta, 3045-601, Coimbra, Portugal)
Jörg Priess (Helmholtz-Center for Environmental Research - UFZ Department for Computational Landscape Ecology Permoserstraße 15, D-04318 Leipzig, Germany)
Paulo Pereira (Environmental Management Laboratory Mykolas Romeris University, Vilnius, Lithuania)
Juan Martínez Murillo (University of Malaga, Spain)
Sander Jacobs (Research Institute for Nature and Forest (EV-INBO), Havenlaan 88 bus 73, 1000 Brussels, Belgium)

Authors
Michael Leone (EV-INBO)
Sander Jacobs (EV-INBO)
Raïsa Carmen (EV-INBO)

INSTITUUT
NATUUR- EN BOSONDERZOEK

Published in 2021 by the Belgian Science Policy Office
WTCIII
Simon Bolivarlaan 30 Boulevard Simon Bolivar
B-1000 Brussels
Belgium
Tel: +32 (0)2 238 34 11
http://www.belspo.be

Contact person: Aline van der Werf
+32 (0)2 238 36 71

Leone, M., Jacobs, S. & Carmen, R. ***UrbanGaia final report***. Final Report. Brussels: Belgian Science Policy Office 2021 – 33 p. (BRAIN-be - (Belgian Research Action through Interdisciplinary Networks)

TABLE OF CONTENTS

CONTENTS

1. INTRODUCTION

More than half of the global population is living in cities. The need for resilient and healthy ecosystems, fostering biodiversity and maintaining human wellbeing is particularly pressing in urban contexts where the highest population densities are coinciding with highest environmental impacts. Urbanization provokes fragmentation and degradation: ecological connectivity and ecosystem condition (quantity as well as quality) are heavily affected. This decreases ecological resilience, ecosystem functioning and biodiversity, in turn affecting the supply of ecosystem services (ES) and all potential benefits related to them (figure 1, red arrows).
Urban Green-Blue Infrastructures (U-GBI), ranging from technical solutions with an ecological component to entirely nature-based solutions, are hypothesized to increase ecological connectivity and quality, improve biodiversity and functioning, deliver multiple ES and direct improvements of human wellbeing. Moreover, U-GBI have an indirect well-being effect by mitigating the negative urbanization cascade (figure 1, green arrows). U-GBIs are defined here as sets of ecosystems, linked into a spatially coherent system through flows of organisms, and interaction with the landscape matrix in which it is embedded, which can be used to conserve and sustain or enhance biodiversity, ecosystem functions, and to provide services to human populations (e.g., Opdam et al. 2006). In other words, multifunctionality and connectivity are seen as core functional characteristics of U-GBI (Hansen and Pauleit, 2014; Wang and Banzhaf, 2018; GRETA project, 2018; Girma et al., 2019).

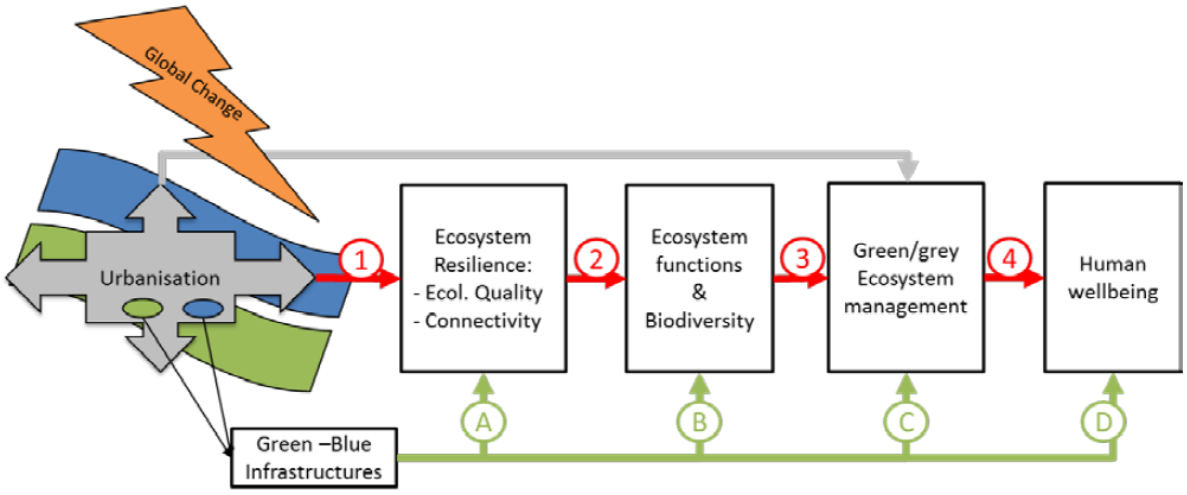

Figure 1. UrbanGaia theoretical framework: Urbanisation and the cascading effects on human wellbeing (red arrows 1-4) are hypothesised to be remediated or avoided by U-GBI impacts on different components (green arrows A-D).

UrbanGaia contributes to the socio-ecological knowledge base on critical features of U-GBIs, and provides tools for guiding their establishment, management and evaluation. The project has the explicit aim to develop a realistic indicator framework to evaluate, manage and develop performant GBIs in cities.
Cities are complex socio-ecological systems, with sharp spatial gradients in well-being and human needs. The needs and desires to improve well-being are highly variable within and between cities and over time. This immediately invokes ethical questions of distribution: which benefits are needed and wanted and who benefits from them. The demand for – and use of - ES is therefore equally diverse and context-dependent. U-GBI design and availability should be based on ecological, social, economic values held by all relevant stakeholders. Therefore, ethical values related to governance and environmental justice are equally important for U-GBI planning to achieve desired social and environmental synergies. Besides evaluating the ecological, social, and economic contributions of U-

GBI, fair accessibility and division of benefits (environmental justice) and the governance process, which contributes to the planning and realization of multifunctional and just U-GBI, should be evaluated as well. These considerations were included in the development of the UrbanGaia indicator framework.

Furthermore, the UrbanGaia project analyzed how policy documents contribute to the realization of multifunctional and just U-GBI. The uptake of the U-GBI concept in policy documents was assessed, followed by an assessment of whether ecological, social, economic, governance and justice values were associated with U-GBI. Moreover, UrbanGaia studied the ES use, and motivation of use, of visitors within U-GBI. Results on U-GBI usage provide information that can be included in U-GBI planning processes to design and manage sustainable nature and user-oriented U-GBI and to align the indicator framework to the local usage.

The work was carried out in four urban case studies which were selected to cover a broad range of socio-ecological and governance contexts in Europe. The case studies included different types of U-GBI, such as a steam valley in Genk, Belgium, parks and brown fields in Leipzig, Germany, urban forests and parks in Vilnius, Lithuania and Coimbra, Portugal.

2. METHODOLOGY AND RESULTS

The results are presented in logical order. Firstly, the development of an inclusive evaluation framework for multifunctional and just U-GBI (section 2.1) is presented. As a first step, a general framework was created based on the IPBES plural values typology (Díaz et al. 2015; Díaz et al. 2018) (section 2.1.1). Then, a specific framework for evaluating governance processes was built (section 2.1.2). Thirdly, we present results from the application of the framework (section 2.2), which consists of an analysis of availability and uptake of U-GBI indicators (section 2.2.1) and a Governance performance assessment for U-GBI in Genk (section 2.2.2). Fourthly, we look at the policy setting and how it contributes to multifunctional and just U-GBI (section 2.3). Lastly, we study the usage of U-GBI by visitors and their motivation behind their use (section 2.4).

2.1 Development of the U-GBI evaluation framework

The UrbanGaia project developed a framework for effective and sustainable evaluation, development and management of U-GBI. U-GBI is envisioned to provide multiple benefits (e.g. EC, 2013) and should contribute to the wellbeing of all. Therefore, the UrbanGaia framework was intended to combine ecological, social, economic, governance and justice aspects of U-GBI. As a result of internal discussions, the IPBES plural values typology (Nature Contributions to People (NCP)) (Díaz et al. 2015; Díaz et al. 2018) was used as a starting point for the framework (section 2.1.1). A motivation for choosing this starting point was the inclusion of governance and justice aspects within the NCP framework. A goal for UrbanGaia was to develop governance performance indicators (section 2.1.2) to assess the governance impact on U-GBI (section 2.2.2) which now could be aligned to the broader evaluation framework.

2.1.1 Modifying the NCP framework to a KPI framework relevant for U-GBI

Instead of proposing a set of indicators – which rarely fully consider the local context - to be used for the evaluation of U-GBI, UrbanGaia developed an indicator hierarchy. The indicator hierarchy aims to compare diverse sets of indicators across cities (table 1). At the bottom, most granular, level are the city indicator sets. These are (potentially) measured by available datasets in the specific city context. At the next level, these city indicators are associated with urban green space key performance indicators (KPI). These KPI are concepts, not necessarily linked to concrete datasets, which potentially vary in interpretation between cities. For instance the KPI „regulation of hazards and extreme events" has a different meaning (and different city indicators) in a wildfire-prone city like Coimbra compared to a flooding-prone city such as Genk. These KPI then organize in benefit categories, which relate to the diversity of societal benefits (and policy goals) of urban green infrastructure, and cover the three main dimensions of human-nature relationships: the physical dimension (nature itself, ecological and intrinsic values); the contributions to people (ES, economic and instrumental values) and the social dimension (diverse values concerning quality of life)

The researchers had iterative discussions on the KPI's and values and co-constructed the hierarchal indicator structure. When listing possible indicators for each city, city practitioners were also invited to comment on the structure. The KPI and overarching values are co-constructed by confronting the NCP typology (Díaz et al. 2015; Díaz et al. 2018, Rounsevell et al. 2018) with the city indicator sets. KPI and values were adapted/amended to create a common hierarchical framework to organize information on multiple benefits of urban green spaces. Further explanation of the values categories and the KPIs can be found in deliverable 14.

Table 1. Overview of all dimensions, values, and KPI

Dimension	Value	Key performance indicator (KPI)	City indicator
Nature	**Maintaining and strengthening nature and biodiversity**	Individual organisms	
		Biophysical assemblages	
		Biophysical processes	
		Biodiversity	
		"Nature itself"	
	Quantity and quality of GBI	Connectivity of paths and roads	
		Accessibility	
		Facilities	
		Location	
Contributions	**Regulation NCP**	Habitat creation and maintenance	
		Pollination and dispersal of seeds and other propagules	
		Regulation of air quality	
		Regulation of climate	
		Regulation of ocean acidification	
		Regulation of freshwater quantity, flow and timing	
		Regulation of freshwater and coastal water quality	
		Formation, protection and decontamination of soils and sediments	
		Regulation of hazards and extreme events	
		Regulation of organisms detrimental to humans	
	Material NCP	Energy	
		Food and feed	
		Materials	
		Medicinal, biochemical and genetic resources	
	Non- material NCP	Physical and psychological experiences, including learning and inspiration	
		Supporting identities	

People	**Cultural values of GBI**	Stewardship	
		Identity, sense of place	
		Heritage values	
	Health and wellbeing	Social relations	
		Physical and mental health	
		Education and knowledge	
		Safety and security	
	Governance & Justice	Understanding of the complexity of the issues and local context	
		Achieving collaboration, engagement and coherence	
		Designing and implementing (innovative) multifunctional solutions	
		Procedural Justice	
		Distributional Justice	
	Economic aspects	Jobs created	
		Profits for business	
		City attractiveness	

2.1.2 Assessment framework for governance performance indicators

UrbanGaia developed a framework for a governance performance analysis to evaluate the planning and implementation of Urban Green-Blue Infrastructure (U-GBI). This assessment framework fits within the broader KPI-framework and provides KPIs and indicators for the benefit category Governance & Justice.

Multifunctionality and connectivity are core characteristics of U-GBI (Hansen and Paulet, 2014; Wang and Banzhaf, 2018; GRETA project, 2018; Girma et al., 2019) and therefore, it is often defined as contributing to a wide range of ecological, socio-cultural and economic benefits such as supporting biodiversity, provision of ES (e.g.adaptation to climate change and increased possibilities for recreation) and increasing quality of life benefits (e.g. health and mental wellbeing) (Hansen and Pauleit, 2014; Hansen et al. 2016; Pakzad and Osmond, 2016). To design multifunctional U-GBI that responds to the local needs, environmental justice (Aragão et al. 2016; Rigo and Németh, 2018; Nesbitt et al., 2019; Zhu et al., 2019) is an (just as) important characteristic of U-GBI in order to achieve desired social and environmental synergies. Within this framework, we focus specifically on procedural justice; the inclusion of all relevant user-groups within the U-GBI planning process. Thus, to reach multifunctional and just U-GBI, these characteristics should be considered during its planning, in order to create U-GBIs that respond to the local goals and needs and to create broad public and political support.

For an area-based and integrated project, a collaborative governance style is seen as the most appropriate approach. This means stakeholders should collaborate in a network, in which government, market and civil actors can be involved (Kronsell & Backstrand, 2010). This should be done through deliberative processes or participatory processes in which stakeholders are given the opportunity to discuss and agree on a shared vision and approach through consultation and negotiations (Edelenbos

2000; van Tatenhove, 2001; Hajer et al. 2004; Sayer et al. 2013). Deliberative processes promote the legitimacy and the fairness (environmental justice) of solutions in spatial projects, provided they are inclusive (Kronsell & Backstrand 2010; Aragão et al. 2016). The UrbanGaia governance performance framework aims to assess how a U-GBI planning process contributed to the multifunctional and procedural justice characteristics by comparing it to a collaborative governance style. Through a literature search, a framework with 3 KPI's, 11 indicators and 31 variables was developed (table 2).
As governance processes are social processes, heavily depended on local context, and its course is not quantifiable, the framework is designed to collect qualitative data through interviews with involved stakeholders. For each variable, a question is formulated that starts with "to what extent has … been considered/done/applied/etc." to which the interviewee provides an open answer. After the open answer, the interviewee is also asked to give a score (from 1 (no extent) to 5 (full extent)) in order to combine a qualitative statement with a quantitative score that can be used for the indicator. Furthermore, the experts scored the relevance of the variable (0- no relevance, 1 – somewhat relevant, 2 – relevant) for the reason that the assessment is based on a generic list of variables that may not be as relevant for each case study. E.g. a question about green-grey integration might not be as relevant if the case study is an urban forest with little to no grey infrastructure. Moreover, the confidence of their answer (0 – no confidence, 1 – somewhat confident, 2 – confident) was scored as each participant may have had a different involvement in the process and might not have full sight on all the variables of the assessment. The confidence score is used to weight the average of the scores.
The framework is designed to evaluate one planning process of a U-GBI location. The assessment is done through interviews with stakeholders that were involved during this planning process. To get a complete picture of the process, multiple stakeholders from different sectors were included so that multiple points of view are recorded. The full framework, including the questions linked to the variables can be found in deliverable 7.

Table 2. Governance performance indicators

KPI	Indicator	Variable
Understanding the complexity of the issues and local context	**Understanding the area's assets, opportunities and threats**	Biophysical/environmental understanding
		Socio-cultural understanding
		Economic understanding
	Information gathering for informed decision making	Scientific literature
		Best practices
	Anticipation of the future	Understanding of drivers influencing the future of the city
		Vision
		Scenario's
Achieving engagement, collaboration and coherence	**Mobilizing representative partners across sectors**	Ecological/environmental partners
		Socio-cultural partners
		Economic partners
	Social inclusion (inhabitants)	Level of public participation
		Level of inclusiveness
		Adaption to vulnerable groups
	Establishing a common pathway	Existence of common concerns for the area
		Uniformity in the area's vision/interests of actors

		Social learning and aligning interests
		Managing diversity, paradox and tensions
		Readiness of actors to develop shared strategies
		Influence of significant power differences
Designing and implementing (innovative) multifunctional solutions	**"Playing field"**	Policies (administrative and/or jurisdictional boundaries)
		Available budgets (financial boundaries)
		Available manpower
	Green-grey integration	Integration of green space/elements with (grey) infrastructure
	U-GBI contributes to multiple policy objectives	Biophysical/environmental
		Socio-cultural
		Economic
	Policy-instruments to support implementation of U-GBI	(Diversity of) policy-instruments to create/exploit U-GBI
	Mobilizing (external) support	Political support
		Financial support
		Social support

2.2 Application of the KPI framework

2.2.1 Analysis of availability and uptake of U-GBI indicators

Despite the evident importance of urban green spaces for urban quality of life, it remains unclear how cities measure, track and compare the quality of their urban green spaces or the actual multiple benefits. The main challenge is to develop—at the city level—a set of indicators, which balances feasibility (data availability, resources, time and technical capacity) and quality (in relevance for multiple benefits, scientific credibility and clarity) (van Oudenhoven et al 2018, Demolder et al 2018). Numerous academic and grey literature papers propose indicator sets for urban green spaces (Baycan-Levent et al 2009, Azadi et al 2011, De La Barrera et al 2016), but these rarely fully consider the local context, which determines the choice of data and information used by the cities. The UrbanGaia project assessed which data and information is available at the city level, (ii) how this evidence covers multiple indicators related to urban green spaces, (iii) how cities evaluate feasibility, relevance, credibility and clarity for these indicators, and (iv) which indicators are currently measured and used.

A list of possible indicators was inventoried for each city. This inventory was assembled by revising policy documents for each country and city, interviewing local experts and city administrators, and by organising focus groups. Indicator qualities (relevance, feasibility, clarity, credibility) were scored in follow-up interviews with city officials using a 5 point likert scale. Additional information was recorded on the level or ease of implementation, and how often and by which institution the indicator (would) be implemented. We did not collect or compare data on green infrastructures, or propose new indicators. Our data focuses on how existing indicators themselves perform. This is an essential point as these indicators are the „agents" which are meant to effectively transfer relevant knowledge to decision making. Using straightforward data exploration and regression, we analyse which ecological, economic and social indicators are typically chosen by cities and why.

Which urban green space benefits can be covered by the indicators?

We first analyse the complete list of indicators inventoried for each of the four cities (Carmen et al 2020). Figure 2(a) shows the overall coverage of each of the benefit categories by all available indicators. It shows that, among the urban green space benefit categories, Non-material contributions and Health and wellbeing are well covered, while Material contributions, Regulation contributions, and Governance and justice are underrepresented. Figure 2(b) shows the distribution of indicators over the three dimensions of interest. Vilnius stands out because of its focus on the Nature dimension, the other three cities are quite similar.

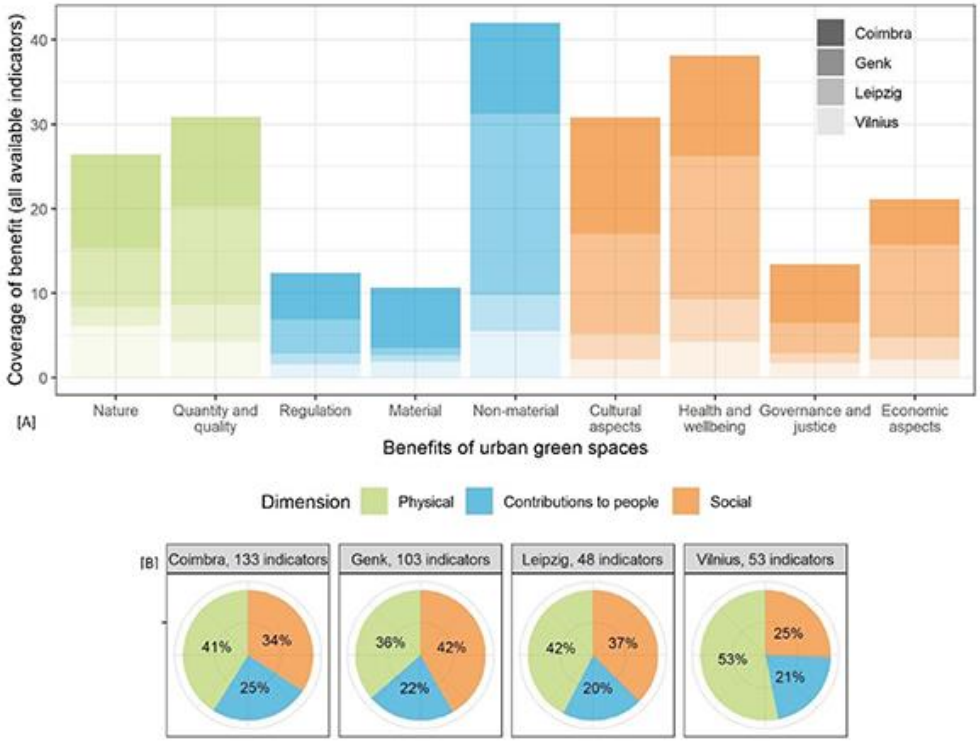

Figure 2. Coverage of the benefit categories by all available indicators. Indicators are associated with one or several KPI (1 = partly associated, 2 = perfectly associated). Coverage of a benefit category is the weighted sum of these scores over city indicators and its underlying KPI. The weights are related to the number of KPI in this benefit category.

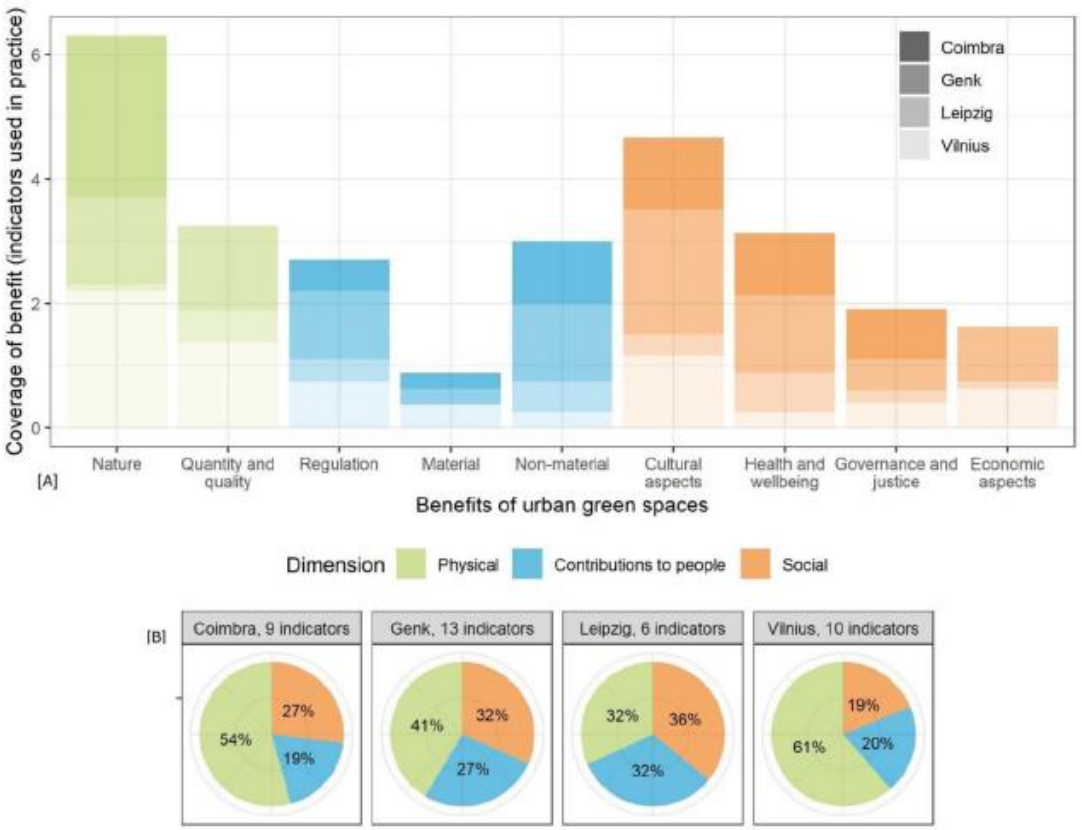

Figure 3. Coverage of the benefit categories by the indicators that are used in practice

Which indicators are chosen by the cities?

Figure 3 shows the total coverage score of indicators that are measured and used to track the urban green space's performance. Figure 3(a) shows that Nature and Cultural aspects are covered the best, while Material contributions lack support. Coimbra and especially Vilnius focus on the physical dimension, while Genk and Leipzig are quite balanced in the benefit categories that are covered (figure 3(b)).

How do cities make their choice of indicators?

As expected, cities select indicators that have, on average, high indicator quality (figure 4). This intuitive observation is confirmed by a simple logistic regression model. It appears that relevance and feasibility are the most important factors to explain indicator implementation.

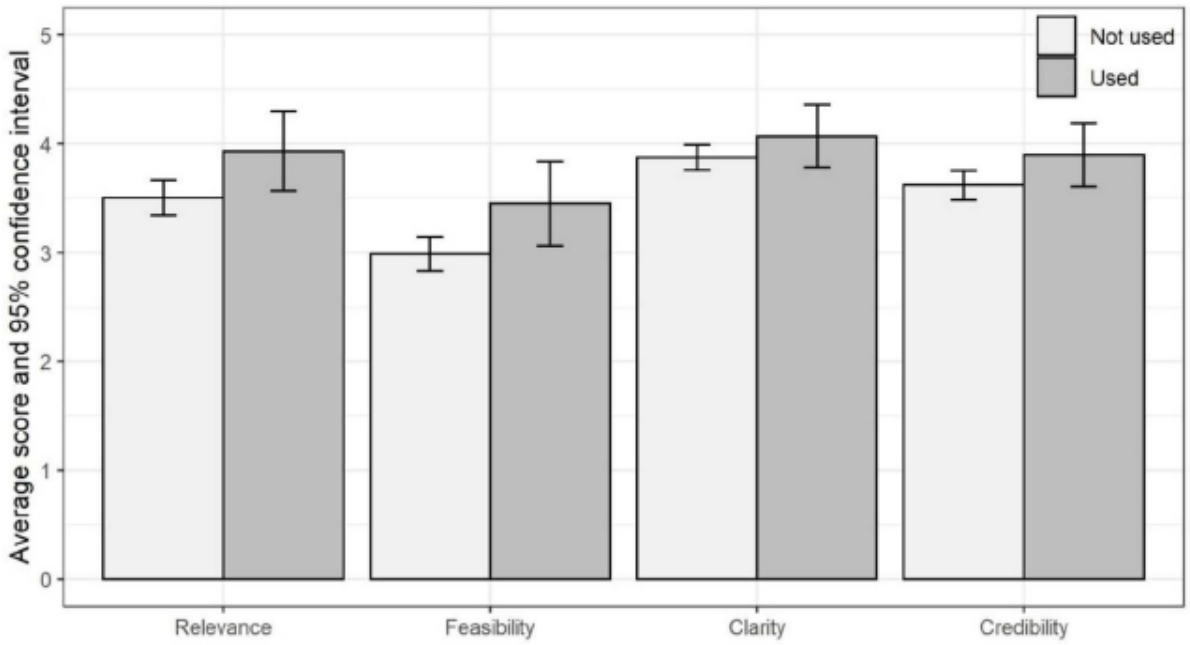

Figure 4. Indicator quality; average quality score and 95% confidence interval for indicators that are used or not used in practice.

We found that cities tend to focus on 6 to 12 high quality indicators that cover all three dimensions (physical—contributions—social). The stakeholder focus groups and interviews confirm that indicators are selected in a rather pragmatic manner: they are publicly available, freely provided through other organisations or very easy to implement. The physical dimension is covered the best (figure 3), as cities mostly rely on the expertise of park managers and natural scientists. While the physical quality is a necessary basis, the actual societal impact of green spaces is measured through its final contributions to people and impacts on quality of life. Contributions (ESs) are somewhat less covered, which is probably due to the fact that these sit 'in the middle' of the material processes and social benefits and are often less tangible to measure. Cities could benefit from bringing in more social science perspectives and skills in the day to day green space management.
Indicators are fundamental to evaluate the impact of urban green and blue infrastructures. Cities use indicators sets covering several benefit categories for urban green space within physical, contributions to people, and social dimensions. The used city indicator sets are thus effective and efficient, but can be easily complemented with a few efficient (feasible) indicators to patch specific blind spots.

The full study can be found at Carmen et al. 2020.

2.2.2 Governance performance assessment for U-GBI in Genk

A governance performance assessment was applied for the Stiemerbeek valley project in Genk. Six experts and five inhabitants who participated in the planning process for the redevelopment of the valley were interviewed for the assessment. The governance performance framework (table 2) was filled in with the experts. The inhabitants were involved through a separate process and therefore they were not involved enough throughout the whole planning process to answer an considerable amount of variables of the framework. Therefore, they were asked open questions on their view of their inclusion in the planning process. These answers were included in the qualitative analysis, but not in the scoring exercise.

Table 3 presents the scores (of only the experts) of the indicators and KPI's. The KPI score is an average of the indicator score. The indicator score is an average of the "weighted variable scores" and weighted by the scored relevance of the variable. The average of the variables were weighted by the confidence of the experts answers. Some highlights of table 3 are:

- the variables of 'anticipation of the future' scored high (4,41), especially the vision of the city has for the area (4,91),
- throughout the governance process, there was a good understanding of the biophysical (4,67) and socio-cultural (4,63) assets, issues and opportunities,
- ecological and environmental partners were well represented in the process (4,71), but the representation of socio-cultural (3,5) and economic partners (2,67) could be improved. Although the representation of socio-cultural partners was not always considered as relevant (relevance score: 1,25),
- more attention could have been paid to the adaption of plans to vulnerable groups (2,67),
- more or better policy instruments are needed to support the implementation (3,4) of their plans,
- and available budget (2,80) scores low while being fully relevant (relevance score: 2) which indicates that budget hampers the implementation.

The qualitative analysis of the open answers (of both the experts and inhabitants) supports the findings of table 3. A summary of the qualitative analysis, expressed in strengths and challenges of the governance process, can be found in table 4. The full results of the Genk case study can be found in the annex of deliverable 12.

Table 3. Scores of the planning process of the Stiemerbeek.

KPI	KPI score	Indicator	Indicator score	Variable	Weighted variable score	Releva-nce of variable
Understanding the complexity of the issues and local context	4,27	Understanding the area's assets, opportunities and threats	4,41	Biophysical/environmental understanding	4,67	2,00
				Socio-cultural understanding	4,63	2,00
				Economic understanding	3,89	1,83
		Information gathering for informed decision making	3,81	Scientific literature	3,63	1,80
				Best practices	4,00	1,80
		Anticipation of the future	4,58	Understanding of drivers influencing the future of the city	4,73	2,00
				Vision	4,91	2,00
				Scenario's	4,09	2,00
Achieving engagement, collaboration and coherence	3,94	Mobilizing representative partners across sectors	3,75	Ecological/environmental partners	4,71	2,00
				Socio-cultural partners	3,50	1,25
				Economic partners	2,67	1,50
		Social inclusion (inhabitants)	3,90	Level of public participation	4,56	1,83
				Level of inclusiveness	4,33	2,00
				Adaption to vulnerable groups	2,67	1,67
		Establishing a common pathway	4,17	Existence of common concerns for the area	4,50	2,00
				Uniformity in the area's vision/interests of actors	3,83	2,00
				Social learning and aligning interests	3,60	1,83
				Managing diversity, paradox and tensions	4,22	1,80
				Readiness of actors to develop shared strategies	4,22	2,00
				Influence of significant power differences	4,57	2,00
Designing and implementing (innovative) multifunctional solutions	3,82	"Playing field"	3,71	Policies (administrative and/or jurisdictional boundaries)	4,33	2,00
				Available budgets (financial boundaries)	2,80	2,00
				Available manpower	4,00	2,00
		Green-grey integration	4,14	Integration of green space/elements with (grey) infrastructure	4,14	1,40
		U-GBI contributes to multiple policy objectives	3,79	Biophysical/environmental	4,80	2,00
				Socio-cultural	3,43	1,50
				Economic	2,33	1,00
		Policy-instruments to support implementation of U-GBI	3,40	(Diversity of) policy-instruments to create/exploit U-GBI	3,40	1,83
		Mobilizing (external) support	4,05	Political support	4,56	1,67
				Financial support	3,43	2,00
				Social support	4,25	2,00

Table 4. Summary of qualitative analysis: strengths and challenges of the planning process of the Stiemerbeek

Strengths	Challenges
Understanding the complexity of the issues	
• The complex problems and opportunities of the Stiemerbeek have been considered, discussed and included in the project from various domains, such as the environment (water, nature, climate), socio-cultural (mobility, recreation, social cohesion) and economy (entrepreneurship).	• It is a challenge to explore, stimulate and realize economic opportunities. Consideration should also be given to a balance between permitted economic activities and environmental and natural disruption.
Stakeholder engagement	
• There has been cooperation between government agencies on different scales (region, regional and local) and from different sectors (e.g. VLM, VMM, Aquafin, Province of Limburg, City Services Environment & Sustainable Development, Neighborhood Development, Mobility, Economy), with inclusion civil actors (Natuurpunt, Friends of the Stiemer, Betty's Garden, local residents) and market actors (Tractebel, Fluvius). • The environmental sector was well represented in the planning process and much has been invested in involving the local population. • The citizen panel "Friends of the Stiemer" was set up for residents who wanted to be more involved in addition to community participation.	• In addition to the city service Economy, it is a challenge to involve partners who can properly represent the local economic sector. • Achieving diversity in population participation is a challenge, both in terms of diversity in age, culture and the involvement of vulnerable groups.
Collaboration	
• The water problem of the Stiemerbeek is a common concern of the stakeholders involved and was the starting point for cooperation between the project partners. Other themes such as upgrading nature, mobility, etc. could be linked to this. • The efforts of project coordination were appreciated by the partners and citizens involved and promoted trust and cooperation. • Citizens were consulted via the citizen participation trajectory, where citizens could share their ideas and concerns. Some of the citizens indicated that this has brought the vision of the city more in line with their ideas and concerns.	• Because residents were consulted and the city does not necessarily commit to their suggestions, some residents were not sure what was being done with their input. This can reinforce the feeling of mistrust among residents who already have less confidence in (local) politics.
Outcomes	
• A clear vision has been developed and the process to this end and the rolled out vision is cited as an example for comparable projects in other Flemish cities. • The goals steer towards the multifunctional use of the Stiemerbeek: environmental goals (linking nature with nature and nature with people), sociocultural goals (linking nature with people and people with people) and economic goals (linking nature with entrepreneurship) have been formulated. • There is a lot of support and support for the redevelopment of the Stiemerbeek from (local) policy, politics and society.	• More complete representation from the economic and socio-cultural sector could have made it possible to better identify and incorporate new and / or other opportunities around e.g. entrepreneurship, social cohesion, accessibility for (vulnerable) user groups. • It is a challenge to implement all plans, especially financially.

• By involving residents, it became clear that there are residents with a great interest in the area as well as motivated to make a voluntary contribution through, for example, the implementation of management interventions or the collection of monitoring data.	

2.3 Policy setting: uptake of the U-GBI concept in urban policies and planning

With the prospects of urban population continuing to grow and demands for more livable, 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. Especially in largely sealed urban contexts, green infrastructure can deliver a wide range of ecological, socio-cultural and economic benefits. To reach the EU's political ambitions, it is vital that the local scale takes up the same concepts. To plan green infrastructure that provides wanted benefits, it is essential to integrate local values and sustainability targets. This includes broader relational values such as accessible and respectful decision making to peoples' living environment and fair access and equal distribution of green infrastructure's functions. 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 what interactions municipalities have with other agencies - as possible ways for the concept green infrastructure to circulate - that may influence urban green space policies.

While the concept can be found in every case study, its' uptake and interpretation differs. We found that before 2013 (the year the EU green infrastructure strategy was published), green infrastructure - as understood by the EU strategy, containing characteristics of multifunctionality and connectivity - was not present in relevant policy documents (figure 5, direct mention). We found a variety of related concepts - containing either the multifunctionality or connectivity characteristic - in each case study (figure 5, indirect mention). After 2013 an increase in uptake of (direct mentioning of) green infrastructure and relevance of this concept in policies can be noted.

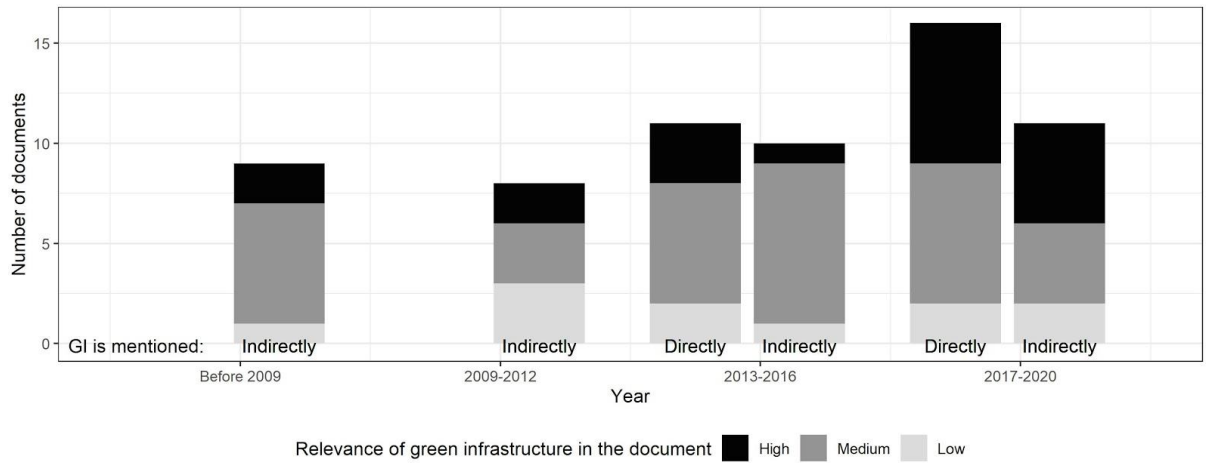

Figure 5. Indirect and direct use of the green infrastructure concept over the years (1995-2019) and the relevance of the concept in the documents, to urban issues to which green infrastructure can provide a solution.

Figure 6 shows the median scores over all governance (national, state, regional, local) levels of values shaping the green infrastructure concept. The nature dimension has been found an important value dimension in all countries. This is not surprising as natural elements are the concept's starting

point and a selection of values can be included as is deemed important for the local context. Values related to regulation functions, non-material contributions and governance aspects are also well associated with green infrastructure. However, values related to material contributions, cultural relations, economic aspects and justice aspects are far less considered across case studies.

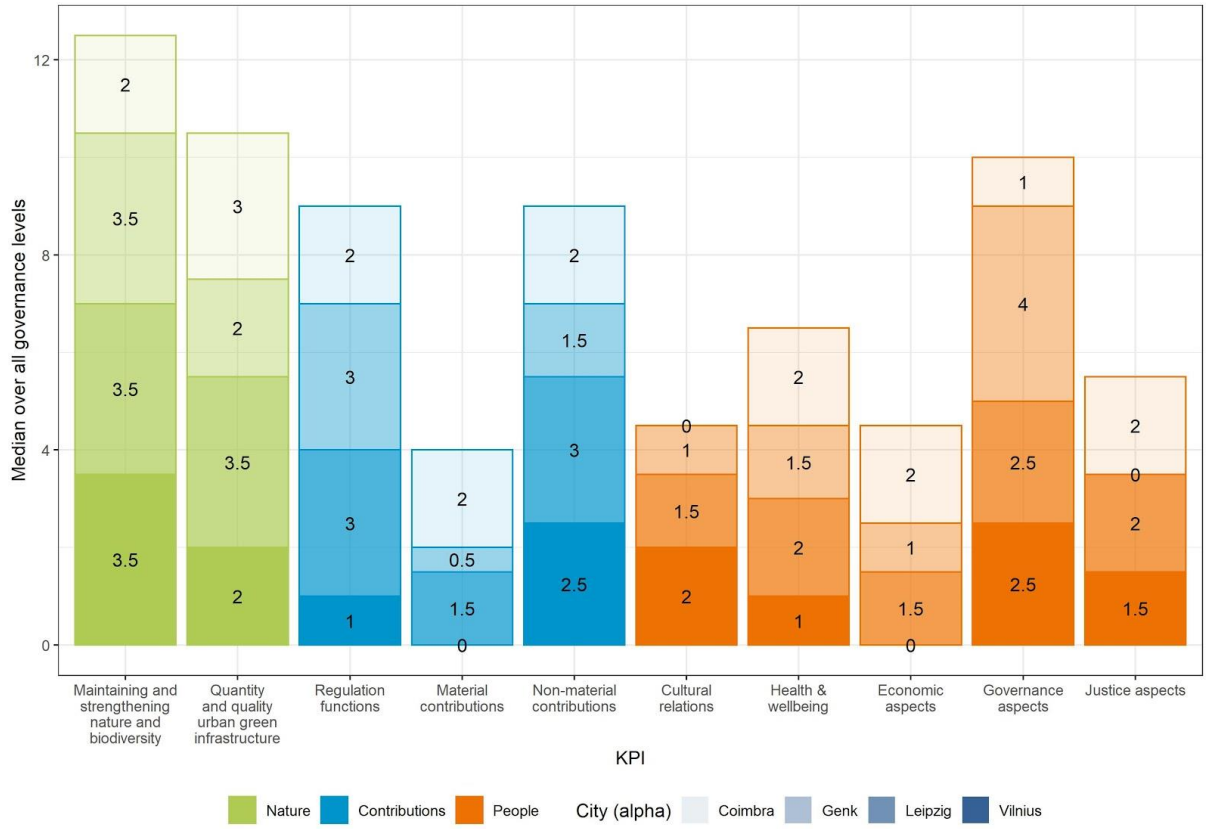

Figure 6. Median score of all governance levels for each value.

The varied uptake can be explained by the presence of established or new environmental concepts. It requires time and commitment for environmental concepts such as green infrastructure to be taken up in policy as they need to challenge, replace or coexist with established concepts. Furthermore, green infrastructure can be seen as a boundary concept as it is has a certain degree of abstractness which allows it to be increasingly flexible. The concept can be molded to local contexts as there is space for multiple interpretations and its content can be negotiated. This can be seen as an opportunity to shape green infrastructure with a multitude of values, as long as it doesn't transform the abstract understanding of the concept. Results show that some values are only occasionally associated with green infrastructure, and provides an opportunity for policy makers to aim for an increasingly multitude of benefits. However, to ensure a well-balanced and fair perspective in both policy making and planning, more attention to (environmental) justice values should be given in policy documents and plans. Moreover, to spread a concept to local applications it needs multiple driving forces to incentivize the concepts use and re-use in order to make it recognized and shared. We see the EU's strategy on green infrastructure as a first driving force resulting in the concepts uptake in member states' policies. But more driving forces are needed for widespread and local application of the concept. Examples of driving forces for municipalities are written material such as (inter)national journals or handbooks that inspire planning and design of green infrastructure, participation in (inter)national or regional networks to exchange experiences and practices, participate in a research

project that study and support the implementation of the concept on the ground and exchange knowledge.

The full results can be read in deliverable 2, which is in preparation to be published (see table 7).

2.4 Use of U-GBI by visitors

The smartphone application MapNat has been developed by the Leipzig team, with the contributions of all the partners. The main objective of MapNat is to serve as a tool for citizens and scientists to map the use of ES . The app version developed for the use in UrbanGaia was based on an earlier version ESM-App devloped in the FP7 project OpenNNESS (Priess and Kopperoinen, 2016). All partners contributed to improve the applicability of the tool, e.g. in terms of structure and design and adding the translations to their own national languages. Furthermore, the UrbanGaia team jointly revised and improved the ES and land use related terminology and structure to include recent progress made in addressing ES (Diaz et al. 2018) and to facilitate applications by lay persons e.g. via considering a large number of feedbacks from users. The MapNat methodology has been applied in surveys in urban parks in the case studies Coimbra, Leipzig and Vilnius, and additionally in urban brownfields in Leipzig.

In addition to its application in the UrbanGaia case studies in Coimbra, Leipzig and Vilnius (see Palliwoda et al. 2020; Priess et al, submitted paper (see table 7)), MapNat has also been used in teaching ES mapping to university and highschool students in Brazil, Germany, Lithuania and Portugal. The app currently has several hundred scientific and non-scientific users mapping the use of ES almost worldwide (see figure 7) and is available via Google's and Apple's app store.

Figure 7. Ecosystem service use mapped by MapNat users (numbers indicate ES recorded in the region)

We analyzed the influence of spatial and socio-demographic factors to ES that are used by citizens, to their use motivation and to perceived benefits & disturbances across central parks in three case studies (Coimbra, Leipzig, Vilnius). In situ surveys with randomly selected visitors were applied in each of the case studies to compare derived benefits across cities in different socio-ecological settings. Results provide new insights into urban human-nature relationships of different user groups in these European cities and may contribute to support nature & user-oriented sustainable management and planning of UGBI.

Multiple ES uses occurred in all parks and physical interactions dominated park visits, but despite mostly similar park attributes, use and users of other ES seem to differ across Europe (figure 8, figure 9). Most of the perceived disturbances in all case studies were attributed to human behaviour or infrastructure, maintenance and vandalism problems such as others walking their dogs (unleashed), having barbeques or broken / lacking seating, or trash in the parks, i.e. disturbances mostly addressed grey and social aspects rather than green UGI components (figure 10). This potentially leaves more options for designing and managing green UGBI components than previously expected. Planners can encourage the flow and perception of benefits by improving facilities and grey infrastructure to reduce disturbances. Our results furthermore highlight that good accessibility and short distances between home or office and parks strongly influence the means of transport towards non-motorised forms and the use of public transport (figure 11).

We interpret this and similar comparative studies as starting points to assess patterns of ES use and users in U-GBI, but results in Europe and elsewhere also point to the difficulty in transferring results about ES use and user motivations to parks in other cities. Our results suggest that the design of U-GBI must meet local specific characteristics in order to offer benefits for their users. This result underlines the importance of framework is flexible enough to include different indicator sets in each city and a governance approach that includes local values. The full results are currently under review for publication (Priess et al, submitted paper (see table 7)).

Furthermore, the case study of Leipzig (see Palliwoda et al. 2020 for full results) found that tree cover in urban parks negatively influences physical interactions used by respondents. In parks with high tree cover, more respondents were benefitting from regulating services such as noise mediation or shade provision. Brownfield visitors preferred sites with low to medium tree cover, mainly for walking the dog but also for other ES. These insights highlight how vegetation in U-GBI can be employed to steer the use, which can contribute to decision-making on design and management of U-GBI.

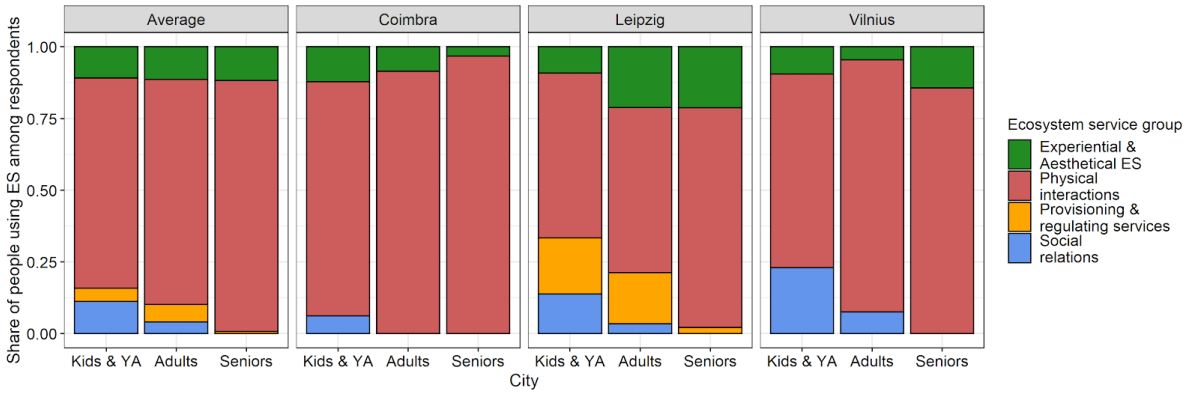

Figure 8. ES use of respondents from three different case studies

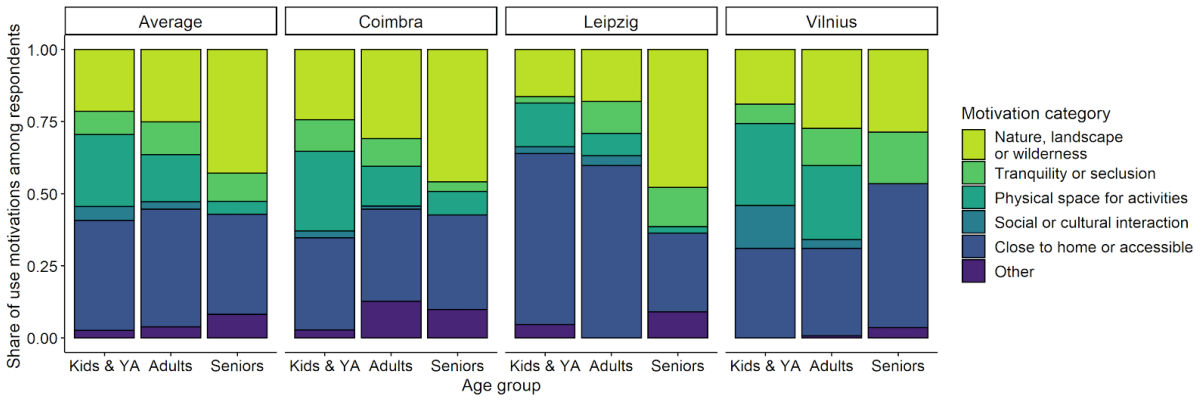

Figure 9. Use motivation of respondents from three different case studies

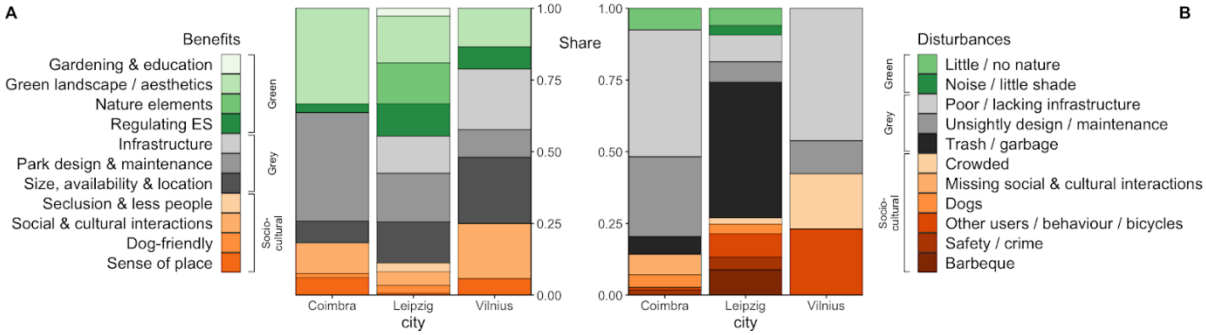

Figure 10. Perceived benefits and disturbances of respondents from three different case studies

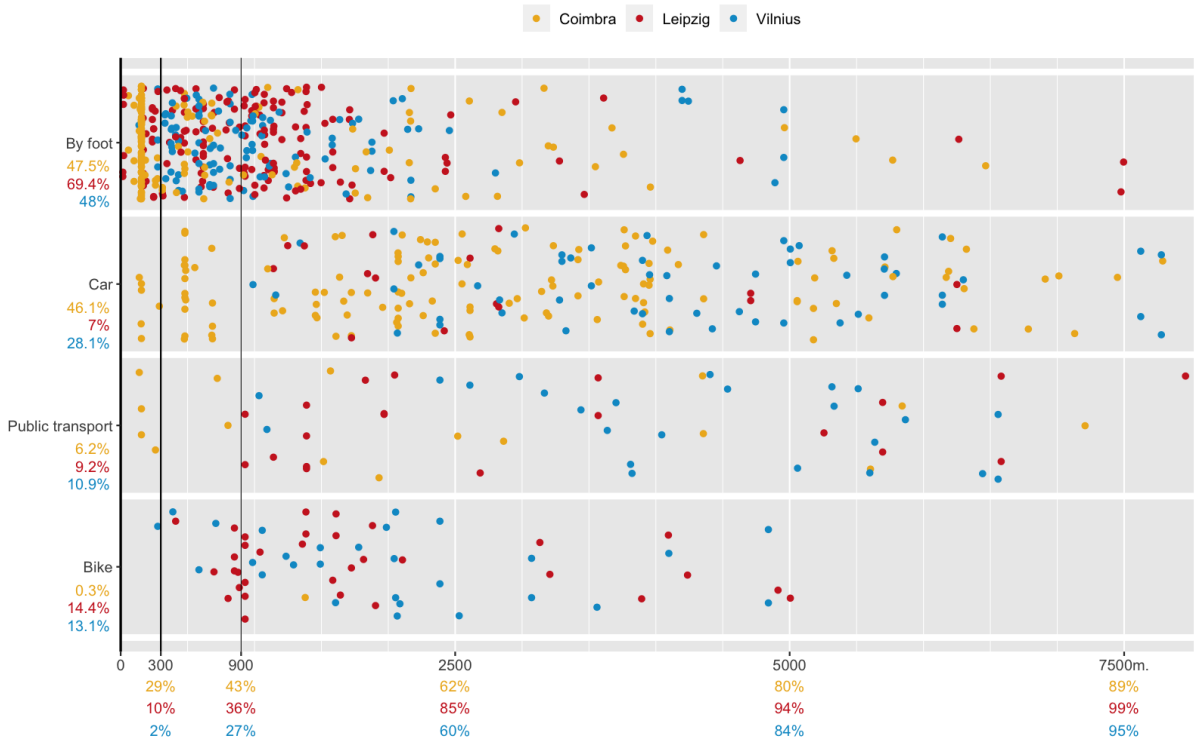

Figure 11. Means of transport used by respondents and distance to home from three different cities. The different colours represent the different cities: yellow = Coimbra, Red = Leipzig, Blue = Vilnius.

3. DISSEMINATION AND VALORISATION

A collaborative process was implemented at the beginning of the project, by involving the key actors at each city participating with UrbanGaia. Key actors advised about suitable U-GBIs to be addressed in each case study, participated in (the development of) URBANGAIA activities and acted as a gatekeeper to involve other relevant stakeholders when needed. They were essential to provide information and to help with the definition and evaluation of KPIs, the identification and selection of realistic set of indicators, and the provision of relevant policy documents and management priorities. Furthermore, there was regular exchange of ongoing research, results and possibilities for feedback which provided a reality check. Key actors in each case study were park managers, employees from the city's office for urban green space and water, or other organizations responsible for the management and design of UGBI.
Concretely about the collaboration between EV-INBO and the city of Genk: in collaboration we selected the case study of the Stiemerbeek, we adjusted research methodology to the needs of the city, we organized a focus group with experts for the identification of relevant indicators and scored these indicators according to a number of criteria, access was provided to experts and inhabitants that participated in the planning process, and policy documents were provided for analysis. Reportedly, the city will use the UrbanGaia indicators list for the further development of their monitoring approach and the city has used the results (strengths and challenges) from the governance performance analysis for the development of new planning processes within the city.

In 2018, UrbanGaia organized, together with BioDiversa sister-project Imagine, a joint meeting to share approaches and preliminary results between the two projects.

Table 5 presents a full list of dissemination activities performed throughout the UrbanGaia project:

Table 5: Dissemination activities (including presentations, posters, book chapters, conference papers, non-peer reviewed publications, newsletters, etc.)	**Type of publication**
2020	
Palliwoda, J: Future development and management of Leipzig's urban green and water -ideas and relevant topics from the citizen's perspective. URP conference, Leipzig	Presentation at International conference
Oral session "Making sense of Nature-based solutions: environmental, economic and social aspects" at the European Geosciences Union General Assembly, 8-13 April, Vienna (Austria).	Session at International conference
Carla S.S. Ferreira, Barbara Frigione, Milan Gazdic, Michelle Pezzagno, António Ferreira. Effectiveness of green areas and impact of the spatial pattern on water infiltration within cities. In European Geosciences Union General Assembly 2020, 4-8 May. In Geophysical Research abstracts, EGU2020-441. (oral presentation)	Presentation at International conference
Pinto, V.P., Ferreira, C.S., Pereira, P., Ferreira, A.D. Analyzing social media photo posts distribution as a potential indicator for UGBI user preferences: the case of Coimbra, Portugal. EGU 2020	Poster
Pinto, V.P. A importância dos Serviços dos Ecossistemas e o papel da Ciência Cidadã no seu conhecimento e difusão. MapNat presentation session for school kids. Coimbra	Presentation & outdoor session
2019	
Palliwoda, J.: How does the "Green" in Urban Green Infrastructure shape Ecosystem Service use? Examples from Leizig, Germany. ESP 10 World conference in Hannover	Presentation
Palliwoda, J., Priess, J.A.: How does the "Green" in Urban Green Infrastructure shape Ecosystem Service use? Examples from Leizig, Germany. GLP conference in Bern, Switzerland	Poster
Priess J.: How can smartphone-based tools contribute to transformative pathways in	Presentation

agricultural frontiers and elsewhere. Leverage Points 2019, Lüneburg, Germany	
Priess J. and J. Palliwoda: Kartierung von Naturnutzung in Leipzig (Mapping of nature use in Leipzig). MapNat training for school kids, Leipzig, Germany	Presentation & excursion
Priess J. and J. Palliwoda: Kartierung von genutzten Ökosystemleistungen und der Einfluss von Flächeneigenschaften in Parks und auf Brachflächen in Leipzig, IÖR Dresden, Germany	Presentation
Schwarz N., J. Priess, A. Haase, J. Palliwoda, L. Pinto: Urban Green Infrastructure: factors shaping urban ecosystem services and disservices. SESSION 10 D, ESP 10 World conference in Hannover, Germany	Conference Session
Priess J. and J. Palliwoda: Current and expected future provision of urban green in Leipzig: which UGIs and for whom?, ESP 10 World conference in Hannover, Germany	Presentation
Palliwoda J. and J. Priess: Nutzung von Ökosystemleistungen in Leipziger Parks und Brachflächen. Department for Urban Green and Water, Leipzig, Germany	Presentation
Pinto, L.V., Ferreira, C.S., Pereira, P., Sander, J., Misiune, I., Leone, M., Martínez-Murillo, J., Palliwoda, J., Priess, J., Ferreira, A.: Integration of Ecosystem Services and Green and Blue Infrastructures Concepts in the Land Use Planning Process: the Coimbra Case Study. TerraENvision 2019	Poster
Pinto, L.V., Ferreira, C.S.S., Pereira, P., Ferreira, A.D.: Integration of ecosystem services and green and blue infrastructure concepts on portuguese land use planning at the national and regional levels. III CNESA	Poster
Pinto, L.V., Ferreira, C.S., Sander, J., Martínez-Murillo, J., Ferreira, A.: A review on Urban Green and Blue Infrastructures and their Ecosystem Services and Disservices - Navigating through troubled waters. ESP10	Poster
2018	
Palliwoda, J.: The use of (cultural) ecossystem services in urban green infrastructure and the influence of ecological and spatial parameters. A case study in Leipzig. IAPS conference, Rome	Presentation at International conference
Priess J. et al.: Mapping ecosystem services - examples of recent rural and urban studies. Brandenburgische Technische Universität Cottbus, Cottbus, Germany	Presentation at International conference
Priess J. and J. Palliwoda: Mapping ecosystem services with the smartphone-based application MapNat. Helmholtz Centre for Environmental Research, Leipzig, Germany	Presentation at International conference
Priess J. et al.: Mapping ecosystem services in Leipzig. IAPS Rome, Italy	Presentation at International conference
Priess J.: Participatory mapping as a contribution to research puzzles of relevance for transdisciplinary research. WS transdisciplinary perspectives on land issues Wiesenburg/Mark September 10-12, Germany	Presentation at International conference
Priess J. et al..: Mapping ecosystem services on brownfields in Leipzig – use pattern, valuation and motives of users contribute to ongoing 2030 urban sustainability planning. IEMSS2018, Fort Collins, USA	Presentation at International conference
Ferreira, C., 2018. *Re-Naturing urban and peri-urban areas: strategies to enhance human resilience and mitigate climate change impacts*. **International Meeting TERRAenVISION**, 27th January – 2nd February, Barcelona (Spain). In "TERRAenVISION Book of Abstracts". (*Invited Key Note Lecture*)	Presentation at International conference
Ferreira. A., Ferreira, C., Leitão, I., Pinto, L., Pereira, P., Jacobs, S., Martinez-Murillo, J., Priess, J., 2018. *Improving Ecosystem Environmental Services in urban areas of four European cities*. Work presented in **European Geosciences Union General Assembly**, 8-13 April, Vienna (Austria). In Geophysical Research abstracts (EGU2018-16234). https://meetingorganizer.copernicus.org/EGU2018/EGU2018-16234.pdf	Presentation at International conference
Priess et al.: Mapping ecosystem services in Leipzig. ESP Europe 2018, San Sebastian, Spain	Presentation
Priess J. B. Burkhard et al.: Mapping ecosystem services with the smartphone-based application MapNat. DG ENV, Fun Fair June 2018, Brussels, Belgium	Presentation & demonstration
Joerg Priess, David Barton, Benjamin Burkhard, Dagmar Haase, Jennifer Hauck, Leena Koopperoinen, Catharina Pueffel 2017: Mapping ecosystem services - examples of recent rural and urban studies. Invited talk at Brandenburgische Technische Universität Cottbus, 23.1.2018	Invited presentation

Joerg Priess & Benjamin Burkhard, Julia Palliwoda, Dagmar Haase, Jennifer Hauck, Catharina Pueffel 2018: Mapping ecosystem services with the smartphone-based application MapNat. Brussels, DG Environment, June 11.-12. 2018.	Invited presentation
Joerg Priess, Catharina Pueffel, Dagmar Haase 2018: Mapping ecosystem services on brownfields in Leipzig – use pattern, valuation and motives of users contribute to ongoing 2030 urban sustainability planning. IEMSS2018, June 25-29 Fort Collins, USA	Presentation at International conference
Joerg Priess, Catharina Pueffel, Dagmar Haase 2018: Mapping ecosystem services on brownfields in Leipzig – use pattern, valuation and motives of users contribute to ongoing 2030 urban sustainability planning. IAPS 2018, July 9-13, Rome, Italy	Presentation at International conference
Jorg Priess 2018: Participatory mapping as a contribution to research puzzles of relevance for transdisciplinary research. Workshop transdisciplinary perspectives on land issues. Wiesenburg/Mark, Germany, 10-12th September 2018	Invited presentation
Julia Palliwoda, Joerg Priess 2018: Under the cover - How tree canopy and other traits (might) influence th use of cultural ecosystem services in urban green (work in progress). IAPS 2018, July 9-13, Rome, Italy	Presentation at International confernce
Paloma Hueso-González, Ricardo Remond, Juan F. Martínez-Murillo, Paulo Pereira. 2018. Mapping green and blue infraestructures using digital globe images in vilnius city (Lithuania). International meeting TerraenVision, Barcelona, Jan-2018.	Presentation at International conference
Paloma Hueso-González, Ricardo Remond, C. Ferreira, A. Ferreira, Juan F. Martínez-Murillo. 2018. Methodological approach for mapping ecosystem services in urban and suburban areas. European Geosciences Union Assembly, Viena (Austria), Apr-2018.	Presentation at International conference
Paloma Hueso-González, Ricardo Remond, C. Ferreira, A. Ferreira, Juan F. Martínez-Murillo. 2018. Mapping Urban Ecosystem Services in Coimbra city (Portugal). European Geosciences Union Assembly, Viena (Austria), Apr-2018.	Presentation at International conference
A.J.D Ferreira, C.S.S. Ferreira, I.A. Leitão, L.M. Pinto, P. Pereira, S. Jacob, J.F. Martinez-Murillo, J. Priess. Otimização dos serviços ambientais dos ecossistemas em áreas urbanas de diferentes cidades europeias. In "Ambiente e direitos humanos". A.I. Miranda, M. Lopes, L. Tarelho, F. Martins, P. Roebeling, M. Coelho, J. Labrincha (eds.). Universidade de Aveiro, Conferência Internacional de Ambiente em Língua Portuguesa, XX Encontro REALP, XI CNA. Vol. I, p. 495-504. (in portuguese)	Book Chapter
Pinto, L.V., Ferreira, C.S., Sander, J., Martínez-Murillo, J., Ferreira, A.D.: Urban Green and Blue Infrastructures, Nature-Based Solutions and their Ecosystem Services and Disservices - A review	Presentation at International conference
Leone, M., Pinto L.V., Jacobs, S. (2018) Towards sustainable cities: Ecosystem Services, Urban Green and Blue Infrastructures, and Nature Based Solutions, Poster and video at BEES (Belgian Ecosystems and Society) Christmas market, Brussels, Belgium	Poster
2017	
Juan F. Martínez-Murillo, Paloma Hueso-González, Carla Ferreira, Sander Jacobs, Michael Leone, Ieva Misiune, Daniel Depellegrin, Paulo Pereira, Jörg Priess, Nina Schwarz, Julia Palliwoda, Antonio Ferreira. 2017. Managing urban biodiversity and green infrastructure to increase city resilience: 4-case studies in Europe. Congreso Nacional de Geografía, Madrid, oct-2017.	Presentation at International conference
Leitão, I., Ferreira, C., Ferreira, A. 2017. *Estudo dos serviços dos ecossistemas: ferramenta para a sustentabilidade na Região Centro*. In "Livro Verde para o Desenvolvimento Rural da Região Centro", Ferreira A., Kikuchi R., Ferreira C.D., Costa R., Cunha M.J., Rodrigues A.M. (eds.) Cernas, Coimbra. p. 133-146. (*in Portuguese*)	Book Chapter
Ferreira, C., Amorim, I., Pires, E., Kalantari, Z., Walsh, R., Ferreira, A., 2017. *Temporal changes in potential regulating ecosystem services driven by urbanization*. Work presented in **European Geosciences Union General Assembly**, 23-28 April, Vienna (Austria). In Geophysical Research abstracts (EGU2017-1594-1)	Presentation at International conference
Ferreira, A., Boulet, A.-K., Leitão, I., Ferreira, C., 2017. *Optimização dos serviços ambientais dos ecossistemas ao serviço da sustentabilidade na agricultura*. in **Encontro com a ciência e tecnologia em Portugal**, 3-5 July, Lisbon, Portugal. (*in Portuguese*)	Presentation at National conference

4. PERSPECTIVES

On the KPI framework:

- On a theoretical level, our study advances the current state of art on urban green space by providing a comprehensive yet adaptable evaluation framework. The framework applied to evaluate green space impact is inspired by the IPBES framework (see section 2.1.1). By confronting this with the urban context and the four city-specific indicator sets (which articulate specific priorities) we have obtained a hierarchical classification of key performance indicators, validated in real-life practice. The framework is flexible enough to include different indicator sets in each city, while ensuring a minimum acceptable degree of comparability at higher levels. This urban green space checklist can be used to assess impacts on plural values in other urban contexts.
- Our results confirm that feasibility is one of the main criteria for indicator selection. While researchers long relied on credibility, salience and legitimacy (Cash et al. 2003) to evaluate indicators, our study shows large differences in the ease of implementation depending on local context and support from local partners. Applied research, which aims at improving evidence-based decision making on urban green spaces should therefore inventory the resource and capacity limitations to measure and interpret these indicators. While increasing resources and capacities are certainly needed on the municipalities' side, we argue that researchers should avoid compiling idealized, exhaustive and perfect indicator sets, and implying these should be measured for each green space project and repeatedly over time. This is unrealistic, demotivating, and does not advance evidence-based decision making.

On the governance performance assessment:

- Governance processes are social processes and differ per context. Despite the differences, when aiming multifunctional and just U-GBI, these aspects should be reflected in the governance process. By combining a qualitative and quantitative approach a framework was developed that scored three stages of the governance process. The quantitative scoring allows for comparison with other governance processes, while the qualitative answers allow an in-depth understanding of the strengths and challenges of the governance process. This in-depth understanding can provide cities with lessons learned for future U-GBI governance processes.
- The governance performance assessment is developed as an integral part of the KPI framework. Besides monitoring ecological, socio-cultural and economic benefits of U-GBI, the KPI-framework allows also to monitor whether the governance process contributed to set goals and aimed for benefits.

On policy uptake of the U-GBI concept:

- The policy assessment highlights a varied uptake of the EU concept in the case studies, which can be explained by 1) the presence of other established or new environmental concepts which are favored, and 2) the moldability of the green infrastructure concept, which can lead to local adaption of the concept, but also the risk that it is molded into an interpretation and application that moved away from the original ideas. To spread the concept to local and

widespread application, multiple driving forces are needed to incentivize the concepts use and re-use in order to make into something recognized, common and shared. Examples are the availability of written material such as (inter)national journals or handbooks that inspire planning and design of green infrastructure, participation in (inter)national or regional networks to exchange experiences and practices, participate in a research project that study and support the implementation of the concept on the ground and exchange knowledge. Policy makers (at all levels) are encouraged to invest in these, and other, driving forces (while having a common understanding of the concept) in order to realize a world that the concept describes.

On insights of U-GBI usage for planning and management:

- Our results confirm that urban parks with diverse tree canopy and vegetation structures, a mixture of open and shaded areas, potentially including water bodies can increase the use of regulatory and aesthetical ES in U-GBI and increase nature interactions. Thus, the diversity of tree cover, vegetation structure and landscape elements all contribute to multifunctional ES provision and use and should be considered in U-GBI planning and management. Brownfields provide additional space for complementary ES use, thus contributing to the avoidance of potential use conflicts in managed U-GBI like parks. The sites being used for their seclusion exemplarily illustrate the importance for spatial planning to address and to provide space for conflicting ES. The integration of low-maintained and secluded sites or areas can thus avoid trade-offs between ES and contribute to multifunctional U-GBI.
- Results of our study show that it is difficult to transfer results about ES use and user motivations from one park or city to other parks or cities. Our results suggest that the design of U-GBI must meet local specific characteristics in order to offer benefits for their users. This result underlines 1) the importance of a governance process that includes the local assets, issues and opportunities, while including user-groups, to design U-GBI that meets local demands and 2) when monitoring benefits, to have a framework that is flexible enough to include different indicator sets in each city.

On future urban nature projects:

- The UrbanGaia project helped to strengthen the urban nature expertise within EV-INBO and put the theme on the organization's agenda:
    - This resulted in the participation of a new H2020 project: Interlace. This project focusses on restoration and rehabilitation of urban green space while stimulating knowledge exchange between 3 European and 3 Latin American cities. EV-INBO will bring its UrbanGaia expertise through applying an governance performance analysis.
    - Furthermore, as a result of the UrbanGaia project and other INBO-initiatives, the theme "Nature in the City" has been included in the strategic planning of INBO-activities for the coming years (2020-2024).

5. PUBLICATIONS

Table 6: List of peer-reviewed publications accepted, in press or published	Year
Ferreira C.S.S., Kalantari Z., Pereira P. 2021. Liveable cities: Current environmental challenges and paths to urban sustainability. Journal of Environmental Management, 277, 111458 https://doi.org/10.1016/j.jenvman.2020.111458	2021
Ferreira A.J.D. 2021. On the relevance of environmental law evolution as a fundamental pillar of the European Union. In: Advances in Science, Technology & Innovation, Abrunhosa et al (eds): Advances in Geoethics and Groundwater Management: Theory and Practice for a Sustainable Development , 978-3-030-59319-3, 483413_1_En (21)	2021
Ferreira A.J.D., Barai E., Leitão I., Ferreira A.M., Boulet A.-K., Pereira P., Oliveira M.F., Ferreira C.S.S. 2021. Ethical issues on the use of Citizen Science approaches. Advances in Science, Technology & Innovation, Abrunhosa et al (eds): Advances in Geoethics and Groundwater Management: Theory and Practice for a Sustainable Development, 978-3-030-59319-3, 483413_1_En (62).	2021
Carmen R., Jacobs S., Leone M., Palliwoda J., Pinto L., Misiune I., Priess J.A., Pereira P., Wanner S., Ferreira C.S., Ferreira A. 2020. Keep it real: Selecting realistic sets of urban green space indicators. Environmental Research Letters, 2020, 15(9), 095001 https://doi.org/10.1088/1748-9326/ab9465	2020
Palliwoda, J., Banzhaf, E., Priess, J. A. 2020. How do the green components of urban green infrastructure influence the use of ecosystem services? Examples from Leipzig, Germany. Landscape Ecology 35 (5): 1127–1142 https://doi.org/10.1007/s10980-020-01004-w	2020
Leitão I., Ferreira C.S.S., Ferreira A.J.D. 2019. Assessing long-term changes in potential ecosystem services of a peri-urbanizing Mediterranean catchment. Science of the Total Environment 660, 993–1003. https://doi.org/10.1016/j.scitotenv.2019.01.088	2019
Püffel C., Haase D., Priess J.A. 2018. Mapping brownfields in Leipzig. Ecosystem Services 30, 73-85. DOI: https://doi.org/10.1016/j.ecoser.2018.01.011	2018
Pereira P., Brevik E., Trevisani E. 2018. Editorial: Mapping the environment. Science of the Total Environment, 610-611, 17-23. https://doi.org/10.1016/j.scitotenv.2017.08.001	2018

Table 7: List of peer-reviewed publication in review or in preparation at time of reporting	Publication status	Journal if submitted/in review
Pereira P., Misiune I., Ferreira C. 2021. Mapping ecosystem services and disservices in a protected area located in Vilnius (Lithuania): A stakeholder perception approach.	In preparation	
Ferreira A.J.D., Parreira M.J., Bogdziewicz K., Ferreira C.S.S., Oliveira F. 2021. Towards the construction of an urban green infrastructure legislation framework in Europe. Science of the Total Environment	In preparation	
Priess J, Pinto LM, Misiune I, Paliwoda J. 2020. Ecosystem service use and the motivations for use in central parks in three European cities. Urban Studies (in review, manuscript ID: CUS-1204-20-11)	Submitted/in review	Urban Studies

Leone M., Misiune I., Pinto L.V., Palliwoda J., Carmen R., Jacobs S., Priess J.A. 2021. Uptake of the Green Infrastructure concept in urban policies and planning: a field study in 4 European cities.	In preparation	
Palliwoda, J., Priess, J.A. 2021. What do people value in urban green infrastructure? Linking spatial characteristics to users' perceptions of nature benefits and disturbances.	Submitted/in review	Ecology & Society
Palliwoda, J., Haase, A., Suppee, C., Rink., D., Priess, J.A.2021. Topics and visions for the development and management of urban green and blue infrastructure - the citizens perspective.	In preparation	

6. ACKNOWLEDGEMENTS

UrbanGaia is funded through the ERA-net BiodivERsA 3: 2015 call under grants BRAINbe BR/175/A1/URBANGAIA-BE (Belgium); 01LC1616A (Germany); S-BIODIVERSA-17-17-1 (Lithuania), and BIODIVERSA/0008/2015 (Portugal). The research is performed in cooperation with CERNAS (Coimbra, Portugal), INBO (Brussels, Belgium), UFZ (Leipzing, Germany), Universidad de Malaga (Malanga, Spain), Mykolas Romeris University (Vilnius, Lithuania). We also thank the cities' local governments, field workers, and contacts for their time and effort invested in the project.

7. REFERENCES

Aragão, A., Jacobs, S., Cliquet, A. (2016) What's law got to do with it? Why environmental justice is essential to ecosystem service valuation. *Ecosystem Services*, 22, 221-227.

Azadi, H., Ho, P., Hafni, E., Zarafshani, K. & Witlox, F. (2011) Multi-stakeholder involvement and urban green space performance. *J. Environ. Plan. Manage.*, 54, 785–811.

Baycan-Levent, T., Vreeker, R. & Nijkamp, P. (2009) A multi-criteria evaluation of green spaces in European cities, *Eur. Urban Reg. Stud.*, 16, 193–213.

Carmen, R., Jacobs, S., Leone, M., Palliwoda, J., Pinto, L., Misiune, I., Priess, J.A., Pereira, P., Wanner, S., Ferreira, C.S.S. (2020) Keep it real: selecting realistic sets of urban green space indicators. *Environmental Research Letters*, 15.

Cash, D.W., Clark, W.C., Alcock, F., Dickson, N.M., Eckley, N., Guston, D.H., Jäger, J. & Mitchell, R.B. (2003) Knowledge systems for sustainable development. *Proc. Natl Acad. Sci. USA*, 100, 8086–91.

De La Barrera, F., Reyes-Paecke, S. & Banzhaf, E. (2016) Indicators for green spaces in contrasting urban settings. *Ecological Indicators*, 62, 212–9.

Demolder, H., Van Gossum, P. & Van Reeth, W. (2018) Evaluatie Van De Natuurindicatoren : Criteria En Resultaten (Instituut voor Natuur-en Bosonderzoek: Brussels) (https://doi.org/10.21436/inbor.15618945)

Díaz, S., Demissew , S., Joly, C., Lonsdale, W. M., & Larigauderie, A. (2015) A rosetta stone for nature's benefits to people. *PLoS Biol.*, 13.

Díaz S. et al. (2018) Assessing nature's contributions to people. *Science*, 359, 270–2

EC - European Commission (2013) Green Infrastructure (GI) — Enhancing Europe's Natural Capital. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. COM(2013) 249 final, Brussels.

Edelenbos, J. (2000) *Proces in vorm. Procesbegeleiding van interactieve beleidsvorming over lokale ruimtelijke projecten*. Proefschrift, Technische Universiteit Delft. Uitgeverij LEMMA BV., Utrecht.

Hajer, M.A., Tatenhove, J.P.M. & Laurent, C. (2004) Nieuwe vormen van Governance. RIVM rapport 500013004

Hansen, R. & Pauleit, S. (2014) From Multifunctionality to Multiple Ecosystem Services? A Conceptual Framework for Multifunctionality in GreenInfrastructure Planning for Urban Areas. *AMBIO*, 43, 516-529.

Hansen, R., Rolf, W., Santos, A., Luz, A.C., Száraz, L., Tosics, I., Vierikko, K., Rall, E., Davies, C., & Pauleit, S. (2016) *Advanced urban green infrastructure planning and implementation*. GREEN SURGE Deliverable 5.2.

Girma, Y., Terefe, H., Pauleit, S., Kindu, M. (2019) Urban green infrastructure planning in Ethiopia: The case of emerging towns of Oromia special zone surrounding Finfinne. *Journal of Urban Management*, 8, 75-88.

GRETA - "*GReen infrastructure: Enhancing biodiversity and ecosysTem services for territoriAl development*". Draft Final Synthesis Report. Version 20/11/2018.

Kronsel, A. & Bäckstrand, K. (2010) Rationalities and forms of governance: a framework for analysing the legitimacy of new modes of governance.

Nesbitt, L., Meitner, M.J., Girling, C., Sheppard, S.R.J. (2019) Urban green equity on the ground: Practice-based models of urban green equity in three multicultural cities. *Urban Forestry & Urban Greening*, 44, 1-13.

Opdam, P., Steingröver, E., van Rooij, S.(2004) Ecological networks: A spatial concept for multi-actor planning of sustainable landscapes. *Landscape and Urban Planning*, 75, 3-4, 322-332.

Pakzad, P. & Osmond, P. (2016) Developing a sustainability indicator set for measuring green infrastructure performance. *Procedia - Social and Behavioral Sciences*, 216, 68-79.

Priess J.A. and L. Kopperoinen (2016) Chapter 5.6.3. Citizen science. In *Ecosystem Service Mapping*. B. Burkhard and J. Maes (eds.), PENSOFT, Sofia.

Rigo, A. & Németh, J. (2018) "We're not in the business of housing:" Environmental gentrification and the nonprofitization of green infrastructure projects. *Cities*, 81, 71-80.

Rounsevell, M., Fischer, M., Jacobs, S., Liekens, I., Marques, A., Molnár, Z., Osuchova, J., Shkaruba, A., Whittingham, M. & Zlinszky, A. (2018) Chapter 1: setting the scene The IPBES Regional Assessment Report on Biodiversity and Ecosystem Services for Europe and Central Asia. (Ed) M. Rounsevell, M. Fischer, A. Torre-Marin Rando & A. Mader (Bonn, Germany: Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) pp 1–54.

Sayer, J. et al. (2016) Measuring the effectiveness of landscape approaches to conservation and development. *Sustain Science*, Springer, DOI 10.1007/s11625-016-0415-z

van Oudenhoven, A.P.E. et al. (2018) Key criteria for developing ecosystem service indicators to inform decision making. *Ecological Indicators*, 95 417–26

van Tatenhove, J. van (2001) *De meervoudige groene ruimte*. In: H. de Haan, A.P.J. Mol en G. Spaargaren (eds.), Het precaire evenwicht tussen distantie en betrokkenheid, Wageningen

Wang, J., Banzhaf, E. (2018) Towards a better understanding of Green Infrastructure: A critical review. *Ecological Indicators*, 85, 758-772.

Zhu, Z., Rend, J. & Liue, X. (2019) Green infrastructure provision for environmental justice: Application of the equity index in Guangzhou, China. *Urban Forestry & Urban Greening*, 46.