WP3

Methodological review and framework: Cultural ecosystem services provided by green and blue infrastructure

(ENABLE Deliverable 3.0)

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1. Introduction

Over 75% of the European Union's population currently resides in or lives in close proximity to cities (World Bank 2015), with foreseen increases by 2050 (Eurostat 2016). A frequent consequence of this ongoing urbanization process is the loss of green spaces and biodiversity, which has been shown to decrease human well-being and health, amongst other consequences (Regional Public Health 2010). As such, policy makers are increasingly exploring ways to simultaneously create healthy and liveable conditions for citizens while also supporting the conservation of biodiversity (Naumann et al. 2011). Maintaining and establishing urban green and blue infrastructure (GBI; see Box 1 for definition) is highlighted in multiple studies and increasingly recognized in policy as a promising tool for achieving both of the aforementioned aims in parallel (Tzoulas et al. 2007, Lafortezza et al. 2013, Norten et al. 2015, European Commission 2016, USEPA 2017, Bowen & Lynch 2017).

In addition to the aforementioned benefits, GBI is also frequently associated with a range of further benefits arising from the delivery of ecosystem services. Benefits such as climate adaptation and improved attractiveness for investors have been frequently highlighted and analysed within the literature (e.g. Gill et al. 2007, Bowler et al. 2010, Kabisch et al. 2016). However, societal benefits arising from the delivery of cultural ecosystem services (CES), such as reducing mental stress by providing a sense of tranquillity and health (Chiesura 2004, Tzoulas et al. 2007) or fostering a sense of community (Kweon et al. 1998, Kuo 2003, USEPA 2014) have historically been far less prevalent in GBI discourse.

Given this background, Work Package 3 (WP3) of the ENABLE-project aims to analyse citizen perceptions of and preferences for various CES provided by GBI. WP3 - in cooperation with WP2 - will also identify potential means to integrate such knowledge and information in municipal planning processes. A particular focus will be on the integration of perceived benefits and citizen preferences for GBI into multi-criteria decision analyses (MCDA) at municipal level, as one decision-making instrument.

The present review will inform the design of WP3's methodological framework, which will be applied in up to five case study areas within the project. Specifically, this paper will outline the status quo of research and experiences in this field as a basis for the WP3 approach. Academic as well as grey literature sources have been reviewed, focusing on those which present both theoretical foundations as well as 'real world cases' which employ perception/preference assessments to assess citizens' views and which map the benefits of CES perceived to support policy and planning decisions at the municipal level. In line with the aim of the work package and following the assumption that including preferences of citizens into political processes is crucial to design and implement sustainable and effective GBI interventions, the focus of the review will be on the **cultural ecosystem services** (CES) provided by urban ecosystems and biodiversity (see Box 1).

For this purpose, the following guiding hypotheses have been derived:

- Within current political frameworks, citizen preferences for CES are seldom taken into consideration when designing and developing GBI. The stakeholder consultation processes that do take place are often 'non-participative' or low in their actual degree of participation[2] (Hart 1992) due to a lack of robust and efficient methodologies for other types of more inclusive assessment.
- There is no standardized and comparable assessment methodology for conducting Multi-Criteria-Decision-Analysis on land use decisions at the municipal level.
- Including preferences/values of citizens into political processes is crucial to design and implement sustainable and effective GBI interventions meeting people's needs.

In addition, the subsequent research questions are addressed by the review:

- What are success factors, drivers and barriers for integrating citizen preference assessment methods into formal decision-making processes at the municipal level?
- Which valuation methods[3] have been used to assess CES in which contexts? What are their relative advantages as compared to one another? What factors determine their applicability in different urban settings?
- What are the roles/purposes of different assessment and valuation methods in supporting decision or policy-making processes at the municipal level?

Box 1: What is meant by 'green and blue infrastructure' (GBI) and 'cultural ecosystem services' (CES)?

What is meant by 'green and blue infrastructure' and 'cultural ecosystem services'?

The ENABLE project defines **green and blue infrastructure (GBI)** as the arrangement and network of green and/or blue environmental components in a spatially structured landscape mosaic, together with the linkages and interactions between components that can deliver a wide range of ecosystems services and socio-economic benefits.

Cultural ecosystem services (CES) are nonmaterial benefits people obtain from their interactions with ecosystems encompassing recreation, tourism, physical and mental health as well as aesthetic appreciation, inspiration, education and spiritual experiences (Millennium Ecosystem Assessment, 2005). In a wider sense CES also include relational values and further benefits e.g. place attachment, identity, social belonging (Chan et al 2016). The human-environment relationship is key in the delivery of these services.

[2] Following Hart's 'Ladder of Participation' (1992), 'non-participation' consists of manipulation, decoration, or tokenism, while the remaining degrees of participation (from lowest to highest) include e.g. assigned but informed, consulted and informed, shared decisions, or self-initiated and directed.

[3] Methods may include group-based deliberative valuation, Q methodology and an online stated preference survey, multi-criteria analysis, participatory GIS, photoseries analysis (for ecosystem service supply), narrative assessment of cultural ecosystem services, photo-elicitation method, ecosystem service card game , eco Chain Participatory Biodiversity Management, time use studies, etc.

2. Methodology

The literature review to identify relevant CES provided by ecosystems and biodiversity in urban areas commenced with a key word search within the SCOPUS and ScienceDirect databases. The keywords searched for included: *cultural ecosystem services*, *socio-cultural values*, *socio-cultural preferences, wellbeing, health* and *recreation* in different combinations with the terms *urban, green infrastructure, blue infrastructure, green areas, green spaces, parks, urban parks, urban gardens* and *biodiversity*.

We then assessed the current use and integration of preference assessments in multi-criteria decision analyses (MCDA), as well as the current application of preference methods in impact assessments. The objective was to identify if and how MCDA are applied in decision-making and planning processes at the municipal level. This assessment encompassed different subtopics, e.g. the current application of preference methods, limiting factors/barriers to their respective application (e.g. lack of capacity and/or resources, inflexible regulatory framework, cultural barriers, etc.), and the integration of MCDA within municipalities. A keyword search in SCOPUS and ScienceDirect applied the following terms: *municipal planning, spatial planning, decision-making,* and *operationalisation* in combination with *multi-criteria analysis* and *cultural ecosystem services.*

Thirdly, we identified available methods to conduct preference and perception assessments of CES. In order to identify current applied methodologies, a final keyword search within SCOPUS and ScienceDirect for the literature published since 2011 was applied using the words *preference assessment, perception, participatory method, and multi-criteria analysis* in combination with *cultural ecosystem services, socio-cultural values,* and *green and blue infrastructure*. Additionally, grey literature derived from relevant research project results (i.e. *URBES, GreenSurge, GreenLULUS, GreenInUrbs,* and *OpenNESS*) were consulted. In total, 98 studies and articles were reviewed.

Finally, we derived lessons learned and implications from the reviewed literature to inform the ENABLE case study approaches. Specifically, challenges to improving existing methodologies/ approaches at municipality level are discussed, particularly regarding the designing of more robust and efficient assessments which also empower citizens to take part in decision-making processes. While some assessments may sacrifice efficiency to reach higher degrees of engagement, considerations like the level of empowerment, ownership and motivation created to actively engage in GBI design, implementation and maintenance activities should also be taken into account when making decisions.

3. CES provided by green and blue infrastructure and biodiversity – An overview

The benefits of living in an urban environment in comparison to a rural area can be manifold, relating to increased economic welfare or facilitated access to art and culture, etc. However, research suggests that living in urban areas may also lead to an unhealthier lifestyle resulting in e.g. more frequent mood and anxiety disorders as well as increased cases of schizophrenia (e.g. Mortensen et al. 1999, Pedersen & Mortensen 2001, van Os et al. 2004, Krabbendam & van Os 2005, Peen et al. 2010). Green and blue infrastructure has been found to enhance urban residents' quality of life by offering opportunities for diverse nature experiences and closeness to nature and leisure activities (Kaplan 1983), as well as to promote biodiversity conservation (CBD COP 2010).

As population density continues to increase and therewith the challenges facing urban populations, GBI and the ecosystem services it produces become even more crucial to the well-being of citizens. In particular, cultural ecosystem services are deemed essential and have thus experienced growing attention within the scientific community. Such services can refer to physical interactions with ecosystems (experiential and physical use), be connected to intellectual and representational interactions (environmental education, aesthetic, inspiration), or be of a spiritual or emblematic nature (symbolic). In addition, urban ecosystems can provide mental health benefits and offer a setting for fostering communal interaction. Based on the Common International Classification of Ecosystem Services (CICES 2018)and selected literature covering the relationships between people and nature as well as between people but involving nature (Chan et al. 2007, Voigt & Wurster 2015, Gomez-Baggethun & Barton 2013, Dickinson and Hobbs 2017), the prevalent CES categories provided by urban green and blue infrastructure

Table 1; these categories form the foundation for the work on CES planned within WP3 of the ENABLE project.

Table 1. Cultural ecosystem services provided by urban green and blue infrastructure

Category	Description
Environmental education, scientific research, local knowledge	Subject matter of education and research; e.g. allotment gardens or urban forests (with less management activities) used for environmental education
Aesthetic	Sense of place, artistic representations of nature; specifically, individuals can appreciate certain aspects of biodiversity, which are often linked to the level of management of green and blue areas: wilderness, species diversity and/or structural diversity
Symbolic	Emblematic plants, animals, or ecosystems; e.g. national symbols such as American eagle, British rose, Welsh daffodil or landscapes, such as Scottish heather
Experiential use	Experiential use of plants, animals and land-/seascapes in different environmental settings (e.g. bird watching); specifically, individuals can appreciate certain biodiversity aspects, e.g.: species diversity and/or occurrence of birds/pollinators
Physical use	Physical use of land-/seascapes in different environmental settings; e.g. walking, hiking, climbing, boating, leisure fishing
Mental well-being	The positive impacts of nature experience on human cognitive function and mental health; e.g. memory, attention, concentration, impulse, inhibition and mood/happiness
Inspiration	Inspiration for art (e.g. writing, painting, music), environmentalism (including environmental education) or creativity derived from the existence of or contact with certain species or ecosystems/nature
Place attachment and Identity	Group of cognitions and affective sentiments held regarding a particular geographic locale and the meanings one attributes to such areas; e.g. source of social cohesion, shared interests, neighborhood participation
Community/ social setting	Relates to feelings towards a group and strength of attachment to communities fostered by an green urban ecosystem (eg having picnics in a park or meeting friends in green areas along an urban canal)

Based on the Common International Classification of Ecosystem Services (CICES)4 version 4.3 and selected literature (Chan et al. 2007, Gomez-Baggethun & Barton 2013, Voigt & Wurster 2015)

The nine defined categories of CES reflect how multifaceted the benefits of GBI can be and highlight the potential for it to address a myriad of citizen needs and preferences, following specific design

[4] http://biodiversity.europa.eu/maes/common-international-classification-of-ecosystem-services-cices-classification-version-4.3

characteristics. This research project recognises this potential and the resultant need for more inclusive planning and design processes to help to ensure that urban GBI responds to population priorities, while also balancing broader city objectives (e.g. the delivery of provisioning, regulatory and maintenance services, mobility considerations, etc). It is thus an essential step for planners and policy makers to assess and take account of the experiences of urban green space users when planning and developing a city (Jim & Chen 2006, Baur et al. 2013, Buchel & Frantzeskaki 2015).

4. Relationship between CES and biodiversity

Green urban areas are often the only spaces in cities where people can experience nature and gain positive effects (benefits) from it. The diversity of urban GBI ranges from larger wilderness patches to semi-natural areas to strictly designed parks or urban gardens. There is a need to explore whether different degrees of naturalness of GBI in cities and the associated biodiversity impact the delivery of CES and how CES are being perceived by citizens (Dickinson and Hobbs 2017). In this context, attributes of GBI such as species composition and vegetation structure play an essential role.

The linkages and causalities between naturalness and biodiversity and the delivery of CES has been widely overlooked in scientific research on the topic, which has focused largely only on the benefits of environmental amenities (Sandifer et al. 2015). There are, however, a few studies that examine the relationship between ecosystem services and biodiversity, drawing on existing literature. Results from a systematic review reveal linkages between biodiversity attributes (species abundance, species diversity, and community habitat structure and species richness) and CES, such as landscape aesthetics and recreation (Harrison et al. 2014), But the authors also reveal that further research is needed to improve the evidence base on the correlations between biodiversity and the generation of ecosystem services. Schwarz et al. (2017) found that CES are often linked only to taxonomic biodiversity metrics (species richness and diversity) rather than functional biodiversity metrics (e.g. habitat structure). Yet, significant uncertainty and knowledge gaps remain with regards to the (intrinsic) relationships between biodiversity and CES, which also highlights the importance to understand human perceptions of urban biodiversity (Schwarz et al. 2017). While there is evidence that green space users have a preference for certain aspects of urban green areas over the diversity of animals and plants (e.g. beauty and naturalness) (Voigt et al. 2014), measuring and mapping perceptions of biodiversity in urban areas still remains challenging (Voigt & Wurster 2015).

The foreseen research in WP3 of ENABLE further explores the relationship between CES provided by urban biodiversity within the context of citizens' quality of life. A particular focus will be placed on the CES of e.g. environmental education, aesthetic, symbolic, existence and experiential and inspirational use. Attributes of nature/GBI will be used to explore these rather intrinsic relationships. Research is also expected to better integrate nature/biodiversity issues in urban planning and support the design and planning of new GBI to allow biodiversity (in its abundance, structure, shape) to unfold its potential and contribute to the delivery of CES.

5. Measuring societal perceptions and preferences for CES to improve GBI planning

GBI offer a range of socio-economic benefits to the public as a product of the diverse CES they produce. However, in order to reap the CES in urban areas, heterogeneous, multifunctional and accessible GBI need to be integrated throughout cities (Gomez-Baggethun et al. 2013). Over the last decade, the importance of CES more generally - and particularly in urban areas - has received

increasing attention within scientific research and policy processes (Buchel & Frantzeskaki 2015). However, it can be argued that societal preferences for certain services over others have largely failed to inform decision-making processes or policy design (Laurens et al. 2013, Barton et al. 2017).

While a portfolio of methods exists to assess and integrate CES into policy, their use remains quite limited. This gap can be credited to a lack of experience with and awareness of such methods, the need to often combine multiple methods to gain a holistic view of citizen preferences, and the potentially costly nature of performing such assessments due to their highly participatory nature (Martin-Lopez et al. 2014). Diverse citizen values can also impact the robustness of these methods, as variations in individuals' priorities and perceptions can highly impact assessment conclusions and drastically vary significantly, depending on the groups involved. Additionally, the formalised nature of municipal planning decisions and permitting is a constraint, as integrating CES would require flexibility and the ability of adapting to new challenges. However, it is important that these preferences be incorporated into larger GBI planning decisions so that investments in this field will utilize the maximum socio-cultural benefits from newly implemented and re-designed green spaces as much as possible.

The benefits of incorporating citizens' preferences into planning GBI are not only present in theory, but have been reaped in numerous cases throughout the EU and globally. At a park in Berlin "Gleisdreieck", for example, the initial planning started in cooperation with citizen's activist groups as early as in the 1970s (see Box 2). In Philadelphia in the USA, a city considered to be the national leader for GBI implementation, public engagement and citizen involvement in GBI planning processes resulted in the transformation of a school lawn into a biodiverse meadow. The green space has since been used as an environmental teaching tool for students, served as a symbol for the surrounding community, and fostered social connections amongst users (see Box 3). Further case study examples of integrating citizen preferences and perceptions into GBI planning processes in the EU are presented in Table 1 (Annex). However, these cases illustrate the exception rather than the rule. The outstanding challenge for the future would thus be to integrate CES into decision-making support information at larger administrative scales, while paying particular attention to the incremental decision-making processes that erode GBI over time.

Box 2: Example for integrating citizens' perceptions and preferences into GBI planning and implementation: Berlin, Germany

***Gleisdreieck Park and "Interkultureller Garten Rosenduft"* – Incorporating CES preferences into urban planning in Berlin**

Gleisdreieck is a large public park in Berlin that stands on the former grounds of a train yard. The park is an excellent example of urban renewal and conversion of former industrial urban spaces into well utilized and popular urban green space. The planning of the park started informally with citizen's activist groups advocating for the railyard's conversion into greenspace starting in 1974. It wasn't until the early 2000s that the process was formalized and the city of Berlin began to undertake the project in an official capacity. From the initial surveys to gauge opinion on the idea of the project to extensive working groups during the planning and construction phases; at many stages of the process citizen stakeholders were consulted and played a crucial role in shaping the park.

Beyond the park as a whole, a specific part of the park, the Interkultereller Garten Rosenduft, serves as a particularly good example of green infrastructure that engages CES, incorporates biodiversity, and involved citizen stakeholders in the planning process. The Interkultereller Garten Rosenduft is a small garden within the Gleisdreieck that was founded by the non-profit group Verein Südost Europa Kultur e.V. specifically to provide a place of community and therapy for Bosnian refugees. The garden is open to the public and encourages intercultural conversation between Germans, the refugees, and people of all cultures through communal gardening and inter-cultural events celebrating Bosnian heritage. The garden is home to a variety of vegetables, flowers, and other plants, as well as bees native to Germany and Bosnia.

Sources: Grün Berlin Gruppe 2017, Südost Europa Kultur e.V. 2017, Senatsverwaltung für Stadtentwicklung und Umwelt 2017

Box 3: Example for integrating citizen's perceptions and preferences into GBI planning and implementation: Philadelphia, USA

***'Green City, Clean Waters'* – Green infrastructure planning in Philadelphia, USA**

Philadelphia, like many American cities, uses a largely combined sewer system that results in millions of gallons annually of raw sewage being leaked into surrounding bodies of water during rain events. To address these negative impacts, the Philadelphia Water Department[5] adopted a comprehensive and ambitious green infrastructure plan "***Green City, Clean Waters***" in 2011 to reduce storm water pollution. The 25-year plan pledges $2.4 billion in funding to reduce combined sewer overflow by 85%; already, over $356 million have been committed to capital projects.

Prior to the plan's release, the city conducted community meetings and outreach events on the content of the plan and other broader municipal storm water management initiatives in order to increase public awareness and gather feedback and support on planned activities and green infrastructure interventions. In these meetings and through surveys, residents expressed demand for green infrastructure initiatives and support for the plan.

In addition to the development of physical infrastructure, the plan emphasizes the enhanced provisioning of social benefits. Amongst those mentioned are: improved quality of life and health for residents through the renovation and improvement of recreation spaces and green areas and reduction of the urban heat island effect. The plan has also created jobs and increased property values substantially.

Community engagement and education are also pillars of the plan, aiming to inform citizens about the urban water challenge and the scope of activities foreseen in response. Recognizing the crucial role of the public for installing GBI as well as for lifestyle adaptation to help reduce combined sewer overflow, the plan commits $2 million annually in outreach and education efforts[2]. This annual monetary commitment has been used not only to hold public meetings, but also to develop strong partnerships with civic groups, install educational public art pieces, and develop a school curriculum to bring the ***Green City, Clean Water***s plan into classrooms.

Moreover, the program provides a framework for communities to implement green infrastructure initiatives. To this end, the Philadelphia Water Department website has a dedicated page providing communities with guidance on the process of initiating GBI, which includes resources such as applications for GBI project grants and other informational materials. Although the Philadelphia Water Department allows individuals to submit project proposals, it prioritizes proposals that represent community interests and have undergone community-based planning. All selected projects must also include a community outreach and engagement process.

A specific success story of these outreach and community empowerment measures is the meadow project at Cook Wissahickon Elementary School. The Wissahickon Sustainability Council is a committee of the Home and School Association, including families, teachers, and other community members. This Council initiated the project with The Community Design Collaborative, a nonprofit urban design firm, and were supported by the Philadelphia Water Department, the Schuylkill River Restoration fund, and the Schuylkill Center for Environmental Education. The project transformed a lawn on the school's property into a biodiverse meadow that is since used as an environmental teaching tool for students. The initiative has gained acceptance and support from the broader neighborhood community, including the small minority who initially were opposed.

Philadelphia Water has exceeded its 2016 five-year goal, making it the most comprehensive green infrastructure plan in the United States and making Philadelphia the national leader in green infrastructure.

Sources: Tanenbaum, 2015; Griffith 2013; Philadelphia Water Department 2011; Philadelphia Water Department, 2017

[5] The Philidelphia Water Department is the municipal government agency that oversees water supply and wastewater management in the city.

Decisions about maintaining, restoring and creating new GBI can be improved with the assessment of perceptions and valuation of CES (Primmer et al. 2015, Rinne & Primmer 2015, Langemeyer et al. 2016). More specifically, Andersson et al. (2015) proposes that the CES produced by GBI and biodiversity could function as a useful entry point for integrating societal views into planning processes, building upon the appreciation of GBI already in place. Integrating people's perceptions and preferences of CES may also serve to empower civil society. This can foster community action to maintain urban ecosystems and biodiversity, as people have been shown to organize together to protect urban green spaces when their and related perceived benefits are threatened (Schmelzkopf 2002, Saldivar-Tanaka & Krasny 2004, Ernstson & Sörlin 2009, Nikolaidou et al. 2016, Wilker et al. 2016). Finally, Andersson et al. (2015) highlights the connection between CES, civic engagement and urban ecosystem stewardship, and argues that recognition of CES values may enhance civic stewardship action, which in turn may facilitate the planning and implementation of GBI.

When taking preferences for certain CES into account, it is also important for policy makers and planners to be aware and take account of the different types of users of urban ecosystems and biodiversity (Buchel & Frantzeskaki 2015) and recognize that the provisioning of certain CES could entail the hindering of delivery of others (i.e. creating so-called 'trade-offs') (e.g. Turkelboom et al., 2017). Integrating preferences for different CES categories can enable the development of recommendations for broadening the implications of GBI and enhancing and maintaining its accessibility across and beyond demographic groups (Ernstson et al. 2008, Nikolaidou et al. 2016, Wilker et al. 2016).

Given that both qualitative and quantitative metrics can be used to assess CES and inform decision-making processes, Multi-Criteria Decision Analysis is often proposed as a useful decision-support method. Langemeyer et al. (2016) has identified a total of 64 studies published between 2004 and 2013 that have applied MCDA to assess ecosystem services. Of these, 50% were applications of MCDA to actual planning issues, while 50% were academic papers focusing on method development and theory or did not deal with ecosystem services. However, the reviewed applications leave room for increased integration of cultural ecosystem services and socio-cultural benefits, as defined in this report. Less than 5% of the studies addressed urban planning issues; furthermore, standardized approaches to MCDA in order to better integrate CES into urban planning are still lacking. This is in part due to some potential limitations which accompany the selection of MCDA for decision support, e.g.: 1) need clear problem definition of decision alternatives; 2) does not consider the institutional feasibility of the decision alternatives; 3) only a small group of stakeholders is usually involved, so representativeness is limited; 4) can be manipulated or close down policy discourses if not used in participatory and transparent way; 5) requires stakeholder involvement throughout the process (Langemeyer et al. 2016).

6. Assessing cultural ecosystem services

In order to adequately address cultural and other ecosystem services associated with GBI and biodiversity in urban areas in planning processes, user-based perceptions of and preferences for the resultant benefits must be assessed. A number of different methods have been identified in the literature to measure (cultural) ecosystem services in urban GBI, representing both qualitative and quantitative approaches. Some of these methods may be applied independently, while others are often most effective and informative when applied in coordination. While this list is not meant to be inclusive or provide an indication of frequency in the reviewed documents, it is meant to serve as an

indicative list of some of the most relevant methods for addressing this paper's research questions and outline those (first order) preference assessment approaches considered for application within ENABLE's WP3:

- **Cost-based method:** 'Exchange-based' techniques that use the cost (observable market-prices) of actual measures to maintain ecosystem service provision as a proxy for the value of avoiding, mitigating or restoring the loss of services ecosystems provide (i.e. Hedonic Pricing Method). (Oslo, NYC, Lodz)
- **Blue-green factor scoring:** Different green and blue 'elements' are scored based on their importance for a single or multiple ES and an area-weighted score is calculated for a proposed property development. (Halle, NYC, Oslo)
- **Q-method**: This method reveals and describes divergent views in a group as well as points of consensus on the assessed topics through the sorting of statements. (Halle, Stockholm)
- **Preference assessment survey**: Direct and quantitative consultative method for analysing perceptions and associated value of ES. Data is collected through surveys using a consultative approach with different variations, such as free-listing exercises, ES ranking, rating or ES selection. (Lodz, NYC, Barcelona)
- **Photo elicitation**: People's visual experiences and perceptions of landscapes in terms of ecosystem services and the multi-functionality of landscapes is analysed using this method. (NYC)
- **Participatory GIS**: consists in assessing the spatial distribution of ES according to the perceptions and knowledge of stakeholders. It can integrate the perceptions and presents the outputs in the form of a map of ecosystem services (i.e. Mental Mapping Method). (Halle)

In addition, **MCDA** (as a second order preference assessment method) evaluates the performance of alternative courses of action with respect to criteria that capture the key dimensions of the decision-making problem (e.g. ecological, economic and social sustainability), involving human preferences.

A detailed table on the features of these and further methods can be found in the Annex. It can be said that a number of studies exploring CES have applied a structured questionnaire survey method. However, this does not necessarily represent the optimal approach, as many different aspects factor into deciding which valuation method is best to determine user-based CES (e.g. the type of data and equipment needed for the valuation and the amount of time and economic resources (person hours, financing) available). Some methods may have further constraints, such as difficulties in quantifying uncertainty, unrepresentative scale, low comparability and exclusion of certain stakeholders (i.e. minorities). Factors such as the setting (rural vs. urban) can also influence the applicability of methods and require consideration. For example, integrating the valuation-based articulation of CES into decision-making processes is more challenging in urban than rural areas due to the high cultural and social heterogeneity; methods selected for use in urban areas thus need to include mechanisms to account for and be sensitive to this diversity in perceived services (Gomez-Baggethun & Barton 2013).

In assessing CES, it is important to identify whether the significance of a method is limited due to geographical and local specificities as well as the possible shared cultural background of interviewees (Voigt & Wurster 2015). Additional quantitative and qualitative information (e.g. more interviews, spatial data) could aid in providing more insight to determine the existing knowledge and

perception/appreciation of urban ecosystems and species' diversity. Furthermore, it must be identified how certain terms (i.e. species diversity, GBI) are defined by interviewees/subjects, and perhaps definitions have to be provided to ensure comparability.

7. Summary

Research questions addressed by the review:

- **What are success factors, drivers and barriers for integrating citizen preference and value assessment methods into formal decision-making processes at the municipal level?**

  Integrating citizen preference and perceptions of CES with regards to urban ecosystems and biodiversity into planning and policy-making is essential when making significant decisions about city design and the approach to integrating GBI. Success factors in integration of preferences have been linked to continued local stakeholder involvement throughout implementation of a GBI project (see Annex, Table 2), through workshops, site visits, open consultation events and thorough feedback rounds. Preference integration has proven successful for spaces frequently used by the public or the specific stakeholders, so that interest in co-creation for was high to improve benefits. It also proved significant to tailor preference integration processes to the stakeholder type, i.e. nature activities to involve youths, audit for local businesses. However, the assessment of preferences and their integration into decision-making processes remains infrequent. Challenges arise due to the high cultural and social heterogeneity of urban settings, the time and resource intensive nature of applying one or several appropriate methods, and the lack of awareness and experience of many planners regarding these methods.

- **Which valuation methods have been used more frequently to assess CES and in which contexts? What are their relative advantages as compared to one another? Does their applicability vary by geographic setting, e.g. in rural versus urban contexts?**

  In the majority of cases, the method of conducting a 'preference assessment survey' has been applied for integrating citizens' preferences in municipal policy and planning processes due to the fairly simple and cost-efficient makeup of the method. Further methods that could foster integration into planning processes include e.g. cost-based methods, GIS-based assessments of spatial distribution of CES, Q-method for sorting preferences. While MCDA is a common method for valuating ecosystem services, it has not often been applied for cultural ecosystem services.

- **Which methods explicitly aim to support decision or policy-making processes?**

  Many different aspects factor into which valuation method is most suited to incorporate user-based CES into decision or policy-making processes. Those methods explicitly aiming to support processes usually quantify CES in some way to make data comparable, e.g. by using a representative scale, include all types of stakeholders (such as minorities) and quantify uncertainties.

Guiding hypotheses of the review:

- **Within current political frameworks, citizen preferences for CES are seldom taken into consideration in the process of designing and developing GBI. The stakeholder consultation processes that do take place are often confined to informative forms.**

During the last decade, the importance of CES - particularly in urban areas - has received increasing attention within scientific research and policy processes. The benefits of incorporating citizens' preferences into GBI planning processes are not only present in theory, but have been illustrated in numerous cases throughout the EU and globally. However, existing scientific literature on the topic has failed to sufficiently inform political decision-making processes of the multitude of benefits that CES distribute to the urban population via GBI. The case studies presented in the review that incorporate citizen preferences into the design and development of GBI are exceptional examples, rather than the norm.

- **Planning processes at the municipal level lack robust and efficient methodologies for directly assessing citizen preferences for ecosystem services in the design of GBI projects.**

  A significant reason for the inconsistency between available scientific information and the limited number of CES-related policy instruments in place is the lack of knowledge, resources and/or experiences of current planning processes at the municipal level to gather and integrate citizen preferences in the design of GBI projects. Additionally, many municipal authorities do not wish to apply a method associated with what is considered to be high levels of uncertainty. The formalised and fixed nature of current decision-making processes is a further issue, as integrating CES would require flexibility and the ability to adapt to new challenges. Finally, many decisions made at the municipal scale are small and incremental in nature, making it challenging to justify the often time and resource intensive preference and value assessment methods for each individual decision.

- **There is no standardized or easily comparable assessment methodology for conducting Multi-Criteria-Decision-Analysis at the national level.**

  Given the quality of preference data, a viable option to accommodate the value pluralism of CES is the valuation method of Multi-Criteria Decision Analysis. However, this successful integration was only tested for the standard definition of ecosystem services and have not yet integrated or addressed the CES provided by ecosystems and biodiversity. A more in-depth analysis in reference to an easily comparable assessment methodology for conduction MCDA of CES at the national level is required and will perhaps be assessed within the ENABLE case studies at a later stage of the project.

- **Including preferences/values of citizens into political processes is crucial to design and implement sustainable and effective GBI interventions**

  To successfully implement GBI, perception-based assessment and valuation of citizens' preferences must be incorporated into urban decision-making processes. CES produced by ecosystems and biodiversity could function as useful to integrate public perception and preferences into planning processes. Integrating people's perceptions and preferences may also serve to empower civil society and thus foster the autonomous maintenance of urban ecosystems and biodiversity, as people have been shown to organize themselves to protect urban green spaces when their values and the benefits they receive are threatened. There is thus a significant connection between CES, civic engagement and urban ecosystem stewardship; this stewardship aspect may indeed help to facilitate the planning and implementation of GBI.

Annex

Table 2: Case study examples of integrating citizen preferences and perceptions into GBI planning processes in the EU

City/Case	Objective	Type of stakeholders involved	Organising institutions	Methods used	Outcome/Results	Challenges	Reference/links
Main River Valley, Germany: "Grüne Mitte Project"	The city of Maintail decided to develop a long-term strategy in order to protect and enhance its environmental, productive and recreational value	State authorities, local government, environmental NGOs; Public participation process: residents of immediate area, city residents and users, and youth.	City council	"Future workshops" to develop ideas; "Planning workshops" to produce an implementable plan, Discussion forum	17 'core projects' were developed; Decision of the City Council to endorse citizens' proposal	The city of Frankfurt was preparing a bid to host the Olympic Games in 2012 and, just as the Grüne Mitte planning workshops had finished, it announced plans to expand its proposal into the Grüne Mitte.	Drazkieiczw et. Al (2015): Public participation and local environmental planning: Testing factors influencing decision quality and implementation in four case studies from Germany City of Maintal, 2002
Furnas Landscape Laboratory, Sao MIguel, Portugal	The project aimed to restore and convert the Furnas Lake Hydrographic Basin into a nature and recreation space after years of pollution and degradation from unsustainable agriculture practices.	Local community, businesses, scientific/education institutions, NGOs, and government bodies	Furnas LandLab	Site visit and nature activities with schools and youth groups; direct communication between project managers and community; corporate sponsorship of plantings; sustainable business opportunities (i.e. rustic golf course); scientific research partnerships	Highly successful project that is utilized and supported by community, conservationists, and the business community. Because of the engagement the site is well utilize and well funded. Received a National Landscape Award in 2012	Environmental cleanup challenges, integration of businesses into plan and space usage.	Ferreira et al. (2015). Furnas Protected Landscape, Sao Miguel Island Natural Park. Furnas, Landscape Laboratory. *Governo dos Acores*. The European Commission (No date). Green Infrastructure in Portugal.
Leeds City Region Green Infrastructure Strategy, Leeds, UK	Extensive, multi level strategic regional plan to expand, integrate, and improve green infrastructure	Leeds City Region Partnership, green infrastructure specialists, local governmental bodies, local organizations and stakeholders	Leeds City Region Partnership	Emphasis on scaling of plans to a local level. The plan calls for consultation of local government bodies and other relevant local organizations in order to assess community needs and ensure efficient implementation of green infrastructure.	A series of specific projects were produced by the plan and are being implemented in the Leeds City Region.	Connecting green infrastructure with business opportunities, economic constraints	Leeds City Region Partnership (2010). Green Infrastructure Strategy.
Gärtnern in Frieburg, Freiburg im Breisgau, Germany	City-wide small garden development plan utilizing vacant space.	Freiburg Stadtplanungsamt, Stadtlandschaftarchitektur (firm from Stuttgart), community members	Freiburg Stadtplanungsamt	Extensive community consultation to develop a needs assessment and action plan for implementation of small gardens. The program includes surveys, a community stakeholder advisory group, and workshops for best practices.	*To be determined*. Surveys have been conducted, but more workshops and advisory group meetings planned through fall 2017	*To be determined*	Freiburg im Breisgau (2016). Gärtnern in Freiburg. http://www.freiburg.de/pb/,Lde/1038340.html

City/Case	Objective	Type of stakeholders involved	Organising institutions	Methods used	Outcome/Results	Challenges	Reference/links
Greening the BIDs, Victoria, London, UK	Partnership with Business Improvement District to assess environmental impacts in the area and then work to integrate green infrastructure into larger business development plans.	BIDs, Local authorities, businesses and developers, neighborhood organizations, wildlife trusts and NGOs, relevant community groups, regional/national organizations with specific expertise	Victoria BID	Overall audit of green infrastructure in the area to then create green infrastructure in the BID that is developed and supported by local stakeholders. Businesses and other relevant groups were consulted extensively to allow for green infrastructure to be used as an economic development tool.	As a result of the audit and planning with the business community, 33 trees planted, a large green wall at Rubens at the Palace Hotel was constructed, Green Infrastructure Audit Best Practice Guide was created, and studies were commissioned to quantify benefits of GI on businesses.	Making the clear connection between green infrastructure and goals of the BID	Clean and Green: We work to improve and enhance the physical landscape of Victoria. (No Date). http://www.victoriabid.co.uk/our-work/clean-green/ Cross River Partnership (2016). Green Capital: Green Infrastructure for a future city.
Malmö, Sweden	Urban agriculture project that is by the community for the community.	Local community organizations, public officials, Street and Parks Department, other citizens	Friends Group, The Street and Parks Department	Grassroots initiated project was institutionalized by the Street and Parks Department. The idea was initiated by the Friends Group and the Street and Parks Department gave the group access to an abandoned nursery site and as time went on they also granted financial resources, oversaw construction of amenities on site, and eventually provided labor and maintenance support. Malmö Street and Park Department also provides similar user participation in initiating other small scale projects.	The amenities and use of the site was directly influenced by the Friends Group. Because of the nature in which the project was founded, it now serves as a place where schools and immigrant groups engage in urban farming activities.	Applying this type of community engagement is difficult to scale. The city has done so with a number of successful projects, but because of the case-by-case nature of this type of participation, it is difficult to institutionalize. While the project is successful, it has still not completely fulfilled the goal of being a place that is accessible to all interested people.	Delshammar, Tim. (2015). Malmö, Sweden. Case Study Portrait: part of a GREEN SURGE study on urban green infrastructure planning and governance in 20 European cities.
Berlin, Germany	Greenspace and green infrastructure development across Berlin	Senatsverwaltung für Stadtentwicklung und Umwelt, activist groups, normal citizens	Senatsverwaltung für Stadtentwicklung und Umwelt	Public consultation is mandated by law as part of the general urban planning process. Often for green space and green infrastructure projects more public consultation is done than what is required. For Gleisdreieck Park surveys and work group discussions were used.	Citizens' ideas and needs were directly incorporated into plans and the park designs. One specific example is the expressed interest of a design that combined wilderness and the historical heritage of the site; this was successfully executed and can now be seen in the park design.	Not everybody's opinion could be accommodated. Some wanted to leave the park as more of a conservation space than normal park.	Hansen, Rieke. (2015). Berlin, Germany: Case StudyProtrait; part of a GREEN SURGE study on urban green infrastructure planning and governance in 20 European cities.

City/Case	Objective	Type of stakeholders involved	Organising institutions	Methods used	Outcome/Results	Challenges	Reference/links
Utrecht, Netherlands	Develop a city-wide green structure plan	Utrecht Department for Urban Development, local residents	Utrecht Department for Urban Development	Inhabitants of the city were asked to give feedback on one of ten neighborhood green plans.	Citizens' views were incorporated into the plans, allowing for local knowledge, prevention of bottlenecking of green infrastructure, and later participatory maintenance and engagement with built spaces.	Keeping citizens' input within a particular scope that doesn't contradict larger plan goals or other policy initiatives; ensuring trust of citizens and that their views are valued	Buizer, Marleen (2015). Utrecht, The Netherlands: Case Study Portrait; part of a GREEN SURGE study on urban green infrastructure planning and governance in 20 European cities.
Lisbon, Portugal	Provide citizen involvement in urban planning and budgeting process	Local citizens, government actors	Lisbon Participatory Budget	Participatory budgeting where any non-governmental actor can submit an idea for the municipality. It is then technically reviewed and then voted upon and implemented	In 2012, more than 200 projects were approved and implemented through the participatory budgeting process, 30% of these were GI/green space-related. The Lisbon Participatory Budget is 2.5 million Euro.	Getting enough people to participate was difficult early-on but now participation grows every year.	Santos, Artur, et al. (2015). Lisbon, Portugal: Case Study Portrait; part of a GREEN SURGE study on urban green infrastructure planning and governance in 20 European cities.

Table 3: Valuation methods of CSVS adapted from OpenNESS (Kelemen et al. 2015)

Method	Description	Advantages	Limitations	Data		Time			Resources		
				quali-tative	quanti-tative	short	medium	long	low	medium	high
Cost-based method	'Exchange-based' techniques that use the cost (observable market-prices) of actual measures to maintain ecosystem service provision as a proxy for the value of avoiding, mitigating or restoring the loss of services ecosystems provide.	• ease of use • speed of use • draws on existing data • covers wide range of ES • regulatory compatibility • recognised and established accounting approach	• Does not include welfare measures • Uncertain effectiveness of mitigation, restoration and offsetting actions impossible to quantify ex ante • Modelling may be required to assess effectiveness		X	X			X		
Participatory GIS	Participatory mapping of ES consists in assessing the spatial distribution of ES according to the perceptions and knowledge of stakeholders. It can integrate the perceptions and presents the outputs in the form of a map of ecosystem services	• Integrates stakeholder perceptions • Allows involving multiple stakeholder types • mapping ES in areas where spatial data is unavailable • GIS skills needed to develop this method are relatively simple	• Mostly applied at local scales and integration of results into decision-making has been elusive. • Comparability is low. • The spatial resolution of the results and accuracy might be lower for certain services than other approaches.		X	X	X		X	X	
Photo-elicitation method	This method aims to translate the people's visual experiences and perceptions of landscapes in terms of ES. It has been particularly used to explore how landscape multi-functionality is related with public perceptions toward landscapes and ES.	• Technique has been found as very suitable to assess cultural services and with potential to assess a range of values (e.g. spiritual, heritage, aesthetic). • Results can help to identify potential social conflicts (trade-offs) between social groups	• Photos only show a limited and framed view of the surrounding, captured at a specific moment in time • Problems of generalisation with scale. It is important to have in mind that the higher scale, the more generic the photo description of ES.		X		X			X	
Preference assessment survey	Direct and quantitative consultative method for analyzing perceptions and associated value of ES. Data is collected through surveys using a	• Can provide robust quantitative information (from representative sampling) • Avoids	• Key stakeholders (ex. minorities) could be ignored when some characteristics apply for a very limited percentage of the	X	X		X			X	

Method	Description	Advantages	Limitations	Data		Time			Resources		
				quali-tative	quanti-tative	short	medium	long	low	medium	high
	consultative approach with different variations, such as free-listing exercises, ES ranking, rating or ES selection.	incommensurability issues • Standardization of questions could promote comparability with other case studies	population • Individual surveys could miss very rich information from deliberative processes, such as social learning.								
Scenario Planning	Various tools and techniques are applied (often in combination) to develop plausible descriptions of alternative future options. Assumptions about future events or trends are questioned, and uncertainties are made explicit.	• Facilitates learning • Can be developed in a participatory way which makes active engagement of stakeholders possible • A range of policy or response options can be considered and assessed for robustness	• Robustness and internal consistency of scenarios can only be guaranteed if quality control mechanisms are built in the process • Highly demanding in terms of expertise, time, etc. • Time consuming for local stakeholders	X	X	X				X	
Ecosystem services card game	Combines photo-elicitation with a rating exercise. It encourages interviewees to discuss why an ES is important and by rating ES according to usefulness, importance or other locally relevant factors, a quantitative ranking of ES can be obtained.	• Relatively simple and quick • Can be tailor-made according to specific situations • Includes local knowledge • Stimulates stakeholders to think within a holistic ES framework	• It is important to keep in mind that the card game only values perceptions of stakeholders. • Good for evaluating cultural services, but not regulating services • A predefined list of ES has a framing effect on the results	X	X	X			X		
Q-Methodology	Uses factor analysis of rankings of qualitative statements to identify and understand the range of social perspectives that exist on the topic (rather than to provide a representative sample of the frequency of views held, as a quantitative survey would aim to do)	• Capable of addressing a wide range of ES • Allows respondents time to consider and reflect on values • Relatively quick to implement • Data can be readily conveyed to policy-makers	• Requires literate respondents • Requires trained facilitators • Requires an iterative process to data collection • Requires time and effort from respondents • Potentially affected by local nuances	X		X	X		X	X	
Stated preference valuation	Respondents are presented hypothetical scenarios leading to	• Covers wide range of ES, use and non-use values	• willingness-to-pay measures assume respondents don't hold		X		X			X	X

Method	Description	Advantages	Limitations	Data		Time			Resources		
				quali-tative	quanti-tative	short	medium	long	low	medium	high
	environmental change. The answers (monetary amounts, ratings, etc.) are scaled following an appropriate model of preference to yield a measure of value of the proposed ES change.	• Trade-offs can be evaluated using choice experiments • Uncertainty at population level can be addressed • Representative sampling of populations	rights to environmental quality; • respondents may hold commitment to their environment that they are not willing to trade against prices in monetary exchange								
Travel cost methods	This method is based on the observation that recreational services can only be realised through physical access to nature. This implies that individuals seeking to enjoy the service will need to spend resources (time and money) to travel to the site.	• method can be used to provide a public policy rationales for providing green spaces for recreational activities. • can be used to study designs of recreational site quality • draws on revealed data; hypothetical biases are avoided	• It requires large data sets on recreational activities • It requires extensive GIS pre-processing of data • The methods is specific to estimation of ES and cannot be generalised to estimate a range of other services.		X		X			X	
Value transfer	Applying quantitative estimates of ES values from existing studies to another context - from a 'study site' with available value estimates, to a 'policy site' where time or resource constraints preclude the possibility of doing a primary valuation study.	• Ease of use, available valuation databases • Draws on existing data • Low cost • Speed of use	• decision-makers will often not know their own requirements for statistical reliability of valuation estimates • insufficient benchmarking of cost uncertainty • lacking credibility when on-site information is not used		X	X			X		
Multi-criteria Decision Analysis (MCDA)	MCDA methods evaluate the performance of alternative courses of action with respect to criteria that capture the key dimensions of the decision-making problem (e.g. ecological, economic and social sustainability), involving human preferences.	• Covers wide range of ecosystem services • Trade-offs can be evaluated • Can facilitate multi-stakeholder processes, transparency, etc. • Uncertainty can be addressed by sensitivity analysis	• Representativeness • Some criteria such as cultural heritage vital for sustenance might not be amenable for trade-offs • Manipulation and closing down of policy discourses if not used in participatory and transparent way	X	X	X				X	

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