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Authors: Anton Shkaruba, Massimo Sargolini, Siiri Külm, Ana Sopina, Flavio Stimilli, Valentina Polci

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BETTER Life PARTNERS:

CESKA ZEMEDELSKA UNIVERZITA V PRAZE (CZU)
PIC 999912570, established in KAMYCKA 129 SUCHDOL, PRAHA 165 00, Czechia

MARTIN-LUTHER-UNIVERSITÄT HALLE-WITTENBERG (MLU)
PIC 999871539, established in UNIVERSITÄTSPLATZ 10, HALLE 06108, Germany

UNIVERSITÀ DEGLI STUDI DI CAMERINO (UNICAM)
PIC 999845737, established in PIAZZA CAVOUR 19F, CAMERINO 62032, Italy

ACEEU GMBH (ACEEU)
PIC 896865008, established in WILHELM-SCHICKARD-STR 14, 48149, MÜNSTER, Germany

EESTI MAAULIKOOL (EMU)
PIC 999857280, established in KREUTZWALDI 1, TARTU 51014, Estonia

DAUGAVPILS UNIVERSITATE (DU)
PIC 999830702, established in VIENIBAS STREET 13, DAUGAVPILS 5401, Latvia

UNIWERSYTET PRZYRODNICZY W POZNANIU (PULS)
PIC 999880463, established in ULICA WOJSKA POLSKIEGO 28, POZNAN 60 637, Poland

HELIXCONNECT EUROPE SRL (HELIXCONNECT)
PIC 893409868, established in 282A CAMERA 1, BUCOVAT 307352, Romania

UNIVERZITET EDUCONS U SREMSKOJ KAMENICI PRIVATNE USTANOVE (EDUCONS)
PIC 973147263, established in VOJVODE PUTNIKA 87, SREMSKA KAMENICA 21208, Serbia

List of Abbreviations

Abbreviation	Definition
DCoE	Digital Center of Excellence
ECR	Early Career Researcher
EDS	Ecosystem disservices
EU	European Union
HEI	Higher Education Institution
(H)EIL	(Human) Ecosystem Integration Lab
LS	Life Sciences
NGO	Non-governmental organization
ORCID	Open Researcher and Contributor ID
SER	Socially Engaged Research
SME	Small and medium-sized enterprises
STEM	Science Technology Engineering Mathematics

3. GENERAL APPLICATION GUIDELINES

Here we propose how the three-step methodology can be applied to understand ecosystem disservices and to offer decision making logic for the planning process aiming at the preservation of urban biodiversity in an inclusive manner. This methodology can be adapted to other forms of engaging stakeholders and ECRs to the planning process as well, as long as its core component is kept, which is joint fact finding with the citizens about the environment they live in.

STEP no.1 – PERCEPTION OF URBAN NATURE BY CITIZENS

The objectives of methodology step no. 1 – Perception of the urban nature and the quality of life by citizens include:

1) Design a **protocol for a qualitative or quantitative analysis of citizen's perceptions of the quality of environment** ("to stimulate interviewees to articulate their views on complex topics, using their own words", "to categorise the views into a logically consistent classification system"),
2) Conduct **interviews with different stakeholders** in case study regions,
3) **Analyse the interview outcomes** using suitable qualitative or quantitative methods,
4) **Interpret the results** with the stakeholder dialogue.

First footsteps towards citizens' perception of urban nature

In order to understand the perception of urban environment by citizens we suggest to focus on urban nature, and to use the analytical framework of "ecosystem disservices" (please see Chapter 2 for the theoretical foundations and suggestions for the application). The value of such an approach is that citizens normally can easily relate to what they perceive as negative manifestations of the urban nature, this easier triggers their involvement and interest in discussing problematic issues. Importantly, if urban nature is recognized as a potential disservice, and not only as the service, this occurs to many as an inclusive and citizen-centric view.

The first suggested step is an inventory of ecosystem disservices occurring in the study location. For the first version of guidelines we have run classification exercises in Estonia, which were partly based on earlier findings from Belarus (Skryhan & Shkaruba, 2022). The classification was based on extensive field studies and stakeholder interactions of different formats, and the framework produced as a result (Table 1) should be suitable for any urban

locations in the EU, while specific types of ecosystem disservices should be identified for each individual location or groups of locations with comparable biophysical and socio-cultural conditions. The first recommended step therefore is to come up with detailed lists of ecosystem disservices examples for each group. Depending on the scope and the scale of the planning process and the participatory exercise, this can be done either based on a field survey of the location combined with the interviews with local residents, on expert interviews, or a workshop with local citizens. These methods can be combined as necessary.

Once ecosystem disservices are identified and categorized, we suggest to elaborate with citizens on the range of acceptable options for managing the disservices. Such discussions can be carried out in a form of interviews, small group talks as well as larger structured workshops. They should be used as an opportunity to introduce new knowledge, such as on successful practices, as well as on nature based solutions (potentially) generated by the ecosystems associated with the disservices in question. This step is important in terms of estimating the range of what is feasible in relation to disservices, and the limits to possible trade-offs.

In the situations when quantitative measures of citizen's perceptions are preferred, we suggest to consider the approach based on the repertory grid technique, as e.g. was explored for the evaluation of quality of landscapes across Europe (Hisschemoller et al, 2022). In that study the following was entailed by the step 1:

- The repertory grid technique was used to identify the dimensions through which people evaluate urban landscapes.
- The perception of urban landscape quality is examined by using photographs that represent case study regions.
- Interviewees evaluated xy photographs by bipolar constructs to articulate the dimensions of urban nature.
- Selection of interviewees: stakeholders interested in the urban nature and representatives of projects / initiatives of the case study, balance between gender and sectors.

STEP no. 2 – IMPLEMENTING CITIZENS' PERCEPTION INTO SPATIAL PLANNING DESIGN

The objectives of methodology step no. 2 – implementing citizens' perception into spatial planning design include:

1) Develop an analytical framework and research protocol that **relates and confronts the views of the stakeholders and the views of urban planners**,
2) Carry out case studies of urban nature perception in urban regions of Estonia,
3) **Comparative analyse the case study** findings to provide inputs for the stakeholder dialogue (to feed to the step no. 3).

Second footsteps towards implementing citizens' perception into spatial planning design

Building on the findings received on the step 1, the step 2 is exploring the options for reaching the planning solutions that would offer a healthy compromise between what the citizens need, what is feasible in terms of planning and/or management solutions, and what is needed to protect or restore urban nature. Having identified ecosystem disservices specific to the location, and having understood the range of available management options, we can proceed with the search of such a compromise.

Figure 1 shows the generic scheme of decision making process concerned with ecosystem disservices. Depending on the characteristics of disservices it suggests the management approaches that may vary from technical measures to awareness raising campaigns. The range of possible solutions should be available as an outcome of the previous step, whereas the preferences of citizens need to be compared against available planning and management options.

The scheme has been developed and tested for North- and East Europe contexts, however we expect it to be applicable to most Europe. In order to make sure that the studied region is the case, it can be suggested to take well known examples of successful urban nature projects, and to check, how its implementation history fits the logics suggested by the tree (see the examples below).

Example 1: Curated Biodiversity (Tartu, Estonia)

Background

In 2024, Tartu is set to become Europe's Capital of Culture, with the city's public space constituting a significant component of the overarching program. The project titled 'Curated Biodiversity' within the program is instrumental in enhancing the city's appeal, rendering it a more enjoyable environment by introducing a diverse array of activities and fostering the presence of nature in its parks.

The initial biodiversity-enhancing phase of the 'Curated Biodiversity' project, initiated in the summer of 2020, involved a reduction in mowing within three city center parks. Taller grass resulting from this measure promotes the growth of a greater variety of plant species, creating a more diverse environment that serves as a favorable habitat for insects, small animals, and birds. The encouragement and promotion of biodiversity are important to ensure the availability of clean water, soil, and air, as well as to extend the benefits of nature to urban areas and the entire community.

Throughout the project, numerous new pocket parks and plant beds, featuring local flora, emerged in the city center. Collaborating with art students, captivating architectural works began to grace the urban landscape of Tartu. The revitalized natural environment, characterized by increased lushness, contributes to the overall species richness and diversity of the parks. These central city parks serve as a landscape laboratory, generating conclusions that serve as both examples and guides for other cities. Simultaneously, a guide for citizens on fostering biodiversity in their homes and gardens is in preparation.

Decision-making tree exercise

Enhancing biodiversity in urban areas is crucial for mitigating the impacts of climate change and minimizing the loss of species and their habitats. Beyond its environmental significance, biodiversity also contributes to improved mental and physical well-being for city dwellers. The

project 'Curated Biodiversity' serves as a noteworthy example of how cities can elevate the value of their ecosystems and support ecosystem services.

To elucidate the decision-making process for identifying and managing ecosystem disservices (EDS) in connection with the project, the initial step involves pinpointing potential EDS. In this context, two prominent issues emerged based on feedback and concerns voiced by local citizens after the project's commencement. The first concern centered on the "unmanaged look" of central city parks following a reduction in mowing, prompting citizens to express their apprehensions about the altered aesthetics. The second EDS pertained to fears of an increase in ticks and other insects attracted to the new habitat created by the taller grass. In assessing whether these EDS posed direct harm to health, life, or property, the conclusion was negative, as the identified EDS were more aligned with Nature-related fears (1.5) and Aesthetic issues (1.6) (Figure 1). These concerns were largely attributed to a lack of awareness regarding the benefits of biodiversity and its particular importance in urban green spaces.

Recognizing the significance of public concerns, project leaders and city government officials responded proactively. Information boards were strategically placed in city parks to educate residents about the project's objectives, dispel misconceptions, and highlight the benefits of the unconventional park management approach. Public awareness became integral to the project, manifesting in diverse initiatives such as social media posts, newspaper articles, invitations for residents to participate in planting local species in parks, and the organization of outdoor information days. Consequently, specific measures outlined in points 2.6.1, 2.6.2, 2.6.3, and 2.6.4 of the decision-making tree were implemented to address public concerns and thereby transform EDS into positive outcomes.

Example 2: Urbancows (Pärnu, Estonia)

Background

In 2012, the project "Restoration and Public Access of Urban Coastal Meadow Complex in Parnu Town" (LIFE10 NAT/EE/000107) was initiated. The beach meadows in the city of Pärnu had been neglected for decades, resulting in degradation. Consequently, restoration efforts commenced in 2010, focusing on a twenty-hectare area. Initially, the field underwent mowing, followed by grazing. However, this approach proved insufficient to achieve the necessary restoration outcomes.

The project's objective was the rehabilitation of beach meadows, coastal habitats, and the habitats of various protected species within the Pärnu beach meadow nature reserve. This involved addressing rust accumulation, sediment removal, restoration of the natural water regime, and enhancement of living conditions for protected species. Through intensive grazing and the removal of aged reeds and bushes, approximately 220 hectares of beach meadows and 74 hectares of meadows were successfully restored.

To enhance visitor engagement, the project included the construction of two bird-watching towers featuring unique architecture and a 660-meter wooden boardwalk educational trail, facilitating a closer encounter with nature. Additionally, several studies and monitoring initiatives were conducted to assess the project's outcomes. Although the project officially concluded in 2016, the maintenance of beach meadows persisted, employing the same strategies implemented at the project's inception. Cattle continued to graze on the Pärnu beach during the summer months. This practice was essential for preserving the species richness, uniqueness, and aesthetic appeal of the rare coastal meadows of Pärnu. Without ongoing grazing, the restored areas would revert, undermining the progress made thus far.

As the city of Pärnu lacks its own cattle, it leases the coastal meadows to animal owners who bring their mountain cattle to graze from spring to summer. This leasing arrangement ensures the sustainability of the restoration efforts and the continued ecological health of the coastal meadows in Pärnu.

Decision-making tree exercise

To elucidate the decision-making process, two identified ecosystem disservices (EDS) are associated with human health, and two with aesthetic concerns. While the inclusion of cows in the restoration of urban coastal meadows is a positive aspect, their presence may lead to a short-term pollution of beach water due to animal feces, posing a direct harm to human health (1.2, Figure 1). Pärnu beach, in close proximity to the coastal meadows, is a popular destination for locals and tourists during the summer. The second EDS involves the risk of potential animal biting, despite the presence of fences around the coastal meadows. People's inclination to feed the cows heightens the risk, emphasizing the need to address this potential harm. Two additional EDS related to aesthetic issues (1.6) include the possibility of loud noises and unpleasant smells caused by the grazing cows.

In accordance with the decision-making tree, two distinct approaches are available for addressing the identified EDS. Both EDS related to point 1.2, "Risks related to human health,"

can be directly addressed. In the case of potential beach water pollution, the city government, in collaboration with scientists and stakeholders, must identify the cause and extent of harm, determining measures to prevent short-term pollution. Although grazing improves ecosystem services (ES) conditions, the broad spectrum of stakeholders affected by this EDS includes all users of the coastal area, beach, and water. Removal of the EDS is not feasible within the decision-making tree logic. Therefore, ongoing control of water quality (point 2.8.3) is imperative and regulated by Estonian legislation. Additional measures to prevent short or long-term pollution must be implemented.

Concerning the potential risk of animal biting, the EDS can be mitigated through the removal of the risk (point 2.7.5). Erecting signs on the fences to warn passersby of the potential danger is an effective means to achieve this.

For the other two EDS related to possible unpleasant smells and noise caused by grazing cows, as there is no direct harm to health, life, or property, the decision-making tree categorizes them under point 1.6, "Aesthetic issues." In the subsequent step of the decision-making tree, the answer might be "yes" when deciding whether these EDS can be ignored. Presently, residents in nearby apartments and other buildings have not lodged substantial complaints, rendering point 2.3, "Measures are not needed," appropriate. However, if these EDS become more significant, further actions based on the decision-making tree logic will need to be implemented.

Importantly, the duration of the planning process as guided by Figure 1 may significantly vary, depending on the character and the scale of the project. It may take years if the acceptance of certain nature-based solutions require a significant mindset shift of the whole community of citizens and decision-makers. Skryhan and Shkaruba (2022) describe such a situation for recognizing an urban forest as a nature protected area, the initially preferred alternative being an entertainment park. In the situations when the thought solutions have to do with management, and a limited subset of stakeholders is affected, the actual deliberation may take days.

In case if the step 1 was implemented based on the statistical measurement of urban landscape quality perception (e.g. after Hisschemoller et al, 2022), the decision-making tree would need to be revised in terms of the specific landscape quality objectives measured in the study. The quantitative assessment would also potentially provide an option for

quantifying decision-making logics. The analysis of landscape quality perception may entail:

- Analysis of the different levels, scopes, and topics of case study regions (characteristics, landscape governance, rural-urban dimension, urban changes and transitions, urban challenges),
- Analysis of case studies covers the process of political agenda, actors-network, the role of knowledge, analysing transformations by indicators,
- Most relevant constructs identified within the first footstep are identified as indicators of urban landscape quality for which calculation methods are proposed
- Filling in and, if necessary, revising the landscape quality indicators.

STEP no. 3 – INTEGRATING CITIZENS' PERCEPTION, SPATIAL PLANNING DESIGN, AND GOVERNANCE POLICIES

The objectives of methodology step no. 3 – Integrating citizens's perception, spatial planning design, and governance policies include:

1) **Share findings of footsteps no. 1 and no. 2 with the stakeholders** involved in the case studies,
2) **Explore innovative governance options** according to the directions suggested by **the decision-making tree** (not each case study has to apply the same mode of stakeholder dialogue and the tree needs to be considered critically too),
3) **Disseminate tool results** to a wider audience, encouraging discussion and feedback.

Footsteps forwards integrating citizens' perception, spatial planning design, and governance policies

At the practical level, Step 3 involves the implementation of Joint Fact-Finding (JFF) sessions. These sessions serve the purpose of synthesizing the findings from previous steps and fostering multi-stakeholder consensus regarding their outcomes. The goal is to establish a unified understanding and determine the collaborative strategies for moving forward. JFF is closely related to adaptive planning where experts and non-experts have both an important role by building an agreement based on use of scientific information for the decision-making process. JFF sessions involve 4 steps:

- (1) Validation of the finding;
- (2) Commitment step to define the panel of participants and agenda,
- (3) Fragmenting the defined problem in sub-tasks,

- (4) Addressing different packages of sub-groups to form recommendations.

Typically, it is advisable to execute Steps (3) and (4) in distinct sessions, given the extensive nature of the tasks involved.

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