

GREEN SURGE

LINKAGES BETWEEN ECOSYSTEM SERVICES, URBAN GREEN INFRASTRUCTURE AND WELL-BEING

MILESTONE NR MS 27

Report MS 27:

**Work package 3:
Partners involved:
Researchers:**

Functional linkages

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LIST OF ABBREVIATIONS

Abbreviations	
ESS	Ecosystem services
FLA	Focal learning alliance
MEA	Millennium ecosystem assessment
MS	Milestone
UGI	Urban green infrastructure
ULL	Urban learning lab
WB	Well-being
WP	Work package

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1 INTRODUCTION

1.1 The Content of Milestone 27

Milestone 27 (MS), as part of WP 3, introduces an analysis of the linkages between supply and the demand of/on selected ecosystem services (ESS) and human well-being (WB), provided by urban green spaces in Ljubljana. The main approach of this study is to explore how different stakeholders perceive and evaluate ESS in Ljubljana and which of the ESS are more important from the viewpoint of the organisation they represent in the Urban Learning Lab (ULL) Ljubljana.

The research presented here focuses predominately on ULL stakeholders and their perception of functional linkages between ESS, well-being, and urban green infrastructure (UGI).

European urban planners, managers, decision makers, and other city players are becoming increasingly aware of UGI and its role in ensuring ESS for increasing human well-being (Hansen et al. 2015). Stakeholders with different knowledge and values perceive the role of UGI in well-being differently. In multi-stakeholder groups, such as in the ULLs, where stakeholders from different sectors are involved, some functional linkages between ESS, UGI and well-being may often not be recognised equally. To bridge the gap between stakeholders' perceptions and knowledge in this context and to further increase stakeholder knowledge and awareness of the benefits UGI and related ESS provides to city residents, approaches are required, which help understand and discuss the importance of UGI for well-being and its potential role in urban planning. One of those approaches is the ESS approach

1.2 Theoretical background

1.2.1 Linkages between ecosystem services, urban green infrastructure and well-being

Green areas in cities comprise various ecosystems, where we can observe the interdependence and interconnection of city's urban and natural environments (Špes, 2009). These links lead to ecosystem services that are crucial for life in cities and for its inhabitants. City planners should acknowledge the importance of urban green areas for the well-being of city residents in their planning strategies. (Špes, 2009). In recent years ecosystem services and urban green areas in cities have become a frequent topic. A lot has been written about the degradation of ecosystem services in various categories of green infrastructure in cities and about their impact on human well-being (Haase et al., 2014; Kabisch et al., 2015).

Cilliers et al. (2013) state that the concept of ecosystem services occurs primarily in connection with the interpretation of the impact of connectivity of ecosystems and ecosystem services to human well-being. They also describe how this relationship affects the preservation of a stable urban development. Ecosystem services gained wide recognition with the launching of the "Millennium Ecosystem Assessment" (MEA) (2005). This report presents a structured framework for understanding the development and analysis of the effects of changes in the environment on humans.

Humans are a part of ecosystems that provide a range of benefits. These benefits are called ecosystem services and can be divided into supporting, provisioning, regulating, and cultural groups according to the MEA classification. These groups of services affect human well-being with different intensi-

ties and form components of human well-being (MEA, 2005). Components of human well-being adapted from MEA are:

- **security** (including secure access to natural and other resources, safety of person and possessions, and living in a predictable and controllable environment with security from natural and human-made disasters) as a safe environment and resilience to ecological stresses such as droughts, heat island effect, floods, and pests;
- **basic materials for a good life** represent access to resources for a viable livelihood (including food and building materials) or the income to purchase them
- **health** consists of adequate food and nutrition, avoidance of disease, clean and safe drinking water, healthy physical environment, and energy for comfortable temperature control;
- **good social relations** (including social cohesion, mutual respect, good gender and family relations, and the ability to help others and provide for children) represent realization of aesthetic and recreational values, ability to express cultural and spiritual values, opportunity to observe and learn from nature, development of social capital, avoidance of tension and conflict over a declining resource base;
- **freedom and choice** means the ability to influence decisions regarding ecosystem services and well-being.

These five dimensions reinforce each other, both positively and negatively.

The concept of the MEA (2005) is related to the assessment of changes in the environment on the basis of the quality of the components of human well-being. UGI are an important part of the citizens' living environment and therefore have a major impact on well-being. Different groups of ESS impact the individual components of human well-being differently. UGI are composed by different urban ecosystems. These ecosystems provide various ESS.-Specific ESS group has its own intensity impact on a specific human well-being component. For example, regulating ESS group has strong impact on health and security component of well-being but weak impact on social relations (Figure 1).

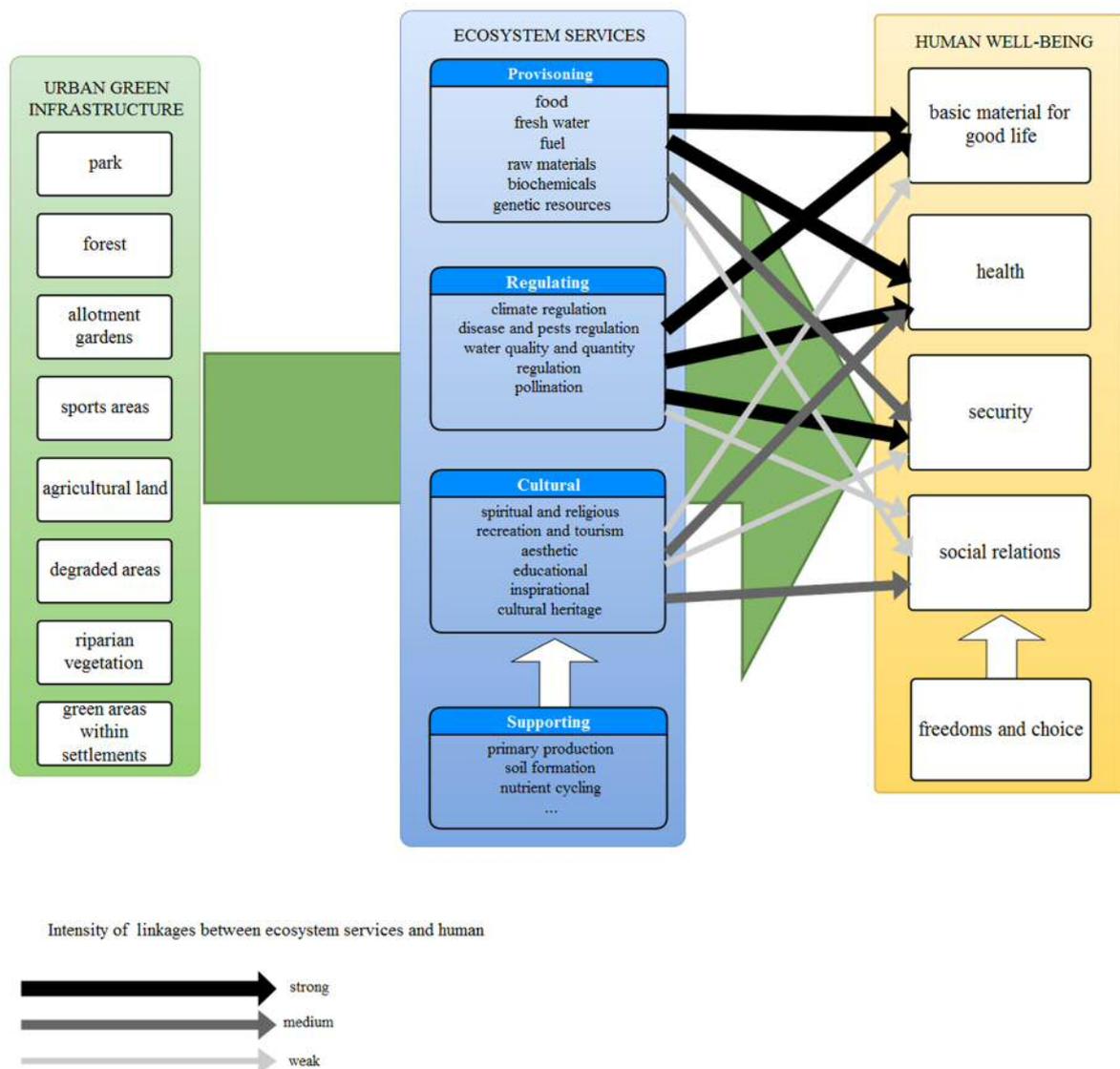


Figure 1: Linkages between ecosystem services, urban green infrastructure and human well-being (adapted from MEA, 2005).

1.2.2 Participatory assessment of ecosystem services

Sustainable solutions in cities are needed to ensure that people and nature can coexist and that ecological benefits are equally accessible to all city residents (Larondelle et al., 2016). Local knowledge and the involvement of stakeholders in the planning process, as well as a constructive science-policy dialog, are options to improve the planning process and can complement a sustainable solutions implementation process (Larondelle et al., 2016). Such a planning process can be facilitated by the use of decision support approaches and tools (Langemeyer et al. 2016). In addition for expert mapping and evaluation of ESS, there is a need for stakeholders' inclusion in UGI planning. Knowledge of stakeholder perceptions of ESS in different UGI types could serve as the basis for the attempt to improve the consideration of ESS based on UGI in urban planning processes and strategy development'. Workshops, focus groups, round tables, role games and other participatory activities represent mediating or boundary methods to show spatially explicit connections of human well-being and urban

ecosystem services to facilitate their incorporation in the planning process (Cotter et al., 2014). To gainfully integrate local knowledge from very different stakeholder groups, a transparent method is needed in which inputs can be directly observed and scientific discoveries do not lose strength and are explained via the simplifying or unpacking of complex concepts without compromising or discounting the meaning of these concepts (McIntosh et al., 2009; Sutherland et al., 2013; Mascarenhas et al., 2016). Colour coding and ranking can be useful when handling complex changes and different perspectives (Soste et al., 2014; Cowling et al., 2008).

1.2.3 Aim and goals of MS:

The aim of this methodology for estimating perceived links and values between components of human MS was to design wellbeing, ESS and their provision through the UGI in the ULL of the GREEN SURGE project. The developed approach was tested on ULL Ljubljana.

In particular, the objectives in this MS are to:

- Evaluate the perception of linkages between ESS and UGI and define their effect on WB using a theoretical model of linkages between ESS and WB (define how are ESS and UGI linked and how they affect WB);
- Identify how stakeholders of ULL Ljubljana perceive ESS and connect them with different types of UGI (test the model in the case of ULL Ljubljana);
- Compare current vs. desired levels of ESS supplied by UGI in the city.

Through this approach, we aim to:

- Raising awareness in ULL about ESS;
- Create a basis for incorporating ESS concepts in local urban planning (documents) and further UGI planning practices in cities.

2 METHODS

In the case of the ULL Ljubljana, we organised a ULL stakeholder workshop on the ESS perception in different UGI types. The gathered data were analysed and connected with the concept of human well-being from the MEA (2005). In this section, the ULL Ljubljana is presented and described, the workshop method is introduced and the process of result and value generation is explained.

2.1 ULL Ljubljana

The perception of ESS in connection with UGI was researched in the Ljubljana Urban Learning Lab (ULL). The ULL is a multi-stakeholder interest group involving researchers, decision makers, businesses, non-governmental organisations, and a youth community interest group.

The following stakeholders represent the ULL Ljubljana:

an educational and research organisation (the Biotechnical faculty at the University of Ljubljana),; the organisation responsible for planning, governing and developing the city of Ljubljana (Municipality of Ljubljana -MOL), , which is engaged in the ULL with three departments (for culture, for environmental protection, and for urban planning); an expert organisation specialising in youth work through project-based-learning (NGO Zavod Bob); the small-to-medium enterprises (SME) as experts in construction and green infrastructure maintenance (Lavaco and TISA); an expert in urban gardening as an SME/NGO (Institute for sustainable development- ITR); and thirteen young people: three individuals with mild learning disabilities involved in the programmes of Zavod Bob, six students (geologists, landscape architects, agronomists), and four young experts (psychologist, sociologist, architect, librarian). The ULL has an operational and a strategic level. On the operational level, the ULL spin-off project LIVADA is focused on young people as a vulnerable group in society as such, but is also sensitive to the needs of young people with learning disabilities in formal education systems. The goal of the spin-off project is to establish a new park by the year 2017, located in Ljubljana on a selected site owned by the Municipality. The ULL uses a project-based learning approach to test integrating young people in the process of participatory planning and governance of urban green areas to improve ESS of urban green areas. On the strategic level, the aim of the ULL Ljubljana is to apply the experience from the operational level to the city policy level, and to propose a possible alternative model of participatory planning and governance of public urban green areas to, finally, increase ESS provision by urban green spaces in Ljubljana. By this, the ULL will demonstrate and propose that an improved approach to green city development translates into greater involvement of the community in the planning and governance of urban green areas, which further contributes to higher quality of urban green spaces. The ULL stakeholder map is presented in Figure 2.

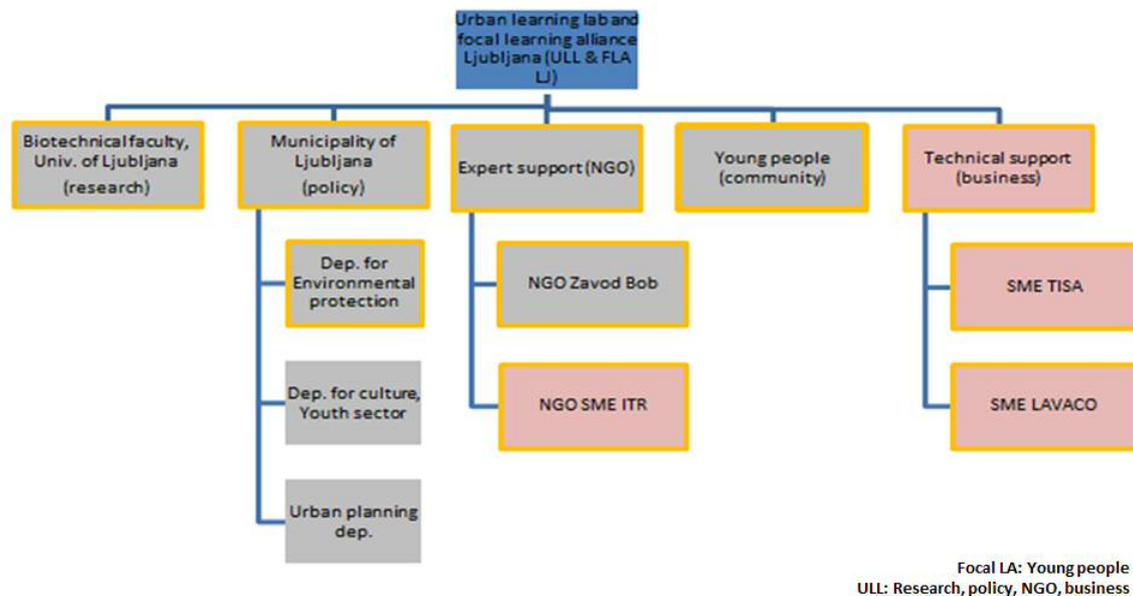


Figure 2: Ljubljana Urban learning and Focal Learning Alliance stakeholder map in April, 2016.

2.2 ULL Ljubljana workshop

The workshop took place in Ljubljana on April 12th 2016 at the Livada site. The workshop was structured into two main parts. First, a short presentation of the concept of ESS was followed by a presentation of chosen UGI types for Ljubljana. The list of types is adapted to the themes and scope discussed in ULL Ljubljana: a) park; b) forest; c) allotment gardens; d) sports areas; e) agricultural land; f) degraded areas; g) riparian vegetation and h) green areas within settlements. UGI types were selected based on quantitative representation of green areas in Ljubljana. Therefore, forest, park, agricultural land, sports areas cover the largest areas of land among all UGI types in the city. Moreover, the analysis of existing planning documents of the municipality was made (Spatial Master Plan, 2010; Environment Protection Programme 2014-2020, 2014) and their highlighted policies for the development of green infrastructure (allotments, degraded areas, riparian vegetation). In the official spatial records some green categories are classified as built-up area only, although they contain certain shares of urban green and thus, may to ESS provision (Nared and Simoneti, 2011).

In order to find out more about how important some key ESS were perceived by workshop stakeholders, the workshop attendees were asked to vote on the most important ESS (primary) and less important (secondary ESS), from the viewpoint of the organisation they were representing (task 1 of the workshop). Each person was given a marker pen of a different colour to mark the ESS in the suggested

services' list according to the importance ascribed to individual services by their organisation (

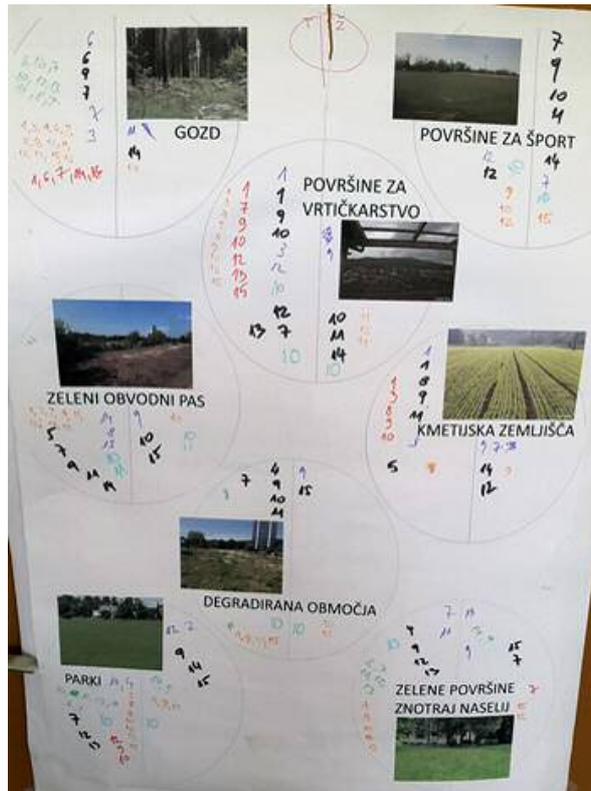


Figure 4: Filled poster of Task 2 at ULL Ljubljana workshop.

Table 1).

As their second task (Figure 4), participants were asked to link ESS to different types of UGI in Ljubljana from the viewpoint of their respective organizations. Each attendee was given a list of ESS (Table 1) from where they selected ESS and assigned them to the UGI poster (Figure 3). List of ESS was adapted from MEA but not formed for the needs of the learning alliance stakeholders. In addition to the ESS, which they had already linked to an UGI (provision state of the ESS for an UGI), they were also asked to select ESS that they would want to have in an UGI type (demand state).



Figure 3: Stakeholders from the ULL Ljubljana in action at the workshop



Figure 4: Filled poster of Task 2 at ULL Ljubljana workshop.

Table 1: List of ESS used for the workshop (adapted from MEA, 2005).

PROVI-SIONING SERVICES	Food
	Fresh water
	Fuel

	Raw materials
	Biochemicals
	Genetic resources
REGULATING SERVICES	Climate regulation
	Water regulation
	Pollination
	Disease regulation
CULTURAL SERVICES	Recreation and tourism
	Aesthetic value
	Spiritual and religious values
	Educational value
	Inspirational value
	Cultural heritage

2.3 Linkages between UGI - ESS - human well-being

Different UGI types provide numerous ESS which are clustered in three distinguished ESS groups (provisioning, regulating, cultural). According to MEA (2005) different ESS groups are not equally important for individual human WB components (for example provisioning ESS are more important for health than for social relations).

After the workshop, votes of ESS in each UGI type were counted and sorted into ESS groups. By this task we later identified how much each type of UGI impacts WB, based on the answers of the ULL Ljubljana stakeholders.

2.4 Well-being metrics

The following equations (Equation 1-4) were used to calculate the perceived ESS provision per UGI and their contribution to individual WB component. The intensity of linkages between ESS and WB are based on MEA (2005). The linkages were quantified using weight factors presented in Table 2.

Demand is defined as sum of perceived provision of ESS provided by green areas and additional ESS, desired by the respondents at those green areas. The approach to calculating potential additional contribution of ESS to WB is shown in Equation 5 (example for security component of WB).

Equation 1

$$\text{WB security provision} = \left(\frac{X_P \times f_m + X_R \times f_s + X_C \times f_w}{N \times (n_P \times f_m + n_R \times f_s + n_C \times f_w)} \right) / 100$$

Equation 2

$$\text{WB basic material provision} = \left(\frac{X_P \times f_s + X_R \times f_s + X_C \times f_w}{N \times (n_P \times f_s + n_R \times f_s + n_C \times f_w)} \right) / 100$$

Equation 3

$$\text{WB health provision} = \left(\frac{X_P \times f_s + X_R \times f_s + X_C \times f_m}{N \times (n_P \times f_s + n_R \times f_s + n_C \times f_m)} \right) / 100$$

Equation 4

$$\text{WB social relations provision} = \left(\frac{X_P \times f_w + X_R \times f_w + X_C \times f_m}{N \times (n_P \times f_w + n_R \times f_w + n_C \times f_m)} \right) / 100$$

Equation 5

WB security demand

$$= \text{WB security provision} + \left(\frac{Y_P \times f_m + Y_R \times f_s + Y_C \times f_w}{N \times (n_P \times f_m + n_R \times f_s + n_C \times f_w)} \right) / 100$$

Where ...

X_P = number of perceived provided provisioning ESS

X_R = number of perceived provided regulating ESS

X_C = number of perceived provided cultural ESS

f_w = weak linkage between group of ESS and component of WB

f_m = medium linkage between group of ESS and component of WB

f_s = strong linkage between group of ESS and component of WB

N = number of respondents

n_P = number of provisioning ESS

n_R = number of regulating ESS

n_C = number of cultural ESS

Y_P = number of demanded provisioning ESS

Y_R = number of demanded regulating ESS

Y_C = number of demanded cultural ESS

Table 2: Linkages between ESS and WB represented with weight factors.

	WB basic material	WB health	WB security	WB social relations
$n_P = 6$	$f_s = 3$	$f_s = 3$	$f_m = 2$	$f_w = 1$
$n_R = 4$	$f_s = 3$	$f_s = 3$	$f_s = 3$	$f_w = 1$
$n_C = 6$	$f_w = 1$	$f_m = 2$	$f_w = 1$	$f_m = 2$

3 RESULTS

There were 21 people involved in the ULL workshop. 2 ULL stakeholders represented the business sector, 4 local government, 3 NGOs, 5 research organisations, and 7 youngsters/students. All the participants already heard about the concept of ESS from the view point of the organisation they present. They were more familiar with expression ‘ecosystem functions’ as forest functions in Ljubljana have been discussed before in several documents (e.g. The City of Ljubljana, 2010). After the short introduction on ESS and the chosen UGI types, participants started to solve given tasks. A discussion followed the tasks to allow participants to express their ideas on the workshop and ESS in Ljubljana in general. Municipality representative stated that concept of ESS has been already included in strategic planning documents but under different expressions (as functions and benefits). Few participants mentioned that also in Ljubljana ‘ESS’ expression should be used because of its widely cross sectoral recognition and international usage. Some participants found it difficult to choose between primary and secondary ESS, because they thought that all ESS are equally important.

Results of Task 1 (Figure 5), where stakeholders were asked to identify most important ESS for them (primary) from the viewpoint of the organisation they were representing, show that researchers and youngsters identified more primary ESS than other ULL stakeholder groups. The biggest difference between identified most important and less important (secondary) services exists in the business sector, with only 2 out of the 16 services identified as most important (primary). Among all, ESS food and educational value were chosen by the largest number of participants ($n_{\text{food}}=13$, $n_{\text{educ}}=14$). ESS ‘biochemicals’ and ‘spiritual and religious values’ received the smallest number of votes ($n=4$).

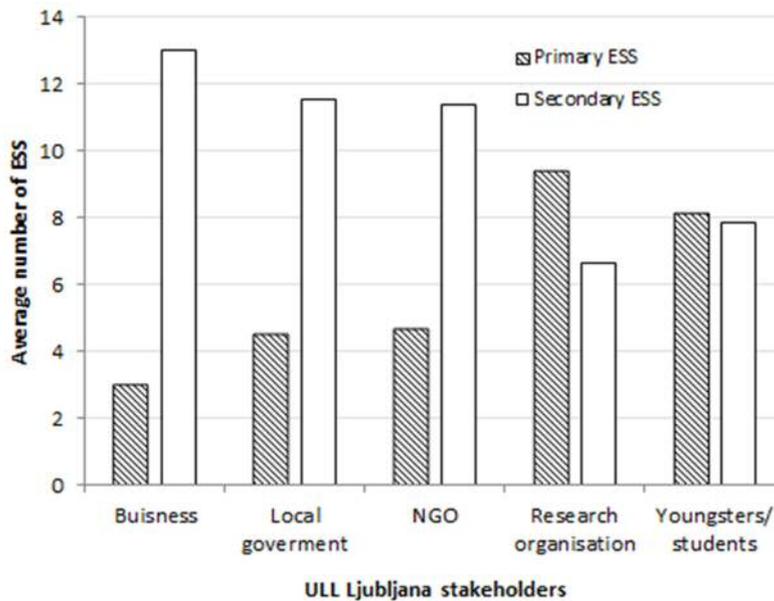


Figure 5: Results of evaluation of primary and secondary ESS perceived by different stakeholder groups (Task 1) ($N_{\text{business}}=2$; $N_{\text{local government}}=4$; $N_{\text{NGO}}=3$; $N_{\text{research org.}}=5$; $N_{\text{youngsters/students}}=7$).

Participants identified the largest amount of ESS in UGI type forest, followed by UGI agricultural land, allotment gardens and park (Figure 6).

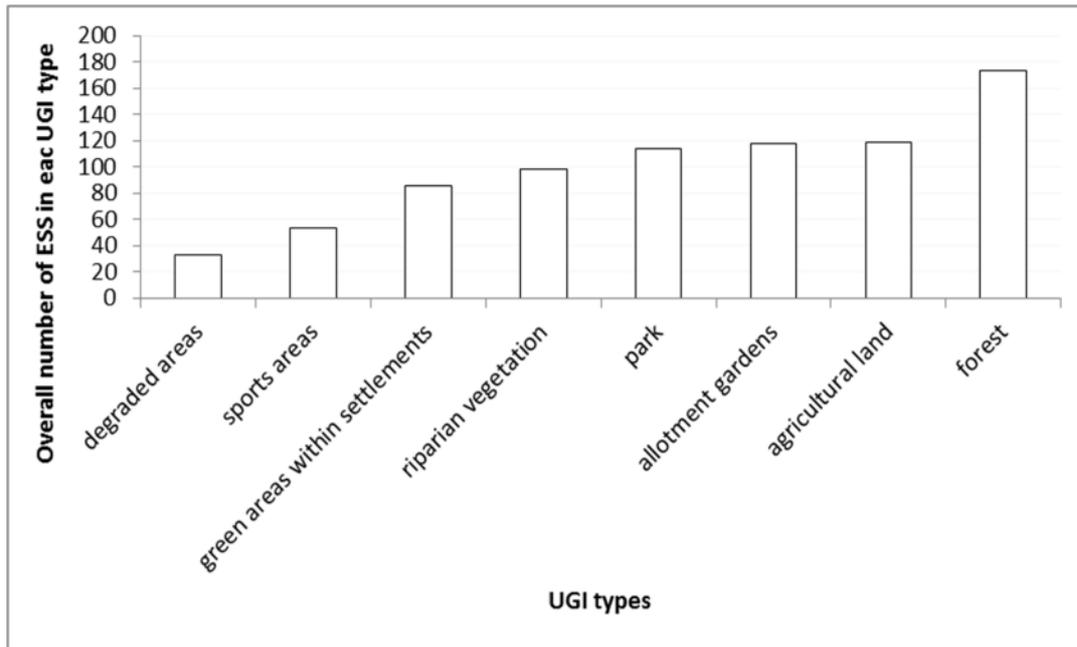


Figure 6: The number of identified ecosystem services in each of UGI type in Ljubljana by all respondents (N=21)

Results of Task 2 (Figure 7-14):

- All types of UGI have the same relative difference (percentage) between provision of and demands for ES.
- Results show that stakeholders wished all UGI types in Ljubljana could offer more services contributing to the component of well-being in social relations. In particular, these EES are of a cultural nature, such as recreation and tourism, or hold an aesthetic and spiritual value.
- Among UGI types in Ljubljana, results show that forests have a biggest contribution on all components of WB, on the other hand the UGI types of sports and degraded areas exert the least influence on all components of WB.

PARKS

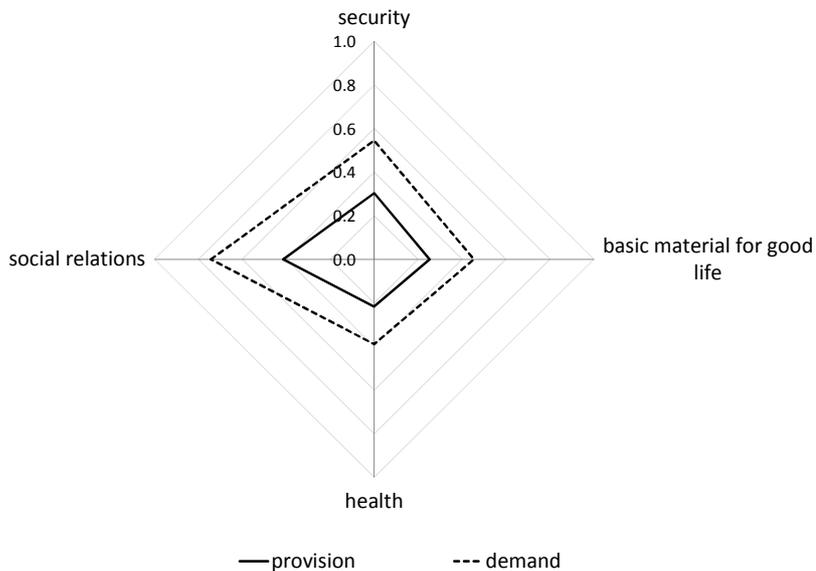


Figure 7: Relative representation of the calculated links between human wellbeing components and perceived ESS provision and demand through parks in Ljubljana (N=21).

FORESTS

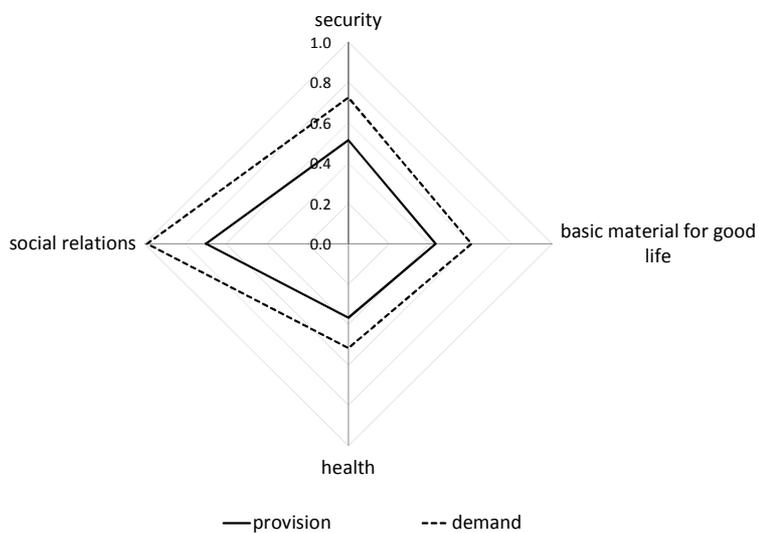


Figure 8: Relative representation of the calculated links between human wellbeing components and perceived ESS provision and demand through forests in Ljubljana (N=21).

ALLOTMENT GARDENS

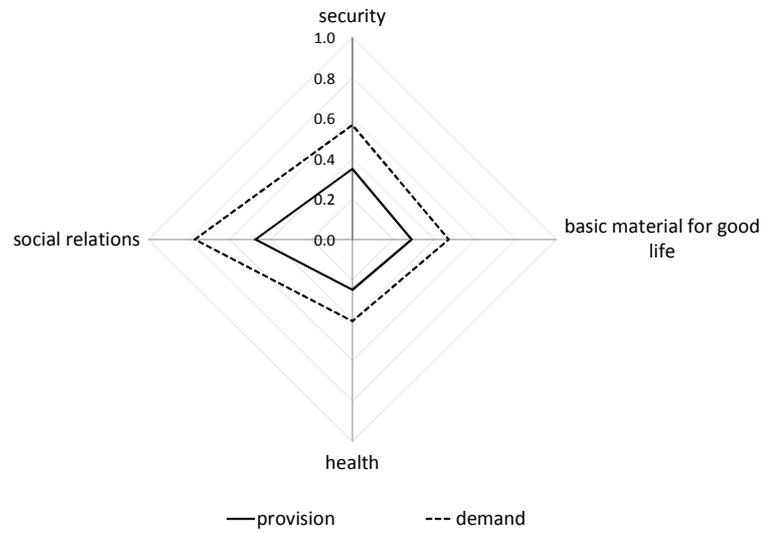


Figure 9: Relative representation of the calculated links between human wellbeing components and perceived ESS provision and demand through allotment gardens in Ljubljana (N=21).

SPORTS AREAS

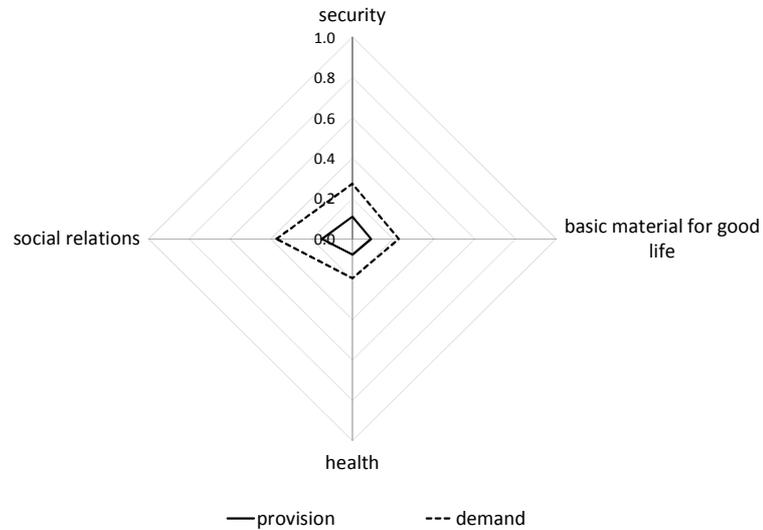


Figure 10: Relative representation of the calculated links between human wellbeing components and perceived ESS provision and demand through sports areas in Ljubljana (N=21).

AGRICULTURAL LAND

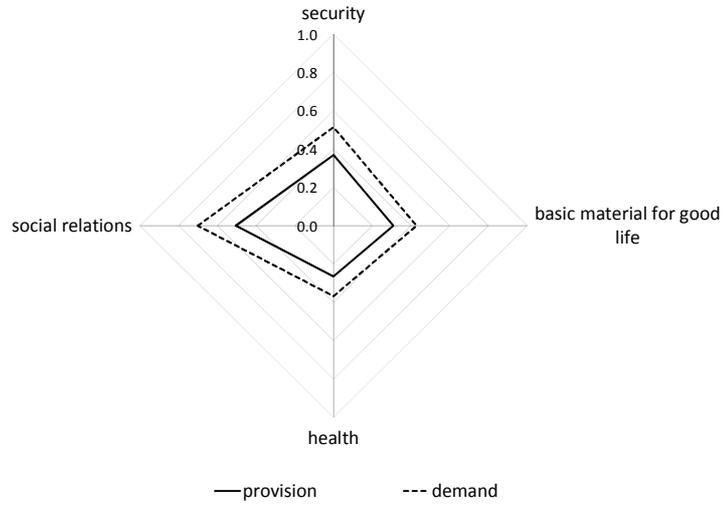


Figure 11: Relative representation of the calculated links between human wellbeing components and perceived ESS provision and demand through agricultural land in Ljubljana (N=21).

DEGRADED AREAS

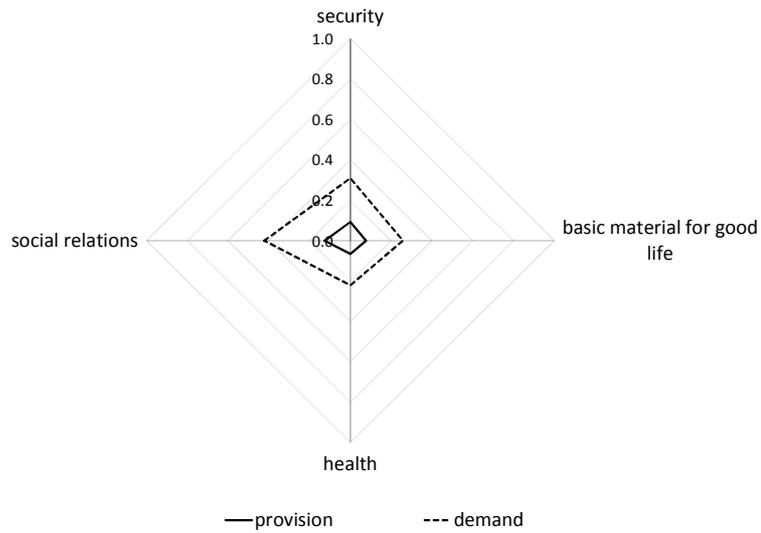


Figure 12: Relative representation of the calculated links between human wellbeing components and perceived ESS provision and demand through degraded areas in Ljubljana (N=21).

RIPARIAN VEGETATION

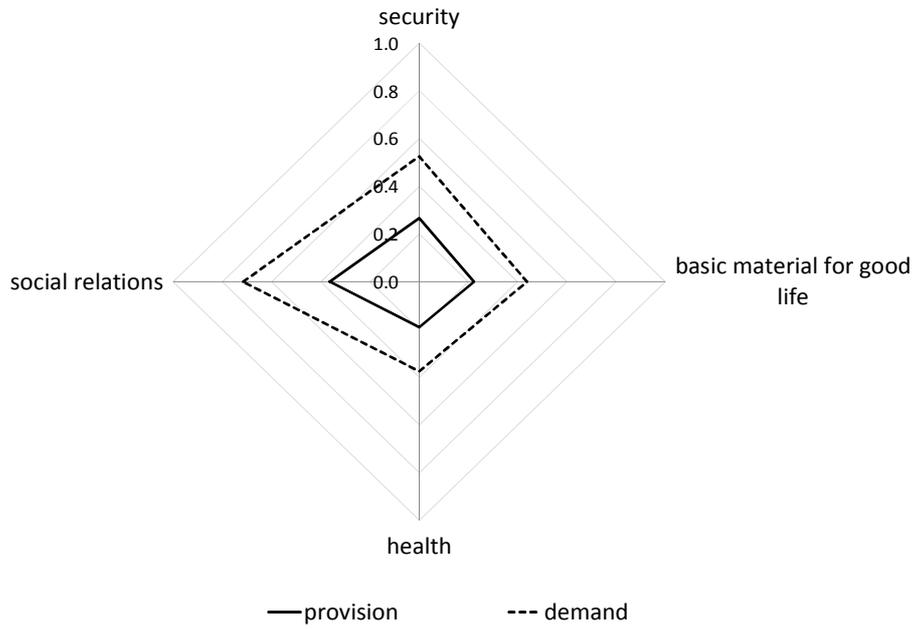


Figure 13: Relative representation of the calculated links between human wellbeing components and perceived ESS provision and demand through riparian vegetation in Ljubljana (N=21).

GREEN AREAS WITHIN SETTLEMENTS

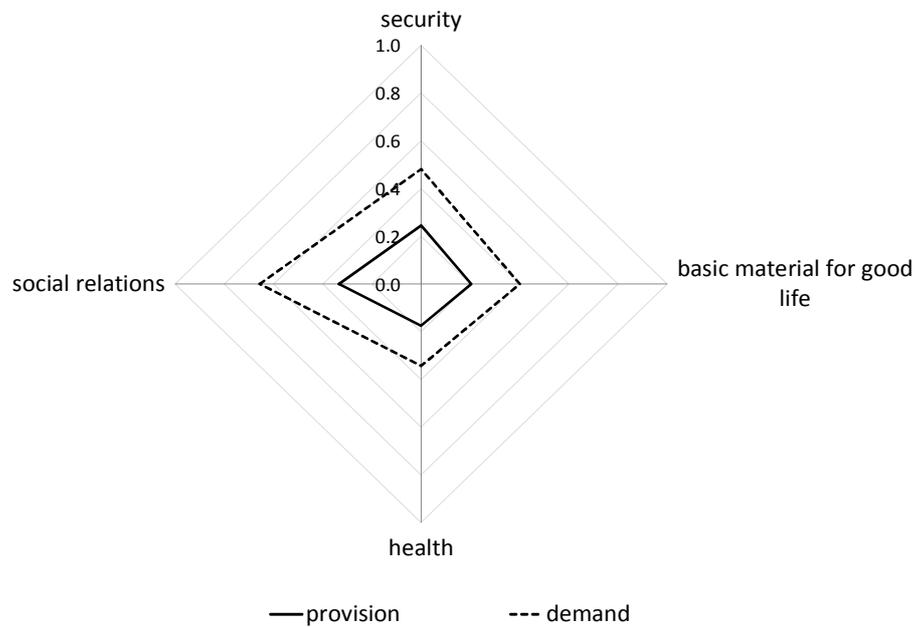


Figure 14: Relative representation of the calculated links between human wellbeing components and perceived ESS provision and demand through green areas within settlements in Ljubljana (N=21).

Moreover, if we look at the results from a more detailed view, the ESS could be presented for each UGI type separately. In this way, we could see differences among each ESS group as perceived by our stakeholders (Figure 15).

PARKS

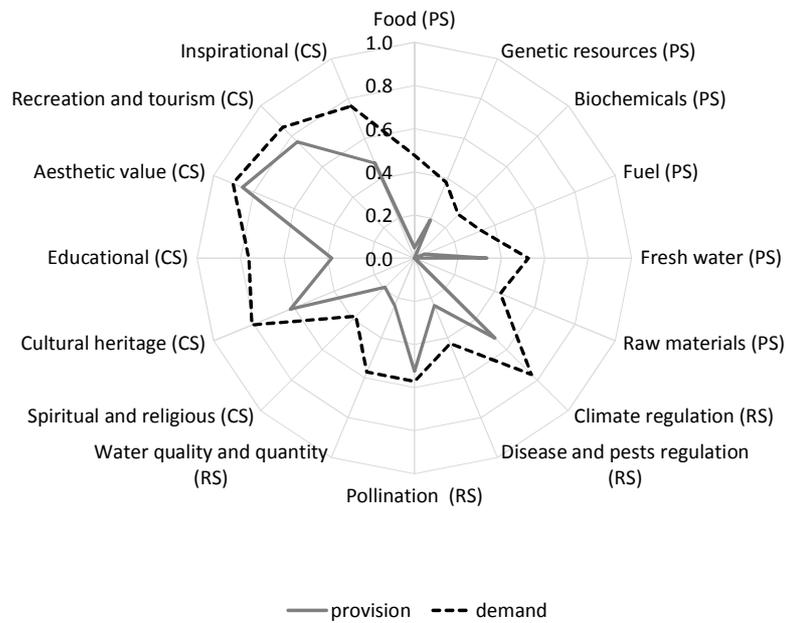


Figure 15: Relative representation of the calculated links between the services contributing to human wellbeing components and their provision and demand through parks in Ljubljana. Comment: PS = provisioning services, RS = regulating services, CS = cultural services (N=21).

4 DISCUSSION

For the interpretation of results, it should be noted that stakeholders were not equally represented (e.g. two business representatives vs. seven youngsters). The aim of the study was not the representation of a larger statistical population but the views of learning alliance stakeholders in Ljubljana.

The fact that stakeholders from research organisations and youngsters identify more ESS as being important than stakeholders from business, local government and NGO, might reflect a greater awareness of the former to the topic of ESS, due to the activities each one of these types of stakeholder carries out. Different perceptions of the spatial distribution of ESS and the scale of their demand by different types of stakeholders have been previously identified by García-Nieto et al. (2015). As those authors stress, those differences can be related to the information, mental models, connections to the landscape or values that different stakeholders have. On the other hand, Cárcamo et al. (2014) observed few significant differences among different stakeholder groups when prioritizing ESS. The results of the workshop in Ljubljana might also be linked with inaccurate stakeholder perceptions. These interpretations would benefit from a comparison of perceived data with empirical data (Menzel and Teng, 2010; Aretano et al., 2013; Mascarenhas et al., 2016).

Supply and demand of ESS follow the same pattern of distribution across components of WB for all types of GI. This points to the notion that results are not sensitive to the type of UGI. Nevertheless, for every type of UGI and every component of WB, the number of ESS demanded is always higher than the number of ESS supplied: this points at a deficit of ESS supplied but it raises some additional questions, most notably: are the expectations of stakeholders realistic (are they demanding ESS that the UGI simply cannot supply?) Or could the GI be enhanced in order to supply more ESS? These questions could be object for further research.

Both supply and demand of ESS are higher for the component of WB “social relations” for all types of UGI. This is an unexpected result, best illustrated by the relationships between health and sports areas or between basic material for good life and agricultural land (as the main areas of provisioning ESS supply). It is also unexpected considering that the linkages between ESS and social relations are weaker than for the remaining components of WB (Figure 1).

The gap between ESS provision and demand is bigger (greater demand than provision) for the WB component of social relations as for the remaining WB components, for all types of UGI. This reflects the idea that, in a social-ecological system conceptualized through the widely accepted ESS cascade framework (Haines-Young and Potschin, 2010), this WB component will be more influenced by the social system than by the ecological system. This means that the contribution of UGI’s biophysical features and functions, relative to the contribution of other social determinants of WB, is lower for the WB component of social relations than for other components of WB (see Figure 1). Additionally, there seem to be three clusters of UGI types regarding these gaps: (i) parks, forests and allotment gardens (bigger gap); (ii) degraded areas, riparian vegetation and green areas with settlement; (iii) sports areas, agricultural land (smaller gap)

One of the aims of this research is creation of a basis for incorporating ESS concept in local urban planning. Quantification and mapping of ESS are considered as one of the main requirements for the implementation of the concept into environmental institutions and decision making ([Daily and Matson, 2008](#)). Although participatory mapping was not conducted in the workshop, the identification of ESS linked to different types of UGI and based on pictures and concrete UGI examples in the ULL can be one of the first steps to inform that process. It can also be useful to support decision-makers responsible for urban planning in a variety of ways, including:

- (i) identifying needs for awareness raising, for example where mismatches are identified between stakeholders' perceptions and empirical data;
- (ii) identifying areas of surplus or deficit of ESS supply;
- (iii) identifying the components of WB in need of greater enhancement through ESS;
- (iv) raising awareness of the stakeholders involved in such a process, simply by reflecting together about the topic of ESS provided by UGI.

Management and spatial planning of ESS, as a complex environmental issue, should be addressed through transdisciplinary approaches (Chan et al., 2012; García-Nieto et al., 2015). A focus on ESS in participatory decision-making processes can provide a common language that facilitates comparisons of management alternatives. This can foster dialogue among groups with different interests and beliefs and increase the likelihood that plans are mutually acceptable ([Granek et al., 2010](#)).

5 REFERENCES

- Aretano, R., Petrosillo, I., Zaccarelli, N., Semeraro, T., Zurlini, G., 2013. People perception of landscape change effects on ecosystem services in small Mediterranean islands: A combination of subjective and objective assessments. *Landscape and Urban Planning* 112, 63–73. <http://dx.doi.org/10.1016/j.landurbplan.2012.12.010>
- Cárcamo, P.F., Garay-Flühmann, R., Squeo, F.A., Gaymer, C.F., 2014. Using stakeholders' perspective of ecosystem services and biodiversity features to plan a marine protected area. *Environmental Science & Policy* 40: 116–131. <http://dx.doi.org/10.1016/j.envsci.2014.03.003>
- Chan, K.M.A., Satterfield, T., Goldstein, J., 2012. Rethinking ecosystem services to better address and navigate cultural values. *Ecological Economics* 74, 8–18. <http://dx.doi.org/10.1016/j.ecolecon.2011.11.011>
- Cilliers S., Cilliers J., Lubbe R., Siebert S. 2013. Ecosystem services of urban green spaces in African countries-perspectives and challenges. *Urban Ecosystem*, 16: 681–702
- Cotter, M., Berkhoff, K., Gibreel, T., Ghorbani, A., Golbon, R., Nuppenau, E.-A., Sauerborn, J., 2014. Designing a sustainable land use scenario based on a combination of ecological assessments and economic optimization. *Ecol. Indic.* 36, 779–787.
- Cowling, R.M., Egoh, B., Knight, A.T., O'Farrell, P.J., Reyers, B., Rouget, M., Roux, D.J., Welz, A., Wilhelm-Rechman, A., 2008. An operational model for mainstreaming ecosystem services for implementation. *Proc. Natl. Acad. Sci.* 105, 9483–9488.
- García-Nieto, A.P., Quintas-Soriano, C., García-Llorente, M., Palomo, I., Montes, C., Martín-López, B., 2015. Collaborative mapping of ecosystem services: The role of stakeholders' profiles. *Ecosystem Services* 13: 141–152. <http://dx.doi.org/10.1016/j.ecoser.2014.11.006>
- Haines-Young, R.H., Potschin, M.P., 2010. The links between biodiversity, ecosystem services and human well-being, in: Raffaelli, D., Frid, C. (Eds.), *Ecosystem Ecology: A New Synthesis*. CUP, Cambridge.
- Hasse D., Frantzeskaki N., Elmqvist T. 2014. Ecosystem services in urban landscapes: Practical Applications and governance implications. *AMBIO*, 43:407–412
- Jazbinšek Sršen, N., 2014. Environment Protection Program 2014-2020 for the City of Ljubljana. The City of Ljubljana, Department for Environment Protection, Ljubljana.
- Kabisch, N., 2015. Ecosystem service implementation and governance challenges in urban green space planning—The case of Berlin, Germany. *Land Use Policy* 42: 557–567. <http://dx.doi.org/10.1016/j.landusepol.2014.09.005>
- Larondelle N, Frantzeskaki N, Haase D 2016. Mapping transition potential with stakeholder and policy-driven scenarios in Rotterdam City. *Ecological Indicators*.
- Mascarenhas, A., Ramos, T.B., Haase, D., Santos, R., 2016. Participatory selection of ecosystem services for spatial planning: Insights from the Lisbon Metropolitan Area, Portugal. *Ecosystem Services* 18: 87-99. <http://dx.doi.org/10.1016/j.ecoser.2016.02.011>
- Menzel, S., Teng, J., 2010. Ecosystem Services as a Stakeholder-Driven Concept for Conservation Science. *Conservation Biology* 24, 907–909. <http://dx.doi.org/10.1111/j.1523-1739.2009.01347.x>
- MEA: Millennium Ecosystem assessment. 2005. *Ecosystems and human well-being: Synthesis*. Island Press .Washington DC. 138 p.

- McIntosh, B.S., Giupponi, C., Voinov, A.A., Smith, C., Matthews, K.B., Monticino, M., Kolkman, M.J., Crossman, N., Van Ittersum, M., Haase, D., 2009. Bridging the gaps between design and use: developing tools to support environmental management and policy, 33–48.
<http://www.millenniumassessment.org/documents/document.356.aspx.pdf> (Accessed 20.04.2016)
- Nared, P. V., Simoneti, M. (2011). Analiza podatkovnih baz o mestnih zelenih površinah kot izhodišče za razpravo o povezavi med kakovostjo in uporabnostjo podatkov/ Analysis of green areas databases as a starting point of discussion on relation between quality and usefulness of data. *Geodetski vestnik*, 55(2), 366-380
- Špes M. 2009. Mesto kot ekosistem. Filozofska fakulteta, Univerza v Ljubljani. Razprave. Dela 31. 5-20
- The city of Ljubljana, 2010. Urban Master Plan of Ljubljana. Government RS, <https://urbanizem.ljubljana.si/index3/> (Accessed 20.04.2016)
- Soste, L., Wang, Q.J., Robertson, D., Chaffe, R., Handley, S., Wei, Y., 2014. Engendering stakeholder ownership in scenario planning. *Technol. Forecast. Soc. Change*.
- Sutherland, W.J., Spiegelhalter, D., Burgman, M.a., 2013. Policy: twenty tips for interpreting scientific claims. *Nature* 503, 335–337.