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Front cover photography: Sveta Gora, a settlement with a franciscan monastery overlooking the Soča valley, renowned as a Marian pilgrimage site, is located near the Slovenia-Italy border, at the intersection of Alpine, Medditerranean and Dinaric landscapes (photograph: Jure Tičar).
Fotografija na naslovnici: Sveta Gora, naselje s frančiškanskim samostanom nad dolino Soče, ki je znano po marijanskem romarskem središču, leži na meji Slovenije in Italije ter na stiku alpskih, sredozemskih in dinarskih pokrajin (fotografija: Jure Tičar).

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UNVEILING THE CULTURAL ECOSYSTEM SERVICES OF URBAN GREEN SPACES: A CASE STUDY OF LJUBLJANA, SLOVENIA

Aleš Smrekar, Jernej Tiran, Katarina Polajnar Horvat

BOJAN ERHARTIČ

Tivoli, the largest park in Ljubljana, is a popular place to relax.

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Aleš Smrekar[1], Jernej Tiran[1], Katarina Polajnar Horvat[1]

Unveiling the cultural ecosystem services of urban green spaces: A case study of Ljubljana, Slovenia

ABSTRACT: This paper analyses the value of cultural ecosystem services in urban green spaces. A field survey of 900 respondents in Ljubljana, Slovenia, examined cultural ecosystem services in seven types of urban green spaces and compared the results with two types of non-green public spaces (old town, shopping mall). Differences between the types were assessed using one-way variance analysis (ANOVA). Results showed statistically significant differences between the types, with sports facilities standing out as valuable for recreation and education. The old town's cultural heritage and aesthetics were highly valued, while shopping malls ranked lowest. The study emphasises the importance of urban green spaces for quality of life of residents and informs land use planning decision-making.

KEYWORDS: urban green space, recreation, cultural ecosystem services, quality of life, Ljubljana, Slovenia

Odkrivanje kulturnih ekosistemskih storitev na mestnih zelenih površinah: študija primera v Ljubljani, Slovenija

POVZETEK: Članek analizira vrednost kulturnih ekosistemskih storitev na mestnih zelenih površinah. S terensko raziskavo, v kateri je sodelovalo 900 anketirancev iz Ljubljane, smo vrednotili kulturne ekosistemske storitve na sedmih tipih mestnih zelenih površin in rezultate primerjali z dvema tipoma nezelenih javnih površin (staro mestno jedro, nakupovalna središča). Razlike med tipi smo analizirali z enosmerno analizo variance (ANOVA). Rezultati so pokazali statistično pomembne razlike med tipi, pri čemer so športni objekti izstopali kot dragoceni za rekreacijo in izobraževanje. Kulturna dediščina in estetika starega mestnega jedra sta bili visoko ocenjeni, medtem ko so se nakupovalna središča uvrstila na najnižje mesto. Raziskava poudarja pomen mestnih zelenih površin za kakovost življenja prebivalcev, rezultati pa so lahko koristni pri sprejemanju odločitev o prostorskem načrtovanju.

KLJUČNE BESEDE: mestne zelene površine, rekreacija, kulturne ekosistemske storitve, kakovost življenja, Ljubljana, Slovenija

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1 Introduction

Many Europeans are leaving the countryside for urban areas, which has led to a dramatic increase in environmental pressures, particularly in the second half of the 20th century (Antrop 2004; Urbanc et al. 2023). In this context, ecosystem services provided by urban green spaces, such as air purification, temperature regulation, water management, and mental health benefits, are becoming increasingly vital. These services help mitigate the negative environmental impacts of urbanization and play a crucial role in enhancing the quality of life in cities. Recognizing and understanding the importance of these ecosystem services is essential for fostering more sustainable and resilient urban environments (Gómez-Baggethun et al. 2013).

Citizens are exposed to negative environmental pressures, such as pollution, overcrowding, excessive noise, and information overload (Polajnar Horvat and Smrekar 2017; Smrekar et al. 2019; Tzortzi and Ioannou 2022), also called ecosystem disservices (Lyytimäki and Sipilä 2009). Coping with the challenges of everyday urban life puts a strain on people's physical and mental health and, combined with an increasingly sedentary lifestyle, has negative health consequences (Collado et al. 2016). There is a wealth of evidence on the health, social, and psychological benefits of spending time in nature, urban green spaces (Joye and Van den Berg 2013). Such spaces were particularly important during the COVID-19 pandemic when movement was restricted and locally limited (Bakir and Sahar 2021; Grasseni 2022). Studies show that various types of recreational environment possess various restorative quality, which is higher in more natural environments (Tyrväinen et al. 2014). However, some studies show that non-green settings, such as shopping malls, have certain recreational dimensions and are not automatically inferior to more natural surroundings (Craig et al. 2018).

The diversity of Earth ecosystems has an impact on human well-being (Haines-Young and Potschin 2010). The problem is that ecosystems are increasingly being transformed and have become increasingly unrecognizable in recent decades, leading to a loss of biodiversity, disruption of natural processes, and a reduced capacity to provide essential ecosystem services that humans and other species rely on for survival (Ribeiro and Šmid Hribar 2019). These consequences have contributed to a growing awareness of the importance of ecosystems and the need to understand the services they provide to modern society (Millennium Ecosystem Assessment 2005; Pakfetrat et al. 2020; Suhadolc et al. 2022). The urban green spaces of the highest quality include the spectrum of ecosystem services: supporting, regulating and cultural (Wallace 2007; European Environmental Agency 2018). The cultural ecosystem services are directly experienced by people, as their availability depends on the level and type of interactions between people and the natural environment (Plieninger et al. 2013; Gavrilidis et al. 2023).

Cultural ecosystem services play a crucial role in enhancing urban life, contributing to mental well-being, social cohesion, and active lifestyles. Despite their importance, they remain under-researched, particularly in the context of urban green spaces. The concept of cultural ecosystem services has already been introduced and recognized in other operational frameworks, such as environmental and conservation policy (Tengberg et al. 2012), while it is still quite unknown in the fields of health-enhancing physical activity, sport, and recreation (Sielaff et al. 2024).

The aim of this research is to fill the gap in knowledge regarding cultural ecosystem services in urban green spaces. The research focuses on the following key questions:

1) How do users perceive cultural ecosystem services in urban green spaces?
2) Are there significant differences in the valuation of cultural ecosystem services and disservices across different types of urban green spaces?
3) Do old town and shopping malls possess lower value compared to urban green spaces?

The case study for this research is the city of Ljubljana, the capital of Slovenia, which has just under 300,000 residents and more than 125,000 daily commuters. Ljubljana presents an interesting case for analysis due to its diverse range of urban (green) spaces (Smrekar and Tiran 2013; Smrekar et al. 2019). Furthermore, Ljubljana has received numerous awards for its sustainability initiatives, including the title of European Green Capital 2016, in part due to its focus on urban greening projects and the development of new recreational and sports facilities (Kozina et al. 2019; Poljak Istenič 2019).

2 Theoretical background

Human well-being is closely linked to the natural environment (including urban green spaces) and its values (Jabbar et al. 2022). Although this is firmly established, it remains difficult to assess how the

biophysical characteristics of a given space contribute to the well-being of people associated with that space (Bieling et al. 2014).

The concept of natural capital emerged in the early 1970s (Schumacher 1973), emphasising the need for more sustainable utilization of natural resources. This notion sparked a systematic research agenda into ecosystem services. Initially, the primary goal of the ecosystem services concept was to raise awareness of the adverse effects of biodiversity loss on both ecosystem functionality and societal well-being (Gómez-Baggethun et al. 2010). A significant milestone in the development of the ecosystem services concept was the Millennium Ecosystem Assessment (2005, p. V), which underscored society's fundamental reliance on ecosystem services and helped establish them. According to this document, ecosystem services are defined as »the benefits that people obtain from ecosystems« and are divided into four types of direct benefits:

- supporting services: these enable ecosystems to provide services, such as food provisioning, flood regulation, and water purification;
- provisioning services: products derived from ecosystems, such as food and fibre;
- regulating services: benefits derived from regulating ecosystem processes, e.g., climate regulation and water purification;
- cultural services: non-material benefits that people derive from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experience, including, for example, knowledge systems, social relationships, and aesthetic values.

Following the Millennium Ecosystem Assessment (2005), several key initiatives further shaped the field. The Economics of Ecosystems and Biodiversity – TEEB (Sukhdev et al. 2010) was instrumental in integrating biodiversity values into decision-making processes at various levels, emphasising the importance of ecosystem services in policy and economics. Shortly thereafter, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services – IPBES was formed in 2015 (Brondizio et al. 2019), strengthening the science-policy interface on biodiversity and ecosystem services globally. In parallel, the European Union undertook the systematic mapping of ecosystems (Maes et al. 2020), aiming to standardize the evaluation of ecosystem services across different types of ecosystems. This led to a structured approach for assessing ecosystem states. Building on these foundational works, the Common International Classification of Ecosystem Services – CICES (European Environmental Agency 2018) further refined the classification of ecosystem services into three broad categories – provisioning, regulating, and cultural services – accompanied by detailed subcategories that add precision to the assessment and application of ecosystem services (Šmid Hribar et al. 2021).

Recently, de Groot et al. (2020) published a work analysing 960 studies on the economic valuation of ecosystem services. The highest value estimates are for air quality management, recreation and tourism. For others, there is relatively limited information (e.g., spiritual experiences and ornamental resources). In a similar way, data on ecosystem service studies published in Slovenia were identified, compared and described (Šmid Hribar et al. 2021). The main findings are that the number of scientific and professional articles about ecosystem service in Slovenia is increasing (39 articles in total). The most represented field is forestry, while the most commonly explored individual ecosystem services are cultural, namely recreation and ecotourism.

The term ecosystem disservice is derived from the ecosystem service approach and is thus conceptually related to it. The term is used rarely in papers that were published before Millennium Ecosystem Assessment (2005). One of the first definitions of ecosystem disservice was published by Lyytimäki and Sipilä (2009, p. 311), where ecosystem disservices were defined as »functions of ecosystems that are perceived as negative for human well-being«. Millennium Ecosystem Assessment (2005) uses a general, anthropocentric perspective that builds on a general, universal understanding of human well-being. On a closer look, the general idea of human well-being can be divided into a multitude of categories of human well-being, representing the different values, beliefs and necessities of a multitude of different groups. This subdivision leads to the problem that the identification of ecosystem disservice becomes very dependent on which effects are perceived by individuals and societies as negative in a given context. Very often, noise and waste in the landscape are perceived as ecosystem disservices which are a consequence of human use of ecosystems, not a disservice from the ecosystem itself (Plieninger et al. 2013). For example, a rarely mentioned adverse service that is clearly linked to ecological structures or functions is the perceived fear of wolves roaming in forests (Agbenyega et al. 2009). The concept of ecosystem disservices has its roots in urban ecosystem research (Lyytimäki and Sipilä 2009; Escobedo et al. 2011; Dobbs et al. 2014; Lyytimäki

2014), particularly in the context of complex human-environment systems characteristic of urban spaces (von Döehren and Haase 2015). They have been used to assess the value of green spaces to urban residents (Lyytimäki et al. 2008; Lyytimäki and Sipilä 2009).

Guo et al. (2022) analysed 524 studies of ecosystem disservices. Relevant searches on ecosystem disservices can be found on various ecosystem types. Among them, there are abundant research cases on ecosystem disservices in urban and agricultural ecosystems. Urban ecosystem disservices were associated with changes of biodiversity. Several studies also advocated for better integration of ecosystem services and disservices in stakeholder decision-making on urban green spaces by assessing trade-offs and synergies. Some articles also associated the disservices of urban ecosystems with the public awareness and demand for urban green space.

The concept of cultural ecosystem services is previously defined in this chapter in the context of four types of direct benefits. Cultural ecosystem services can involve the use of natural resources directly (e.g., enjoying walking or viewing the scenery) or indirectly (e.g., the cultural heritage and spiritual value of green spaces) (Sen and Guchhait 2021). Unlike other ecosystem services, such as carbon sequestration and water or air purification that require scientific knowledge to be recorded, cultural ecosystem services are directly experienced and intuitively understood by people who come into contact with nature and the close connection between citizens, and nature offers a valuable opportunity for increasing awareness of the multifunctionality and interconnectedness of different ecosystem services and their significance for quality of life (IUCN 2015, cited in Sen and Guchhait 2021).

In the analysis of valuation of cultural ecosystem services (Matos Márquez et al. 2023), 349 scientific articles were included. The first article was published in 2010. A temporal trend towards an increase in the number of articles has been observed between the years 2010 and 2022. The terrestrial environment and recreational value being the most emphasised among all the analysed articles. The recent themes in the research area are associated with landscape, protected areas, perception, urban green space and social media studies.

Recreation is thus one of the most important cultural ecosystem services in the European context and probably the most tangible, as Kenward and Sharp wrote as early as 2008. The majority of people spend their leisure time outdoors (Sievänen et al. 2009). Recreational activities such as walking, jogging, or playing outdoors provide them the opportunity to directly experience the benefits of a cultural ecosystem. This is especially true for people living in urban environments where contact with natural ecosystems is often limited (Daniel et al. 2012). Natural ecosystems provide many important benefits such as physical exercise, aesthetic experiences, intellectual stimulation, inspiration, and other contributions to physical and psychological well-being (Chan et al. 2011). Numerous studies (Hartig et al. 2003; Karmanov and Hamel 2008; Bowler et al. 2010) have shown that even short stays in green spaces can have positive effects on human health and thus contribute to the economic productivity of society. Urban green spaces can improve environmental conditions and thus the health and quality of life of citizens. They also support green economy, create job opportunities and enhance biodiversity (Tzortzi and Ioannou 2022).

Many studies from different parts of the world report that, compared to urban environments, natural environments improve people's mood. The general conclusion is that being in a built-up urban environment leads to the perception of an incoherent environment. The results also suggest that large urban parks and large urban forests have a positive effect on the well-being of urban inhabitants (Tsunetsugu et al. 2013; Tyrväinen et al. 2014). In contrast to most other studies on nature experiences, which at best compare (for example) a walk through a forest with a walk through an urban centre (Tyrväinen et al. 2014), Craig et al. (2018) looked at comparisons with another everyday experience, in their case shopping. The role of shopping in people's lives goes far beyond the provision of food and other necessary household items and has important symbolic and recreational functions (Falk and Campbell 1997; Miller 1998; Shaw 2010). Although nature experiences have generally been found to be more enjoyable and to evoke more positive memories than shopping experiences, the results are far from clear (Craig et al. 2018). Another form of recreation is so-called recreational shopping, which is usually defined as an activity that consumers enjoy as a leisure activity (Baeckstroem 2006). All these studies indicate that different recreational environments seems to have a significantly different cultural ecosystemic services.

3 Methods

3.1 Selection of cultural ecosystem services and disservices

Our empirical analysis is based on the concept of cultural ecosystem services. The set of services included is mainly based on the highly cited paper by Bieling et al. (2014), but is also supported by the review paper by Yang and Cao (2022). The list of ecosystem services is the following:

- recreation and sports,
- education,
- aesthetics,
- relaxation,
- natural heritage,
- cultural heritage,
- sense of place,
- inspiration and
- spirituality.

A concise list of ecosystem disservices, as identified in various studies, is presented herewith (Lyytimäki et al. 2008; Lyytimäki 2014; von Döhren and Hasse 2015):

- unpleasantness,
- fear and
- noisiness.

In addition to the categories that are typically included, we have also incorporated shopping and hospitality. A comparison of experiences between nature and shopping, which are relatively uncommon (Craig et al. 2018), provides an interesting insight into how people respond to the natural and built environment.

3.2 Selection of urban green spaces

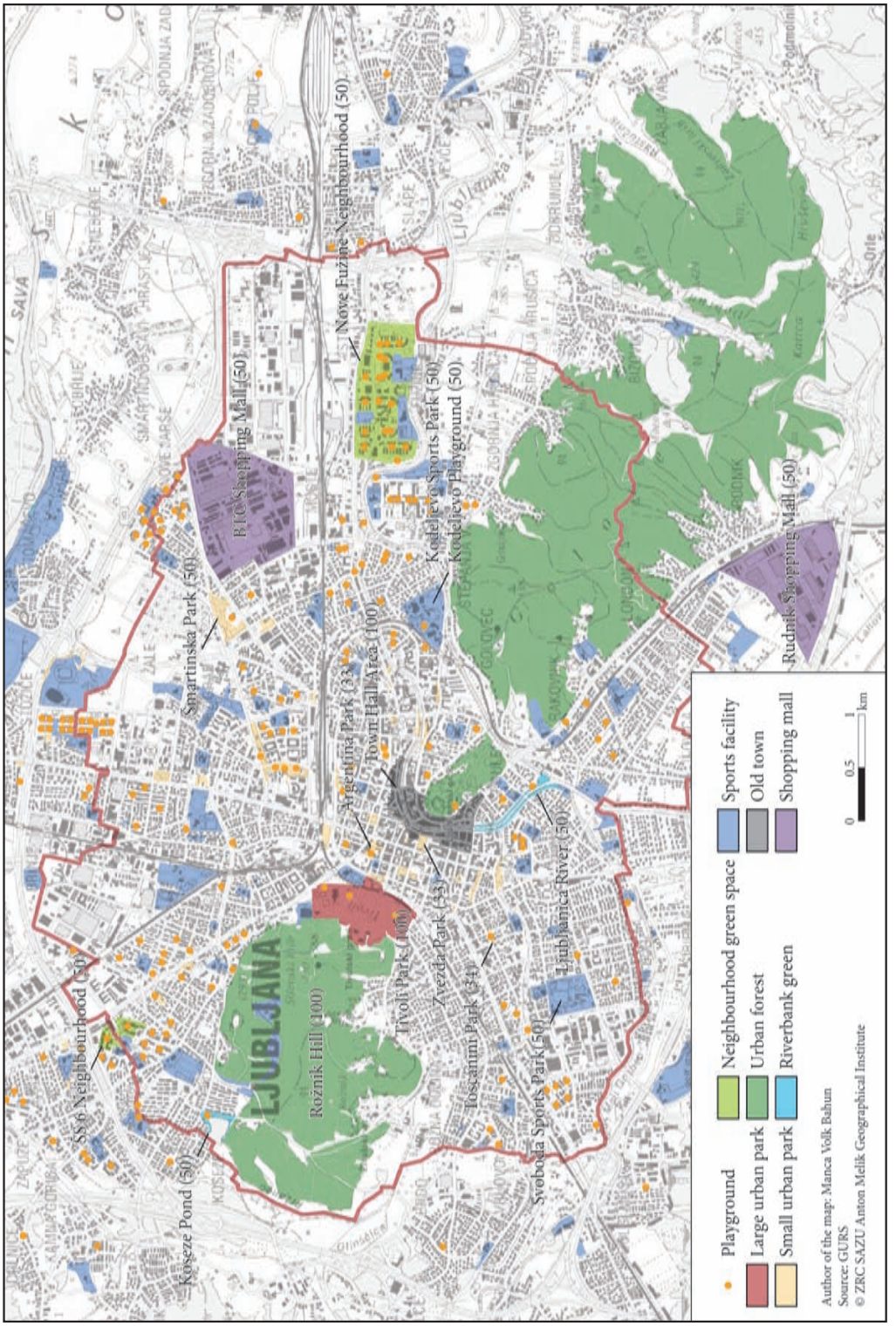
The urban green spaces in the City of Ljubljana were selected based on available public data, our expert opinion, and existing typologies of urban green spaces (e.g., Cvejić et al. 2015; Tiran et al. 2018). Most of these spaces are considered to have cultural ecosystem services. The typology consists of seven types of urban green spaces:

- large urban park,
- small urban park,
- neighbourhood green space,
- urban forest,
- riverbank green,
- open sports facility, and
- open playground.

Table 1: Types and locations of urban green spaces (1–7) and added non-green public spaces (8–9) with numbers of completed surveys.

	type	location (number of completed surveys)
1	large urban park	Tivoli Park (100)
2	small urban park	Zvezda Park (33), Argentina Park (33), Toscanini Park (34)
3	neighbourhood green space	ŠS 6 Neighbourhood (50), Nove Fužine Neighbourhood (50)
4	urban forest	Rožnik Hill (100)
5	riverbank green	Ljubljanica River (50), Koseze Pond (50)
6	sports facility	Kodeljevo Sports park (50), Svoboda Sports park (50)
7	playground	Šmartinska Park (50), Kodeljevo Playground (50)
8	old town	Town Hall Area (100)
9	shopping mall	BTC Shopping Mall (50), Rudnik Shopping Mall (50)

Figure 1: Urban public spaces in Ljubljana with a selection of case studies and number of respondents. ► p. 141


LJUBLJANA
SAVA
Ljubljanica
Rožnik Hill (100)
Tivoli Park (100)
Zvezda Park (33)
Argentina Park (33)
Town Hall Area (100)
Toscanini Park (34)
Smartinska Park (50)
BTC Shopping Mall (50)
Nove Fužine Neighbourhood (50)
Kodeljevo Sports Park (50)
Kodeljevo Playground (50)
Rudnik Shopping Mall (50)
Ljubljanica River (50)
Svoboda Sports Park (50)
Koseze Pond (50)
SS 6 Neighbourhood (50)
Playground
Large urban park
Small urban park
Neighbourhood green space
Urban forest
Riverbank green
Sports facility
Old town
Shopping mall
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km
Author of the map: Manca Volk Bahun
Source: GURS
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As a contrast to the established forms of recreation on urban green spaces, where we can talk about ecosystem services, recreation, such as walking and recreational shopping, can also take place in non-green public spaces:

- old town,
- shopping mall.

In the next step, we selected 1–2 representative urban green spaces per each type (Jones et al. 2022). They represent spaces where according to our knowledge people spend a lot of their leisure time and recreate (Table 1; Figure 1).

3.3 Field survey

We chose the field survey method as it provides the most efficient way to systematically assess the residents' experience of the use of green spaces and non-green public spaces at numerous locations in the city. The survey was conducted from August 7th to October 19th, 2018. We designed the questionnaire where we asked survey respondents how they value selected cultural ecosystem services and disservices on a 6-point Likert-type scale (1 = Negligible, 2 = Very little, 3 = A little, 4 = Moderately, 5 = Very much, 6 = Exceptionally). In each given unit, we performed quota sampling and tried to find a demographically diverse sample of 100 respondents in each type of space analysed. The requirement for participation was that the respondent had lived in Ljubljana for at least one year before the survey was taken. Each respondent answered to the questions for the specific location, which represents the selected type of space. 100 interviews were carried out in each type of location, resulting in the overall sample of 900 people.

3.4 Statistical analyses

To test the differences in cultural ecosystem services across the urban space types, we performed the one-way variance analysis (ANOVA). Because the group sizes were almost equal, we were able to execute the parametric test regardless violating other two basic assumptions (homogeneity of variance, normal distribution) as the evidence show that these assumptions do not have to be met in case of equal group size (Field 2009). We also ran Tukey's *post hoc* tests to see if there are statistically significant differences between means of every group against every other group. To interpret the results, the Eta squared (η^2) was calculated to measure the effect size. We also calculated the overall score of all cultural ecosystem services and disservices for each type spaces by summing all the scores, with disservices being recoded. All the statistical analyses were done by the IBM SPSS Statistics 22.0 program.

4 Results and discussion

The average and overall scores across space types and cultural ecosystem services and disservices are presented in Figures 2–4. Sport facilities received the highest overall score, indicating that in Ljubljana they are not only sufficiently available and well-designed from a landscape planning perspective, but also function effectively as multifunctional spaces. For all cultural ecosystem services, the differences between the types were small but statistically significant with $p < 0.05$ (Table 2). If we exclude the old town and shopping malls from the analysis, the differences remain significant, except for the sense of place, natural heritage and stimulating inspiration (Table 3). The effect size (η^2) is reduced to small (below 0.06) in most cases (see Table 4).

Regarding both »other«, non-green types of public spaces, the results suggest that shopping malls have a considerably lower value compared to urban green spaces; as expected, the only exception was shopping and hospitality services. The old town even scored the highest in terms of aesthetics and cultural heritage, while it received the second highest overall score among the all types.

Recreation and sports is an exceptionally valuable cultural ecosystem service in sport facilities for 60% of respondents (mean score of 5.4). They are followed by urban forests (5.1) – probably due to their size and variety of recreational options they offer. Surprisingly, people do not consider small urban parks to be very valuable spaces for recreation and sports (3.2), which is just nearly higher than the old town (3.1) with statistically insignificant difference. This can be partly ascribed to limited size of these spaces and

lack of sports infrastructure. Shopping malls (2.2) are considered the least attractive from this point of view. There was a significant effect of the urban green type on values of recreation and sports, $F(8, 896) = 66.31$, $p < .001$. The effect size, eta squared (η^2), was 0.37 (or 0.21 if both non-green types are excluded), indicating a large effect, the largest of all groups of cultural ecosystem services.

Ljubljana residents consider sports facilities also to have the highest **educational value**, with 43% rating them as extremely valuable (mean score of 4.7), similar to old town (4.3), probably due to a rich cultural heritage. The respondents assign surprisingly lower educational value to the large city park (3.7), urban forests (3.6) and riverbank greens (3.4), which can be partly ascribed to the fact that this is not their primary function. The educational value is smaller also in small urban parks (2.9) and, understandably non-green shopping malls (1.9), which more than half of respondents (55%) rate as negligible in this respect.

The highest **aesthetical** value has the old town (5.0) which can be attributed to its rich cultural heritage. This is followed by the admittedly well-maintained green spaces, such as playgrounds (4.9), riverbank green and large urban park (both 4.8), and sport facilities (4.5). The urban forest (4.1) received an unexpectedly low rating; 13% of respondents even considered it a trivial or invaluable space in this regard. This is not consistent with the findings of Bieling et al. (2014) that more natural spaces are more attractive than anthropogenically transformed spaces. This arouses a question if urban dwellers are increasingly alienated from »untamed« nature even in Ljubljana, which is still relatively very green city compared to larger urban agglomerations. Visitors of shopping malls found them the least aesthetically pleasing (3.2).

From the **relaxation** point of view, most types of spaces performed very well, resulting in the highest average value among all the types (4.9) and mostly statistically insignificant differences between individual types. Respondents can relax best in the urban forest, the large city park, riverbank green spaces, and sports facilities (all 5.3) and playground (5.2). Below the average, we can find the old town, but also with

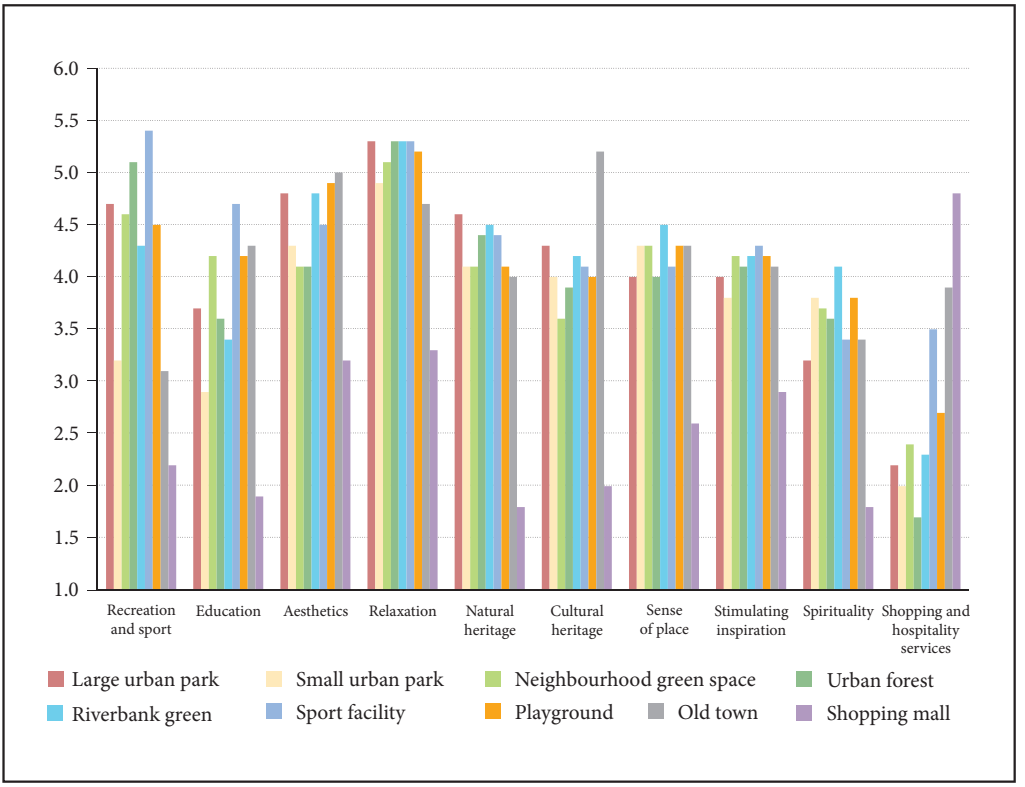

Figure 2: The average value of cultural ecosystem services across types of spaces.

a very decent score (4.7). Once more, the respondents are least able to relax in shopping malls (3.3). The results are in line with existing research showing the importance of open space for relaxation purposes compared to indoor spaces (Ito et al. 2024).

In terms of **natural heritage**, differences between spaces were very small. If we exclude shopping malls (1.8) from the analysis, they even become statistically insignificant. Value of natural heritage was the highest in the large city park (4.6), closely followed by riverbank green spaces (4.5). It is surprising that the urban forest (4.4) was not ranked higher than sports facilities (4.4), which also had the highest share of 32% of »extremely valuable« ratings. We can also interpret this as a result of careful design of sports facilities, which have a lot of greenery. The results are consistent with a study by Plieninger et al. (2015), which found that residents have less and less contact with natural spaces and therefore feel more comfortable in more urbanised environments. Discomfort in nature is becoming more and more evident especially for urban children (McAllister et al. 2012).

Speaking of **cultural heritage**, Ljubljana residents value the old town the most: 87% of respondents consider it very or extremely valuable (5.2), confirming that it is a hotspot of historical sites with a high cultural value (Tiran 2017). The neighbourhood green space (3.6) is found to have the lowest value among the types of urban green, also with statistically significant difference to some other types. The shopping malls (2.0), on the other hand, is rated the least valuable by respondents, with 53% going so far as to call it insignificant.

Table 2: The results of the ANOVA test across types of cultural ecosystem services.

		Sum of Squares	df	Mean Square	F	Significance
Recreation and sport	Between Groups	880.923	8	110.115	66.310	.000
	Within Groups	1487.900	896	1.661		
	Total	2368.822	904			
Education	Between Groups	578.466	8	72.308	38.095	.000
	Within Groups	1691.199	891	1.898		
	Total	2269.666	899			
Aesthetics	Between Groups	257.916	8	32.239	22.842	.000
	Within Groups	1266.040	897	1.411		
	Total	1523.956	905			
Relaxation	Between Groups	358.628	8	44.829	46.425	.000
	Within Groups	866.153	897	.966		
	Total	1224.781	905			
Natural heritage	Between Groups	587.392	8	73.424	42.479	.000
	Within Groups	1543.518	893	1.728		
	Total	2130.910	901			
Cultural heritage	Between Groups	567.881	8	70.985	41.188	.000
	Within Groups	1530.409	888	1.723		
	Total	2098.290	896			
Sense of place	Between Groups	264.135	8	33.017	19.234	.000
	Within Groups	1543.230	899	1.717		
	Total	1807.366	907			
Stimulating inspiration	Between Groups	150.748	8	18.843	9.994	.000
	Within Groups	1689.447	896	1.886		
	Total	1840.194	904			
Spirituality	Between Groups	335.667	8	41.958	20.225	.000
	Within Groups	1856.756	895	2.075		
	Total	2192.424	903			
Shopping and hospitality services	Between Groups	818.237	8	102.280	55.943	.000
	Within Groups	1643.617	899	1.828		
	Total	2461.854	907			

Table 3: The results of the ANOVA test across types of cultural ecosystem services (shopping malls and the old town excluded).

		Sum of Squares	df	Mean Square	F	Significance
Recreation and sport	Between Groups	276.219	6	46.037	29.909	.000
	Within Groups	1071.311	696	1.539		
	Total	1347.531	702			
Education	Between Groups	221.825	6	36.971	18.042	.000
	Within Groups	1420.032	693	2.049		
	Total	1641.857	699			
Aesthetics	Between Groups	62.459	6	10.410	7.747	.000
	Within Groups	935.248	696	1.344		
	Total	997.707	702			
Relaxation	Between Groups	15.462	6	2.577	3.845	.001
	Within Groups	466.532	696	.670		
	Total	481.994	702			
Natural heritage	Between Groups	20.688	6	3.448	1.918	.075
	Within Groups	1243.795	692	1.797		
	Total	1264.484	698			
Cultural heritage	Between Groups	31.958	6	5.326	2.826	.010
	Within Groups	1296.626	688	1.885		
	Total	1328.584	694			
Sense of place	Between Groups	17.275	6	2.879	1.721	.113
	Within Groups	1167.525	698	1.673		
	Total	1184.800	704			
Stimulating inspiration	Between Groups	15.915	6	2.653	1.447	.194
	Within Groups	1274.284	695	1.834		
	Total	1290.199	701			
Spirituality	Between Groups	46.761	6	7.793	3.433	.002
	Within Groups	1577.627	695	2.270		
	Total	1624.387	701			
Shopping and hospitality services	Between Groups	185.804	6	30.967	15.609	.000
	Within Groups	1384.783	698	1.984		
	Total	1570.587	704			

Table 4: The effect size of the space types across cultural ecosystem services.

	Eta Squared (η^2)	
	all types	non-urban green excluded
Recreation and sport	0.372	0.205
Education	0.255	0.135
Aesthetics	0.169	0.063
Relaxation	0.293	0.032
Natural heritage	0.276	0.016
Cultural heritage	0.271	0.024
Sense of place	0.146	0.015
Stimulating inspiration	0.082	0.012
Spirituality	0.153	0.029
Shopping and hospitality services	0.332	0.118

In terms of **sense of place**, indicating to evoke the most emotions (Gottwald 2022), green spaces on the riverbank are rated the highest (4.5). This is in line with several researches so far, as they report a strong sense of place associated with different inland blue space environments (Plieninger et al. 2018; Grace et al. 2023; Grzyb 2024). However, the differences between the types are among the smallest, except for the shopping malls (2.6). If we exclude both non-urban green types from the analysis, the differences are not statistically significant; however, the old town scored very high in this regard.

The results are very similar regarding **stimulating inspiration**. Respondents are most inspired by sports facilities (4.3), where they can practice a variety of sports activities. It is the variety of facilities that attracts visitors in large numbers (Ichsan et al. 2019). Very closely followed by other types, without statistically significant differences; once more, the least inspiration is found in shopping malls (2.9). Once again, with the exclusion of non-urban green types from the analysis, the effect of space type becomes insignificant.

In terms of **spirituality**, the differences are slightly bigger. Respondents are most attracted to the green spaces along the riverbanks (4.1), which is in line with the several researches, for example, urban residents have reported that walking beside rivers and lakes can provide spiritual healing (Dou et al. 2017; Smith et al. 2021). They are followed by small city parks and playgrounds (3.8 each), while shopping malls unsurprisingly receive the lowest rating (1.8). With non-green categories excluded, eta squared only indicates the small effect (0.03).

In terms of **shopping and hospitality**, shopping malls received the highest score (4.8). They are followed also by the old town (3.9). The highest score among the urban green spaces was attributed to sport facilities (3.5), which form a homogenous subset from this point of view and also seem to offer some of this services. The other types of urban green spaces considered scored much lower in this category. Research in recreational shopping typically emphasises the emotional worth of shopping and the pleasure realized from the activity. Such consumers of all ages spend more time in shopping malls than anywhere else except home, work and school (Bäckström 2006). On the contrary, some authors argue that shopping tends to be more stressful for consumers oriented towards traditional outdoor recreation (Albrecht et al. 2017).

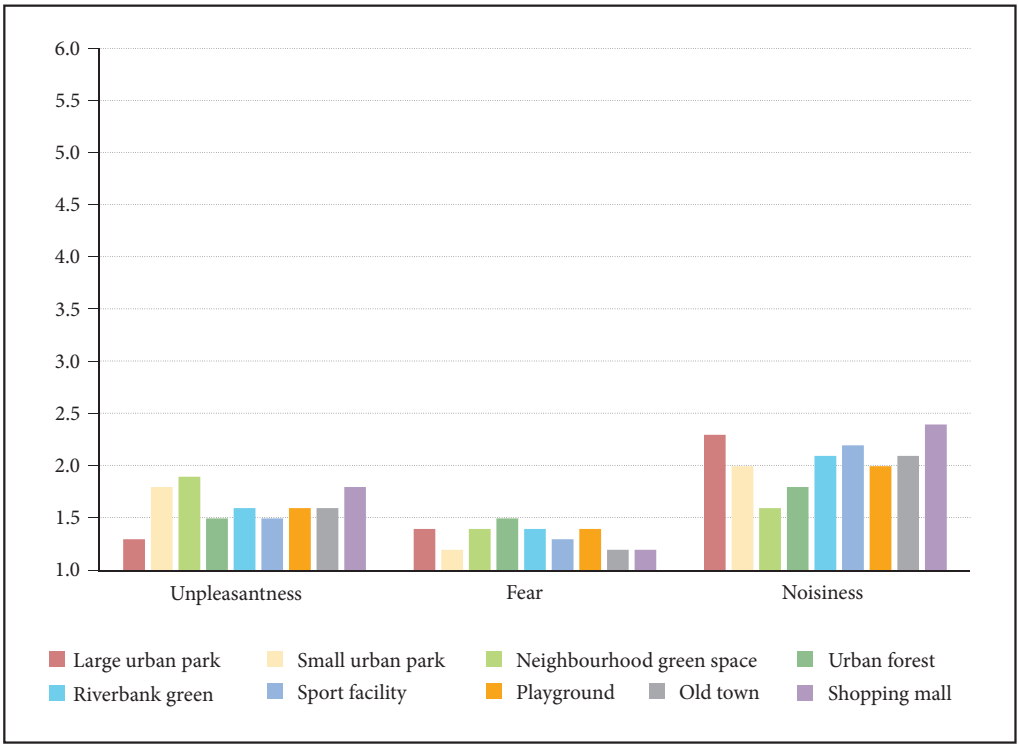

Figure 3: The average cultural ecosystem disservices' values across types of areas.

For all cultural ecosystem disservices (unpleasantness, fear, noisiness), the differences across the types were small (Figure 4) but statistically significant (Table 5). If we limit the analysis to urban green spaces, the differences remain significant and even bigger, except for fear, where they became insignificant (Table 6). In all cases, the effect size is small (Eta Squared below 0.06; Table 7).

Respondents generally do not see any of the studied disservices as problematic. From the viewpoint of **unpleasantness**, the lowest score was given to the large city park (1.3), with as many as 73% rating unpleasantness as negligible, while neighbourhood green spaces (1.9), small urban park and shopping mall (1.8) received the highest score, but still relatively low. However, a deeper insight to the results of the individual survey spaces show bigger differences within certain types (e.g., ranging from 1.3 to 2.2 for neighbourhood green space), suggesting that these results can be very sensitive to a case study selection.

The feeling of **fear** received similar scores across all types with *post hoc* tests showing statistically insignificant differences between individual types, ranging from 1.2 to 1.5. This confirms the image of Ljubljana as a safe city (Meško et al. 2008) and this does not seem to depend on location. Nevertheless, we speculate that the levels of fear in the nighttime could be higher and also with a higher differentiation between types. The highest value (1.5) is achieved by the urban forest, which is consistent with the findings of other studies that urban inhabitants are more afraid of »wild« nature (Tzoulas et al. 2007; Hofmann et al. 2012).

Table 5: The results of the ANOVA test across types of cultural ecosystem disservices.

		Sum of Squares	df	Mean Square	F	Significance
Unpleasantness	Between Groups	27.160	8	3.395	3.856	.000
	Within Groups	789.709	897	.880		
	Total	816.870	905			
Fear	Between Groups	9.664	8	1.208	2.260	.022
	Within Groups	479.510	897	.535		
	Total	489.174	905			
Noisiness	Between Groups	47.607	8	5.951	4.532	.000
	Within Groups	1177.850	897	1.313		
	Total	1225.457	905			

Table 6: The results of the ANOVA test across types of cultural ecosystem disservices (shopping malls and the old town excluded).

		Sum of Squares	df	Mean Square	F	Significance
Unpleasantness	Between Groups	22.130	6	3.688	4.490	.000
	Within Groups	571.724	696	.821		
	Total	593.855	702			
Fear	Between Groups	3.798	6	.633	1.066	.382
	Within Groups	413.408	696	.594		
	Total	417.206	702			
Noisiness	Between Groups	33.322	6	5.554	4.359	.000
	Within Groups	886.672	696	1.274		
	Total	919.994	702			

Table 7: The effect size of the space types across cultural ecosystem disservices.

	Eta Squared (η^2)	
	all types	non-urban green excluded
Unpleasantness	0.033	0.037
Fear	0.020	0.009
Noisiness	0.029	0.036

Noise, however, is somewhat more problematic with bigger differences between the types. Surprisingly, the lowest noise pollution was given for green spaces in the neighbourhood (1.6), while the highest noise pollution was attributed to shopping malls (2.4). However, even there, a large percent of respondents (36%) rated the noise level as negligible. When interpreting these results, we must be aware that the noise has various sources (traffic, people, industry) and can be very »place-sensitive« (Tiran 2017).

Running ANOVA for overall scores (by summing all ecosystem services and disservices; see also Figure 4) show statistically significant differences between the types, also in case of excluding non-green spaces from the analysis (Table 8 and 9). However, in the latter case, the Eta squared indicates that differences are very small (Table 10).

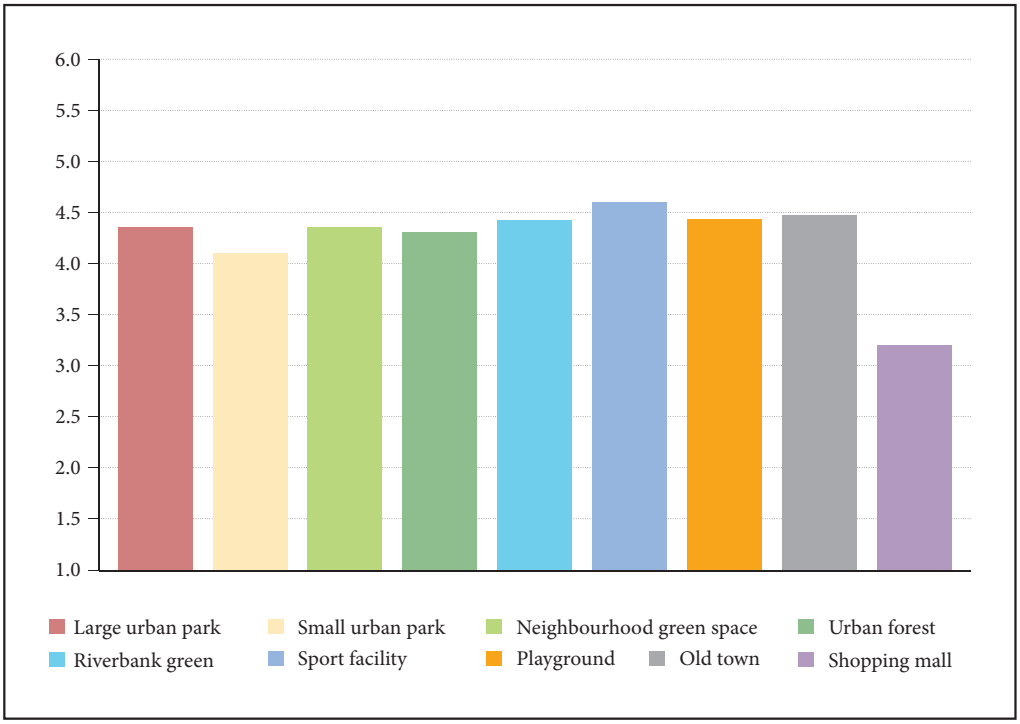

Figure 4: The overall mean scores of cultural ecosystem services and disservices across types of spaces.

Table 8: The results of the ANOVA test for overall scores of cultural ecosystem services and disservices.

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	22649.923	8	2831.240	34.377	.000
Within Groups	71735.184	871	82.360		
Total	94385.108	879			

Table 9: The results of the ANOVA test for overall scores of cultural ecosystem services and disservices (shopping malls and the old town excluded).

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	2248.990	6	374.832	4.488	.000
Within Groups	56375.609	675	83.519		
Total	58624.600	681			

Table 10: The effect size of the space types for overall scores of cultural ecosystem services and disservices.

	Eta Squared (η^2)	
	all types	non-urban green excluded
Overall score	0.240	0.038

5 Conclusion

The purpose of the research, executed in the city of Ljubljana, was to identify how cultural ecosystem services are valued by urban residents and what are the key differences between selected types of spaces.

The results show that the differences between types of urban green spaces in terms of the perceived value of their cultural ecosystem services do exist but they are generally smaller than expected. Overall, sports facilities received the highest mean score (4.6), with majority of respondents rating them exceptionally valuable for recreation and sports (5.4). Two non-urban green types performed very differently: shopping malls had far the lowest overall score (3.2), while the old town had the second highest one (4.5).

Urban forests did not score as well as expected. The results are somewhat surprising because urban forests are a type of space most similar to a natural environment. This fact also contrasts with the findings in the literature, which considers urban forests to be the type with the highest number of ecosystem services. A possible explanation could be that people are being increasingly alienated from »untamed« nature and seem to feel more comfortable in more urbanised environments.

The fact that shopping malls scored quite poorly on most aspects do not support understanding shopping as a recreational activity, even if people sometimes have to walk considerable distances to do so. On the other hand, promoting old towns as spaces for leisure seems to make sense because they possess numerous cultural ecosystem services, especially regarding aesthetics and cultural heritage.

We should also note some limitations of the research. As this questionnaire was used for the first time and respondents did not think of this topic before, the survey results could have certain measurement error, related to coping with the cognitive demands of attitude measures in surveys, also known as »satisficing« (Krosnick 1991). This could also explain somehow small differences between the types. Furthermore, the results could be sensitive to the case study selection and microlocation of field surveying.

The results presented in this study could contribute to the understanding and recognition of the concept of cultural ecosystem services. However, further testing of the methodology is needed, also in other types of cities according to size, population density and quantity and diversity of urban green spaces. As the research was executed before covid-19, it would make sense to repeat the research also in post-pandemic times to test the presumption of increased importance of urban green spaces (Noszczyk et al. 2022). Future studies should also investigate services and disservices in indoor recreational spaces, such as gyms and fitness centres and analyse the impact of services and disservices on subjective well-being. Our findings have important implications for stimulating active and healthy lifestyles and encouraging recreation not only in urban green spaces and natural environments, but also in other urban public spaces.

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