

Article

# Social Relevance of Ecosystem Services Provided by Urban Green Infrastructures: A Mixed Qualitative–Quantitative Case Study Approach

Sofia Baldessari <sup>1</sup>, Isabella De Meo <sup>2</sup>, Maria Giulia Cantiani <sup>3,\*</sup> and Alessandro Paletto <sup>1</sup>

<sup>1</sup> Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria (CREA), Research Centre for Forestry and Wood, 38123 Trento, Italy; sofia.baldessari@crea.gov.it (S.B.); alessandro.paletto@crea.gov.it (A.P.)

<sup>2</sup> Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria (CREA), Research Centre for Agriculture and Environment, 50023 Firenze, Italy; isabella.demeo@crea.gov.it

<sup>3</sup> Department of Civil, Environmental and Mechanical Engineering, University of Trento, 38123 Trento, Italy

\* Correspondence: maria.cantiani@unitn.it

**Abstract:** Urban green infrastructures (UGIs) are important elements of the urban matrix providing ecological functions and several ecosystem services beneficial to citizens. Recently, their contribution to the well-being and quality of life of citizens has been widely recognized by both the scientific community and policymakers. This study aims to explore the social relevance of UGI ecosystem services through a mixed qualitative–quantitative case study approach. First, a quantitative literature review was conducted using bibliometric network analysis, followed by a participatory process through a Scientific Café with a sample of Italian stakeholders involved in the UGIs' planning and management. The bibliometric network analysis identified 443 documents (from 2000 to 2024) primarily focused on three ecosystem services provided by UGIs—climate change mitigation, biodiversity conservation, and cultural services, such as health benefits, aesthetic, and recreation. The qualitative results of Scientific Café highlight a particular interest of stakeholders in cultural services such as physical and mental benefits provided by UGIs, as well as improving the urban aesthetic value. Additionally, the role of UGIs in microclimate regulation and heat mitigation was emphasized. The combined analysis of perspectives from the scientific community, policy-makers, stakeholders, and citizens provides a foundation for developing a participatory governance approach to UGIs.

**Keywords:** bibliometric network analysis; Scientific Café; participatory process; focus group discussions; green areas; Italy

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## 1. Introduction

In recent decades, the key role of green infrastructures in improving the quality of life and well-being of urban populations has become increasingly interesting in the eyes of both the scientific community and policymakers worldwide [1,2]. In 2020, the World Health Organization (WHO) recognized the contribution of green spaces to maintaining citizens' mental and physical well-being [3], while the 2030 Agenda for Sustainable Development emphasized the importance of ensuring universal access to safe, inclusive and accessible green and public spaces by 2030. In accordance with the Goal 11, Target 11.7 of the Sustainable Development Goals (SDGs), the inclusiveness and accessibility of green areas must be ensured especially for women and children, older persons, and

persons with disabilities [4,5]. At the European level, the environmental policy of the European Union (EU) has promoted green infrastructure both for rural and urban areas within its EU Biodiversity Strategy for 2030, emphasizing the pivotal role in supporting Trans-European network connectivity and enhancing the provision of ecosystem services [6]. Furthermore, in 2021 the European Commission promoted the Green City Accord (GCA)—a movement of mayors of European large cities—to improve the quality of life for all Europeans and accelerate the implementation of the European Green Deal (2020). Among the priorities of GCA, there is the conservation and enhancement of urban biodiversity, which can be achieved by increasing the extension and quality of green areas in cities [7,8].

Green infrastructures have been defined by the European Commission (2014) as a strategically planned network of high-quality natural and semi-natural areas with other environmental features, designed and managed to deliver a wide range of ecosystem services and protect biodiversity in both rural and urban settings [9]. The role of green infrastructures is of pivotal importance in urban areas due to the global phenomenon of population growth and urbanization [10]. In fact, the world's population is expected to increase to 9.8 billion by 2050, and the world's population living in urban areas will reach 68% of the total by 2050 [11]. In Europe, currently urbanized areas consisting of human settlements with a high population density cover 22% of EU territory; this is the result of a growth trend over the last 20 years that has led to a 3.4% increase in urbanized areas per decade [7]. Regarding the population, an increase of 30 million additional people in EU countries is expected by 2050 [12]. In a context of increasing urbanization and population density, urban green infrastructures (UGIs)—e.g., parks, gardens, allotments, community gardens, cemeteries, green roofs, urban orchards, urban and peri-urban forests—are assuming an ever-increasing importance [13].

In accordance with the definition provided by the European Commission [9], the UGIs provide several ecosystem services (ESs) essential for the psychological and physical well-being of the urban population, such as heat mitigation, noise reduction, flood protection, rainwater runoff regulation, microclimate and air quality regulation, outdoor recreation and aesthetic pleasure [14,15]. All these ESs fall into the four categories described by the Millennium Ecosystem Assessment (MEA) in 2005, as follows [16]: provisioning services (the products obtained from ecosystems for basic human needs); regulating services (those that control the states and rates of physical and biotic systems and processes in ways that are beneficial to humans); cultural services (the nonmaterial benefits that humans obtain from ecosystems); and supporting services (those necessary for the production of all other ecosystem services).

In the literature, many studies explored the importance of UGIs in the provision of different ESs from the biophysical point of view [17]. Some studies have focused on the water storage and water retention capacity of UGIs and the reduction in air temperature through evapotranspiration [18,19], while others have considered the role of UGIs in reducing the heat island and pollution island effects [20,21]. Furthermore, a more limited number of studies investigated the monetary value of environmental benefits provided by UGIs [22,23]. However, only a few studies have considered as their main focus the social perception of ESs provided by UGIs. Among these studies, Giannico et al. analyzed citizens' perceptions of the benefits provided by UGIs in 51 European cities [24], while Ostoić et al. focused on citizens' perceptions of the current state of urban forests and green spaces in seven Southeast European cities (i.e., Zagreb, Novi Sad, Beograd, Banja Luka, Sarajevo, Podgorica, Skopje) [25]. Recently, Molari et al. investigated citizens' perceptions of green walls in terms of attractiveness, their integrative role in the environment, and comfortable space in Turin and Lisbon [26]. In the Asian context, Kim et al. conducted a study on residents' perceptions of informal green spaces in Ichikawa city (Japan) [27],

while Chen et al. analyzed the ESs (i.e., air pollution removal, temperature reduction, rainwater runoff regulation, noise abatement) demand related to the UGIs in Guangzhou in southern China [28].

Starting from these considerations, the aim of the present study was to investigate the social relevance of ESs provided by UGIs through a mixed qualitative–quantitative case study approach. Firstly, a literature review was carried out, and subsequently a participatory process was undertaken in a case study in Italy. The main research question was whether the relevance of ESs assigned by the international scientific community (through literature review) converges with or differs from that assigned by local stakeholders (through an Italian participatory case study process). The present research was developed in the context of the Horizon Europe Project ForestValue2. ForestValue2 brings together owners and managers of national and regional Research, Development and Innovation (RDI) programs in eleven Member States of the European Union (EU) and in one Associated Country, with the aim of contributing to the alignment of national research and innovation policies.

## 2. Materials and Methods

The present study was structured in two steps. In the first step, a Bibliometric Network Analysis (BNA) was performed to investigate ESs provided by UGIs according to the international literature and producing quantitative data. The second step consisted of a qualitative analysis of ESs based on the opinions provided by a sample of Italian stakeholders involved through a participatory process and a related event (Scientific Café). The main ESs provided by UGIs that emerged from the BNA and the Scientific Café were compared to highlight convergences and divergences between the international scientific community and the stakeholders in an Italian case study.

A mixed qualitative–quantitative approach was adopted in this study in order to provide a more comprehensive understanding of a complex phenomenon, such as the role of UGIs in the provision of ESs useful for the well-being and quality of life of citizens. The quantitative data provided by the literature can offer a broad picture of the phenomenon of ESs provided by UGIs, while the qualitative information provided by stakeholders can offer an in-depth analysis of interventions and actions to improve the delivery of individual ESs. This type of data allows for the exploration of individuals' motivations, personal experiences and perceptions, which are often beyond the scope of quantitative methods.

The integration and comparison of the main ESs analyzed by scientific literature (quantitative approach based on bibliometric network analysis) with those perceived as more important by a sample of Italian stakeholders (qualitative approach) is the innovative aspect of this study.

### 2.1. Bibliometric Network Analysis: Methodology

The BNA is based on the combination of the bibliometric approach with the social network approach; the first one is used to analyze scientific productivity on a specific topic, while the second one is aimed at understanding the relationships among all components (e.g., keywords, concepts) of a system to identify the key role of some components of the system itself [29,30].

In the present study, the BNA aimed to identify and examine the international literature on ESs provided by UGIs. The peer-review publications were retrieved from the Scopus database (<https://www.scopus.com>) accessed on 2 September 2024 using the following string of keywords: (“urban forest\*” OR “peri-urban forest\*” OR “urban greening\*” OR “urban green infrastructure\*”) AND (“perception\*” OR “preference\*” OR “social”) AND (“ecosystem service\*” OR “environmental service\*”). These keywords

were searched in the titles, abstracts, and keywords of individual publications, considering as a timeframe the last 25 years (period from 2000 to 2024). All data were exported as “comma-separated values” (CSV) files and processed using the VOSviewer software (version 1.6.17). The VOSviewer is an open-access software used to create, visualize, and explore maps combining bibliometric reviews and network analysis [31]. The main output provided by VOSviewer is the network of connections among the bibliometric data grouped in clusters.

In this study, co-occurrence analyses were conducted to create network maps of the keywords used in the literature, highlighting the main ESs provided by green areas in the urban context investigated by the international literature. The results provided by the co-occurrence analysis can help us to identify the most important and recurring keywords. Consequently, the concepts investigated by the international scientific community are obtained and evidenced. The BNA on ESs provided by the UGIs was implemented using the two following indicators [31]:

- Co-occurrence (O)—the number of co-occurrences of two keywords is the number of publications in which both keywords occur together in the title, abstract, or keyword list;
- Total link strength (TLS)—the cumulative strength of the links of an item with other items.

The values of co-occurrence and total link strength of the single ecosystem service analyzed in the literature were used as a proxy for their importance in the eyes of the scientific community.

## 2.2. *Scientific Café: Methodology*

In the second step of the study, based on a qualitative case study approach, a participatory process was conducted to analyze the perception of a sample of Italian stakeholders on the relevance of ESs provided by green areas located in the urban context. Among the different methodologies that can be used in the participatory process, based on the utilization of diverse techniques, in the present research, a Scientific Café—also known as World Café or Apéritifs Scientifique—was conducted. As stated by Nesseth et al. [32], Scientific Café is a public discussion of socially pertinent questions and needs that have scientific content in an informal setting, with instruments to ensure effective and well-structured communication between scientists, practitioners, civil society, and decision-makers. In other words, these events are informal occasions for the general public (citizens) and/or stakeholders to meet scientists—e.g., researchers and experts—and to discuss scientific topics of interest to them [33]. According to Baldessari et al. [34], Scientific Café encourages informal, open discussions in small groups (less than 50 participants), with the advantage of bringing out new ideas and initiatives as a result of joint discussion.

In this study, a Scientific Café was conducted on 11 September 2024 in Italy in the city of Padua (Northeast Italy). Following the rule of organizing these forums external to the academic environment to favor an informal environment and facilitate interaction, the Café was conducted within a National Congress of Forests. This contributed to the success of the event, given high number of participants who were attending the Congress who could also participate to the Scientific Café.

The event was organized from June to August 2024, considering the following steps proposed by De Meo et al. [35]: (i) identification of the scientific topic; (ii) selection of the audience; (iii) logistical organization of the event; (iv) definition of the participatory technique; and (v) definition of the desired outcomes.

Concerning the topic, as previously mentioned, the scientific issue discussed was “The ESs provided by UGIs”, and in particular, how they are perceived by citizens and the possible management actions that can be taken to valorize their role in the UGIs.

The selected audience were stakeholders with a direct or indirect interest in the planning, management, and governance of UGIs, which were directly invited to participate by the research team or informed of the Scientific Café by reading the Congress program. In particular, technicians of public green areas, freelancers who deal with green spaces design, and representatives of private companies that manage green spaces were invited to participate in the event. The invitations to stakeholders were made following a stakeholder analysis—conducted between 20 and 31 August 2024—that allowed us to identify all the key stakeholders of the region (Veneto) and of the three surrounding regions (Friuli-Venezia Giulia, Trentino-Alto Adige, Emilia-Romagna). The stakeholder analysis, applied following the methodology proposed by Grilli et al. [36], is a technique that is used to identify all groups of people, organized or unorganized, who share a stake in a particular issue [37].

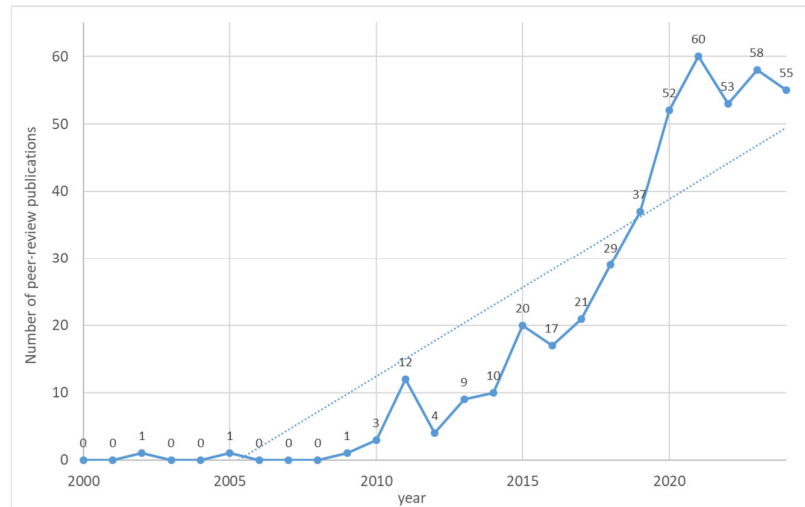
Regarding the logistical organization of the event, an in-person Scientific Café was preferred to collect a greater amount of information from the participants. Then, the organizing group established the schedule, including the overall duration of the Scientific Café, the length of expert interventions and the time allocated for the participatory process moderated by the facilitator. An expert on the topic and a facilitator were involved to support the organizing staff in introducing the issue and facilitating the event. Afterwards, the “Problem Tree” and “Strategy Tree” techniques were employed [35]. The participants, working individually or in small groups, wrote down on notes what they considered to be the main critical issues concerning the ESs provided by UGIs, which were then grouped with the facilitators by theme; ideas for solutions and strategies to overcome the elements of weakness were also proposed. At the end of the session, the facilitators presented a summary of the concepts that emerged.

The key ESs related to UGIs that need to be valorized through planning and management and the key actions undertaken to pursue such valorization are the main outputs of the Scientific Café. The Scientific Café participants answered based on their knowledge and skills; therefore, the outputs are mainly referred to the Italian context.

### 3. Results

#### 3.1. Bibliometric Network Analysis: Results

The results of the BNA show 443 peer-review publications on ESs provided by UGIs on the Scopus database. The first publications on this topic date back to 1999, focusing on the role of agroforestry systems and tree forests in offering environmental benefits to local communities [38]. However, the topic started to attract the attention of the scientific community in 2010, from which year an increasing number of publications per year has been noted (Figure 1). In particular, an average number of publications of 40.2 per year (SD = 17.3) is recorded for the period 2015–2024, with a range between a minimum of 17 publications in 2017 and a maximum of 60 in 2021.



**Figure 1.** Trend of peer-reviewed publications on ESS provided by UGIs from 2000 to 2024.

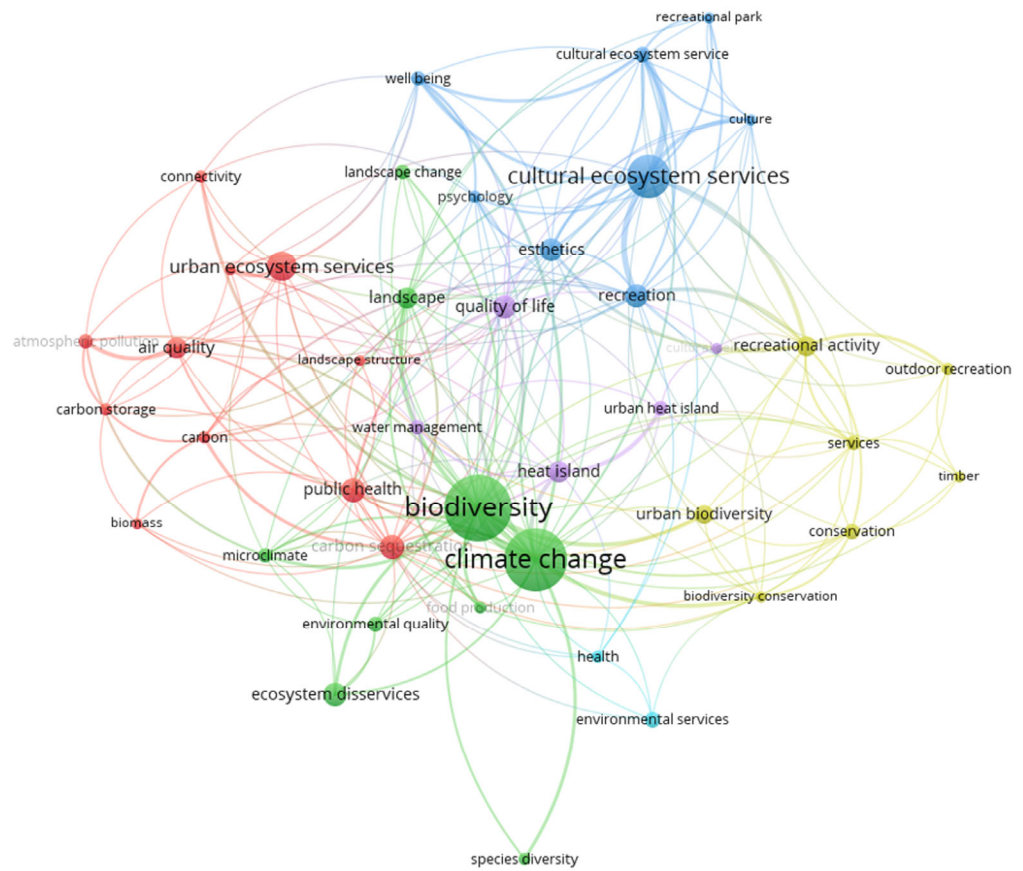
Observing the data on the relevance of ESs by category, the results of the BNA show sixteen keywords related to cultural services, nine related to regulating services, six related to supporting services, and only three related to provisioning services (Table 1). However, the ecosystem service with the highest TLS value is climate change mitigation in the regulating services category (O = 26; TLS = 309), followed by biodiversity in the supporting services category (O = 29; TLS = 296) and cultural ecosystem services (O = 22; TLS = 198). When aggregating keywords by category of ES, the results highlight that academics and researchers have found three main services in the category of cultural services: landscape aesthetics; outdoor recreation; physical and psychological well-being of citizens related to UGIs. Concerning regulating services, the scientific community has mainly focused on climate change mitigation. In fact, except for water management, all the keywords refer to climate change, air quality and related issues. Observing the category of supporting services, almost all publications have considered the various aspects of biodiversity. In addition, it is interesting to underline the low importance given to the provisioning services provided by UGIs. In fact, the few studies found have considered only three ESs—food production (O = 6; TLS = 65), the supply of woody biomass for energy use (O = 4; TLS = 61), and timber (O = 5; TLS = 57).

**Table 1.** Main keywords directly related to ESs provided by UGIs in the international literature.

Ecosystem Service	Co-Occurrence (O)	Total Link Strength (TLS)
Cultural services		
Cultural ecosystem services (plural)	22	198
Aesthetics	9	124
Cultural ecosystem service (singular)	7	118
Public health	9	118
Quality of life	10	113
Landscape	8	99
Well-being	6	89
Recreation	9	85
Recreational activity	6	76
Culture	4	65
Psychology	5	64
Landscape structure	5	59
Outdoor recreation	4	46

Landscape change	6	40
Well-being	4	40
Cultural services	4	17
Regulating services		
Climate change	26	309
Carbon sequestration	11	158
Air quality	7	114
Carbon	4	86
Water management	7	93
Heat island	7	81
Urban heat island	6	56
Microclimate	4	55
Carbon storage	4	51
Supporting services		
Biodiversity	29	296
Urban biodiversity	10	61
Biodiversity conservation	5	59
Connectivity	6	59
Species diversity	5	52
Species richness	4	16
Provisioning services		
Food production	6	65
Biomass	4	61
Timber	5	57

Figure 2 shows co-occurrence network maps with only the keywords directly related to ESs. Considering a minimum number of occurrences of a keyword equal to 5, of the 2888 total keywords identified, 221 meet the threshold. In the first step, the 221 keywords were divided into six clusters, and, subsequently, in the second step, 40 keywords directly related to the urban ESs belonging to five clusters were identified (Figure 2). With reference to this last network, the blue cluster includes most of the studies on cultural services, such as landscape aesthetic, recreation, well-being and health, while the purple cluster is exclusively focused on the mitigation of heat islands and the related quality of life of the residents. The other three clusters include those studies that have simultaneously considered multiple ESs or the synergies/trade-offs between them: carbon storage/sequestration and biomass use for energy in the red cluster; biodiversity and climate change mitigation in the green cluster; and outdoor recreation and biodiversity conservation in the yellow cluster.



**Figure 2.** Co-occurrence network map considering the keywords directly related to the ESs provided by UGIs.

### 3.2. Scientific Café: Results

At the Scientific Café, 40 stakeholders, including technicians of public administrations, freelancers working in urban green design studios, and private sector operators who deal with the management and maintenance of urban greenery, attended the event. Regarding the background of the participants, approximately 75% of the participants have a background in agricultural and forestry sciences/engineering, followed by 15% in environmental/natural sciences, and 5% in architecture/urban planning and social and economic sciences, respectively. The Scientific Café lasted a total of two and a half hours, with a 15 min break in between.

The Scientific Café produced as its main result the list of ESs provided by UGIs that should be valorized through management plans and specific actions (see Table 2).

According to the sample of stakeholders, the key ESs that can be enhanced through the sustainable and rational management of UGIs are the improvement of air quality and the mitigation of heat islands. In particular, the participants at the Scientific Café did not explicitly mention the roles of UGIs in carbon storage and carbon dioxide (CO<sub>2</sub>) sequestration, but repeatedly underlined the roles of parks, gardens, street trees, and urban and peri-urban forests in improving air quality. In accordance with the stakeholders' perspective, the key actions taken to improve green areas for microclimate regulation and air quality depend on the choices of tree, shrub and grass species associated with growth conditions. The sizes of urban parks and forests in the cities used for microclimate and heat mitigation were highlighted as amongst the key aspects by the participants.



Another aspect that emerged during the Scientific Café is the role of UGIs in the health, well-being and quality of life of residents. One keyword mentioned by some participants is “public health”, stressing that the importance of green areas in an urban context has grown in the eyes of citizens, especially following the restrictions imposed by the COVID-19 pandemic.

According to the stakeholders, UGIs are currently considered by citizens as a place to relax and reduce daily stress and anxiety in a natural environment close to home.

Based on the discussion during the Café, it is a widespread opinion among stakeholders that UGIs are valued more highly by citizens for their aesthetic value than for other key ecosystem functions. Therefore, to satisfy citizens’ requests, the aesthetic value of UGIs should be taken into careful consideration during both the design and daily management stages.

The role of UGIs in providing recreational and leisure opportunities was mentioned by participants in relation to physical well-being and social inclusion. Regarding physical well-being, attention has been directed towards UGIs as a place for outdoor sports activities (i.e., running, walking, biking), but also for relaxation and meditation (i.e., forest bathing and therapy). Considering social inclusion, participants evidenced that the UGIs must be places of aggregation and inclusion, especially for the elderly, children, and people with disabilities.

Finally, the role of UGIs as areas of urban biodiversity emerged as a shared point among the participants at the Scientific Café. This is an important aspect that must be taken into consideration in the management of UGIs, in order to promote some urban wildlife and vegetation diversity. To this end, the management aspects to be considered are promoting ecological connectivity between UGIs and other natural ecosystems, maintaining tree-related microhabitats, and improving diversity in terms of tree, shrub and herbaceous species.

**Table 2.** The ESs provided by UGIs and key actions for their valorization in accordance with the stakeholders’ opinions.

<b>Ecosystem Services</b>	<b>Key Actions</b>
<b>Regulating services</b>	
Heat islands mitigation	- Creating large-scale UGIs in urban areas
Climate change adaptation	- Selection of trees and shrubs in UGIs tolerant to climate change
<b>Cultural services</b>	
Public health, well-being and quality of life	- Choice of allergy-free trees and shrubs in UGIs
	- Diversification of tree species composition, structure, and layers (grass, shrub, tree)
Aesthetic value	- Restoring abandoned infrastructure areas (industrial buildings, ruins) through green spaces
	- Co-design UGIs with citizens to improve aesthetic value and recreational opportunities according to users’ preferences
Outdoor recreation	- Involving citizens in the maintenance of green areas, promoting greater participation and social cohesion
<b>Supporting services</b>	
	- Foster ecological connectivity by creating larger UGIs (e.g., urban forests) and building green corridors
Urban biodiversity (flora and fauna)	- Selection of native tree and shrub species in order to favor more mixed UGIs
	- Selection of fruticose tree and shrub species as a food source for wildlife

- 
- Maintaining tree-related microhabitats if they are not dangerous to public safety
- 

#### 4. Discussion

The results of the present study highlight that the international literature has placed greater importance—in terms of empirical studies conducted worldwide—on the regulating services provided by UGIs (i.e., climate change mitigation, heat islands mitigation), followed by supporting services (i.e., urban biodiversity conservation) and cultural services (i.e., public health, aesthetic value, recreational opportunities). Provisioning services have been the least widely investigated by the scientific community, being limited to the production of timber/biomass and food. This order of relevance among ESs categories was partly confirmed by the discussion with Italian stakeholders during the Scientific Café. The focus of the discussion among the participants was first on cultural and regulating services closely connected with the health and quality of life of citizens, followed by the conservation of the natural environment and biodiversity. Conversely, provisioning services provided by UGIs were not mentioned by any of the participants at the Scientific Café.

The comparison between the importance assigned to ES by the scientific debate and by the social perspective according to the MEA (2005) [16] framework is summarized in Table 3. The MEA framework developed in 2010 represents a turning point in the study of ESs at the international level. As highlighted by our literature review, since 2010, the number of scientific articles on ecosystem services provided by natural resources in general and by UGIs in particular has seen a sharp increase. The MEA Report has stimulated the scientific community to analyze nature’s ecosystem services from different perspectives on the one hand, and has raised awareness among policymakers and ordinary citizens on the benefits provided by nature on the other. More recently, IPBES Report (2022) [39] has challenged policy makers with a set of key messages on how to assess nature based on the multiple values of different stakeholders and institutions. Including multiple different perspectives is key to achieving the objectives of the 2050 Vision for Biodiversity and the 2030 Agenda for Sustainable Development [39]. In this political context, our study sought to provide a comparison between the perspectives of the scientific community and those of the technicians and practitioners who manage UGIs.

**Table 3.** Comparison between the importance assigned to ES by the scientific community and by the general public (++++ = very high importance, +++ = high importance, ++ = medium importance, + = low importance, o = negligible importance).

Ecosystem Services	Scientific Debate	Social Perception
Provisioning services		
Food production	++	o
Timber and biomass production	+	o
Regulating services		
Heat islands mitigation	+++	++++
Climate change/Carbon sequestration	++++	++
Water management	++	o
Cultural services		
Public health, well-being and quality of life	+++	++++
Aesthetic value	+++	+++
Outdoor recreation	+++	+++
Supporting services		
Urban biodiversity (flora and fauna)	++++	+++

The results of our study reveal that the strongest point of convergence between the quantitative and qualitative data, that is, between the scientific literature and the stakeholders' perspectives, is the role of UGIs in promoting the health, well-being and quality of life of the urban population. Our sample of respondents emphasized that improving the mental and psychological health of citizens is the most important contribution of UGIs, especially in large cities. Participants in the Scientific Café also underlined that UGIs should primarily be managed with a focus on the psychophysical wellbeing of cities' communities. In fact, physical and mental health is closely linked to the quantity and quality of UGIs.

In other words, UGIs that foster individual reflection and social relations are conducive to people's mental well-being, while UGIs that enable physical activities are conducive to people's physical well-being.

In the literature, some authors have studied the relationship between different types of UGIs and people's mental well-being, highlighting that access to UGIs can reduce stress associated with loneliness by providing opportunities to both cultivate personal relationships and engage in community activities [40–42]. In addition, UGIs are perceived as places to cultivate personal well-being, both physically through the practice of outdoor sports (e.g., jogging, walking, biking) and psychologically through relaxation in a natural environment [43]. Regarding this last aspect, a systematic literature review highlighted that exposure to green areas leads to a reduction in stress, a positive mood, and less depressive symptoms [44]. Moreover, numerous studies have emphasized the growing awareness of citizens of the role of UGIs for their effects on physical and mental well-being following the COVID-19 pandemic. A further critical aspect highlighted by the international literature is the methodological difficulty of mapping and evaluating cultural ecosystem services due to the fact that they are intangible benefits [45,46]. In fact, these benefits are firstly subjective, as they are linked to the sphere of individual values, and secondly dependent on the socio-cultural context [47]. Therefore, studies like this one provide empirical data related to a specific context, and can be of help in the creation of a global database useful for highlighting differences and convergences between categories of stakeholders and countries.

In Italy, three empirical studies conducted between 2020 and 2022 found that the restrictions during the COVID-19 pandemic waves in Italy positively influenced citizens' perceptions of UGIs, leading to a greater interest in green areas [2,13,48].

Furthermore, those authors found an increased need to frequent parks and gardens close to their home during the COVID-19 lockdown. Similar findings were reported for other European cities (see Derks et al. and Beckmann-Wübbelt et al. for the cities of Bonn and Karlsruhe in Germany [49,50], Venter et al. for Oslo in Norway [51], and Da Schio et al. for Brussels in Belgium [52]).

Conversely, Lopez et al., in a study conducted in New York City, found that the numbers of citizens who attended UGIs during the COVID-19 pandemic remained unchanged [53]. Although most of these studies were conducted during or shortly after the period of the COVID-19 pandemic restrictions, it is important to note that public awareness of the mental and physical health benefits of UGIs has persisted, as evidenced by the results of our Scientific Café.

Another cultural service emphasized by both the scientific community and participants in the Scientific Café is the aesthetic landscape value related to the presence of UGIs. According to our sample of stakeholders, this service was considered less relevant than the previous ones, but the literature has attributed considerable importance to this theme.

In fact, Dushkova et al. assessed the attractiveness of UGIs (urban parks) in Russia and China, considering among the various factors the aesthetic value of these green areas

[54], while He et al. estimated the aesthetic landscape value of urban forest parks in Canada based on the Five Senses Theory [55]. As highlighted by several authors, the size and features of UGIs—such as tree species composition and structure—are key factors that influence citizens' aesthetic perception [56,57]. In line with these findings, our sample of stakeholders emphasized the importance of urban and gardens parks, along with the diversification of structural and tree species diversification. Additionally, they suggested that restoring and redeveloping abandoned infrastructure areas, such as industrial buildings and ruins, through green spaces would be a valuable strategy.

Regarding regulating services, our results show that, according to our sample of Italian stakeholders, the most important ESs provided by UGIs involve the regulation of microclimate and heat. Conversely, climate change mitigation and runoff reduction were underemphasized by the participants at the Scientific Café. This represents the main divergence between the opinions of our sample and the literature on the subject. In fact, several studies have investigated and emphasized the capacity and main role of UGIs in mitigating climate change through the reduction in atmospheric CO<sub>2</sub> [10,58,59].

As highlighted by the international literature, UGIs influence the urban microclimate through temperature regulation and carbon storage [60]. Many studies have also investigated the ability of different types of UGIs to reduce air temperature through the evaporation of water from surfaces (evaporation) or plants (transpiration) [61].

Finally, our results underline that urban biodiversity is a key ecosystem service provided by UGIs, according to Italian stakeholders. Specifically, our sample emphasized the role of UGIs as habitat and food sources for urban wildlife. In the literature, some studies have investigated the role of UGIs as an ecological network that promotes urban habitats and supports biodiversity, or acts as a refuge and habitat for target species of the urban environment [62–64]. To foster and maintain urban biodiversity, it is necessary to pay particular attention to the presence of a network of UGIs, ensuring adequate size, and carefully selecting tree and shrub species.

Our results regarding the importance of ESs assigned by the stakeholders are comparable with the results of other studies conducted with in-depth interviews, focus groups or scientific cafés. In a study conducted in Germany, Riechers et al. [65] interviewed three categories of stakeholders (professionals in planning and decision-making positions at three different institutions) and highlighted the key importance of some cultural ecosystem services, such as the aesthetic beauty of the landscape, psychological well-being, and sense of place through nature. Through focus groups, Kičić et al. [45] investigated the importance of cultural ecosystem services provided by the UGIs of the city of Zagreb. Those authors highlighted that, according to the citizens' opinions, the most important ESs are place attachment, aesthetic and recreation. In another study, Slovák et al. [66] analyzed the studies that used the focus group methodology to collect qualitative information on the importance of cultural ESs. Those authors found that the most investigated cultural ESs are recreation, aesthetics, education, and spiritual value. Palacios-Agundez et al. [67] investigated the importance assigned by stakeholders in the Basque Country (Spain) to ESs using the World Café methodology. Those authors found that the four most important perceived ESs were air quality regulation, water regulation, biodiversity, and environmental education. However, that study used a similar methodology to ours, but considered ESs in general and not those provided by UGIs specifically. In summary, the international literature on the social demand for ESs provided by UGIs has highlighted the high importance of cultural services compared to other categories (i.e., provisioning, regulating, supporting), as highlighted by our study.

## 5. Conclusions

The present study adopted a mixed qualitative–quantitative case study approach to investigate whether stakeholders' prioritizations of ESs provided by UGIs are in line with those of international research. This approach is potentially useful in providing advice to decision-makers to guide future UGIs planning. On one hand, the results of scientific research offer support in the management of UGIs to improve the provision of key ESs in a given context (e.g., improving air quality, providing outdoor recreation services, improving urban microclimates by providing cooling). On the other hand, stakeholders' perceptions and preferences are important in better directing decision-makers' choices in satisfying social demands. In particular, UGI managers and planners can enhance the most important ESs in the eyes of stakeholders and citizens, thus increasing the social acceptance of choices and raising mutual trust between policymakers and local communities.

Our results show that most of the ESs studied by the scientific community also coincide with those considered most important by stakeholders, such as urban biodiversity conservation, heat islands mitigation, and the improvement of the public health and well-being of citizens. However, some others—such as climate change mitigation through carbon storage and sequestration—have attracted more attention in the international scientific community.

The main hypothesis of this divergence is that the scientific community is interested in investigating the innovative aspects of a topic (e.g., ESs rarely investigated in the past literature) or those with high relevance at the international political level (e.g., international climate change policy), while ordinary people are more interested in everyday aspects of life such as using UGIs for recreational, aesthetic or wellness purposes. A second possible hypothesis regarding the divergence between the scientific community and stakeholders concerning the role of UGIs in climate change mitigation is the complexity of understanding how forests and green infrastructures contribute to climate change mitigation, particularly in terms of carbon storage and sequestration. These processes are indirect and long-term, making them harder for the public to perceive, compared to more immediate benefits like temperature regulation or recreational spaces. While the role of UGIs in mitigating climate change is well-documented in scientific research, it may seem too abstract a concept to stakeholders without a scientific background. Therefore, raising awareness about the long-term environmental benefits of UGIs, through education and targeted communication, could help bridge this gap.

From a methodological point of view, the main strength of this study is in providing an approach that integrates a quantitative analysis of the literature based on BNA with stakeholder involvement through participation, which is capable of collecting qualitative information. Conversely, the main weakness of the present study is having involved local stakeholders from only one country in a single participatory event. Another limitation of the study is presumably related to the composition of the sample of stakeholders who participated in the Scientific Café. In our sample, there were no representatives of the industrial production sector, and this fact may have influenced the negligible importance assigned to provisioning services (food, biomass and timber production). Conversely, the high number of public administrations representatives may have further emphasized the importance of services related to citizens' well-being and quality of life.

Future steps will be to extend the research to other EU countries involved in the ForestValue2 project and to organize a cycle of Scientific Cafés following the same standard procedure in different cities in each country.

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