

Article

Quantifying Landscape and Social Amenities as Ecosystem Services in Rapidly Changing Peri-Urban Landscape

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Abstract: The peri-urban landscape is a highly dynamic area between the urban zone and the rural belt. The heterogeneous natural landscape around the cities provides several ecosystem services, but progressive urbanization affects it and results in the loss of biodiversity, greenery, and related benefits. This study attempts to quantify the social amenities associated with ecosystem services in the peri-urban landscape of the Gujrat district, in Pakistan, by using the Contingent Valuation Method (CVM). The results show that the peri-urban landscape provides amenities for the well-being of the community. Such amenities and the related recreational opportunities represent ecosystem services that are highly regarded by the residents, so much so that a significant willingness to pay can be associated with them. Therefore, this study highlights that natural areas and green areas' landscapes must be taken into account when facing the social and economic necessity to provide for city expansion in developing countries, especially when aiming to achieve development in alignment with the Sustainable Development Goals. The ecosystem services and their evaluation are confirmed as indispensable tools for conservation and fortification of landscape development.

Keywords: ecosystem services; developing countries' environments; peri-urban landscape; contingent valuation method; sustainability; SDGs

1. Introduction

Currently, urbanization is on the rise. Government and local decision-makers are trying to focus on the development of cities while also ensuring a pleasant and healthy urban environment, which is intrinsically associated with the existence of greenery [1]. Urban sprawl towards the peri-urban landscape is known as one of the major causes of strong environmental problems [2], including risks to ecosystem stability, pressure on local resources, environmental pollution, and reduction of the agricultural land area and its soil fertility as well [3]. Urban and peri-urban areas in the world are affected by noise,

traffic, crowding, and pollution, which makes them and their inhabitants more vulnerable to natural hazards.

Today, it is well known that, even at different geographical scales, the ecological benefits ensured by the ecosystems [4], known as ecosystem services (ES) [5,6], are well accounted for in terms of well-being and the reduction of social vulnerability [7]. Nevertheless, many international reports and scientific studies prove the ongoing environmental degradation in urban and peri-urban spaces [8,9], which is not only dangerous for nature and ecological functioning but also threatens human beings [10]. These risks collide with the recommendations of the United Nations, formalized in the Sustainable Development Goals (hereinafter SDGs) for the present decade of human history [1].

Indeed, loss of biodiversity causes even more environmental problems not only for humans but also for natural resources because of the disturbance of several species' life cycles [11]. Comparing the results of the study with previous literature, the loss of urban green spaces and biodiversity will increase the vulnerability of urban areas to climate change [2]. Many of these problems have been acknowledged by decision-makers, urban planners, urban ecologists, and scientists all over the world [12]. According to the most famous reports [3], human-induced Land Use Change (LUC) has been recognized as the principal factor that dramatically impacts ecosystem processes and structure, and consequently the ES they can provide [13]. However, the availability of data associated with land use change and ecosystems in the urban world is a challenge, as found in the past literature [4]. As a result, the ability of an ecosystem located in the vicinity of a city to support the lives of human beings and environmental sustainability has decreased [14].

In the peri-urban landscape, biodiversity provides a variety of ecosystem amenities to urban and peri-urban residents as well [15]. Understanding and recognizing these multiple services is important to identify and communicate the interdependency between humans and the landscape. The interaction between ecosystems and human life, however, is characterized by complexity and multiple interactions. Due to their complexity, ES are often difficult to measure [16,17], especially in the case of peri-urban amenities and cultural ES, which are very challenging to account for [18].

Therefore, there is a strong need to apply multiple approaches, especially when dwelling on social equity in the use of resources and ES in developing countries [5]. Both quantitative and qualitative methods can be used to evaluate the benefits that nature offers to people and to further optimize the opportunity to realistically achieve the SDGs [5]. Usually, ES valuations are based on the distribution of landscape services in the area under investigation [6]. The valuation of the ecosystem services in the given area, moreover, can be economical or non-economical [19–21]. Among the methods that assign a monetary value to the ES, the contingent valuation method (CVM) estimates the values that people attribute to services, goods, or benefits coming from nature [22–24].

CVM has been mostly adopted for estimating the non-market or non-use value related to ES [7], turning out to be useful when assessing the ES potential in hypotheses of different scenarios or in a landscape that can change very quickly. In the context of landscape planning with ES, the assessment of the peri-urban landscape status and the evaluation of the related ES provide a basic formulation for planning and defining the future domains for peri-urban infrastructure development [13], trying to overcome the challenges in reaching full incorporation into policy of people's interest in aesthetic values and cultural services.

This work is organized as follows: In the first part of the study, a multidisciplinary approach for studying peri-urban landscapes in the rapidly developing city of Gujrat is presented. In the second part of the study, the research tries to highlight the relationship between amenities ensured by green areas and their benefits for local people in the form of ES [25], associating the value that people give to them. This study, therefore, provides a possible application of landscape and ES assessments for integrating the interests of stakeholders, urban planners, citizens, and government in order to implement the SDGs in Pakistan policy-making, aiming to inspire also other countries [26].

2. Materials and Methods

2.1. Study Area

Gujrat is the capital of the Gujrat district, in the Punjab region of Pakistan (Figure 1). The selection of the area makes the study idea for the proposed objectives as the population of the study area is increasing and green area is finishing, which creates a problem for the local residents in the form of loss of urban biodiversity.

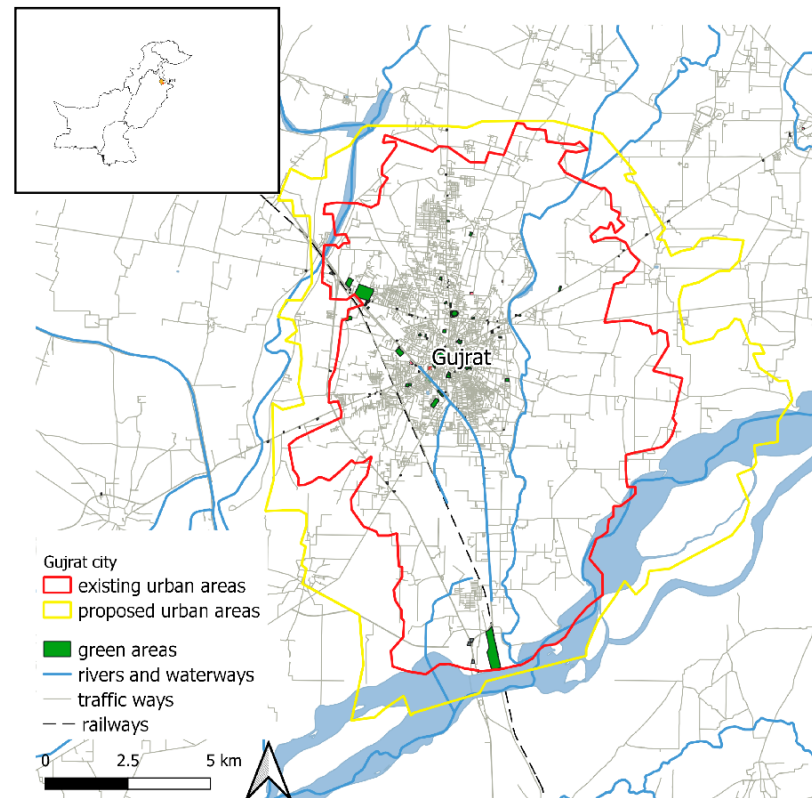


Figure 1. Map of the study area. In the upper left corner, the location of Gujrat in Pakistan is shown.

Gujrat is an old city. “Ude-Nagri,” its ancient name, literally means “the city of pleasant scents and greenery.” Before 1993, the nearest district, Mandi Bhawal Din, was part of Gujrat. However, after 1993, this district became separate [27]. Gujrat city then developed as an industrial city of Pakistan since the era of “Akbar” (the Mughal Empire in British India, from the 16th to the 18th century), resulting in it being one of the fastest-growing capitals of the district, to the point that today it is the 18th largest city of Pakistan [28]. The neighboring regions around this region are Sialkot, Gujranwala, Jhelum [29], and Bhimber Azad Jammu Kashmir (AJK). The total population of this region, including the peri-urban areas, is 390,533 persons, according to the population census of Pakistan 2017 [30].

The current area of the city is 65 Km² [30]. As an industrial city, its extension is expected to grow in an unsustainable pattern unless wise rules and governance suggestions are applied. The population of the surrounding region, indeed, constantly migrates to this urban area and settles there gradually, resulting in continuous urban sprawl.

Green areas in Gujrat city (Figure 1) were mapped by retrieving OSM data from the OpenStreetMap Repository through QGIS software. The data validation was done by digitizing the green area with Google Earth to verify and justify the geographical feature present on the land surface. Moreover, Landsat satellite images were used to validate the resulting map of green spaces in figure no. 4 in Gujrat district with reference to the year 2020. To do this, Landsat-8 Enhanced Thematic Mapper scenes, with 30 m resolution per pixel, were used to provide the spatially explicit base for the evaluation of green areas and of the related potential to provide ES.

In the study area, the green spaces can be divided into two major categories, including formal and informal green areas. In addition to the formal green spaces, including parks, green belts along the roads, and green lawns in public intuitions, about four parks (Nawaz Sharif Park, Children Park, Ayub Park, and Inayat Park) are available for the population of Gujrat, while the informal green spaces, including the trees and agricultural fields, are in the study area.

2.2. Research Methodology

This research is quantitative and based on primary and secondary data analysis. A specially designed questionnaire was used for the collection of primary data, distributed by random sampling in the urban and peri-urban areas of Gujrat city. The ideal sampling size was calculated by relating accuracy, reliability, and the cumulative standard error of the survey by using the variance of the arithmetic variable (paid amount for peri-urban green) in the sample. To check the reliability of the questionnaire and estimate the population standard deviation, a pilot survey was also done before the collection of primary data. Such a pilot study was useful to also avoid running into population clusters with social or psychological disorders that could have affected the validity of the results. According to the nature of the required data, the structure of the questionnaire was categorized into three sections: the socio-economic information section, the peri-urban green space information section, and the willingness to pay section [31,32]. The questionnaire also includes questions associated with the respondents' worries about environmental issues. One section of the questionnaire asked questions referring to local environmental issues, namely air pollution, smog (especially in winter), solid waste, and noise. Another section was related to the global environmental issues of climate change and the greenhouse effect. The survey was coded on a five-point Likert scale. The questionnaire template is available in Supplementary Materials S1.

2.3. Contingent Valuation Method (CVM)

CVM is an evaluation method traditionally applied to quantify the willingness to pay for ES through the administration of a questionnaire [8]. CVM relies on the social acceptance values of distinct urban arrangement scenarios and the consequent effects on population wellbeing [9]. The amount that participants declare to be eventually willing to pay or contribute to avoid a change or to maintain a better situation is determined through an analysis of their preferences; thus, CVM is considered mostly an economic assessment technique. Indeed, CVM is regarded as capable of estimating in monetary terms the value of non-marketable assets, such as ES provided by green belts along roadsides, parks, plants, trees, and green spaces [10].

In the study area, the method assesses whether and how the residents currently use the landscape of urban and peri-urban green areas and the related ES, without the possibility that they can do so in the future. The study aimed to assess the quality and quantity of these services that affect the welfare of urban and peri-urban people in the local area by directly asking the local population about their willingness to pay to maintain green areas and their contributions to well-being. The accessibility, use, and level of visitors to green spaces in the study were measured in terms of the ANGST (Accessible Natural Green Spaces Standard Model). This model measured the population size, distance of green areas from settlement areas, and size of green areas/park in hectares. Unfortunately, our study found the current situation of the study is not according to the rules and standards of this model. A few parks are available for a large population, which creates different issues in terms of their catchment area and unavailability of space.

Therefore, the method relies on querying individuals about their willingness to pay for particular peri-urban landscape services, or ES [33].

The answers were aggregated and visualized through descriptive statistical analyses, and answers related to worries were weighted based on the score reached on the Likert scale.

3. Results

150 people filled out questionnaires. Our study's main focus was on educated participants, with 43% acknowledging the values of peri-urban green areas (ES). 44% of these are men, while 56% are women. These responders come primarily from the Gujrat area and are part of the physically active population, with 40% being between the ages of 15 and 30, and a significant group of age classes from 31 to 45. Mature and elderly people are also represented (Table 1). The education status of the participants was mostly high; nevertheless, 8% of the sample included illiterate people. As for employment, 39% of the interviewed people were students, 19% were public servants, 21% were households, and 7% were unemployed (Table 1).

Table 1. Socio-economic characteristics of the respondents.

Gender	Frequency	Employment	Frequency
Male	(65) 44%	Student	(37) 25%
Female	(85) 56%	Public Servant	(29) 19%
Age (Years)		Private Employment	(32) 21%
15–30	(60) 40%	Household	(31) 21%
31–45	(40) 27%	Unemployed	(11) 7%
46–60	(28) 19%	Financial Status	
61>	(22) 15%	Up to 5000	(12) 8%
Marital Status		5001–10,000	(14) 9 %
Unmarried	(62) 41%	10,001–25,000	(39) 26%
Widowed	(25) 17%	25,001–40,000	(36) 24 %
Married	(63) 41.5%	More than 40,000	(49) 33%
Education			
Illiterate	(12) 8%		
Primary	(9) 6%		
Matric	(28) 19%		
Intermediate	(35) 23%		
Graduate	(23) 15%		
Master	(43) 29%		

Table 2 shows the results regarding the respondents' concern for environmental issues.

Table 2. Distribution of responses on environmental issues.

How Worried Do You Feel about This Aspect?	Local Environmental Concerns	Global Environmental Concerns
	Frequency (%)	
Not at all	(28) 19%	(41) 27%
A little bit	(42) 28%	(37) 25%
Enough	(50) 33%	(41) 27%
Very	(19) 13%	(21) 14%
Very much	(11) 7%	(10) 7%
Total	(150) 100%	(150) 100%

As regards the preference of the respondents who inhabit the peri-urban area, only 9% of participants declared to prefer walking in the urban parks, while 91% of people walk in open green peri-urban green spaces in the surrounding areas. The familiarity of the local population with the peri-urban green spaces of Gujrat is quite high, with four out of five interviewed persons stating to visit these peri-urban spaces on average on a daily basis.

The answers to the question “How long do you stay in peri-urban green spaces?” show that 15% of the sample stay less than one hour, 34% stay 1–2 h, 33% stay 2–3 h, and 18% stay 3–4 h.

The valuation of the willingness to pay for maintaining green areas shows that 57% of the interviewed people declared they would be available to contribute to the conservation of green spaces as well as for the establishment of new ones, while 43% declared they would refuse because they have low income. Figure 2 shows the results of the amount the respondents would pay in local currency. Here it can be deduced that an abrupt change occurs when shifting from PKR 0–200 to PKR 201–400, and that even considering the survival function excluding zero values, less than 20% of participants would pay more than PKR 800.

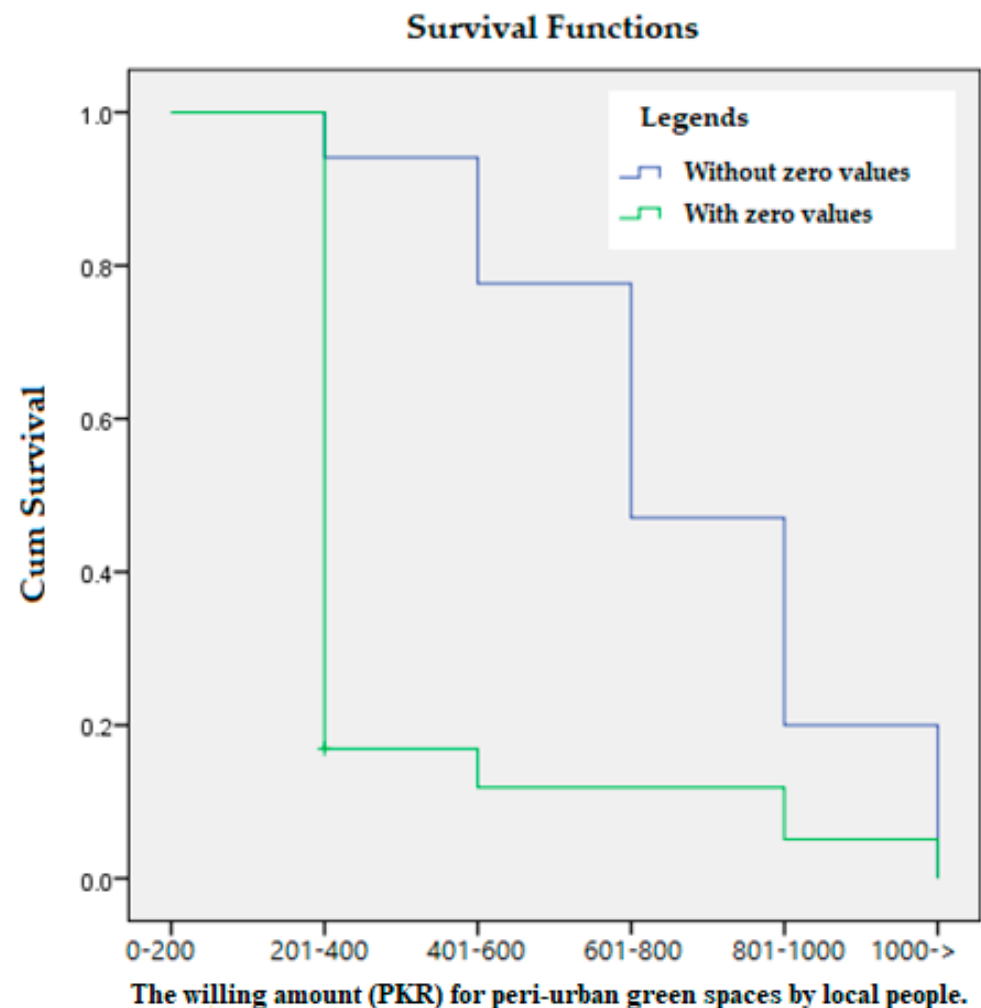


Figure 2. The amount in PKR for peri-urban spaces by local. The green line includes zero values; the blue line represents the answers without zero values.

Three out of four people responded positively to volunteer donations for the development and enhancement of urban and peri-urban green areas. Nevertheless, it has emerged that for the low-income portion of the population, the imposition of any type of fee could represent a problem.

Figure 3 shows the people’s perception of the peri-urban green area of Gujrat in terms of the abundance of green spaces. The majority of interviewed persons answered that Gujrat is a city lacking noticeable urban and sub-urban green spaces.

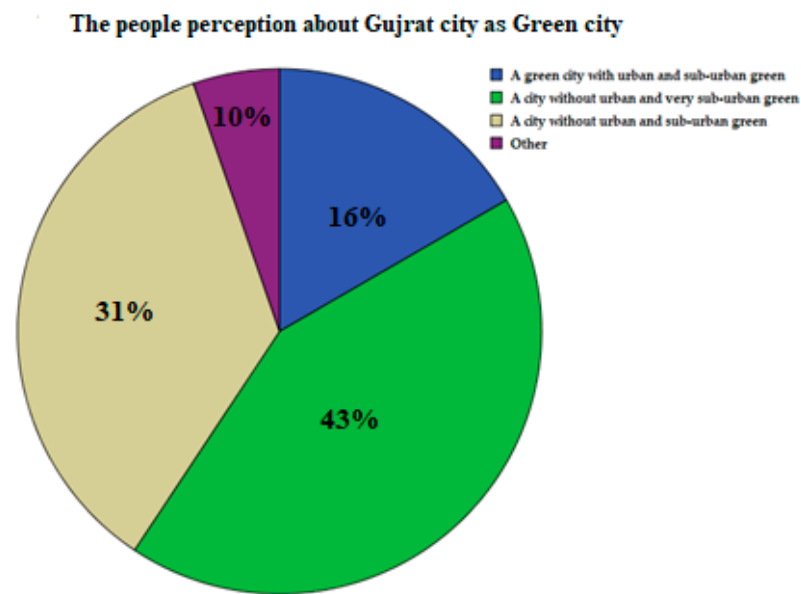


Figure 3. People's perception of Gujrat as a green city.

According to our green areas map and data provided by the municipal corporation of Gujrat, the total urban green area including parks, courtyards of educational institutions, and green belts is 3,117,566 m², whereas the total area of private green spaces (including private lawns, yards, etc.) is 378,813 m². The current spatial distribution of the green space in Gujrat city is shown in Figure 4. We calculated that the area of public green spaces available per resident in Gujrat is 8.9 m².

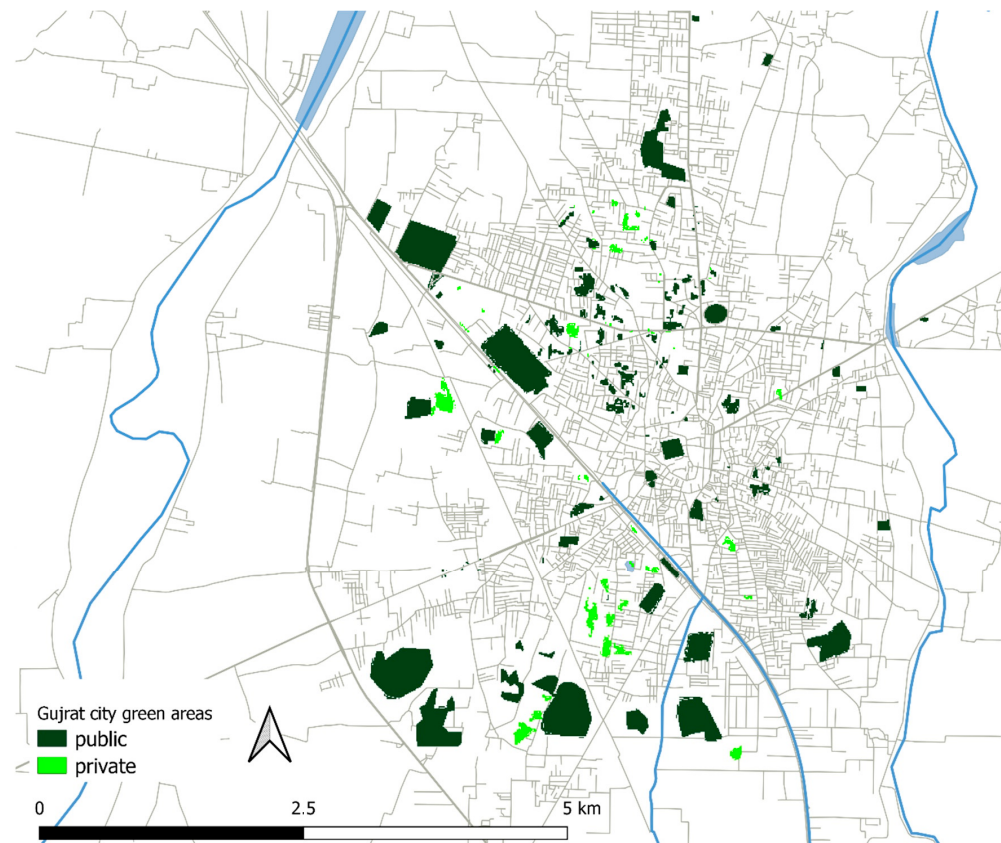


Figure 4. Public and private green spaces in the city center of Gujrat.

4. Discussion

Nowadays, governance emphasis in planning local development is turning toward the creation of appealing and healthful urban areas. Decision-makers seek to fulfill the goals advocated by UN Agenda 2030 because they are required to offer “universal access to safe, inclusive and accessible, green and public spaces” for their population, according to the 11.7 SDG [34].

Green spaces encompass a wide range of places, from woodlands and green belts to small private gardens and green roofs or patchy orchards, that offer a variety of landscape features and ES to enhance living conditions and aesthetic appreciation [35,36]. Usually, these green areas are more frequent in the neighborhoods of cities, lying in the same belt that is the first area targeted for urban sprawl from a populous town. Greenery and the related ES undergo spatial changes, with consequent land cover and land use changes determined by population development, temporal and spatial fluctuations, and political infrastructure.

The Gujrat district in Pakistan has undergone such a development, with the expansion of Gujrat city toward its peri-urban belt, where changes caused by the deployment of infrastructure and traffic ways, along with the built environment, are generating a scenario that threatens the green areas originally found in the peri-urban area. Due to their availability and catchment area, the population of the urban area is increasing gradually with time, creating more challenges for local residents in terms of loss of urban green space and loss of biodiversity.

Such green areas, however, are considered important for most of the interviewed residents because they provide outdoor recreation opportunities, such as walking in natural settings, for considerable parts of the citizens’ daily time. Moreover, this study showed that the available area of public green spaces per resident in Gujrat is 8.9 m². Considering that the World Health Organization recommends an ideal amount of 50 m² of green areas per person [37], with an acceptable minimum of 9 m² of green space per person, the results of this study assessed that green area availability is already below acceptable limits in the study area. Thus, it must be highlighted that the distribution and availability of the green area should be increased while Gujrat is expanding in the peri-urban belt to accomplish the prescription and recommendations of the SDGs for future generations.

The results of this study support this necessity, finding that peri-urban green areas ensure most of the recreational activities of Gujrat residents. Moreover, three out of four people respond positively to volunteer donations for the development and enhancement of urban and peri-urban green spaces [38,39]. The respondents’ positive attitude toward financial support for the maintenance and development of the town’s green areas demonstrates active engagement and emphasizes the value of the ES offered by the peri-urban green areas.

Nevertheless, it turned out that for the low-income portion of the population, the imposition of a fee could be a problem. This increases the need to ensure inclusive green spaces for all segments of the population, in accordance with SDG 11.

Due to the potential to highlight both the value of ES in peri-urban areas and the social-economic issues that need to be addressed by the governance, CVM can suggest an acceptable monetary value for intangible assets in rapidly changing urban landscapes and proves to be an effective tool for activating participatory and shared processes, just as recent studies showed [40–42].

Although there is high potential, it must be noticed that in developing countries where sensitivity to the environment is not always widespread [43–47], practitioners, researchers, and social scientists willing to conduct studies in CVM unfortunately struggle with a variety of problems, including psychological disorders, social disorders, violence, and non-serious behavior of interviewed people as well. We suggest, therefore, that a careful pilot survey is always delivered when directly addressing people.

In comparison with the same scenario in other cities of Pakistan, Gujrat faces more challenges in terms of a lack of proper planning by concerned intuitions. Different planning and management schemes are working in developed urban areas of Pakistan; for example,

in Islamabad, the Capital Development Authority is working for the development of the city. Similarly, in the case of Lahore (an industrial city in Pakistan), the Lahore Development Authority (LDA) is working on different projects, for example, New Lahore (a project in which a new urban area is being established according to planning and development). However, in the case of Gujrat, this situation is critical due to a lack of planning, management, funding, and local government.

In addition, we suggest that it would be worthwhile to conduct new studies in developing countries to deepen the knowledge about environmental issues [48] and landscape conservation necessities according to different socio-economic segments of the population.

Indeed, very few contributions have been made to evaluate the urban and peri-urban green spaces in developing countries by using the contingent's valuation methods and by asking the inhabitants their matters of concern, preferences, and opinions. This study, even if focused on Pakistan [49–59], demonstrates the usefulness of a cost-effective method to estimate the values connected with ES in peri-urban green areas that can be exported to other developing countries as well. The concluding part of the research will clarify the overall situation of the area with respect to associations between green spaces, green areas, and ecosystems and also introduce their research methods for assessment along with recommendations. The research attempts to quantify the ecosystem services by [60–63] stabilizing the local indicators and providing evidence for policy-making.

5. Conclusions

Due to the unavailability of data related to the preferences of people, urban sprawl often follows a pattern that leads to impacts and damages to the ecosystems surrounding the cities. This is particularly true in developing countries, where the need to quickly construct new infrastructure, buildings, and facilities clashes with the lack of data about residents' preferences and the value they place on peri-urban environments. Most of the time, this lack is also dependent on methodological challenges and difficulties, with no standardized assessment methods that can be applied to the wide set of cases occurring nowadays. This study is the first attempt in this area at this type of assessment, proving that the ecosystem services provided by the green areas in the peri-urban landscape improve the natural and cultural heritage. Sustainable urban and peri-urban management cannot be achieved without addressing at the same time the issues faced by the social, economic, and environmental compartments of a city, because all of these are the basic elements of sustainability that enhance the multi-functionality of the social-ecological systems. Apart from quantifying the availability and importance of the green spaces in peri-urban areas of Gujrat city, especially in terms of ES, this paper is believed to have a good chance of participating in local decision-making, since it is critical to have access to and integrate the relevant information at the right time to support policies and decision-making in line with the SDG.

Our study recommends that the government integrate the green parks in the private sector through local collaboration of investors. The private sector is willing to manage the parks for their business and look after the government assets for their business expansion in this particular area, which indirectly increases their market growth and profit. This will encourage the local investors to establish more parks and green areas, increasing the level of ecosystem services through the provision of parks and green spaces. This phenomenon will improve the local environment in the form of urban green, which will help overcome the social pressure in densely populated regions and also help control air pollution.

This can be accomplished by including the significance of urban ecosystems in city stabilization indicators. A paradigm that puts data and evidence at the center of the policy process could help with this, especially in countries such as Pakistan where urban development should not forget the human rights to have inclusive access to green spaces and their related ES [64]. Finally, the work also defines the indispensable tool for the conservation and improvement of landscape development in the study area in the context of the SDGs.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/land12020477/s1>, Supplementary S1.

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