



# Understanding of Cultural Ecosystem Services in Urban Green Spaces: A Case Study in Ramna Park, Dhaka, Bangladesh

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## Abstract

Green spaces provide a variety of ecosystem services. Urban green spaces are particularly valuable because they provide cultural services to urban residents. This study examined people's opinions of cultural ecosystem services in Ramna Park, Dhaka, Bangladesh. We examined the cultural ecosystem services that green places provide by surveying visitors in the study area about which cultural services they are frequently getting and what their primary activities are in such green areas, to learn how urban dwellers utilize these spaces. Since the park at Ramna is conveniently accessible to the residents of Dhaka city due to its structural arrangement, it contributes significantly to the provision of cultural ecosystem services. The findings of this research indicate that individuals discover diverse cultural values not only in areas with superior ecosystems but also in their regular surroundings. This research has important implications as it uses a survey technique to quantify contemporary cultural services.

## Subject Areas

Urban Geography

## Keywords

Cultural Ecosystem Services, Urban Green Spaces, Urban Parks, Park Ecosystem Services, Ecosystem Services Distribution

## 1. Introduction

The notion of ecosystem service has received significant attention from scientists

and policymakers by the release of the Millennium Ecosystem Assessment (MEA) that highlights the complicated relationships that exist between natural habitats and human welfare [1]. Though it's difficult to establish new green spaces in cities with insufficient resources, there is an increasing need for the restorative benefits of nature and leisure time in the hectic modernistic metropolitan environment [2]. Greenbelt deregulation has recently resulted in a megacity that is less sensitive to the advantages of the natural landscape because of the reduction in the overall importance of urban green spaces and the separation of these places [3].

There are several ecological functions that green places provide [4] [5]. Sustainable urban green areas are important because they serve vital roles in stress alleviation and health development for city dwellers, in addition to offering major cultural advantages to those who live there [6] [7]. Therefore, raising the standard of urban ecosystem services in the city—for example, by figuring out what green space resources are available now and which ones should be prioritized for the future—can boost both of the diversity of urban ecosystems and urban health [8] [9] [10].

Ecosystem services have been examined from a number of perspectives since they were included in the Millennium Ecosystem Assessment (MEA) in 2005 [11] [12] [13]. The word 'infrastructure' may be used to define several land use forms, including urban green regions, woods, and shrub and/or herbaceous species. The diversity of direct or indirect advantages that ecosystems provide to humans is reflected in the several types of urban ecosystem services [13] [14] [15]. Among them, cultural services indicate how ecosystems are used for people's pleasure and welfare. Throughout the sustainable development planning of cities, green infrastructure has gained importance in recent years [16] [17]. Urban cultural services are more difficult to measure than other environmental services, and the definition of this word differs across and within cultures. Although the value of cultural services has been acknowledged, the idea of ecosystem services does not yet completely describe or include them [18] [19].

Studies of urban ecosystem services have focused on ecology and landscapes of urban, urban forestry, and environmental health since 1990s [10] [20] [21], while research on cultural services has mostly concentrated on urban relaxation and visitor evaluations [22] [23]. This is founded on the observation that several different domains of cultural services, including spiritual enlightenment, intellectual development, and aesthetic experience [24], are challenging to measure since they are non-physical. Moreover, research methodologies and characteristics used for assessment are inconsistent due to the variety of sociocultural environments (geography, language, and lifestyle), which ought to be recognized more widely in order to more thoroughly comprehend urban cultural services than other indicators of ecosystem services [25] [26].

Studies comparing the usage patterns of urban parks in Asian and European cities have shown variations in local customs and culture as well as personal

preferences [6] [27]. The location of the park and the surrounding natural factors also affect the diversity of ecocultural services [28]. Studies of ecosystem services have recently been connected to many forms of infrastructure, particularly green infrastructure, which offers ecosystem services that enhance the welfare of both humans and the natural world. Similar language may be used to characterize the large-scale distribution of various land cover categories in addition to urban green infrastructure [29]. In research pertaining to ecosystem services, blue and green infrastructures may be regarded as ecological infrastructures, emphasizing the significance of infrastructures for spatially defining ecosystem products and services [15] [30].

Many researches on ecosystem services have been conducted in Bangladesh, especially since the late 2010s. These studies have mostly focused on measuring the economic worth of supply and control services in parks. There has been a recent surge in the amount of studies assessing and measuring cultural services provided by urban parks. For instance, researchers discovered that urban green parks [31] play a crucial role in the ecosystem services provided by urban green areas via a quantitative examination of their function [32].

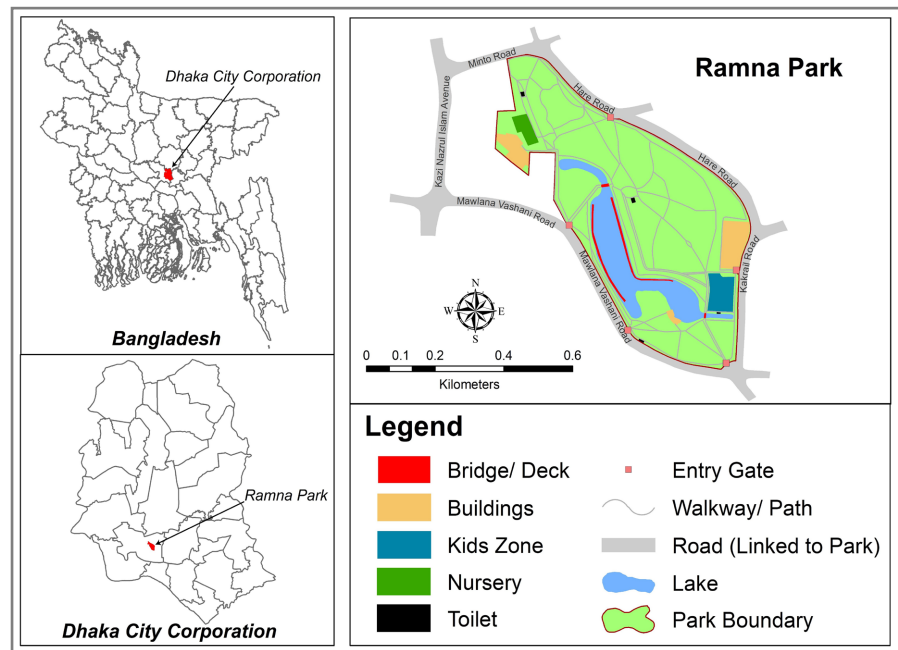
By concentrating on cultural services, the current study attempts to define the role that green spaces in urban area play and investigate their worth from the viewpoint of their users. In particular, the study will look at new, functional urban green spaces and examine their benefits and characteristics as cultural services. Our goal is to identify the types of cultural services that urban green areas provide. Since different types of ecosystem services are found in Ramna Park, Dhaka, Bangladesh, we decided to use the whole park as our research area. Lastly, we talk about how the findings relate to landscape management and planning, especially in light of the various urban infrastructures.

## 2. Material and Methods

### 2.1. Study Area

The study was carried out in Ramna Park (23.7375449N, 90.4011081E) which is situated in central Dhaka, Bangladesh. After the production of Pakistan in 1947, the Ramna zone kept on possessing a significant spot throughout the entire existence of Dhaka city. The most popular park in Dhaka is Ramna Park. The park's history began when the city became the capital in the sixteenth century [33]. Situated in the city's center, this park has a significant cultural and traditional impact on the people who live there. With 68.50 acres of land, it is one of the biggest urban parks. Within the recreational center are a water tank, a lake, a restaurant, and an office. The lake itself spans 8.76 acres (35,500 m<sup>2</sup>) of ground (Figure 1). The Park's walkways have been improved, and five new gates have been installed to provide access from different directions. Furthermore, Ramna Park is encircled by easily accessible highways for visitors.

Ramna Park offers both real and intangible advantages to human existence, such as cultural, regulating, supporting, and supplying services, which are really



**Figure 1.** Location of Ramna Park, Dhaka, Bangladesh.

immeasurable. This park is a unique kind of park that emphasizes ecological qualities and the importance of biodiversity in conjunction with popular scientific activities and cultural elements. Right now, the park offers visitors the greatest opportunity to appreciate the natural surroundings and get up close and personal with nature. This park fulfills several purposes as a combined site for leisure, tourism, entertainment, and social value.

## 2.2. Data Collection and Analysis

In order to identify the primary cultural service types, this research conducted a literature analysis and first classified the various forms of urban green space according to their cultural services. A survey of Ramna Park inhabitants was conducted in light of these results. On October 14, 2021, an initial investigation was conducted. On October 18 to 20, a field survey was conducted, and simultaneously, on October 18 to October 22, an online survey was conducted. Adults over the age of 15 who lived in the research region and were willing to participate were asked to participate in a field survey. Furthermore, we carried out a field survey among the nearby residents; participants included both the researchers' connections and field survey respondents. The survey was split into two sections: one that looked at how people used green spaces, and the other that looked at the cultural services they provided.

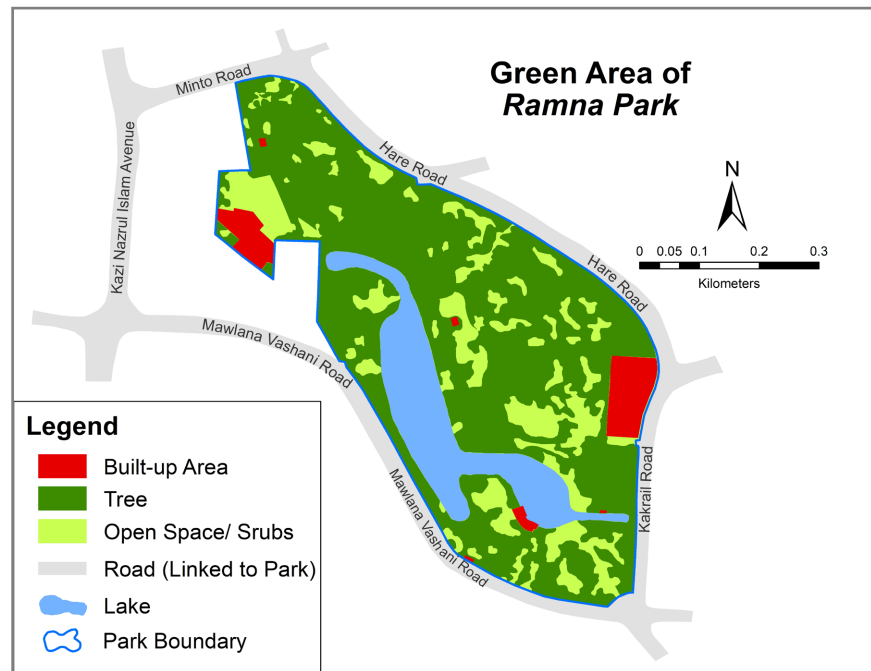
In order to link the survey findings to the appropriate green spaces, a question in the questionnaire asked respondents to indicate which green area of Ramna Park their responses related to. The total of 170 respondents (health service 40, social 38, recreation 30, relaxation 25, aesthetic 22, biodiversity 15), excluding 8 unfaithful replies from 178 valid questionnaires, provided data for the field sur-

vey; were examined using SPSS 20.0 and Microsoft Excel. We looked at linkages and evaluated how effectively urban green areas provided cultural services. Spearman's rank correlation coefficient was used to examine the relationship between pairs of cultural ecosystem services. We conducted Public Participation GIS (PPGIS) to visualize the spatial distribution of those abstract cultural ecosystem services. To depict the distribution in map, we used heat map by giving weight for each of the obtained ecosystem services. PPGIS probably the best way to express qualitative data in graphically. Lastly, we used the Principle Component Service Analysis (PCSA) for understanding the distribution with their perceived cultural services of green spaces, more widely.

### 2.3. Urban Green Spaces

There are many different approaches for defining urban green spaces from a legal and logical perspective. According to academics, "urban green spaces" is a broad term that encompasses open spaces and other specialized applications, depending on the relevant study subject. The phrase "urban green space" encompasses not just more obvious examples of green spaces, such as thick vegetation, but also open, non-forested areas, undeveloped land, and bodies of water [34]. In addition to providing basic services like air purification, meteorological circulation, and mitigating natural disasters, urban green space also serves a variety of cultural objectives. For these reasons, it is an essential element required to create a comfortable urban environment [10].

Urban green areas also provide a place for city dwellers to find relaxation and connect via healthy activities. Urban green areas may be designed in several ways. Bangladeshi cities often have a lot of open space and natural regions within their administrative boundaries, but there isn't much greenery inside urbanized areas outside of greenbelt zones. Bertram and Rehdanz (2015) [35] categorized a number of urban ecosystem types that provide ecosystem services, including: ecosystems with trees, urban forests, parks, lawns, agricultural areas, wetlands, streams, and lakes; Fagerholm *et al.* (2019) [36] also distinguished the number of habitat types—forest, water body, agriculture, grassland, settlement, and quarry—that provide cultural benefits. In Bangladesh, Saika Ummeh and Kikuchi Toshio (2017) [37] classified land into big, medium-sized, and small park areas and their regional features in Dhaka City urban green spaces using the "land cover map" and "use of park" categorization methods. Both the green space that is accessible to individuals and the regulatory requirements for metropolitan urban green spaces were examined in a second kind of study. There was discussion of earlier research that categorized urban green areas based on how people used them. Urban parks, green space facilities, roads, kid-friendly play places, vegetation, open spaces, rivers, reservoirs, green space within public buildings, green space inside residential areas, green space inside cultural assets, and vacant land were all considered green spaces in this research as shown in **Figure 2**.



**Figure 2.** Location of Ramna Park, Dhaka, Bangladesh.

## 2.4. Classification of Cultural Services

Cultural services are non-material advantages that individuals derive through interaction with ecosystems in the context of ecosystem services. Urban natural resources may be utilized directly (for example, to enjoy a stroll or take in the landscape) or indirectly as part of cultural services [38]. The same resource may be experienced in several ways, and depending on how they are conveyed, these perspectives can be perceived in multiple ways. This is because the value of cultural services changes according to human preferences. Therefore, care must be taken when assessing the worth of resources using approaches that account for perception and choice [32] [34].

Six types of cultural services that urban green spaces were identified in this study **Table 1**, based on earlier research on cultural service activities, such as the MEA (2005), whose categories are most often used worldwide. Recreation and ecotourism were treated as distinct categories in earlier research. Instead of focusing on non-residents like visitors, ecotourism was integrated into recreation in this research to assess the ecosystem services provided by urban parks that are structured on cultural services for urban inhabitants.

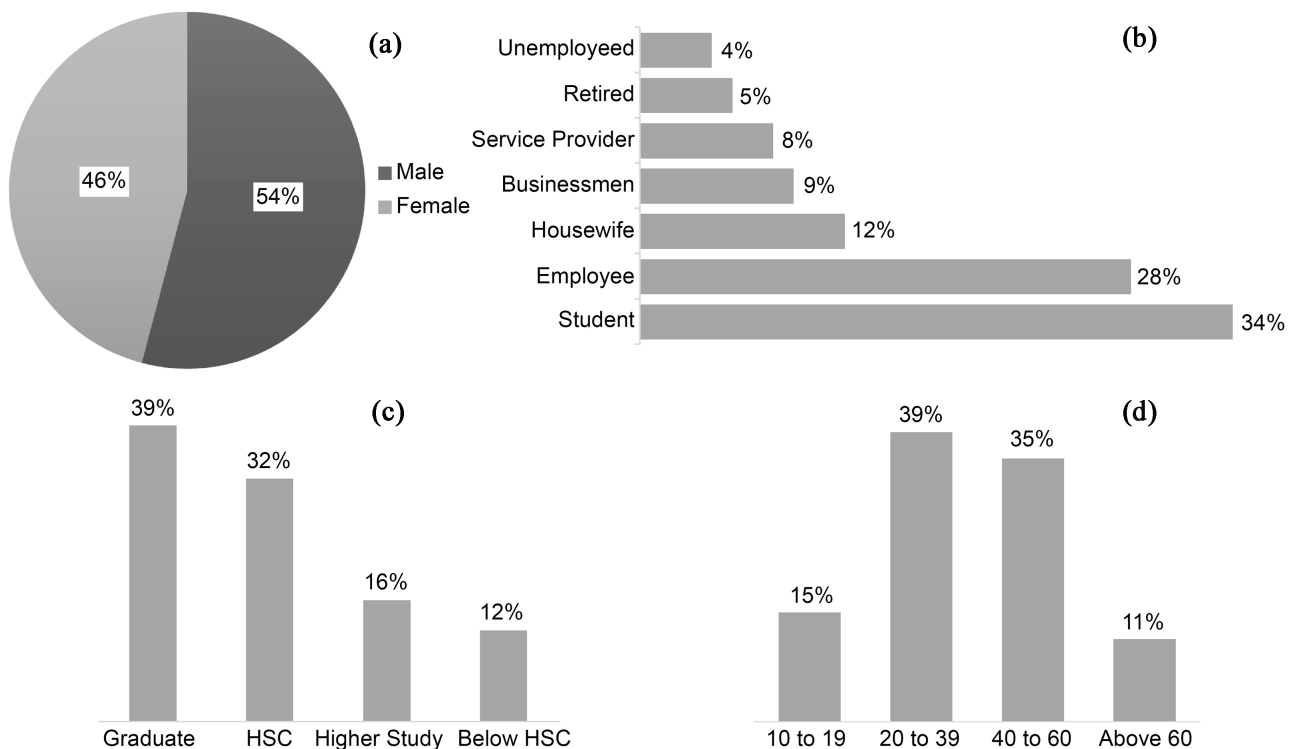
## 3. Results

### 3.1. Characteristics of Respondents

For the field survey, an independent sample t-test was used. The purpose of this statistical test is to find out if the samples vary from one another. It is frequently used in testing hypotheses to see if a procedure really affects the targeted population. The results showed no significant differences in the features of urban

**Table 1.** A list of specific cultural ecosystem services and their definitions.

| Service      | Definition  |
|--------------|---|
| Health value | Establishing a location where regular and ongoing activities are offered to promote both physical and mental health.  |
| Social       | Supplying and fostering an environment that supports the development and stability of local communities.  |
| Recreation   | Recreation that makes it easier to engage in outdoor leisure activities like strolling and unwinding.   |
| Relaxation   | Provide opportunities for refreshment and enjoying free time using different features of park for instance, benches, walkways and rest zone.  |
| Aesthetic    | Facilitating the enjoyment of the ecosystem’s many aesthetic delights; encouraging ideas such as creative inspiration and visual pleasure; and stimulating the senses with the natural environment. |
| Biodiversity | Provides the possibility to see and identify many plants, trees, and Serb species.  |



**Figure 3.** Demographic characteristics of park users in percentage. (a) Male-female ratio, (b) Occupation, (c) Education level, (d) Age group.

green space consumption and demographics.

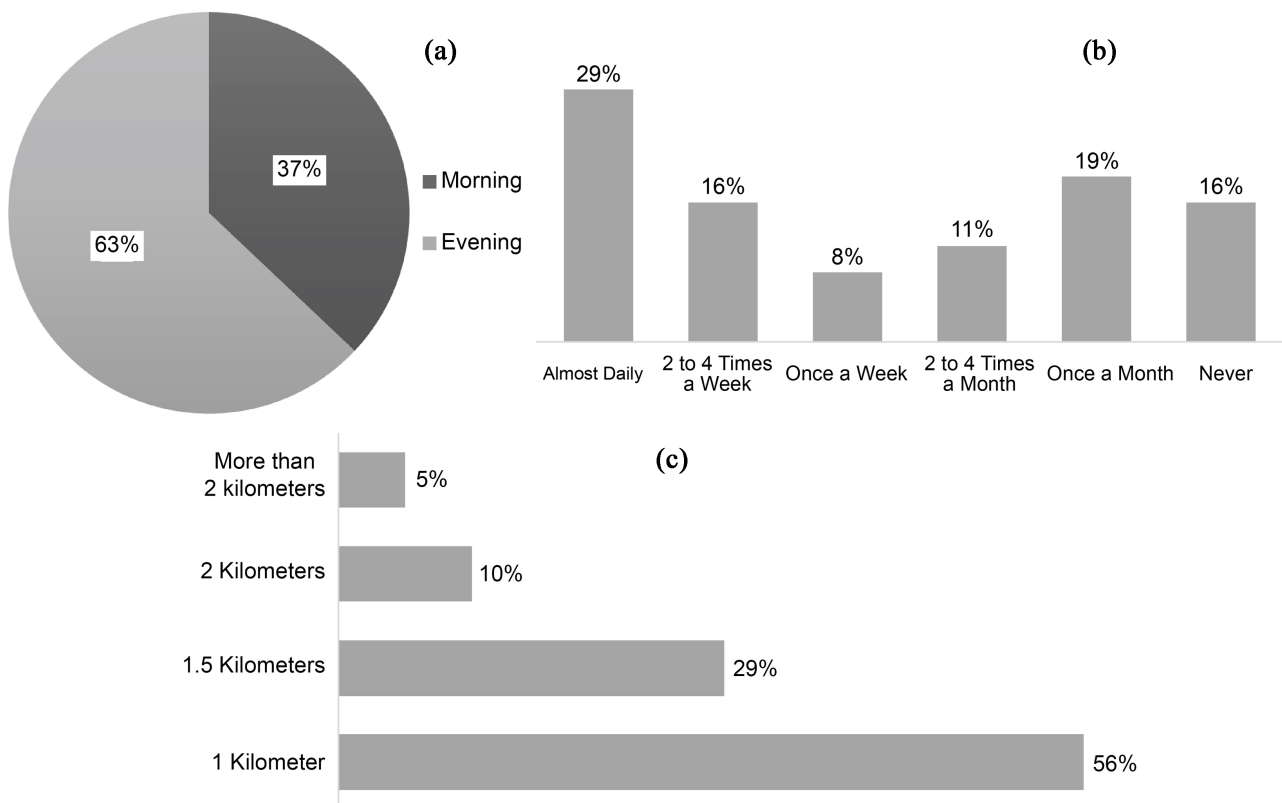
We outlined the characteristics of the participants (Figure 3). Of the 170 respondents, 54% were male and 46% were female, and most were between the age range of 20 to 39 years which is about 39% of the total respondents. The fact that the field interview was conducted throughout the week explains why a large percentage of respondents were males in their 20s and 39s.

The 40 to 60 years’ age group was found to be the second-highest (35%) park users. Mostly, students came to the park as park visitors comprising 34% of the

total respondents. Mostly, students and employees came to the park as visitors comprising 34% and 28% respectively of the total respondents. Among the green space users, 39% were graduated which is almost half of the total sample size. The relative ratios of the resident populations were taken into consideration while analyzing the respondents' distribution across all usage sites in the region.

In order to learn more about how the respondent utilized green spaces, the survey looked at an urban green area that they regularly frequented. It asked about the average number of visits, how they got there and liked it, and what kinds of significant activities they did there. The findings indicate that 63% of people who visited green spaces did so in the evening, while rest 37% of people used the park in the morning (Figure 4). Most of the participants visited the park almost daily which is about 29% but very few (8%) have visited almost a week. Visiting frequency is mostly dependent on the distance of residence from the park. Visitors who use the park more frequently live within a 1-kilometer radius of the park. The percentage of residential proximity for the distance of 1 km, 1.5 km, 2 km, and more than 2 km are respectively 56%, 29%, 10%, and 5%. Regarding park utilization, almost 11% of all respondents said that walking was their primary activity in the green areas.

In order to get insight on the varying uses of green spaces, all participants were asked to indicate which of the 56% of green places they often visit, with the option to provide multiple responses. Local parks, including Suhrawardy Udyan



**Figure 4.** Park usage patterns by respondents. (a) Visiting time, (b) Visiting frequency, (c) Residential proximity.



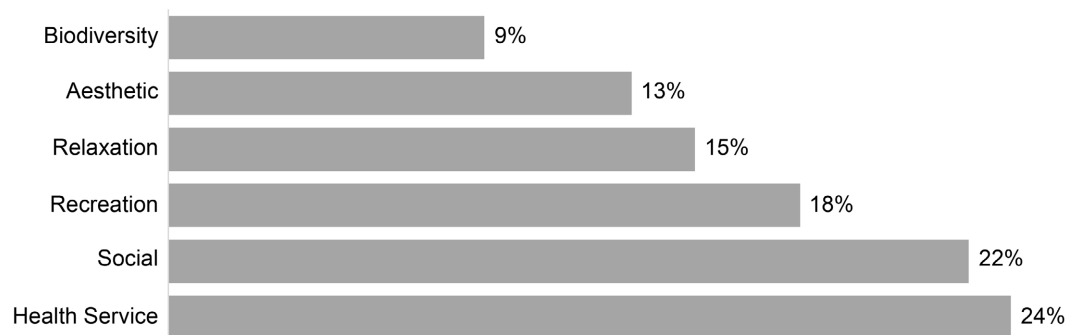
and Ramna Park, came in at the top, followed by Dhanmondi Lake's green areas inside public cultural and educational buildings, as well as the kids' play area. Ramna Park's high usage rates were found in the survey, but with variation based on the respondent's residential region. This was likely due to the park's ease of access by foot. Using a t-test, it was discovered that respondents' distance from their homes affected how often they used Ramna Park, but there was no discernible variation in utilization of other green spaces based on respondents' residence.

### 3.2. Cultural Services Valuation

We intended to gauge public awareness of the cultural services offered by Ramna Park, a green area. Park users were asked to identify whether one or more of six cultural services are supplied by metropolitan parks for the green areas they had recognized in the previous step. These six categories—biodiversity, aesthetics, health services, relaxation, recreation and social—come from earlier research on the public's understanding of cultural services [35] [39] [40]. Thus, public opinion on how well a healthy park provides its cultural services is shown by the number of replies in each class for each green spaces [13]. The most often cited cultural service was health service, followed by social, recreation relaxation aesthetic, respectively. Biodiversity, as an ecosystem service, was found to be the least popular among the users.

Regarding the most obtained cultural ecosystem services (**Figure 5**) which is provided by Ramna park was health service, covering 24% of the total respondents. People lives near the park use it frequently to improve their physical and mental health by doing different types of health activities such as running, walking, etc. In the very early morning of the day, users come to get fresh air and meditation which are also part of mental health service. There are some organizations for meditation and yoga groups that provide health improvement activities. During the survey, other types of intangible services were found as social 22%, recreation 18%, relaxation 15%, aesthetics 13%, and biodiversity 9%.

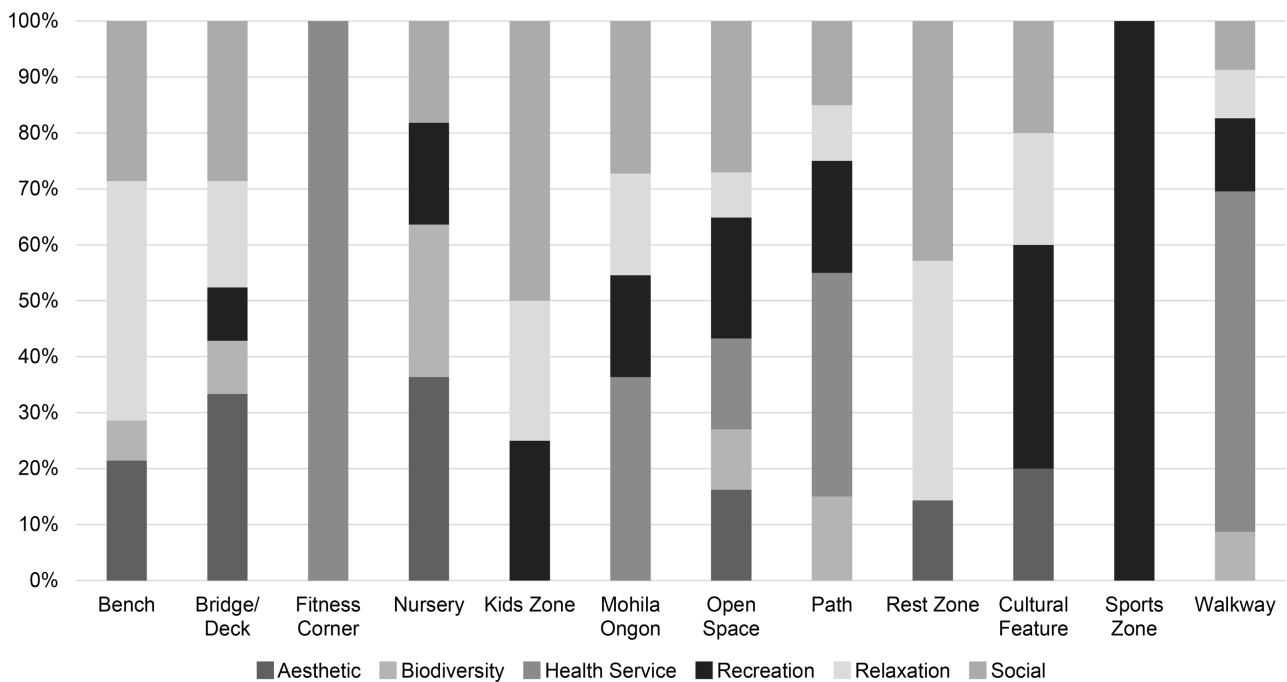
These data were also utilized to identify the green places that people thought had the most value when all the cultural services were taken into consideration. The number of cultural services provided by all respondents is taken into account for the green space. This resulted in the differentiation of six groups.



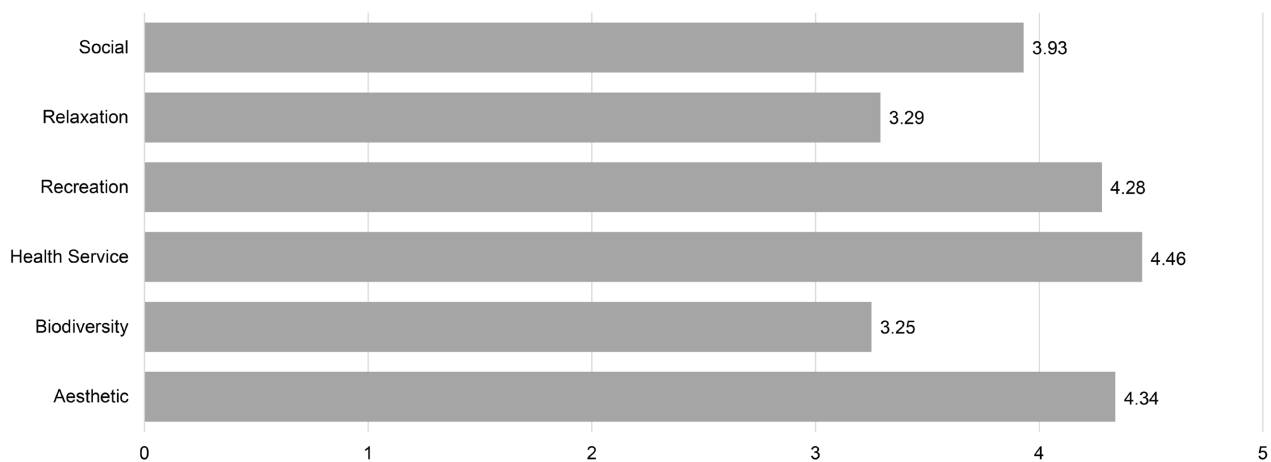
**Figure 5.** Uses of the park by differenct CES.

The findings demonstrate that, while the responsibilities do not overlap, they are mutually beneficial, and each location in the Dhaka metropolitan area provides a distinct role in the provision of cultural services. **Figure 6** demonstrates how the park features are used by different cultural ecosystem services. Open space is a common feature for all the available cultural ecosystem services. Open space was used more for social activities and less for biodiversity. Paths and walkways are also used for all cultural ecosystem services except aesthetics. The single-use feature is the fitness corner and sports zone. The fitness corner is used only for health service and the sports zone is for recreation like playing badminton, soccer, and cricket.

People’s perceptions and emotions can be measured by different scales, here Likert scale (**Figure 7**) is used to evaluate people’s emotions by questionnaire



**Figure 6.** Feature uses by each cultural ecosystem services.

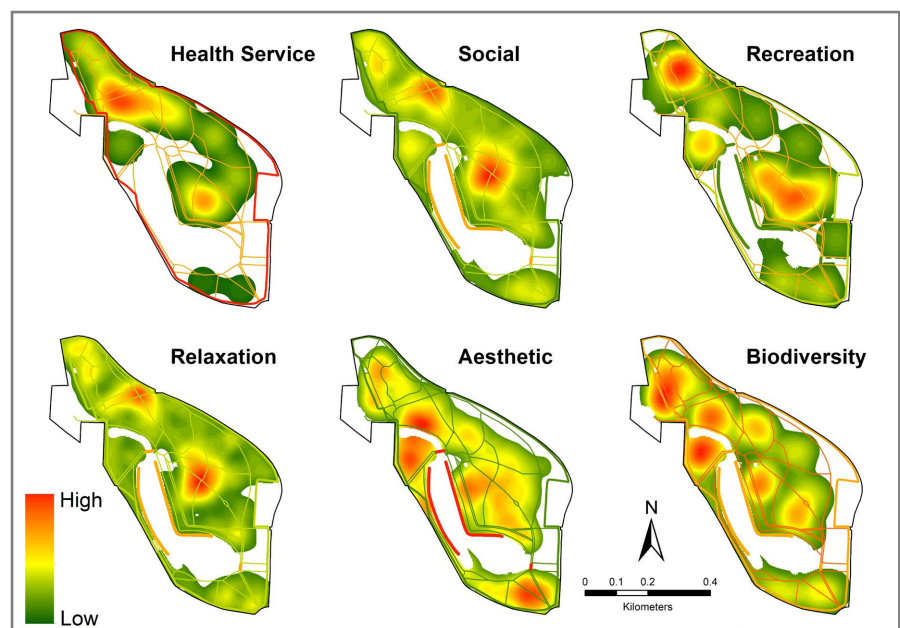


**Figure 7.** User perception by Likert scale.

survey. In the Likert scale, the opinions of the respondents are evaluated in the range of 1 to 5 where 1 state is neutral and 5 states highly satisfaction level of using cultural ecosystem services. Using Likert Scale, it is found that all cultural ecosystem services of the park are valued from 3.25 to 4.46. Among the all-cultural ecosystem services, the health service belongs to the rating of 4.46, which is the highest value and demonstrates that visitors used this park more for health service than other cultural ecosystem services. Aesthetic value 4.34, recreation 4.28, social 3.93, relaxation 3.29, and biodiversity 3.25 are valued by the respondents, according to the Likert scale.

### 3.3. Spatial Distribution of CES

The distribution of cultural ecosystem services for Ramna Park in accordance with the questionnaire survey is depicted in **Figure 8**. The heat maps for all six cultural ecosystem services are produced using PPGIS. Heat maps demonstrate the extensiveness and concentration of cultural ecosystem services provided by the park to its visitors. It was found that all the cultural ecosystem services are almost evenly distributed across the entire park because this park has enough features and facilities for the park's users. The hotspots coexist with the natural landscapes and manmade features such as the lake, walkway, bench, kid's zone, etc. Biodiversity and aesthetic cultural ecosystem services were found as the most extensive area and at the high volume throughout the park due to the variety of species and the scenic beauty. The lake and decorated lined-up trees, tree species, different flowers, and the chirping of the birds attract the visitors more. The social and relaxation cultural ecosystem services were found moderately in the whole park, but more intensely in open spaces. Socializing and relaxing were found more on benches along the path and walkways. Health services are



**Figure 8.** Spatial distribution of cultural ecosystem in Raman Park.

remarkable cultural ecosystem services mostly found along edgewise of the park boundary. In the morning, people visit the park mostly for walking, jogging, running, or exercising. People usually use the surrounding walkways and paths for these types of health services. The recreational activities were held in the open spaces where children and middle-aged people play soccer, cricket, or badminton. The kid's zone is located on the east side and is also a source of recreation for kids.

### 3.4. Interaction between Land Type and Perceptions of Cultural Services

Since the majority of ecosystem services are associated with certain landscape features [39], we investigate the connections between various cultural services and particular land use categories. Separate analysis was performed as well on the relationship between users' zones and the plotted cultural ecosystem service. The amount of cultural service functions that each kind of land performs was determined by studying the various land use types at the locations, taking into account both land cover and land usage. Urban parks (76%), lake sites (78%), and public facilities (65%) had the highest Z scores, which were calculated by adding up all the times a value was assigned to locations belonging to a certain land use category.

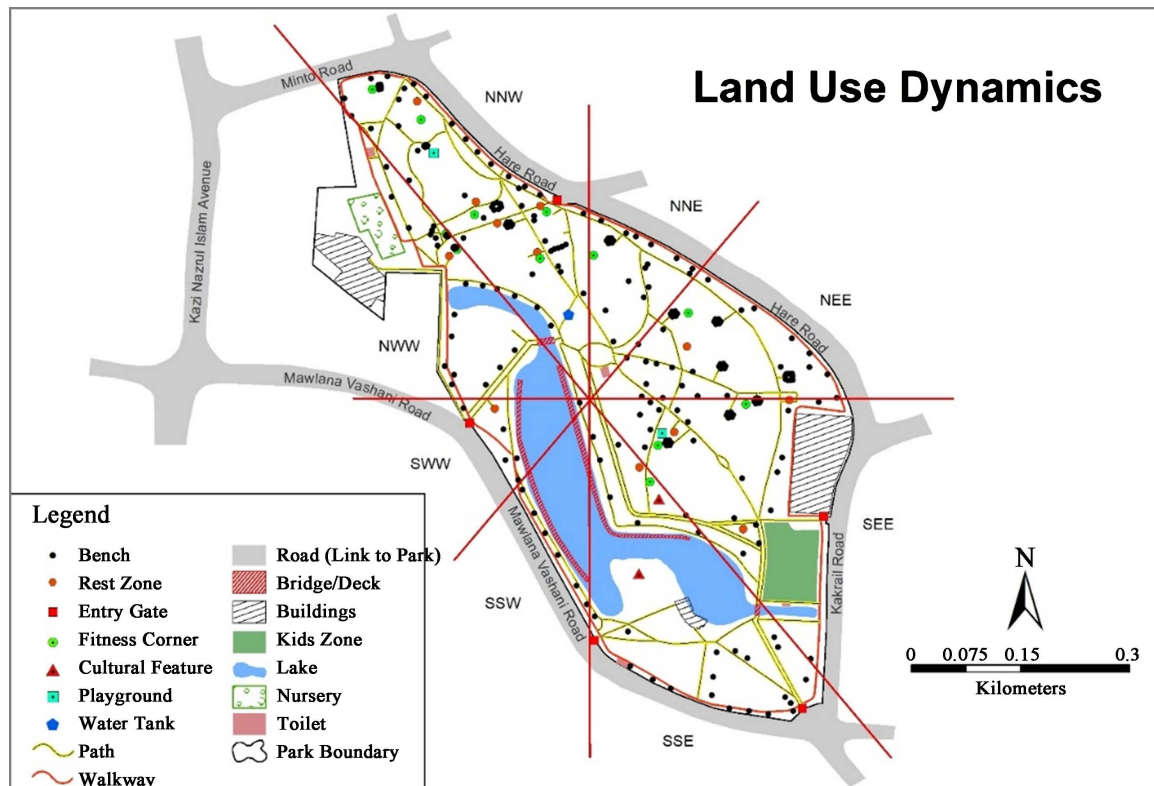
To get better understanding of how green areas are distributed in relation to the perceived cultural services, we graded our data on cultural value perception and performed a principle component service analysis (PCSA). The aesthetic and recreation of the whole variety are taken care of by the first two major components. The first PCSA axis has a negative correlation with cultural site value and a positive correlation with the most "urban park active" activities, such as social interaction and leisure. Artificially manufactured urban green spaces have a positive correlation with the second PCSA axis, whereas natural spaces like lakes and green areas have a negative correlation. Since artificially made green spaces frequently host a variety of cultural programs for children and adults, while typical natural open spaces rarely host such events, we propose that positive values on the second PCSA axis are linked to the children's education programs or activities.

According to the PCSA findings, given their separation in principle component space, non-material services (**Figure 9**)—such admiring nature—are seen as having a distinct character than usable cultural services (like public services). Based on land type and usage, our findings suggest that perceived cultural benefits are not universally present in green areas, but rather are distributed differently across them. For instance, big parks are important in providing cultural eco-system services; roof gardens and reservoirs, on the other hand, were thought to have almost no role in delivering cultural services.

## 4. Discussion

### 4.1. Differences in Perceptions of Cultural Ecosystem Services

This research assesses how individuals in urban communities and on an individual



**Figure 9.** Land use dynamics in zones of the Raman park.

basis, perceive the cultural ecological services offered by urban green areas. Different land types have varied links to ecosystem service awareness and utilization behaviors. Urban parks were the most utilized areas and had the greatest cultural value within the community. These land types and uses were indicated by the majority of respondents as cultural services with.

Next, we contrast value and use. The green spaces in **Figure 2** and Dhanmondhi Lake Park, among others, were highly valued for their perceived cultural services and had high rates of use. For another instance, the National Botanical Garden was ranked higher for cultural service value yet had a lower use rate than Ranma Park. The lack of a substantial difference allayed worries regarding variations in the assessments of nearby or regularly visited green spaces. Visit frequency seems to be more influenced by recollections of regularly visited locations and personal connection to green areas than by perceived cultural service value, according to the link between perception of cultural value and visit frequency. Cultural service ratings tend to cluster in certain places because respondents may find it difficult to discern between various cultural services [41]. This trend might be seen as evidence of the interdependent and inseparable character of many cultural ecosystem services [36] [42].

#### 4.2. Inter-Individual Differences in Perceptions of Cultural Services

Findings of this study are different from earlier research [6] [36] [43], discovered

that, on a homogenous local scale, people's perceptions of cultural services vary depending on their backgrounds. In contrast to other research' findings, this one did not find any evidence of a substantial variation in how people perceived cultural services depending on their origin or gender. Because there are minor variations in the functions and user preferences of different green spaces, it is difficult to identify significant disparities among a group of respondents when analyzing cultural service functions and land utilization. On the other hand, a little disparity in opinions on the green space and services was noted depending on walking distance and mode of transportation, which were connected to age and place of living. There was no discernible difference in terms of other personal characteristics.

## 5. Conclusions

Through the identification of accessible urban green places, this research examined the cultural service function of urban green spaces in Raman Park, Dhaka, supporting the enhancement of cultural services provided. To do this, we examined the cultural services of urban green areas from the perspective of insiders. The following findings were drawn from this study: urban parks often play important roles as producers of cultural ecosystem services in Dhaka City since they are widely accessible due to the city's arrangement. Because of this distribution, cultural service activities are not repeated for every kind of green space; instead, the different locations enhance one another by carrying out unique cultural service tasks. Furthermore, cultural services need a geographically greater number of green spaces, which may be achieved via program and facility improvements. According to this research, individuals are exposed to a wide variety of cultural values in their daily lives, not just when they are in areas with "exceptional" cultural values. Green space and cultural services that are utilized on a daily basis, however, were valued differently. It has been shown that people's experience and awareness are key factors in the evaluation of cultural services. Cultural services are naturally evaluated to represent human experience, in contrast to the majority of regulatory support services [19] [28]. Due to their exclusion from current evaluations of biophysical and economic ecosystem services, the majority of cultural ecosystem services are undervalued in comparison to other quantitative ecosystem services. Therefore, in order to approach management and conservation in an appropriate manner, research on how to recognize and utilize cultural services should be conducted.

Furthermore, via landscape design and the use of green places with low cultural value for environment protection, it is required to maximize the uses of the cultural services provided by ecosystems. Since this stream currently has a low cultural service score, it is anticipated that connecting parkland with Ramna Park using unused land will improve the quality of ecosystem services and create a more equitable spatial distribution of cultural ecosystem services. While this survey solely took into account local residents, several important locations are

also well-liked hangouts and tourist destinations for outsiders. Future research may take into account outsiders who benefit from these ecosystems.

In conclusion, this research has substantial implications since it quantifies the worth of current cultural services using a survey technique, which allows service consumers to determine the entire value of cultural services. It is significant as a case study since it assesses locals' opinions by using metrics that aren't now used in evaluations of ecosystem value. Thus, it is anticipated that this methodology will provide a foundational framework for further assessments of cultural services, which will take into account users' viewpoints of cultural significance in order to ascertain the purpose and worth of cultural services.

## Acknowledgements

We appreciate the participation in the survey from the people living in the Dhaka metropolitan region. The authors' contributions to the conception, design, acquisition, analysis, and interpretation of the data were noteworthy. They also took part in the drafting of the article or its critical revision for significant intellectual content, and they granted final approval of the version that was submitted and any revisions.

## Conflicts of Interest

The authors declare no conflicts of interest.

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