Preferences for urban greenspace functions during public health pandemics. Empirical evidence from Malawi

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Abstract

Purpose – The purpose of this study was to investigate the impact of Corona virus disease on the perceived values of urban green landscapes in a developing country setting. To achieve this objective, the author investigated changes in the preferences for urban green space services among city residents who use nature areas for recreation.

Design/methodology/approach – This study applied the best–worst scaling technique to elicit changes in the preferences for ecosystem services from urban recreational sites in Malawi. The study also used a fractional logit model to examine factors that motivate visitors' willingness to donate/contribute to improve the quality of nature's recreational services.

Findings – This study finds that the COVID-19 pandemic changed visitors' perceptions of urban woodlands, but leisure/recreation remained the most important service with or without the Corona virus outbreak. However, the perceived value of air pollution control and cultural/religious functions gained more prominence ($+3\%$), whereas biodiversity conservation became less prominent (-2%) during the pandemic period. The mean willingness to pay (WTP) was estimated to be US\$28.73, and WTP is positively influenced by education, income status and the user's satisfaction with the recreation site.

Originality/value – The study substantiated the impact of Corona virus disease on the perceived values of urban green landscapes, using Malawi as a case study. This was demonstrated through the changes in preferences for urban green space services among city residents who use nature areas for recreation.

Keywords Urban forestry, Ecosystem services, Nature recreation, Willingness to pay (WTP), Fractional logit regression

Paper type Research paper

1. Introduction

Urban nature sites are widely used for leisure and recreational purposes and, as a result, their presence has been associated with enhanced quality of life among city dwellers (Thompson *et al.*, 2012; Cleary *et al.*, 2019; Grilli *et al.*, 2020; Zhang and Gou, 2021). However, the global COVID-19 pandemic – as declared by the World Health Organization in March 2020 – affected visitations and recreational use of nature sites around the world (Ugolini *et al.*, 2020;

Beery *et al.*, 2021; Ferguson *et al.*, 2022; Pröbstl-Haider *et al.*, 2023; Hansen *et al.*, 2023; Smith, *et al.*, 2023). The pandemic affected people's lifestyles, especially among urban residents who are negatively impacted by environmental and health challenges such as urban heat island, air pollution and psychological stress (Gasper *et al.*, 2011; Thompson *et al.*, 2012; Cleary *et al.*, 2019; Grilli *et al.*, 2020; Zhang and Gou, 2021). Normally, the presence of green spaces such as urban parks and woodlands within cities offers a range of benefits in terms of biodiversity conservation, supply of ecosystem services and improved human health through protective and preventative services (Hirokawa, 2011; Thompson *et al.*, 2012; Bertram and Rehdanz, 2015; Nesbitt *et al.*, 2017; Ugolini *et al.*, 2020; Zhang and Gou, 2021). Indeed, urban vegetated habitats provide a variety of ecosystem services that enhance human quality of life and build resilience during stressful moments, for example, by reducing air pollution, minimizing the urban heat island effect, facilitating mental or cognitive restoration and increasing property values (Thompson *et al.*, 2012; Dumenu, 2013; Bertram and Rehdanz, 2015; Zhang and Gou, 2021; Fu and Xue, 2023).

Recently, the COVID-19 pandemic has reaffirmed the importance and value of green spaces as there is increased use of green spaces for outdoor work and meetings, as well as social gatherings (Beery *et al.*, 2021; Ferguson *et al.*, 2022; Pröbstl-Haider *et al.*, 2023; Smith *et al.*, 2023). Thus, outdoor work-related activities have become popular to reinforce social distancing and reduce contagious re-infections. While Ciesielski *et al.* (2023) show that a ban on access to forest areas during the COVID-19 pandemic (January 2019–December 2020) significantly reduced forest visitation in Poland, other studies show a substantial increase in the recreational use of forest areas, especially where no restrictions were effected. For example, Smith *et al.* (2023) report that the COVID-19 pandemic increased the popularity of protected areas for mountain biking and hiking in Australia. In related studies, Derks *et al.* (2020) and Weinbrenner *et al.* (2021) show that recreational activities in urban forests and parklands strongly increased during the time of lockdowns in Germany. Further, Ugolini *et al.* (2020) reveal that during the COVID-19 shutdowns, there was an increased tendency to visit proximate urban green spaces for physical exercise and relaxation in Israel, Italy and Spain. Similarly, studies conducted in Sweden and New England show a rapid increase in outdoor recreation during the COVID-19 period (Beery *et al.*, 2021; Ferguson *et al.*, 2022). However, Berdejo-Espinola *et al.* (2021) present mixed evidence for Brisbane, Australia, where 26% reported having reduced their use of urban green spaces. The same study reported that 45% of the previous non-users of urban green space began using it for the first time during the restriction period, and 36% of participants increased their urban green space use. Although there seems to be mixed evidence on the effect of the COVID-19 pandemic on outdoor recreation experiences, more studies do suggest that there has been an increase in the number of visitations to forest recreation areas (Derks *et al.*, 2020; Ugolini *et al.*, 2020; Beery *et al.*, 2021; Ferguson *et al.*, 2022).

The purpose of this study was to investigate the impact of Corona virus disease on the perceived values of urban green landscapes in a developing country setting. To achieve this objective, we investigated changes in the preferences for urban green space services among city residents who use nature areas for recreation. Additionally, the study estimated willingness to pay (WTP) to improve nature's recreational services and further examined factors that motivate people's WTP decisions. From a policy perspective, a clear understanding of preferences for urban ecosystem services can inform better strategies aimed at reinforcing biodiversity conservation and the management of urban landscapes or green infrastructure. Notwithstanding the benefits associated with nature sites, most urban vegetated habitats are rapidly being lost, particularly in developing countries. The rapid loss of urban green spaces in developing countries is mainly because of infrastructural development, unplanned urbanization, population pressures, weak legal framework, inadequate financing,

encroachment and escalation of settlements and slums (Dumenu, 2013; Mkula, 2015; Tibesigwa *et al.*, 2020). Thus, there is a need to properly manage nature areas and urban greenery to optimize the multiple benefits generated by green infrastructure.

The rest of the paper is structured as follows. Section 2 gives a brief literature review on the valuation of the benefits of urban forested landscapes. Section 3 describes the methods, outlining sample selection, data collection and econometric estimation of WTP using fractional logit regression. Section 4 presents the results, and Section 5 discusses the results in the context of previous studies. Finally, Section 6 gives study conclusions and policy implications.

2. Literature review on the benefits of urban forested landscapes

A clear knowledge of nature's contribution to urban well-being is of great interest to urban planners and conservation advocacy groups (Nesbitt *et al.*, 2017; Bockarjova *et al.*, 2020). As a result, several past studies have attempted to estimate the economic value of non-priced benefits from urban green spaces both in developed and developing countries (Willis and Garrod, 1993; Dumenu, 2013; Gómez-Baggethun and Barton, 2013; Kabisch *et al.*, 2015; Nesbitt *et al.*, 2017; Bockarjova *et al.*, 2020; Tibesigwa *et al.*, 2020; Diluiso *et al.*, 2021). From a methodological viewpoint, there are two distinct strands in the literature that enumerate the functions and benefits of urban forested landscapes. The first strand of literature represents the field of non-economic valuation, which basically describes ecosystem services and contributions of forested landscapes but does not determine any economic value of the benefits (monetary value) for these services. In this regard, a detailed account of the services derived from urban forests is given, which usually comprise the four categories of ecosystem services classified by the Millennium Ecosystem Assessment as follows: regulating services (e.g. air quality regulation, microclimate regulation, water regulation), cultural services, supporting services and provisioning of natural areas for human use, e.g. exercise and wildlife viewing (Jim and Chen, 2009; Escobedo *et al* 2011; Hirokawa, 2011; Song *et al* 2018). For example, Jim and Chen (2009) and Berglihn and Gómez-Baggethun (2021) outline and describe various ecosystem services provided by urban forests in China and Norway (Oslomarka), respectively. In a related study, Zhang and Gou (2021) show the importance of urban parklands by investigating microclimatic adjustment or the cooling effects of trees during summertime in Deyang city, China. In this study, Zhang and Gou (2021) focused on how crown attributes such as the ratio of crown diameter to branching position height (D/PH) and crown porosity (measured as the leaf area index and leaf gap ratio) affect air temperature. The study found that D/PH had a significant microclimatic impact, as increased D/PH – from 0 to 8 – could help decrease mean radiant temperature by approximately 15 degrees Celsius and improve thermal sensation from warm to neutral. Further, ecosystem functions have been reported in a number of review studies focusing on the functions and benefits of urban forests (Jim and Chen, 2009; Escobedo *et al.*, 2011; Hirokawa, 2011; Song *et al.*, 2018). Studies that adopt the non-economic valuation approach typically tend to only emphasize the role, importance and diversity of forestland ecosystem services.

The second strand of literature uses a quantitative cost-benefit approach which adopt either price-based revealed preference methods (e.g. hedonic pricing and travel cost method) or stated preference methods (e.g. contingent valuation method) to estimate the economic value of non-priced benefits from urban green spaces. Studies that estimate the economic value of ecosystem services using conventional economic valuation methods are quite extensive (Willis and Garrod, 1993; Dumenu, 2013; Gómez-Baggethun and Barton, 2013; Kabisch *et al.*, 2015; Nesbitt *et al.*, 2017; Bockarjova *et al.*, 2020; Tibesigwa *et al.*, 2020; Diluiso *et al.*, 2021; Kim, 2021). For example, Escobedo *et al.* (2015) valued urban-forest cultural ecosystem services using a hedonic regression model and showed that property value

increased by \$1,586 per tree in Florida, USA. Kim (2021) applied the contingent valuation method (CVM) to estimate the economic value of urban forests used as daily leisure spaces offering healing services to tourists in the city of Seoul (Korea). This study estimated tourists' willingness-to-pay (WTP) for establishing a preservation fund, which, based on WTP bids, was valued at US\$530m. Finally, Lamhamedi *et al.* (2021) applied the travel cost method to estimate the recreational use-value of peri-urban forest in Morocco (Val d'Ifrane) and showed that the annual recreational value was nearly €15m.

Other studies, similar to ours, have adopted the best–worst scaling (BWS) technique – which was originally developed by Louviere and Woodworth in the 1990s. Since then, BWS has been widely applied in different disciplines, including health care (Finn and Louviere, 1992), forest management (Loureiro and Dominguez Arcos, 2012; Soto *et al.*, 2018), agriculture, environment and natural resources (Tyner and Boyer, 2020; Ahoudou *et al.*, 2023; Jones *et al.*, 2013) and the tourism sector (Tsuge *et al.*, 2023). For example, Soto *et al.* (2018) applied BWS to study consumer demand for urban forest ecosystem services and disservices in Florida, USA. This study showed that consumer choices for property value were highest in a situation where it was believed that more trees on the property can increase overall property values. Consumers also preferred tree condition (a proxy for minimizing disservices such as decreased visual quality of property and increased risk of property and infrastructure damage) and tree shade (a proxy for temperature regulation). Further, the results showed a negative WTP for ecosystem disservices.

From the reviewed literature on the economics of green spaces, we draw the following conclusions:

- There are more empirical applications of the economic valuation of urban green space in developed regions than there are in developing countries, including sub-Saharan Africa.
- The majority of people generally appreciate ecosystem services (benefits) provided by nature areas and, hence, are willing to pay non-negative price offers to preserve or improve the quality of urban forests and greenery.
- The scale of the estimated economic values varies across geographical locations but also differs because of differences in estimation methods and underlying assumptions.
- A lack of understanding of the benefits of nature impairs the ability to assess whether these benefits outweigh costs and this could lead to widespread destruction of urban vegetated habitats.
- A number of factors, including visitors' characteristics (e.g. wealth status and environmental dispositions) and site characteristics (e.g. scenic beauty and species aesthetic appeal), influence people's WTP decisions.
- There is a notable dearth of research linking green space services and social health outcomes.

These insights provide a strong basis for implementing the present study, which examines the effect of a public health pandemic (COVID-19) on preferences for forest ecosystem services.

3. Methods

3.1 Sampling procedure
The study used survey data collected from urban residents who visited the Lilongwe National Botanic Garden and Lilongwe Wildlife Centre (a wildlife sanctuary) in Malawi. The two nature sites are located within Lilongwe, the capital city of Malawi. The Lilongwe

Wildlife Centre (LWC) is Malawi's only wildlife sanctuary, occupying a 180-hectare protected nature reserve in the middle of the capital city. The LWC is a critical part of the city's unique cultural history and provides an opportunity for the country to conserve its fragile biodiversity, which includes the Miombo woodlands.

During the COVID-19 pandemic, there were government-enforced containment measures such as social distancing protocols, economic shutdowns and various forms of home quarantine. These measures had an effect on patronage of public places and public gatherings. The restrictions were not usual and, as a result, the movements were scaled down, which could have implications not only for the visitation of the nature site but also for the perceived value of the services rendered. Normally, local and international visitors come to the Lilongwe National Botanic Garden and the Lilongwe Wildlife Centre (LWC) for outdoor recreation (for eating out and exercising), spiritual meditation (cultural) and to pursue education/research-related functions.

An onsite face-to-face survey was conducted between November and December 2020, a period when strict COVID-19 restrictions had been eased in Malawi. The advantage of conducting an onsite survey is that researchers are sure that respondents have real knowledge and experience about the recreational site under study. Data was collected using a structured questionnaire, which was administered to a sample of 170 respondents, mainly visitors of Malawian nationality, except for two foreign tourists who were British and Irish citizens. Different public places (canteen/restaurant, walking trails and lawns) within the site were visited to solicit respondents' participation. We used the interception survey technique (Togridou *et al.*, 2006; Mmopelwa *et al.*, 2007; Majumdar *et al.*, 2011; Tu *et al.*, 2016; Quinton *et al.*, 2019) to identify respondents in three easy steps as follows:

(1) Firstly, an enumerator randomly approached a potential respondent at the recreation site and then introduced himself/herself.

(2) Secondly, the surveyor explained the purpose of the study and asked the visitor if they were willing to participate in the survey.

(3) Lastly, the enumerator administered the questionnaire to the willing respondent; otherwise, the surveyor approached the next available visitor.

The respondents were identified through a nonprobability random sampling approach because data on the target population and locations was not available.

3.2 Data

The survey collected information on a number of variables, including visitor demographic characteristics, environmental dispositions, WTP for improved recreational quality, preferences for forest ecosystem services and how the Corona virus pandemic had affected their perceived values of urban forests. Following Mmopelwa *et al.* (2007) and Lundberg *et al.* (2019), we used donations to a hypothetical environmental non-governmental organization – Urban Green Space Conservation Association – as payment vehicles for the stated WTP offers. It was explained that the donation would be used by the organization to successfully implement urban forest landscape conservation and enrichment activities such as reforestation, removing evasive species, enrichment planting, restoring trails, waste picking and promotion of environmental consciousness among the public. The decision maker (respondent) was endowed with K100,000 (not real money) and then asked to choose any amount they would be willing to voluntarily donate to the conservation group while keeping the remainder as a private resource. Our approach addresses the endowment problem experienced in developing countries, where, in some cases, households cannot

allocate part of their income for public projects because of tight budgets (Lankia *et al.*, 2014). We used the BWS technique to rank the most (least) preferred ecosystem services (Cohen, 2009; Finn and Louviere, 1992; Loureiro and Dominguez Arcos, 2012). BWS is a choice-based valuation method that aids preference ranking in such a way that respondents choose the most "superior" and "inferior" option among a set of available alternatives (Cohen, 2009; Finn and Louviere, 1992; Loureiro and Dominguez Arcos, 2012). Figure 1 shows an example of a BWS question used in this study.

Table 1 summarizes the data. The average age of the respondents was 30 years, and over half of the sample were males (58%). On average, respondents travelled 17 km to visit these urban woodlands. The total distance travelled was estimated using an online GIS (Google Map) connecting the central point of the respondents' residential area (the origin) and the urban recreational space visited (the destination). Destination loyalty, or repeat visitation, is often considered as a desirable attribute in tourism marketing (Oppermann, 2000). In this study, respondents reported an average of at least one visit per month, and 75% of the respondents were repeat visitors. Destination loyalty could suggest that respondents were satisfied with their recreational experience at the site, and this could have positive implications in terms of the validity of the stated WTP values, i.e. a possibility of reducing protest bids. In general, users expressed satisfaction with the recreation site; that is, 42% were satisfied, 31% were somewhat satisfied and 20% were very satisfied with the urban woodlands visited. Only 7% of the respondents expressed total dissatisfaction.

3.3 Estimation

To understand the factors that influence willingness to contribute to improving greenspace quality, we use a fractional logit regression model. This modelling approach is suitable for fractions or ratio outcomes where zeros and ones are part of the pertinent data occurring through the same process as the rest of the proportions (Papke and Wooldridge, 1996; Baum, 2008; Cook *et al.*, 2008). We can characterize fractional data as bounded continuous variables that take values within a closed interval [0,1] or [0,100%]. In our study, the dependent variable is the individual's contribution towards financing conservation and rehabilitation activities to enhance the quality of recreational services. The decision maker (respondent) was endowed with K100,000 and asked to choose how much of it – any amount between K0 and K100,000) – that an individual wished to donate to the conservation group and how much to keep. We use fractional logit regressions because our dependent variable is bounded between zero and one, but also because fractional values appear – because it is

Most important	Urban green-space ecosystem services	Least important
☐	Leisure/Recreation	☒
☒	Socio-cultural/Religious	☐
☐	Air pollution Control	☐
☐	Noise Reduction	☐
☐	Research/Education	☐
☐	Biodiversity Conservation	☐

Figure 1.
An example of a best–worst scaling choice set used in this study

Notes: Which of the following functions of this urban green landscape did you consider to be the most (least) important before (during) the COVID-19 outbreak?
Source: Created by author

Variable	Description	Mean	SD
Gender	= 1, if the respondent is male; = 0 if otherwise	0.58	0.49
Age	Respondent age (years)	30.10	10.16
Education	Highest formal education (years)	13.41	2.45
Monthly expenditure	Average monthly expenditure (Kwacha)	151,982	209,615
Visitation frequency	Average number of visits per month	0.57	0.68
Solid waste disposal practices			
	= 1 if household buries waste; = 0 if otherwise	0.58	0.50
	= 1 if household burns solid waste; = 0 if otherwise	0.20	0.40
	= 1 if households compost organic waste; = 0 if otherwise	0.06	0.23
	= 1 if the household hires or pays a private waste collector; = 0 if otherwise	0.23	0.42
	= 1 if household uses other methods; = 0 if otherwise	0.01	0.11
Self-assessed environmental consciousness	Pro-environmental attitude is rated on a scale of 0–10 (0 = not conscious at all and 10 = very conscious)	7.7	0.21
Willingness to pay/contribute	Average willingness to contribute to urban space improvement (Kwacha)	22,317	22,967
COVID-19 affected recreation visits	= 1, if the respondent was affected; = 0 if otherwise	0.50	0.50
Repeat visitor	= 1, if the respondent has visited this urban green space before; = 0 if otherwise	0.75	0.43
Overall level of satisfaction with urban green landscape			
	Not satisfied (%)	7.10	
	Somewhat satisfied (%)	31.36	
	Satisfied (%)	42.01	
	Very satisfied (%)	19.53	
Location	Distance from the respondent's residential area to urban green space (km)	17.02	52.81

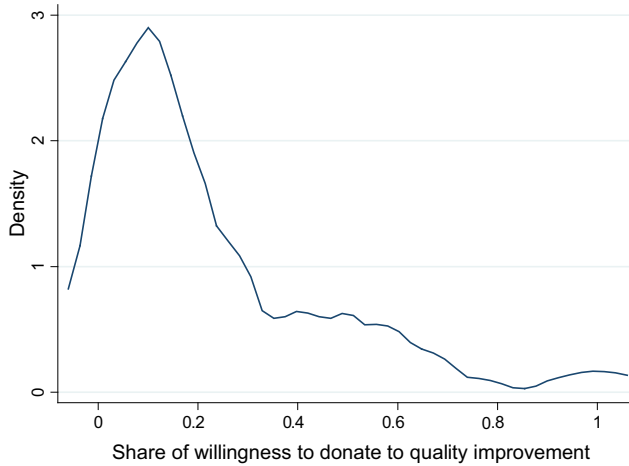**Source:** Created by the author

expressed as a ratio of the amount voluntarily donated to the conservation group relative to the total endowment income. The fractional logit model is appropriate because it uses a complete set of observations by including both fractional outcomes and boundary observations (Papke and Wooldridge, 1996; Baum, 2008; Cook *et al.*, 2008). Thus, estimating a fractional logit model would yield more efficient estimates than applying linear models or Tobit regression. An alternative application of the beta distribution, such as zero inflated beta regression (ZOIB), is inappropriate because, as Figure 2 illustrates, boundary observations are not in excess to justify application of ZOIB or its variants. The ZOIB regression would be suitable if a substantial number of observations were clustered around the lower limits (0) or upper limits (1) of the closed interval. We implement fractional logit regression using Stata's generalized linear model command (Baum, 2008).

4. Results

4.1 Effect of the Corona virus outbreak on user preferences for urban green space functions
To test whether the public health pandemic could have changed visitors' preferences for urban green space functions, we elicited respondents to rank their preferences before and during the COVID-19 pandemic period. Respondents ranked the most important and least important services in terms of how each function contributed towards their recreational satisfaction and, consequently, welfare improvement and quality of urban life. The BWS

Source: Created by author

scores were standardized to indicate the relative importance of the six ecosystem functions. The results are presented in Table 2 and Figure 3.

The positive (negative) values in the (B − W) column show that a given attribute was chosen more (less) frequently as "most important" than "least important". The results show that leisure/recreation function was the most important service among the visitors of the urban green space, with or without the Corona virus outbreak. Because leisure/recreation has the highest probability of being chosen by respondents, it is recorded as a reference or base attribute (100%), while all other attributes are presented relative to the base category. From these results, respondents felt that outdoor recreation, cultural services and air pollution control were the most important functions of urban landscapes during the COVID-19 pandemic.

4.2 Visitors' willingness to pay for an improved recreation experience

Urban green spaces are a key source of recreational opportunities for tourists as well as urban residents. Respondents were asked to express their WTP for potential site

Green space ecosystem function	Pre-COVID-19 period					During the COVID-19 period					Change
	B	W	B − W	$(B/W)^{0.5}$	Std. score (%)	B	W	B − W	$(B/W)^{0.5}$	Std. score (%)	(%)
Leisure/recreation	78	22	56	1.88	30.9	65	15	50	2.08	32.7	1.8
Cultural/religious	28	36	−8	0.88	14.5	34	26	8	1.14	18.0	3.5
Research/education	10	8	2	1.12	18.4	22	20	2	1.05	16.5	−1.9
Air pollution control	17	31	−14	0.74	12.2	22	23	−1	0.98	15.4	3.2
Noise reduction	24	52	−28	0.68	11.2	21	66	−45	0.56	8.9	−2.3
Biodiversity conservation	13	21	−8	0.79	12.9	6	20	−14	0.55	8.6	−4.3
Total	170	170	0	6.09	100	170	170	0	6.36	100	0.0

Notes: Std. = standardised score indicating relative importance out of a sum of $(B/W)^{0.5}$
Source: Created by the author
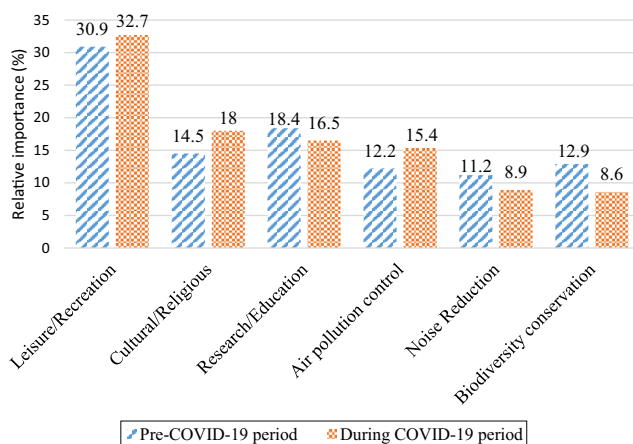
Source: Created by author

improvements through urban forest landscape conservation and enrichment activities such as reforestation, removing evasive species, enrichment planting, restoring trails, waste picking and promotion of environmental consciousness among the public. In response, the majority (94%) were willing to pay positive amounts ranging from K1,000 (US$5.65) to K100,000 (US$565) as a one-time payment, while only 6% of the respondents reported zero WTP. The green space users were generally satisfied with their recreational experience at the two sites.

4.3 Visitors' motivation to contribute to recreational quality improvements
Further, we examined determinants of WTP for or contribute to recreational quality improvements in urban green spaces using a fractional regression model, which is appropriate for a dependent variable constrained between 0% and 100%. The results from a fractional regression model are presented in Table 3. The study examined the effects of environmental disposition, recreational experience or satisfaction with the green space, the respondent's income status, education and distance to the recreational site. The findings show that education, income status and the user's satisfaction with the site positively influence an individual's WTP for quality improvements.

5. Discussion
The COVID-19 pandemic affected tourism services and other economic sectors globally. Therefore, the study hypothesized that the Corona virus outbreak and the associated preventive measures could have changed the perception, preferences and intensity of use of urban greenery spaces. The results presented in Table 2 and Figure 2 confirm that preferences for green space functions had changed during the COVID-19 period compared to the pre-COVID period. It is worth noting that prior to the Corona outbreak, the three highly ranked services were leisure/recreation (31%), research/education (18%) and socio-cultural/religious function (15%). However, during the Corona outbreak, the top three ranked services changed in such a way that leisure/recreation gained ranking from 31% to 33% and the importance of socio-cultural/religious functions rose from 15% to 18%, whereas research/education declined from 18% to 17%. Overall, socio-cultural/religious services and

Variable	Coef.	Std. err.	Marginal effects (dy/dx)	Cluster std. err.
Gender	0.235	0.26	0.0335	0.0374
Age	−0.015	0.02	−0.0022	0.0022
Age_squared	0.000	0.00	1.44E-05	0.0001
Education (reference = primary)				
Secondary	1.497***	0.43	0.1401***	0.0348
Tertiary	1.656***	0.38	0.1634***	0.0275
Log of average visits per month	0.047	0.13	0.0067	0.0188
Log average visit square	0.003	0.01	0.0004	0.0010
Burn solid waste	−0.160	0.35	−0.0228	0.0490
Environmental education	0.273	0.32	0.0390	0.0454
Environ. consciousness	0.172	0.62	0.0245	0.0884
Satisfied with greenspace	0.355**	0.16	0.0505**	0.0229
Log of average expenditure	0.749***	0.14	0.1068***	0.0197
Log of peers bid price (WTP)	−0.052***	0.01	−0.0075***	0.0019
Log of distance to urban green space	−0.61***	0.22	−0.0870***	0.0309
Constant	−10.91***	1.75		

Source: Created by the author

Table 3.
Fractional logit model results and average marginal effects

air pollution control registered remarkable positive changes of 3–4% over the two periods. Specifically, the study findings show that there was an increase in the desire for air quality improvements (air pollution control) during the COVID-19 era, which could reflect people's anxiety that COVID-19 was a serious threat to public health. In addition, cultural/spiritual functions of the forested landscape had become highly important because religiously-inclined people had resorted to seeking divine intervention to deal with the pandemic. Thus, religious believers were using open space and courtyards for their prayers while observing social distancing recommendations. Our findings are consistent with those of Nesbitt *et al.* (2017), who observed that cultural ecosystem services provided by urban forests become increasingly important to urban populations as they navigate through the realities of busy city life. Furthermore, the observance of precautionary measures such as enhanced hygiene and social distancing became prominent during the COVID-19 era. Thus, people were frequently looking for quiet and peaceful environments for work, recreation and outdoor relaxation. On the other hand, biodiversity conservation was perceived as the least important (inferior) ecosystem function during the Corona virus outbreak. Specifically, the green space users were four times more likely to choose leisure/recreation as the most important function of urban parks and woodlands than they would choose biodiversity conservation. Again, these findings were collaborated on by Weinbrenner *et al.* (2021), Ferguson *et al.* (2022) and Smith *et al.* (2023), who found that outdoor recreation in protected areas became unprecedentedly popular during the COVID-19 pandemic in Freiburg (Germany), New England National Forests and South-East Queensland, respectively.

Spending time at nature sites is one way of coping with extreme temperatures and healing from stressful life events, which could potentially lead to mental health problems. Therefore, it is expected that users of urban green spaces could contribute to new efforts towards quality improvements and the sustainability of nature sites. Our WTP results suggest that people are satisfied with recreation experiences at the study sites and therefore are willing to pay positive amounts, except for a small percentage (6%) who had zero WTP values. One possible explanation for zero WTP bids could be that respondents consider urban ecosystem services as public goods and, therefore, think that it is the responsibility of

the government to supply them at no cost to the public (Lo and Jim, 2010; Tibesigwa *et al.*, 2020). Furthermore, zero WTP values could theoretically represent protest bids or respondents who are indifferent between the existence and nonexistence of urban recreational parks. However, after conducting statistical tests [1], it was concluded that their effect on the analysis was nonconsequential and our results are reliable to guide policy recommendations.

The mean WTP for quality improvement is estimated to be K22,317 (US$28.73), representing 22% of the total endowment, whereas the median WTP was K12,000 (US$15.45). The estimated mean WTP value in the current study (US$28.73) is comparable to the amount reported by Dumenu (2013) for their Ghanaian study ($22.55 per year), although there could be differences in the socio-economic characteristics of the respondents. Just like in the warm-glow giving theory developed by Andreoni (1990), this voluntary contribution depicts the extent of an individual's sense of altruism towards nature conservation or a public good and the expected benefits that an individual could get from the nature site. An individual with some initial resource endowment (e.g. labour or cash) makes a trade-off allocation decision between direct consumption or private use and a contribution towards conservation activities (public good). In purely altruistic behaviour, an individual would donate all the resource endowment to the public good, while a purely egoistic individual does not care about public donation but private consumption, and hence keeps all his/her endowment.

Using fractional regression, we explored factors that may explain an individual's donation decision or WTP for improved recreational quality. The positive coefficients for education, income status and user's satisfaction with the recreation site suggest that these factors are likely to increase an individual's WTP for quality improvements. The mean marginal effects show how the expected proportion of the total contribution towards quality improvement would change given a small change in the covariate. For example, the marginal effect of average monthly expenditure is estimated at 0.107, which indicates that for a 1% increase in average expenditure, an individual with average characteristics is expected to contribute 10.7 percentage points to conservation activities. The estimated marginal effects reveal positive effects for secondary education (0.14), tertiary education (0.16) and the user's satisfaction with the site (0.05), whereas marginal effects are negative for distance to the public space (-0.09) and the level of peers' willingness to contribute (-0.01). The findings are consistent with similar studies, for example, Majumdar *et al.* (2011) who found that tourists with a graduate school degree were willing to pay more than tourists with a high school education or less. Similarly, Majumdar *et al.* (2011) and Dumenu (2013) reaffirm the evidence that WTP is positively correlated with the respondent's income. Finally, Togridou *et al.* (2006) show that visitor's satisfaction can have a significant effect on their willingness to support nature conservation. On the other hand, distance to the public recreation space and the level of peers' willingness to contribute (if others are already paying for the nature area) would likely lead to a reduction in individual's WTP /contribute to site improvements. Just like in the technology adoption literature, social influence from peers (the homophily effect) plays an important role in influencing the WTP or donation decision (Khataza *et al.*, 2018). Consistent with this study, Tu *et al.* (2016) report that WTP for access to a given recreational site decreases with increasing transportation costs or distance.

The study found no statistically significant evidence for age, gender and pro-environmental dispositions. Although not statistically significant, environmental education and environmentally-friendly behaviour or practices had the expected positive sign, suggesting that a positive change in each covariate would likely exert a positive influence on WTP for urban green space conservation.

6. Conclusion and policy implications

Urban parks and woodlands provide multiple ecosystem services and, hence, enhance the quality of urban life. Globally, the COVID-19 outbreak had disrupted nearly all sectors of the economy, and, in particular, tourism and recreation services were the most affected. This paper presents an assessment of COVID-19 effects on the perceived values of urban parks and woodlands.

Urban forests have gained unprecedented importance not only in terms of recreational activities but also for maintaining social contacts and coping with psychological stress. Our results confirm that during the COVID-19 period, preferences for green space functions changed in such a way that leisure/recreation and socio-cultural/religious functions gained rankings, but ranking for research/education declined. Green space users were four times more likely to choose leisure/recreation as the most important function of urban parks and woodlands than they would choose biodiversity conservation.

Further, the majority were willing to pay positive amounts for site improvements. The results indicate that WTP would be higher among visitors with secondary and tertiary education. It also seems likely that WTP would increase with higher income. Another important finding of this study is that satisfied visitors or those with positive recreational experiences at the site would be more willing to pay for improvements in urban forest services.

Evidently, municipalities are more likely to prioritize investment in urban greenery if the value of the greenery is clearly visible (Nesbitt *et al.*, 2017). Thus, the results of this study would be useful for urban resource managers and city planners in developing management strategies for urban green infrastructure, which could enhance recreational and amenity benefits for society. A nuanced and supportive policy framework is needed to further incorporate the growing demand for forest recreation and its peaceful environment. For example, the findings would be beneficial in terms of designing an appropriate user-fee policy by either introducing or revising admission fees as a revenue generation strategy for municipalities. It is plausible that park authorities would investigate visitors' WTP for the urban green space and establish motivations for the stated WTP values before user fees or charges can be effected. Because the study findings suggest that visitors are satisfied, municipalities could also consider ways of preserving desirable attributes that increase visitor's patronage.

Note

1. The hypothesis that mean willingness to pay excluding zero bids (K23,720.13) is equal to complete sample mean WTP (K22,316.57) could not be rejected.

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