VALUING RECREATIONAL BENEFITS OF URBAN GREEN SPACES IN NAIROBI CITY: AN APPLICATION OF TRAVEL COST METHOD

BY

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DECLARATION

This research project is my original work and has not been presented for any degree award in any institution.

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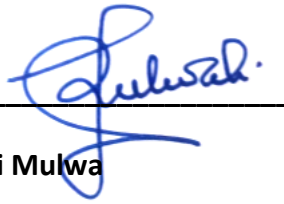
SUPERVISOR'S DECLARATION

The study has been submitted for examination with my approval as the university supervisor.

Signature  **Date 02.12.2022**

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DEDICATION

This work is dedicated to lovely family for the unwavering support, love, encouragement during my academic journey.

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LIST OF ABBREVIATIONS

UGS	:	Urban Green Spaces
TCM	:	Travel cost method
ITCM	:	IndividualTravel cost method
WHO	:	World Heal Organization
UN	:	United Nation
NB	:	Negative binomial
CS	:	Consumer surplus
PSTRAT	:	Poison stratified
MYR	:	Malaysian Ringgits
EFD	:	Environment for Developmnent.

ABSTRACT

There has been increased support for environmental based urban green spaces (UGS), that offers variety of benefits to population such as health, environmental conservancy and recreational amenities for improved life quality. Regrettably, the economic values of Nairobi Green spaces are unknown, hence imminent neglect and encroachment that has contributed to their diminishing size and quality. The purpose of this paper is to estimate the recreational benefits values and assess key drivers influencing visits to Karura forest, Uhuru Park and all Nairobi parks combined. The objective was achieved by use of data collected from 669 Nairobi households. The demand function for the green spaces visits was generated using travel cost method (TCM) and further estimated using Truncated Poisson model (ZTP) model. The recreation value for All Parks combined, Uhuru Park and Karura was estimated at US$ 70.9M, 42.5M, and 6.4M per annum respectively. The results provide support for informed decision making such as improved budgetary allocations, cost benefit assessment for competing projects, policies aimed at conserving, maintaining and expansion of more urban green spaces.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

The exponential population growth, especially in urban areas, has increased outdoor recreation demand. Generally, recreation is an essential human activity that enhances pleasure and increases life satisfaction. Among the places frequented by urban residents during their leisure time is the urban green spaces (UGS). UGS plays a crucial role in city environmental conservation, recreation, and sporting facilities that also contribute to employment creation. In addition, they form an urban environment attraction site for both domestic and foreign visitors. Urban green spaces (UGS) in land-use planning refers to the open-space and blue-space areas mostly reserved for recreational parks, water features, and other natural environments (Jennings et al., 2019). The demand for UGS continues to increase due to the need for outdoor recreation and the desire for relaxation among the urban residents. However, the potential of UGS to promote active lifestyles for visitors and residents is hindered mainly by both financial and natural resources that limit the expansion of urban green spaces. Moreover, development activities and ad hoc planning have also frustrated the growth of UGS (Zhang et al., 2015).

Nairobi, the capital city of Kenya, occupies approximately 696km2 and was established in 1963 (Oyugi and K'Akumu, 2008). (Makorwo and Mireri, 2011). The estimated population for Nairobi county is 4.3 million people, while a total of 9.3 million people live within the metropolitan area, according to the 2019 census. Despite the enormous vast population growth since 1963, the city of Nairobi's planning depends mainly on a colonial master plan crafted in 1948, designed for only 250000 people. The total area allocated to open spaces according to colonial was 27.5 per cent of the city land. The dynamic social, political, and economic priorities associated with rapid population growth coupled with complex land ownership, ad hoc planning, political maneuverings, and grabbing have led to Nairobi's open spaces encroachment. For instance, Nairobi City Park, established in 1921, was encroached on, and the area was reduced from 91 Hectares until the remaining 60 Hectares were declared through a legal notice -gazette supplement no.59 September 2009. Nairobi city lies on a combined area of 3,106.4 hectares translating to 6.56 square meters per capita public open space (UN-Habitat, 2020). The allocation

is below the 10 to 15 square meters per capita recommended for a sustainable city which emphasizes the need to improve the amount of land designated and used as public space by the World Health Organization (2012). Notwithstanding the challenges mentioned above, several UGS have remained Nairobi's topmost frequented recreational sites by both residents and visitors.

The valuation of nonmarket goods, such as urban green spaces, has increasingly become an interesting subject among environmental specialists and experts. Hitherto, most UGS have suffered massive loss and degradation due to non-recognition of their actual market value. Hence, in today's life, the valuation of UGS is inevitable, and avoiding valuation can result in regrettable concerns.

The value placed on individuals' goods and services reflects their efforts to acquire and protect them. Strong protests occur when the loss of UGS is imminent, especially due to development activities, and they strongly reflect the high value that residents place on UGS. For instance, in 1989, the late Nobel Peace Prize Prof Wangari Maathai led a campaign to protest a 60-storey headquarters for the Kenya African National Union that would occupy a massive portion of land within Uhuru Park. A decade later, she was among the critical protesters against developers' incursions to prevent further grabbing of Karura forest. According to the Ndung'u report of 2005, Karura forest, an urban forest gazetted in 1932 was encroached and reduced to 564 hectares from the original 1,041 hectares. Such protests have revealed the importance of UGS and, therefore, the need to estimate the recreational benefits economic values. The purpose of the economic valuation of UGS is to acquire information that can aid in decision-making, especially in matters relating to sustainable development, including optimal budget allocation and conservation. Valuing the cost and benefit of the UGS offers an opportunity to maximise social welfare through principled planning. During the site valuation, the cost of offering the opportunity can be compared to the willingness of the public to use it. The cost can be determined by evaluating the opportunity cost forgone by the individual to achieve their desired needs (Czajkowski et al., 2015). In most cases, the site can pass the cost-benefit test of economic efficiency when the benefits exceed the costs. According to Clawson (1959), theoretically,

allocating an acceptable and accurate value to urban green spaces would offer valuable information in resource management. For instance, the established value of UGS can be used to measure the desirability of attracting investments in such projects. The value can also be used to determine the possible use of such facilities.

1.2 Statement of the Research Problem

Despite the vast potential of Urban green spaces for environmental, social, health, and economic growth, most of them are neglected especially in less developed nations like Kenya. This neglect has provided a fertile ground for grabbing public urban green spaces as witnessed on Karura and city park. Further, with the value of the UGS around Nairobi being unknown, limited efforts have been put in place to increase the size or improve UGS facilities in Nairobi since 1963 notwithstanding the rapid population growth of the city. The economic value of Nairobi green spaces is unknown and therefore decisions on fees charged, budgetary allocations conservations are not optimal. Additionally, the economic value is not incorporated in the evaluation of competing Government projects such as expansion of SGR and the expressway. As a result, the existing UGS have been encroached, and neglected hence deteriorating the size and quality of recreation facilities which negatively affect experience of UGS users. This paper, therefore, seeks to estimate the monetary values of Nairobi green spaces' recreational benefits using the travel cost method. Focus was on the following parks Uhuru Park, Central Park, City Park, 7 August Memorial Park, Jevanjee Gardens, Karura Forest, Nairobi Arboretum and Michuki Memorial Conservation Park.

1.3 Research Questions

The study was guided by following research questions.

1. What is the estimated recreational value of urban green spaces in Nairobi County?
2. What factors influence the number of site trips to Nairobi green spaces?

1.4 Objectives

The aim of the study was to assess the recreational value of Urban Green Spaces in Nairobi County. This was broken down into the following specific objectives.

1. To estimate the recreational value of the main urban green spaces in Nairobi city country using travel cost model.
2. To establish factors that influence residents to visit Nairobi green spaces.

1.5 Justification of the Study

The study findings provide valuable insight to the decision-makers on the economic value of urban green spaces that will form the basis for improving the available resources and optimising social welfare. Estimating the economic value of the UGS will also aid in the attainment of sustainable development goal 11 on creating sustainable cities, especially by increasing the average share of open spaces for public use (UN, 2015). Insights from the paper will also enhance the urban green spaces quality, which will increase their quality and create a higher value for them. The study will also demonstrate the intuitive appreciation of green spaces based on the estimated cost Nairobi residents are willing to pay to enjoy the amenities.

CHAPTER TWO: LITERATURE REVIEW

2.1 Chapter Introduction

The literature review focused on previous research on urban green spaces globally. It focused on the valuation procedures used and the conclusions made by the studies. The study was motivated by the neglect associated with urban green spaces and the increasing threats from urbanization, insecurity, land grabbing, and lack of attention that have hindered public knowledge of the economic value of the UGS. The literature review sought to answer the research questions on the value of recreational benefits accrued from urban green spaces using the travel cost method. Recreational benefits would be explained better by ascertaining the economic value associated with public UGS's. The information obtained will be helpful for public policy-making formulations.

2.2 Theoretical Literature Review

The study relied on some theories that play important role in urban green space conservation and valuations.

2.2.1 Greenway Theory

Greenway's theory embraces a combination of both constructive and natural protection and links urban ecological frameworks (Su et al.,2012). The theory advocates for the call on governments and authorities to protect and conserve UGS and stands as a manifestation for protecting, utilizing, and benefiting UGS. It asserts that once the Urban green spaces are protected and conserved, they can be linked to countryside green spaces. It advocates for breaking the boundaries between rural and urban green spaces, instead calling for blending and allowing residents to benefit from UGSs (Urban Green Spaces). Proponents of greenways theory assert that UGS spaces represent planned, designed, and managed large tracks of land for ecological, cultural, economic, and recreational benefits, among others. Sue et el., (2012) seek to encourage local governments to integrate urban green spaces with the countryside and ensure that people benefit.

2.2.2 Lancaster Theory of Value

Lancaster theory of value Lancaster (1966) supposes that utility derived from consumption of an environmental good is dependent not only on good itself, but it is also its attributes. In this case, the Utility from visiting a Nairobi green space is dependent on price, attributes of site a visitor. According to this theory the user preferences can be well represented by utility function of which the preference constitute the characteristics of the urban green space. Factoring preferences in formulation of Lancaster model has an impact on environmental good offering in the sense that there is an opportunity to adjust attributes of green spaces offered to the visitors. The assumption of Lancaster is that the characteristics of an urban green that interest the visitors of green space can easily be measured. The model further assumes that since utility is derived from attributes of the good, the model should reflect the characteristics the user can afford.

2.2.3 Random Utility Model

The theory of random utility was developed by McFadden (1974). The model assumed that preferences of an individual among available alternatives can be described by utility function Random utility theory assumes that the utility a visitor derives from consumption of an environmental good constitutes two components namely deterministic i.e., price, and other social economic factors etc and random variables. User of UGS will choose a site that offer the greatest utility. Visitors know the utility they derive from each visit but some of factors that influence the site may not be observed. Effects of unit change of each component is estimated. The model gives the probability for which each alternative is selected.

2.3 Empirical Literature Review

A study by Othman and Jafari (2019) on Taman Tasik Cempaka recreation, a lake-based park in Malaysia, using 480 respondents, found that the site was more attractive with an average of three trips per person per month while visitors spend around an hour in each of their visits. The study found that the park was highly beneficial to the community, with an aggregate value of MYR 12I,127 each month. Hence, recommended an average fee of MYR 1.30 at the entrance per visitor. The study generated the demand function for recreation sites using the TCM approach

and estimated the model using the Negative Binomial (NB) and Poisson models. Since price elasticity of demand was inelastic, it was unlikely that the introduction of the access fee could substantially reduce the rate of visitations or the net benefits. The fee levied would be used for the conservation and upkeep of the park.

Mokhtari and Hosseinifar's (2013) study on valuation of Amirkola park in Babol also established negative correlation between the travel cost and the number of visits. The study used 110 questionnaires to obtain data. In this study, males represented 92 percent of the respondents, resulting in male-based responses. Nevertheless, the gender of responses may have resulted from the fact that the cost of travel was mainly paid by the male persons who were the breadwinners. The study further found that most visitors aged between 31-40 years, followed by 21-30 years. The results revealed that most of the visitors had high school diplomas. Most of the visitors indicated preference for recreational sites visits on Fridays and holidays. Further, 47 percent of the respondents indicated that though the park was a public utility and accessed free, imposing an entry fee would not deter their satisfaction and willingness to pay access charge. Using the TCM approach, it was established that the recreational value of Amirkola Park was approximately 9,159 dollars which was higher than other parks such as Chitgar Park and Sisangan Forest Park, estimated to have a recreational value worth 5,189 and 5,293 dollars, respectively.

Delhavi and Adil (2011) study applied the truncated Poisson and endogenous stratification to value Keenihar Lake in Pakistan. The recreational value of the site was estimated for USD 42 million based on the annualized average consumer surplus of USD 116. The study assumed that the recreational site had an average of 1000 visits per day. The study further found that changing the model's specification only resulted in a 5% reduction in the consumer surplus. Previous researchers have also combined two non-market valuation approaches to determine the recreational value. Jabarin and Damhoureyeh (2006) used contingent valuation and TCM to establish the potential magnitude of the Dibeen National Park in Jordan. The study estimated the value of the environmental amenity using 300 questionnaires. The Poisson regression analysis

was applied for the TCM approach, while a Tobit regression was employed for the contingent valuation to value willingness to pay of an individual. The study revealed the value of environmental amenity to be approximately $ 100 per person per recreational day using the travel cost method, while the average willingness to pay was $7.80 using the contingent valuation approach. Overall, the study revealed that the amenity was approximately valued at $19 million, although the value was likely to vary depending on the number of visits.

Zhang et al., (2014) study of Gold coast beach Australia sought to understand the recreational values and characteristics. The study adopted individual travel cost method to estimate the recreational use values. Travel cost, time, site substitute, beach quality and other social economic factors were considered as explanatory variables to the beach visits. The consumer surplus value was analysed using the user data from beach questionnaire surveys. The study established beaches were important for decision making of tourists to beach hence need for protection of the beach for continues tourists' attraction. Regressing the demand function using Negative binomial estimated the Consumer surplus gold Beach 10-14 for residents and $16-19 for tourists, an indication that the total recreation value per year could surpass $500 million per year after including non-use values.

Some studies have also shown that increasing the entrance fee decreased the willingness to pay for recreational sites. Limaei et al. (2014) performed a survey using 96 questionnaires to determine the socioeconomic and recreational value of Masouleh forest Park in Iran. The study employed Travel cost method using age, education, travel cost, and travel time as critical determinants of the model. The study found that the middle-aged people were the most frequent visitors, implying the recreational sites were more attractive to middle-class people. Further, the study found that visitors at a university level were the most frequent recreational site. The study showed that 75 percent of the visitors were willing to pay up to a certain amount, after which increasing the amount resulted in reduced willingness to pay. On conducting the regression analysis, the study revealed that as much as the entrance fee to site a, number of visitors and

time of assessing the site had a significant relationship, the income and the number of visitors did not reveal any significant relationship.

In Africa studies on the environmental goods use and valuation are slowly gaining traction. For instance, Kassaye (2017) in recreation valuation of two parks in Addis Ababa adopted Individual travel cost pproach and with random data collected from 180 respondents. The study truncated the number of visits and modelled annual values of recreational using Truncated Negative Binomial model. The estimation model preferred the semi-log form. The study demand equation used the number of site visits as the predicted variables with the socio-economic features such as mode of transport, knowledge, age, and cost of travel, among others as the regressors. The study estimated the total annual recreational value to be over Birr 19 and 18 million for Future and Hamle 19 recreational sites, respectively.

In Kenya, Mulwa et al. (2017) estimated value of recreation and optimal pricing for Maasai mara National Park. Visitors. The study employed an individual travel cost method, and analysis was done using a log-linear form of count data models, specifically a Poisson regression with endogenous stratification (PSTRAT). Poisson estimation with endogenous stratification was preferred after considering the data was truncated, and endogeneity. As a result, a daily consumer surplus per visitor was estimated at $ 115, translating to $ 73Million per year of Maasai Mara National Park. In addition, from the PSTRAT and using price elasticities for days spent and park fees paid, $ 86.90 per day was estimated as the optimal access charge that would maximize park revenue. Park management could therefore hike the park fee to maximize the consumer surplus or invest in the in-substitute sites.

Leh et al. (2018) identified several issues that should be considered when applying the TCM. The period spent traveling to and from the recreation travel duration should be assessed whether the recreationists choose them out of convenience or enjoyment. Secondly, the survey should determine if the visitors had multi-purpose trips, in which case distribution of the cost is essential

to avoid overvaluation. Thirdly, the study should also accommodate another cost that the recreationist incurs as they pursue to derive benefits from the recreational parks. Lastly, the choice of parks. Depending on the quality of the area, congestion can be regarded as a hindrance to many visitors.

2.4 Summary of literature survey

From the studies reviewed, it's clear that despite the awareness and existence of established economic models to evaluate the economic values of environmental goods, limited studies have been conducted in Kenya and more specifically for Nairobi green spaces. As such, with little information on the value of Nairobi green spaces it is expected that government decisions such as budget allocations to planning and conservancy program are inadequate. Additionally, the studies show, little effort have been made to update the master plan since 1948 despite the growing social, political, and economic needs of city. It then implies that in absence of the true understanding of economic values of Nairobi green spaces, the management have no basis of doing an objective assessment of the various projects especially those effecting the existing green spaces.

CHAPTER THREE: METHODOLOGY

3.1 Chapter Overview

This chapter discussed the methods and procedures that were used to analyze data to achieve objectives of the study. It includes the theoretical and analytical model of the study.

3. 2 Theoretical Framework

Nonmarket goods and services valuations are categorized into two, stated preference and Revealed preference (Boardman et al. 2006). Revealed preference, especially the travel cost method is more appropriate where researcher views the recreational good as aggregate, while stated preference, like contingent valuation approach, is more suitable to value individual attributes that constitute recreational commodity and non-use value.

Stated preference uses surveys to obtain information on cost and benefits from respondents of non-market goods/services who do not pay for service use. Contingent valuation is one of stated preference method and involves use of hypothetical market values to value the environment goods and considers non-use values. The contingent method is more costly (Ecosystem valuation, 2013). Revealed preference majorly focus is on valuing nonmarket goods using observed individual behaviour and choices. Some of the revealed preference methods included Hedonic pricing method and travel cost method (Pearce and Moran 1994). The Hedonic pricing method is applied when a good price is directly affected by the quality of the environment.

The travel cost method relates the costs of consuming recreational good of a green space with its cost. These costs include all travel costs. The travel cost in this case involves out-of-pocket and opportunity cost of time. Unlike contingent valuation, travel cost method is more precise since it uses real values (Clawson, 1959). Travel cost takes different forms including individual travel cost method, zonal travel cost method (Willis and Garrod, 1991). Individual travel cost method compares relationship between the number of trips by an individual with the travel cost incurred.

Zonal travel cost-relationship between the trips with a zone population of and travel costs incurred. The method requires less data gathering and most suitable where the individual visits to the site are few and is less costly (Bergstrom and Cordell 1991; Ecosystem valuation, 2013; Chen et al., 2004). However, the method is criticized for its vagueness in the valuation of non-market goods (Bell and Leeworthy 1990. Individual travel cost (ITCM) is preferred for its adoption of conventional economic models and reliance on actual individual behaviour (Vicente and de Frutos 2010). ITCM unlike the ZTCM has an added advantage for its inclusion of social economic characteristics e.g., income, Education, to explain individual behaviour (Blackwell, 2007).

The study supposes a utility maximization framework of an Urban green space user which is a function of number of trips (y), other aggregate private goods consumed (z) and quality of the green spaces (q) subject to a budget constraint as shown below (Sarker and Surry, 1998).

$$U = U\,(y, z, q), \;\; s.t. \quad py + z = I \qquad (1)$$

Where (p) is the total travel cost per trip, I is total incomes and price of a private good is harmonized as one. According to Sarker and Surry (1998), number of trips are treated as a surrogate to the recreational good. Maximization of utility function yields the Marshallian demand function of Nairobi green space (public good) as shown in equation 2. Marshallian demand function is important to generate the consumers surplus using computed travel cost coefficients.

$$y = f\,(p, I, q) \qquad (2)$$

3.3 Model specification

The visitor determines if the derived utility is commensurate to total travel costs incurred. Other factors that contribute to decision to visit Nairobi green spaces include, price of substitute sites and other social-economic factors of the individual site. As such, the demand function for a Nairobi green park is proposed as in equation 3 (Bowker et al. 1996).

$$V_i = f(\beta_i, p_i, x_i) + \varepsilon_i \qquad (3)$$

Where V_i = number of visits to a green space in Nairobi by a visitor at any given time per annum; $p_i$is total travel cost incurred by an ith individual to a Nairobi green Park; x_i represents a vector of independent variables (social economic and demographic associated with ith visitor; and, β represents unknown parameters to be estimated; ε_i represents the error term.

The V_i to recreational site were nonnegative integer values, hence regression using count data models is preferred as opposed to use of ordinary least square method (OLS) to estimate recreational demand function. Adoption of OLS would lead to errors of inefficiencies and inconsistencies. (Haab and McConell, 2002). Hellerstein and Mendelsohn (1993) prescribe a theoretical framework for adoption of count data to model recreational demand. Poisson model is a basic count model (Gillespie and Collins 2017) and the probability distribution is expressed below:

$$Pr(V_i = n) = \frac{e^{-\lambda_i} \quad \lambda_i^n}{n!}, \quad n = 0,1,2, \ldots \qquad (4)$$

λ_i is a parameter representing conditional mean of V_i and takes the argument of the site demand model specified in equation 3. It is expressed as $\lambda_i = exp.(x_i\beta)$. Further, the data was truncated for number of trips i.e number of trips $(y > 0)$ hence making truncated poison model our preferred model with a probability distribution expressed in equation 5 (Grogger and Carson, 1991) can be used.

$$Pr[(V = v|V) > 0] = \frac{\Gamma(v+\alpha^{-1})}{\Gamma(\alpha_i^{-1})\Gamma(v_i+1)}(\alpha\lambda).(1+\alpha\lambda)^{(v_i+\alpha^{-1})}\left[\frac{1}{1-(1+\alpha\lambda)^{-\alpha^{-1}}}\right] \qquad (5)$$

Noting basic form of count data model is given by:

$$\lambda_i = exp(p, x, \beta) \qquad (6)$$

The expected latent demand (λi) is modelled as semi-logarithmic function as shown below.

$$\lambda_i = \beta_0 + \beta_i \boldsymbol{x}_i + \beta_p p_p + \beta_i \varepsilon_i \qquad (7)$$

where $\boldsymbol{x}$ is a matrix of regressors which constitutes social economic and demographics variables β is a matrix of coefficients. Estimation of (Equation 7) could also be done using other count data models such as Negative Binomial Model, zero truncated Negative binomial model. The consumer surplus (CS) evaluated which is also the net recreational benefit of a Nairobi green park According to Heberling and Tempelton (2009), the net recreational benefit is equivalent to recreation less cost of visiting the Nairobi green space. Integration of visits demand (V) over travel costs ranges yields the consumer surplus of green space (Hellerstein and Mendelsohn 1993) as shown in equation 7.

$$CS = \int_{pr_0}^{pr_c} \lambda_i \, dP = -\frac{\lambda_n}{\beta_p} \qquad (8)$$

Where CS = consumer surplus; pr_0 and pr_c are actual an choke prices; and β_p represents travel cost coefficient. Consumer's surplus per visit is relevant to policy and is given by inverse coefficient of travel cost (Ward and Beal, 2000) expressed in Equation 8. The policy implication is

that the average trip denominator $\left(-\frac{1}{\beta_p}\right)$ is common for all visitors during the survey (Curtis and Stanley 2015). The total consumer surplus for all visitors is expressed as follows;

$$TCS = \left|\frac{N\left(\frac{\lambda_i}{-\beta_p}\right)}{\lambda_i}\right| = \left|\frac{N}{-\beta_p}\right| \qquad (9)$$

Where TCS=total consumer surplus derived from the site, N-total number of visitors to the green spaces, -$\beta_{p=}$is the parameter estimate of travel cost to a Nairobi Green space.

3.4 Data sources and Variable Measurement

The study relied on secondary data from Environment for Development Kenya (EfD-K), housed at the Department of Economics and Development studies of the University of Nairobi. Survey data was collected from 669 households from four districts namely Nairobi East, Nairobi West, Westlands and Nairobi North. Household heads of different social economic background from the four districts were sampled. The variables (dependent and independent) used in the model, their units of measurement and expected signs are shown in Table 1.

Table 1: Variable description and measurements measurement of variables

Variable	Notation	Measurement units	Expected signs
Dependent Variable			
Demand for recreation sites	V	Number of trips to recreation site in Nairobi	
Explanatory Variables			
Travel cost	P	Round trip travel expenses	-ve
Education	Edu	Level of education	+ve/-ve
Age	AG	Age of visitors 17 yr +	+ve/-ve
Income	Inc.	Household income	+ve/-ve
Marital status	Ma	Single or married	+ve/-ve
Gender	Gen	Gender of HH	+ve/-ve
Household	HH	Size of Household	-ve
Employment status	Emp	Working	+ve/-ve
Children	Child	Number of children	+ve/-ve

3.5 Data Analysis

The data collected were coded and keyed to the computer using excel. It was then transferred to the STATA software for analysis and computation of the urban green space value or benefit. Data analysis involved data involved descriptive statistics of the variables as well as the various regression models to compute the value of the urban green spaces.

3.6 Diagnostic Tests

Before any analysis were done, several diagnostic tests were done. These were:

Normality test

Normality test is used to determine if the data collected is from a normally distributed population. To ascertain this the study used the Kolmogorov–Smirnov test to assess the distribution of the data.

Multicollinearity

Multicollinearity occurs when two or more explanatory variables in a model are correlated. The study therefore employed the Variance Inflation Factors (VIF) to test the presence of collinear variables.

CHAPTER FOUR: RESULTS

This chapter summarises the study findings including the descriptive statistics and the statistical model results.

4.1 Descriptive Statistics

The descriptive statistics show that average travel cost was Kes 1695.43, while the mean household age was 33 years with the ranges between 17 and the oldest 99 years. Many of the surveyed households were headed by males accounting for slightly over 50%. The study measured education by years of schooling with the least educated having zero years of schooling and the most learned having 25 years of schooling. The average household size 3.6 people, and over 72% of the sampled population were employed.

Table 2: Descriptive statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Number visits	669	3.848	5.171	1	30
Cost/visit (Ksh)	669	1695.43	783.12	170.30	4500.85
Gender	669	.509	.5	0	1
Age	669	33.266	11.295	17	99
Education	669	13.888	3.242	0	25
Marital status D1	669	.658	.475	0	1
Marital status D3	669	.039	.193	0	1
Child	669	.701	.458	0	1
House hold size	669	3.631	1.983	1	14
Income	669	.752	.432	0	1
Employed	669	.722	.448	0	1

4.2 Model Results

The study settled on the zero truncated poison to establish the factors that influenced the number of trips a typical household in Nairobi to selected parks and generally to urban green spaces around the city. The results are presented below.

Table 3: Zero Truncated Poisson Model results

	Dependent Variable: Number of Visits		
Variables	Model 1 Allparks	Model 2 Uhuru Park	Model 3 Karura Forest
Cost	**-0.00037***** (0.000)	**-0.00041***** (0.00005)	**-0.00059***** (0.000)
Gender	0.06958 (0.116)	**0.21188***** (0.001)	**-0.47317**** (0.027)
Age	**0.01151***** (0.000)	**0.01312***** (0.000)	**0.04741***** (0.001)
Education	**0.01700**** (0.010)	**0.02511***** (0.006)	0.04998 (0.170)
Marital st. D1	**-0.10144*** (0.054)	**0.17363**** (0.025)	-0.53795 (0.111)
Marital st. D3	0.02408 (0.800)	-0.15714 (0.412)	-0.37923 (0.710)
Child	0.07680 (0.225)	-0.07201 (0.403)	**1.01217***** (0.005)
Hhsize	**-0.03836***** (0.006)	-0.01165 (0.522)	**-0.40162***** (0.000)
Income	**-0.19741***** (0.000)	-0.04537 (0.507)	0.39198 (0.169)
Employment	-0.05896 (0.199)	**-0.20895***** (0.002)	0.23110 (0.367)
Constant	**1.50403***** (0.000)	**1.32790***** (0.000)	0.39009 (0.586)
Observations	923 Prob > chi2 = 0.0000	326 Prob > chi2 = 0.0000	70 Prob > chi2 = 0.0000

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The study estimated three zero truncated models for two parks and one for all parks in Nairobi. The results are discussed below.

All Parks

The study sought to establish key components that's influence demand for Nairobi Urban Green spaced. The number of trips (dependent variable) made by residents to several parks in Nairobi was significantly influenced by the travel cost, age, education head, marital status, income of house head and income. As expected, the study established that cost of travel to be inversely related to the number of trips to Nairobi green spaces such that as the cost of travel to parks increase, residents tend to make fewer trips to these spaces. The results are consistent with previous studies earlier reviewed on this paper such as (Othman & Jafari, 2019). Age of the household head influenced the number of trips to urban green spaces such that as age advances, people were more likely to visit Nairobi urban green spaces.

Education of the household head positively impacts on the number of trips residents make in Nairobi to urban green spaces. The more the years of schooling the higher the likelihood that a household will make more trips to urban green spaces. Household size and income are negatively related to the number of visits to all green spaces. The higher the household numbers, the lesser the number of visits to urban green spaces. Similarly, as income increase people reduced number of trips to the urban green spaces was witnessed. Households with over 10, 000 shillings per month tend to visit the urban green spaces less compared to those who earn less.

Uhuru Park

Narrowing to individual parks, for instance, Uhuru park, the study found that the number of visits to the park were likely to be influenced by the travel cost; age, gender, marital status, education and employment status of household head. Like all the parks, the cost of travelling to the park is inversely related to the number of trips such that an increase in travel cost led to reduction in number of visits. Age and education of the household head positively influence the number of trips made by Nairobi residents to Uhuru Park. Household of older house heads were more likely to make more trips to the park, other factors held constant. Similarly, more schooled household head visited Uhuru Park more.

Marital status of the household head was found to positively impact the number of visits a household made to Uhuru Park at a particular period. Compared to single, household with married household heads tend to visit Uhuru Park more. Employment status also affects the number of trips a household is likely to make to Uhuru Park negatively. Those household with employed heads tends to visit Uhuru Park less times compared to unemployed.

Karura Forest

Karura forest, contrary to Uhuru Park, is situated a few kilometers from the Nairobi CBD. However, similar, to previous results for Uhuru Park and all UGS combined, travel cost is a key factor influencing the number of trips that people make to Karura. An increase in travel cost led to reduction in number of visits to Karura forest. Other factors include, household head gender, age, presence of a child and household size. Similarly, gender of the household head was inversely related to the number of trips a household made to Karura. Male headed householdes were less likely to visit Karura compared to those headed by women. Age of the household head positively influenced the number of trips made to Karura . As the age of the head increases, the probability to make more trips to Karura increase holding other factors constant.

Households with at least one child were likely to make more trips to Karura compared to those without kids. Finally, as in the case of all parks, the number of people in a family will influence the number of trips the family makes to Karura negatively. As the number increases, the household is likely to cut the number of trips possibly due to the impact of cost.

4.3 Recreation Value of UGS in Nairobi

Calculation of recreational benefit, was done by estimating demand function using coefficients and mean values of significant variables. The estimated demand function took the following form.

$$V_{ij} = \beta_0 + \beta_1 TC_i \qquad (10)$$

The demand function for visits to Uhuru Park, Karura and all recreation sites was constructed by relating visitors' travel costs (TC) with their number of visits to Nairobi green spaces (V). travel cost coefficients were used to estimate the welfare measures as shown below in table 4

Table 4: Recreational values

Recreation Park	Annual Consumer surplus (CS) per visit (in $)) $\left\|\frac{1}{B_p}\right\|$	No of visitors (N) per Annum	Annual Recreation values for site (in million $)
All parks(combined)	22.5	$N = \left(\frac{490}{669}\right) * 4{,}300{,}000$ = 3,149,477	70.9M
Uhuru	20.3	$N = \left(\frac{326}{490}\right) * 3{,}149{,}477$ =2095366	42.5M
Karura Forest	14.1	$N = \left(\frac{70}{490}\right) * 2095366$ = 449925	6.4M

Using ZTP model, the values of consumer surplus per year for all parks combined, Uhuru parks, Karura and is estimated at USD 22.5,20.3 and 14.1 per visitor per annum, translating to an aggregate value of 70.9M, 42.5M and 6.4M, USD per year.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusions

The aim of this project was to estimate the recreational values of Nairobi urban green spaces. Uhuru Park, Karura forest and all parks combined using travel travel cost method. While the values of all parks combined, Uhuru parks, Karura were estimated at 70.9M, 42.5M and 6.4M USD per year respectively, the values could exceed the estimated amounts since there are other values from Ecosystem goods and services derived from forest conservation. Recognition such environmental goods and services values would be crucial in determination of total Economic values of the forest which in turn would lead to increased budgetary allocations for forest conservation and expansions.

Based on the observations and recreation values results, more people preferred visiting Uhuru Park to Karura park possibly due to proximity to Central business district and minimal transport logistics hence less travel costs.

This paper also sought to determine the impact of social economic factors on the number of visits to the park. Results showed that increase in cost of travel had negative impact on number of visits to Karura across all parks. Size of household impacted negatively on number of visits for Karura park and all parks mostly because of the travel cost involved for with a bigger household. Even though household size was a not a significant determinant for visits to Uhuru Park, the coefficient was negative implying that visitors from big households would still be discouraged to visit this park hence affirming the assertion on negative impact of travel cost. Age of visitors was found to positively influence visitor decision to visit the green parks. The implication was that older people preferred green spaces in general. Education levels of visitors was also found to be a significant factor influencing visits Uhuru and all parks combine and even though the variable was not significant for Karura,the coefficient was positive implying highly educated people visited the green parks. This could possibly be as result of more knowledge on the values of the parks.

5.2 Recommendations

This study provides economic justification for the national and county government policy makers to prioritize maintenance, conservation and expansion of Nairobi green spaces through adequate budgetary allocation of resources. The study will also form the financial benchmark for cost benefit assessment of projects. The higher recreation values to uhuru park may be used to guide decision on future park expansions whereby more parks can be placed near central business districts as compared to city outskirts. Additionally, information of negative impact of cost of visits may be used for decision on subsidizing levies especially for big households to encourage families enjoy recreation service of green parks frequently. Similarly, subsidies should be instituted for younger generations who may mostly not afford travel costs to the various green spaces to also encourage them to visit the parks. This study may also serve as a reference for similar comparative studies of the recreational sites in Kenya. Values to determine the optimal access fees charged for the recreation parks will be useful.

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