AFRICAN PARKS. AFRICAN PEOPLE. AN ECONOMIC ANALYSIS OF LOCAL TOURISM IN ARUSHA NATIONAL PARK

by

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Abstract

Protected areas are an important part of our society. They provide ecosystem services such as climate regulation and water filtration; they secure critical habitat for wildlife, including many threatened and endangered species; and they also provide a form of recreation through wildlife viewing, photographing, hiking, and camping. Eliciting the economic benefits of these protected areas is important to ensure they are properly considered in policy and decision making. But because no markets for these services currently exist, protected areas are often undervalued when compared to alternative land use policies. As lands are put under more pressure from population and economic growth, it is critical that the benefits derived from protected areas are fully understood. Therefore, non-market valuation techniques have been developed to estimate these benefits. Relatively few environmental valuation studies, however, have been conducted in developing countries to date. Here, I apply one such valuation method, the travel cost method (TCM) to estimate the recreational benefits of Tanzania's protected areas to East African citizens. Data were collected from visitors through an on-site intercept survey in Arusha National Park (ANP) during the summer of 2012 . The recreational value, or consumer surplus, of ANP was found to be $13.28 - $37. 88 per person per day spent in the park. One-half of all visitors to ANP are East African citizens, representing an annual recreational value potential of $0.9 - $2.7 million. Recognizing that this is only one of many parks in Tanzania, this study shows that National Parks provide a significant source of revenue and social utility. The results of this study will better inform government officials making decisions about economic development and environmental protection in Tanzania.

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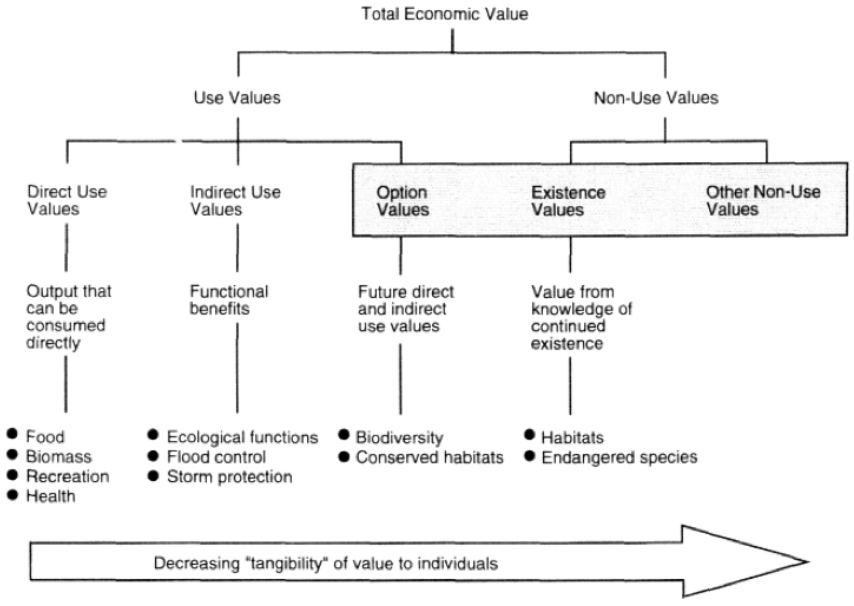
Introduction

In today's world of unprecedented population and economic growth, our needs for and pressures on earth's lands and natural resources are increasing rapidly. Human development is altering landscapes faster than ever before, often causing irreparable damages to the function and vitality of ecological systems. Protected areas provide the land with a reprieve from these pressures, and allow natural landscapes to carry out their functions relatively undisturbed by human development. These protected areas have ecological as well as economic value and have become an important part of social welfare. Ecosystem services such as climate regulation and water filtration benefit humans with clean air and water. Protected areas also provide critical habitat for wildlife, including many species at risk of extinction. There is also a more direct social utility derived by access to these protected areas, which serve many forms of recreation including wildlife viewing, hiking, photographing, and camping. A description of the total economic value derived from protected areas is laid out below, reflecting the level of difficulty with estimating these values.

Figure 1. Total Economic Value of Protected Areas.



(source: Munasinghe & McNeely, 1994)

Although the benefits derived from these protected areas are vast, many are at risk from development pressures today. Conflicts between protected area management and economic

development have intensified throughout developed regions, requiring new approaches to ensuring these areas remain protected from development pressures (Munasinghe & McNeely, 1994). It is necessary in development to assess the trade-offs between economic growth and environmental protection. In order to do so, the costs and benefits of various land use policies must be clearly demonstrated. But, because the benefits of national parks and other protected areas not derived through traditional market-based mechanisms, it is not known how citizens value these areas, resulting typically in exclusion from cost-benefit analysis. In developing countries the environmental trade-offs policy makers are willing to make for economic development are high. Therefore, capturing the value of these protected areas is essential to ensure they are adequately evaluated as countries develop and make policy decisions with long-lasting implications on natural landscapes.

In this study, I will estimate the recreational value local citizens place on protected areas in Tanzania, a developing country in East Africa with rapid population growth (2.85%). Tanzania has also been experiencing high economic growth over the past decade, on average 7% annually. This study will evaluate the size of the local tourism industry in Tanzania and how local citizens value access to these recreation sites.

Background

Tanzania is an ideal location to study the local value derived from protected areas in a developing region for a number of reasons. Since independence from colonial rule in 1961, the country has remained relatively politically stable with little political conflict. They have also boasted a strong commitment to protecting their natural landscapes and unparalleled biodiversity. Over 27 percent, or 260,000 sq. km. of its terrestrial land is under federal protection status, second in size only to Zambia in sub-Saharan Africa (United Nations, 2011). Tanzania offers a number of key wildlife attractions sought by safari-goes, including the Ngorongoro Crater, Mount Kilimanjaro, and the Serengeti plains, home to the last remaining great terrestrial migration of over one million wildebeests, zebra and gazelle. In 2011, Tanzania hosted over 1 million visitors to its fifteen National Parks, generating over $64 million in revenue (personal communication, TANAPA). Overall, the tourism sector accounts for over 17% of Tanzania's GDP, contributing $1 billion in revenue annually to the local economy. In addition, over 200,000

jobs are supported by the industry ("Tanzania Calls for Competitive Tourism", 2013). Tanzania has experienced strong growth in nature-based tourism following tourism policy reforms in the mid-1980s (Wade et al., 2001). Due to the limited data collected on park visitation, however, it is unknown how much of this growth is attributed to local versus foreign tourism. This study will thus serve as a baseline measure of local tourism in Tanzania.

In addition to its commitment to conservation, Tanzania is undergoing a transition as a developing country that forces government officials to make trade-offs between economic development and environmental protection. In 2006, the President of Tanzania announced plans to construct a paved highway that will, if constructed, bisect the Serengeti National Park, interrupting the annual migration route and other resident wildlife. In 2011, a portion of Selous Game Reserve was degazetted to allow for the extraction of recently discovered Uranium deposits. Oil exploration is underway throughout East Africa, generating a need for infrastructure to support the growing industry. Tanzania is currently drawing up plans to mine soda ash near Lake Natron, threatening a critical flamingo breeding site and the local livelihoods reliant on the tourism industry. While the biodiversity within Tanzania has a clear intrinsic value, it is critical to demonstrate that these environmental assets also have economic value, both to visitors and local residents. Nature-based tourism is a large industry in Tanzania and throughout much of sub-Saharan Africa. Because nature-based tourism is considered a "non-consumptive activity", reliant on "intact natural resources to generate revenue", it is generally viewed as a "win-win for conservation and sustainable economic development" (Naidoo & Adamowicz, 2005, p.160).

The welfare derived from access to environmental amenities, including recreation sites, is not captured by conventional welfare estimation techniques using market prices. Access to recreation sites is typically only subject to nominal entrance fees, underestimating a visitor's total willingness-to-pay for access to the site. The true value of a recreation site must therefore be estimated using non-market valuation techniques (Martínez-Espiñeira & Amoako-Tuffour, 2008). The travel cost model (TCM) is one method to estimate the value individuals place on access to recreation sites. The TCM is a demand-based model where the quantity demanded is the number of trips a person takes to the site in a season (typically one year) and the price is the cost of accessing the site. Estimating this demand reveals an individual's willingness-to-pay for access

to the site. The difference between an individual's willingness-to-pay and actual trip costs incurred accessing the site is the consumer surplus, or access value. This information is useful in benefit-cost analyses where the value of a recreation site is estimated against the value of another form of development, such as mineral extraction or road construction(Parsons, 2003). It is also useful to estimate how a change in access to a site, such as an increase in park entrance fees, will impact demand.

While the travel cost model has been applied throughout Africa to estimate use values for foreign tourists, few have estimated the value that local citizens place on access to these same protected areas. This is perhaps due to the presumed low visitation rates among locals in most developing countries. But Tanzania is undergoing an economic transition contributing to a growing middle class. Urbanization is rapidly increasing the urban population within Tanzania, at a rate of 4.7% annually. Compared to a population growth of 2.85%, urban areas are largely contributing to this growing population (CIA, 2013). Cities offer the lure of jobs, an education, and social benefits not typically available in rural areas. The high number of both local and international institutions provides access to jobs for many local Tanzanians and supports a growing economy. Tanzania's urbanization combined with a growing economy may result in an increase in demand for access to recreation sites, particularly nature parks and reserves.

This paper will provide a preliminary assessment of local tourism demand in Tanzania and calculate use values for access to protected areas. Understanding the value of protected areas will better inform government officials making decisions about economic development and environmental protection. In addition, the government of Tanzania announced a price increase to the entrance fees for all National Parks to take effect in July, 2013 (TANAPA, 2012). The individual entrance fee, renamed a conservation fee, will increase more than six fold, from 1,500 TSH per person (approximately 1 USD) to 10,000 TSH (approximately 6 USD) and vehicle fees will increase from 10,000 TSH to 20,000 TSH (approximately 12 USD). Previous studies have revealed a price-insensitivity to entrance fees and thus suggested increases of more than tenfold the current fees (Naidoo & Adamowicz, 2005). These studies, however, have only been conducted on foreign tourists, who's trip expenditures are already orders of magnitude higher than park entrance fees. This may not be the case for local tourists where entrance fees likely

account for a higher percentage of total trip costs. Any suggestions to increase local park fees thus must be considered with caution. The results of this study will determine the price elasticity of recreational demand for Arusha National Park and inform TANAPA of the expected impact to local tourism resulting from these fee increases. The goals of this study are therefore to:

1. provide socio-economic data on local[1] park visitors to better inform management decisions
2. estimate the recreational value of protected areas
3. estimate how the change in park fees will impact demand
4. understand perceptions of local park visitors of park management and conservation, and how these perceptions may drive demand.

Non-Market Valuation

Non-market valuation has become an important tool for understanding how the public values goods and services not sold in the marketplace. These techniques have widely been applied to capture values of environment services such as clean water and amenities such as recreation sites.

Stated Preference Methods

One approach to capture these values is through stated preference methods, which directly elicit an individual's willingness-to-pay for an environmental amenity or other non-market good. The most popular stated preference method is contingent valuation, which captures an individual's willingness-to-pay for an environmental amenity through direct surveying. There are many question formats capable of capturing this information including open and close-ended questions. The open-ended approach describes an environmental amenity and asks respondents to state the most they would be willing to pay to protect that amenity. Payment cards, a close-ended question format, asks respondents to select, from a list, the amount that best matches what they would be willing to pay. Sometimes, the value of an attribute, such as clean water or abundant bird life, can be captured through the use of discrete, or dichotomous choice formats. If a respondent is given the choice of three recreation sites - for example, each possessing different amenities

[1] Local is defined in this study as East African citizens, including: Tanzania, Kenya, Rwanda, Uganda and Burundi. Foreign residents were not included as locals, even if currently residing in an East African nation.

including camping, hiking, fishing, and bird-watching - and each accessible at a different price, the value, or willingness-to-pay for each amenity can be estimated (Brown, 2003).

Revealed Preference Methods

The alternative approach to non-market valuation is through revealed preference methods, which infer the value of an environmental service or good from choices individuals make within markets. For instance, hedonic models compare characteristics of houses or other direct purchases with specific environmental attributes (i.e. visibility, access to nature) to infer how much they value changes to those attributes. For instance, if two otherwise identical homes, one lacking beach front access and one located on the beach, sold on the market for $200k and $220k respectively, we could infer the value placed on beachfront access to be $20k. Hedonic models can also use wage rates and jobs with varying degrees of risk to estimate how workers value changes in those risks. Another revealed preference method uses averting and mitigating behaviors such as the purchase of healthcare preventatives (i.e. sunblock, bottled water, vaccines, etc.) to infer how individuals value changes in environmental risks (Boyle, 2003).

The travel cost approach is yet another revealed preference method that infers the value of a recreation site through the cost visitors incur to access the site. The basic idea of the method is that people incur time and travel costs to access a recreation site. These costs represent the 'price' of access; those that must pay more will visit the park less, and those that pay less will visit the park more often. This method is useful to estimate the economic costs or benefits resulting from:

1. cost increases for access to a recreation site
2. elimination of an existing recreation site
3. addition of a new recreation site
4. changes in environmental quality or amenities of a recreation site

This model uses the number of trips taken as a function of the trip cost and other characteristics to estimate a demand function for site access. There are three variations of the travel cost method including the single site, random utility, and zonal approach. Individual single site models function like classic downward sloping demand functions and are useful when estimating the access value of a recreation site (Parsons, 2003). The quantity demanded in this case is the

number of trips taken to a particular site, and the price is the cost of accessing the site. This access value is useful when estimating the cost of closing a particular recreation site or changes in the cost of access to the site. Another application of the travel cost model is the random utility model (RUM) most widely used for multiple site comparisons. Similar to hedonic modeling, the RUM model accounts for the various attributes of recreation sites and considers the individual's discrete choice of selecting a site based on these attributes. This model is useful to estimate the value of various attributes of a recreation site, such as wildlife populations, water quality, hiking trails, and public amenities. A third approach to the travel cost method, the zonal approach, is the simplest and least expensive approach, although not favorable due to inconsistencies with economic theory (Parsons, 2003). In this approach, existing data on park visitation is used to estimate the access value of a recreation site; valuing amenities or changes in quality of a site is typically not possible given the limited amount of available data. Park visitors are categorized by zone based on the distance traveled to the site, the visitation rate and travel costs are then estimated by zone. From this, a demand function for access to the recreation site can be estimated. Again, this is a dated approach reliant on secondary data, limiting the application of this method.

This research will employ the single site travel cost model to estimate the recreational value of one particular site in Tanzania, Arusha National Park. This demand model can then be used to predict the change in demand resulting from the park fee increase scheduled to take effect in July, 2013.

Theoretical Background : The single site travel cost model

In the single site travel cost model, the variation in price is a function of travel and time costs to the site and, as such, can be assumed that as costs to access the site increases, the number of trips taken deceases creating a downward sloping demand function specified as

$$r = f(tc_r, y, z) \qquad (1)$$

where r is the number of trips taken to the site, tc_r is the price, or trip cost, y is income and z is a vector of other demographic and socio-economic variables predicted to influence the number of trips an individual takes. The linear version of this relationship is defined as

$$r = \beta_{tc_r} tc_r + \beta_y y + \beta_z z \qquad (2)$$

A positive coefficient on income, for example, implies that as income increases, so too does the number of trips taken to the recreation site. A negative coefficient on trip costs will imply that as the cost of accessing a site increases, the number of trips taken decreases. Integrating under this linear demand function for an individual's number of trips taken, and then subtracting the total trip cost estimates an individual's willingness-to-pay for trips, or their consumer surplus. This relationship is demonstrated below in Figure 2.

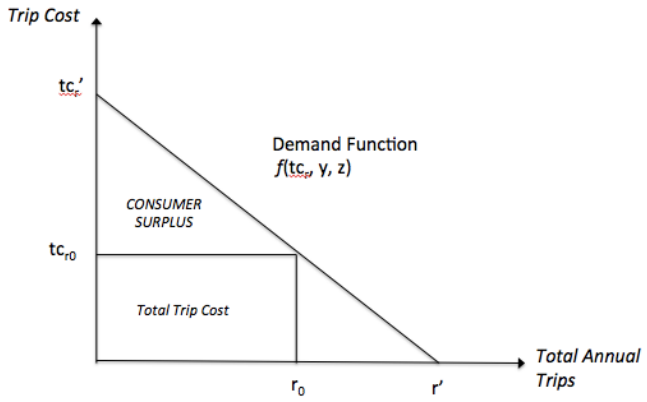


Figure 2. The TCM demand function, trip cost, and consumer surplus.

In this figure, when trip costs equal tc_{r0}, the individual will take r_o trips. The area under the curve from 0 to r_0 represents the total value of the recreation site, comprised of the trip cost and the access value, or consumer surplus, of the visit. As the trip cost increases, the number of trips an individual will take decreases. The choke price, tc_r', indicates the price point at which no trips will be taken.

The value of the recreation site (the consumer surplus) is then estimated by integrating the demand function from the observed trip cost, tc_{r0}, to the choke price at which no trips are taken, tc_r':

$$CS\ (access\ value) = \int_{tc_{r0}}^{tc_r'} r(tcr, y, z) \qquad (3)$$

This annual consumer surplus can then be divided by the number of trips taken to estimate the consumer surplus per trip. The total annual consumer surplus can be calculated by multiplying the annual number of visitors by the consumer surplus per trip, representing the total benefits derived from the recreation site. These total benefits can then be utilized to guide management plans or estimate the trade-off between different development options.

One key limitation to the travel cost model is its inability to estimate non-use or option values, as only current users of the site are included to construct a demand function (Boyle, 2003). As we will see later in this study, over 50% of survey respondents were first time visitors to the park. A growing economy with high rates of urbanization may be fueling higher demand for park recreation in the future. Thus, non-use and option values could be quite high, but are ignored in the travel cost model. Therefore, the use values calculated here are likely to underrepresent total consumer surplus.

Literature Review

The travel cost model was first introduced as a way to estimate the recreational benefits of the U.S. national parks in an unpublished letter to the National Park Service director in 1947 by Harold Hotelling. In it, Hotelling noted that park visitors travel a variety of distances to access parks, incurring significant costs beyond the nominal park entrance fee. Theoretically, the further people must travel, and in turn the higher the trip cost, the less frequently they will visit the park. By integrating this demand function over the whole population, the total level of satisfaction (or consumer surplus) can be estimated. This method, originally coined the "transport cost method" became the accepted method to evaluate the social gain from access to recreation sites (Arrow & Lehmann, 2006). The first applications of the travel cost model did not occur until the 1960's and employed the zonal approach, which uses the number of visitors from specified zones to estimate the access value to a particular recreation site (Mathis, Fawcett, & Konda, 2003). In the 1970's the individual, single site approach addressed some of the limitations of the zonal

approach by collecting primary data from visitor survey results, providing more detail and flexibility in the analysis (King & Mazzotta, 2000).

Today, the travel cost method has been widely applied to estimate use values for recreation-sites worldwide. This method can provide value estimates of recreation-sites in order to balance the demand for development with the need for conservation. One such study of freshwater beaches in Ohio estimated the value of a single-day trip to the beach to be $15-$25 – an annual value of $3.5 - $6.1 million per beach (Sohngen et al., 1999). A study of Pakistan's largest freshwater lake, Keenjhar, found the consumer surplus to be $116 per visit, providing annual recreational benefits of $42.2 million (Dehlavi & Adil, 2011). Shrestha et al. (2002) applied the travel cost model to estimate the recreational value of fishing in the Brazilian Pantanal, reporting a "total social welfare estimate range from $35 to $56 million" (p. 289).

Travel cost methods have been widely applied to estimate the value of marine ecosystems. In Australia, authorities were considering a variety of management options for Lake McKenzie, located on Fraser Island off the mainland coast. Concerns of unsustainable visitor traffic to the popular lake led officials to consider scaling back the number of visitors allowed at the lake. To understand the value of access to this lake among visitors, Fleming and Cook (2008) applied a zonal travel cost method to estimate the current access value of the lake at $19.2 to $44.4 million per year. A study of the recreational value of the Great Barrier Reef attempted to capture both foreign and domestic visitors, addressing measurement issues of estimating air travel and multiple-site destination visits (Carr & Mendelsohn, 2003). Ultimately, they estimated that the 2 million visitors each year reap annual recreational benefits of $700 million to $1.6 billion – an average of $350 to $800 per visit. Today, global warming, water pollution, mining, and over fishing all threaten health and viability of coral reefs. Understanding their recreational value will allow officials to make better informed management decisions to protect these fragile and ecologically critical ecosystem. In addition, studies have revealed that a large portion of the Great Barrier Reef benefits are enjoyed by foreign visitors, suggesting the need for international support in protecting these valuable ecosystems, particularly in less developed countries (Carr & Mendelsohn, 2003).

To date, very few valuation studies have been conducted in developing countries (Navrud & Mungatana, 1994). These few studies have largely been based on foreign tourism to the site as local access is limited in most low-income areas. Mladenov et al. (2007), for example, utilized the travel cost model to estimate whether changes in the level of biodiversity impact how foreign tourists value the Okavango Delta in Botswana. Changes to the Okavango's water supply caused by upstream water withdrawals may reduce the level of biodiversity in the wetlands. They found that "impaired biodiversity would negatively affect the value of this ecosystem", estimated at $285 per person per year, or $23 million (Mladenov et al., 2007, p. 409).

South Africa and Kenya are two exceptions where non-market valuation studies have been conducted on local residents, a reflection of their strong economy and high proportion of affluent citizens. A study of river values in Kruger National Park, South Africa, for example, estimated that "30% of tourism business would be lost if rivers were totally degraded" (Turpie & Joubert, 2004, p. 3302). Nearly two-thirds of the respondents for this study were South African residents. A similar study of the economic value of flamingos on Lake Nakuru National Park, Kenya found that flamingos accounted for more than one-third of the annual recreational value of wildlife viewing at the Park, estimated at $7.5-$15 million (Navrud & Mungatana, 1994). Nearly one-third of the respondents for this study were Kenyan residents, with an average recreational value estimated between $68-$85 per visit ($3.6-$4.5 million per year). In addition, a novel application of the travel cost method was applied to three urban zoological and amusement parks in Nigeria, estimating that urban residents of Ibadan and Lagos gained total annual benefits between $13,000 to $273,000 per site (between $0.37 and $2.31 per trip per adult visitor) (Durojaiye & Ikpi, 1988).

The travel cost method has also been expanded to estimate non-recreational demand. In 2009, the first study to estimate households' private demand for cholera vaccines was conducted in Mozambique (Jeuland et al., 2010). A program to provide free cholera vaccines to approximately 40,000 residents in Beira, Mozambique received attention from surrounding villages, resulting in an additional 30,000 people traveling from outside of the program target area. These individuals experienced long lines and waited an average of 85 minutes, resulting in a per capita willingness-to-pay of 0.85 USD per vaccination. In Indonesia, the travel cost model was adapted to

determine the value of access to fuel wood from nearby forests, estimated at $122 per household (Pattanayak et al., 1999)

As demonstrated, the TCM has been widely applied to estimate the benefits of access to recreation sites worldwide. These estimates are useful when considering changes in access to a site or elimination of a site in favor of an alternative use. Given the growing demand for natural resources such as minerals and oil, estimating access values to recreation sites, particularly protected areas, is essential to conduct a robust cost-benefit analysis for development choices. Tanzania's growing population combined with a growing demand for diminishing natural resources is placing added pressure on protected areas. Warranting the continued protection of these areas demands the full benefits of these sites to be calculated. This study will therefore provide a preliminary assessment of access values for East African citizens.

Methods

The Study Site

Arusha National Park (ANP) is a 552 km^2 national park that lies 26 km outside of Arusha, the tourism capitol of Tanzania's northern circuit. The northern circuit consists of attractions such as Mount Kilimanjaro, the Ngorongoro Crater, Lake Manyara, Tarangire, and the plains of the Serengeti, home to the last remaining great terrestrial migration. Mount Kilimanjaro is situated just 60 kilometers outside of Arusha, the meeting point for most international tourists intending to hike the summit, just over 19,000 feet. Although not a main attraction for safari goers, ANP offers visitors a diverse array of habitats and wildlife, from the montane forest of Mount Meru to the grasslands of Ngurdoto Crater to the alkaline Momella Lakes. Mount Meru also offers a more modest hiking alternative to Kilimanjaro, with a summit just under 15,000 feet. Historically inhabited by Maasai pastoralists followed by the WaMeru, WaChaga and WaArusha people, the area was first set aside as a Forest and Game Reserve under German colonial rule in the 1890's. The area continued to be farmed and used as cattle ranching until the Ngurdoto Crater, lying on the east side of the park, was gazette in 1960 as Ngurdoto Crater National Park. In 1967, the areas encompassing Mount Meru and Momella lakes were gazetted and the park officially

became Arusha National Park[2]. Today, ANP hosts over 60,000 visitors annually. Its close proximity to the town of Arusha and all destinations within the northern circuit makes ANP an ideal destination for day trips, particularly among local residents.

Figure 3. Map of Tanzania's Northern Sector and Arusha National Park. (Source: Google Maps)

Survey Design

The survey instrument was designed in cooperation with African Wildlife Foundation (AWF) and Tanzania National Park (TANAPA) officials. All survey activities were approved by Duke University Institutional Review Board, Protocol #B0160. The survey was structured into three components: demographic and socioeconomic information of the park visitor, site visitation characteristics including travel and time costs to the site, and park perceptions. The survey was pretested both through expert review of Duke professors Dr. Jeffrey Vincent and Dr. Randall Kramer, experts in non-market valuation techniques and survey methodology, and through conventional pre-testing on both employees of TANAPA and AWF. The survey was then translated into Swahili and both versions were made available to survey respondents.

Survey Administration

An on-site intercept survey was conducted during the summer of 2012 at the Ngongongare gate entrance to Arusha National Park. This is the primary entrance point for park visitors; the only other gate, Momella Gate, providing local access to the nearby village, Kisimiri, on the north

[2] Arusha National Park history was extracted from plaques posted at the Ngongongare gate park entrance.

side of the Park. Therefore, 100% of East African citizens visiting the park during survey hours had a probability of being sampled. Week days were randomized but included higher weekend day rates to ensure an adequate sample size for analysis. On average six hours per survey day were spent at the park between 0800 and 1400 hours, capturing visitors as they entered the park. Respondents were approached either during or immediately after payment of entrance park fees. The survey sample consisted of all East African citizens visiting Arusha National Park at the time of the survey, including Tanzania, Kenya, Uganda, Rwanda and Burundi. A recruitment script conducted by the enumerators ensured only East African citizens were surveyed. Surveys began with an informed consent statement that included information on the objectives of the study, assurance of confidentiality, and informed respondents of the voluntary nature of the survey. Only adults over the age of 18 were surveyed, per IRB protocol. Initially two enumerators fluent in both English and Swahili were hired and trained to assist in survey administration. After the first week I continued with only one enumerator as it was not necessary to employ two people given the low traffic into the park. A full copy of the survey instrument can be found in the Appendix.

Seventeen days and ninety-seven hours were logged in the park, collecting a total of 240 surveys averaging 14 per survey day. After the first day in the park, the survey instrument was revised in the following ways:

1. A question capturing a respondent's occupation was added.
2. The question capturing how many hours a respondent planned to spend in the park the day of the survey was changed from open-ended to close-ended.
3. The questions capturing time spent traveling and kilometers traveled were revised for clarity.
4. The questions capturing the number of past visits to Arusha National Park and other national parks in the last 12 months were revised for clarity.
5. An open-ended question was added to capture other parks visited in the past 12 months.
6. The questions capturing driver/guide and vehicle hire fees were revised for clarity. Many people traveled in medium to large sized groups with members outside of their household which resulted in confusion in estimating travel cost expenses.

Due to time and budget constraints, surveying was limited to the three summer months of June, July and August in 2012. TANAPA has historically not collected park visitor information on leisure versus non-leisure local tourism[3], so identifying peak travel seasons for local tourism was not feasible. According to data collected on East African residents versus non-residents, resident visitors account for approximately 50% of park visitation every month throughout the year. During the 2007-2008 fiscal year, TANAPA recorded over 29,000 non-residents and 26,000 residents entering the park, totaling over 56,000 (TANAPA, 2013). This number has grown from 30,000 in 2003-2004. Total park visitation exceeded one billion for all National Parks within Tanzania in 2011. As most foreign tourists visit parks accompanied by a local tour guide and driver, it is not possible to determine which of these resident park visitors were on leisure travel or business. As such, this survey will serve as a preliminary assessment of local park visitation and will serve to inform TANAPA of the local demand for recreation-site access that inform management decisions, and can be replicated across other recreation-sites throughout Tanzania.

Sources of Bias

There are a number of issues that arise from on-site sampling that result in selection bias. First, individuals who do not visit the park were not included in the sample. Therefore the data is truncated at one trip, causing the estimated demand function to be too steep and leading to biased parameters and welfare estimates. In addition, visitors who frequent the park more often will be overrepresented in the data, resulting in endogenous stratification. For instance, a visitor who makes ten trips to the park is ten times more likely to be sampled than a visitor who makes one trip to the park. Both of these sources of bias are unavoidable in on-site sampling that must be corrected for in the model (Martínez-Espiñeira & Amoako-Tuffour, 2008).

Survey Data and Descriptive Statistics

Demographic

Table 1 below provides the demographic information of survey respondents, including country of residence, gender, age, education, monthly income, and occupation. Occupation categories

[3] For instance, a Tanzanian could be visiting the park as a leisure tourist, or as a tour operator. Only leisure tourists can be considered in this valuation method.

were consolidated based on frequency reported. Although as observed, there were more male visitors than female, this number is likely skewed as enumerators identified the head of household to complete the questionnaire, most often a male in the group. Nearly one-half of the respondents were between the age of 18 and 25, reflected by the large proportion of students (one-fifth) visiting the park. Nearly one-third reported an undergraduate education, and one-tenth a masters or PhD. However, the high proportion of educated visitors is not reflected by high income levels. One-quarter of respondents earned less than $100 per month and only 13% of respondents earned over $1,000 per month. Considering that nearly one-third of Tanzanians live below the basic needs poverty line (equivalent to approximately $1 a day), this income distribution represents the most well off residents on Tanzania (The World Bank, 2011). Over 90% of respondents were Tanzanian citizens and 5% were Kenyan. Only one household each from Rwanda, Uganda, and Burundi visited the park during the survey administration period.

Table 1. Demographic Information of Respondents.

Demographic		Frequency	Percent[4]
Country			
	Tanzania	222	93%
	Kenya	13	5%
	Rwanda	1	0%
	Uganda	1	0%
	Burundi	1	0%
Gender			
	Male	164	68%
	Female	75	31%
Age			
	18-25	109	45%
	26-35	77	32%
	36-45	35	15%
	36-55	14	6%
	56+	3	1%
Education			
	Primary	27	11%
	Secondary	114	48%
	Undergraduate	73	30%
	Masters	19	8%
	PhD	3	1%
Monthly Income			
	Less than $100	60	25%
	$100-$500	91	38%
	$501-$1,000	39	16%
	$1,001 - $1,500	20	8%
	$1,501 - $2,000	1	0%

[4] Percentage of total respondents (n=240)

More than $2,000	11	5%
Occupation		
Student	48	20%
Not-for-Profit Organization	39	16%
Tourism	51	21%
Agriculture/Livestock	21	9%
Other[5]	57	24%

An unexpected finding was the large number of visitors with tourism occupations (n=51). Enumerators were careful to pre-screen respondents to ensure that only visitors at the park for leisure were surveyed. However, given the wording of the question, there may be bias in the total number trips reported in the last 12 months[6]. On average, visitors in the tourism sector took 80% more trips in the past 12 months than visitors in the non-tourism sector, reflected in Table 2 below. As can be seen, the average number of trips taken for visitors in the tourism sector was just over three trips in the past twelve months, whereas all other respondents averaged just under two trips.

Table 2. Number of Trips by Occupation.

Occupation	Number of Respondents	% of Respondents	Average Number of Trips	St. Dev.	Min	Max[7]
Student	48	20%	1.93	1.79	1	7
NGO	39	16%	1.82	1.57	1	7
Tourism	51	21%	3.39	2.43	1	7
Agriculture/Livestock	21	9%	1.81	1.69	1	7
Other	57	24%	1.91	1.43	1	7

Park Visitation Patterns

The survey captured both time spent and distance traveled to the park to enable a robust estimation of travel costs. Nearly 60% (n=148) of respondents were visiting ANP on single-day trips, while the remainder (n=90) were on multiple-day trips, spending on average 3.4 nights in the park. Of these multi-day trip visitors, nearly three-quarters were students or in the tourism or

[5] Other occupations include: Retail Trade, Wholesale Trade, Construction, Transportation Services, Education, Healthcare, Professional/Financial Services, Hotel Management, Government Employee, and Other. No individual category consisted of more than 4% of total respondents.
[6] The survey asked respondents to report the number of times they had visited the park in the past 12 months. It did not specify for leisure, therefore the total trips to ANP for respondents in the tourism sector may be inflated.
[7] The survey question for number of trips ranged from 1 to 7+ trips.

NGO sectors. Although not captured in the survey data, it can be assumed that multiple-day trip visitors were visiting ANP to hike Mount Meru, the only recreation activity that requires an overnight stay. Mount Meru is Tanzania's second highest mountain at just under 15,000 feet in elevation that attracts both local and international tourists. Mount Kilimanjaro is a larger tourist attraction, but Mount Meru is also popular among local hikers for its accessibility. Table 3 summarizes the visitation patterns and expenditures for both single and multiple-day trip visitors. Multiple-day trip visitors on average traveled a greater distance to the park and also visited the park more frequently than single-day trip visitors. Although average household income was lower for multiple-day trip visitors, the average reported expenditure per trip was higher. In addition to collecting data on trip expenditures, a number of questions relating to park perceptions were included to better inform policy decisions made by TANAPA. TANAPA was particularly interested in learning how the proposed price increase in park entrance fees will impact demand. Notably, multiple-day trip visitors reported being more likely to visit the park less if entrance fees were increased than single-day trip visitors.

Table 3. Summary Results of Survey Data: Single versus Multiple Day Trips.

	Single Day Trips	Multiple Day Trips	Total Visitors Trips
PART I.VISITATION PATTERNS			
Trips	149	89	240
Average Distance Traveled (km)	31	39	34
Average Time Traveled (hrs)	1.3	1.8	1.5
Annual Trips	1.9	2.8	2.2
Average Number of Hours in Park	4.8	5.6	5.1
PART II. ECONOMIC VARIABLES			
Average expenditure per trip (US$)	$78	$111	$91
Average monthly household income (US$)	$545	$388	$480
Average monthly park expenditures	$42.16	$33.40	$38.40
PART III. GENERAL PARK PERCEPTIONS			
I visit this park because it is close to home.	3.6	3.9	3.7
I plan to visit other national parks in Tanzania.	4.3	4.4	4.3
This park is well managed.	4.1	3.8	4.0
This park offers a high-quality nature experience.	4.0	3.8	3.9
I believe protecting wildlife is important.	4.6	4.7	4.6
I believe conservation should be taught in schools.	4.5	4.4	4.5
The entrance fee is a factor in deciding to visit parks.	3.5	3.8	3.6
I would visit parks MORE often if the entrance fee was LOWER.	3.9	4.2	4.0
I would visit parks LESS often if the entrance fee was HIGHER.	3.5	4.1	3.7

1 Respondents were provided with ranges: '1-3', '4-6', '7+'. Respondents were coded as 2, 5, and 7 respectively.

2 Respondents were provided with ranges: Average of bracket for ranges, $75 for 'Less than $100', and $2,500 for 'More than $2,000' were used.

3 Average reported based on survey respondents. Based on 5-point scale from 1= strongly disagree to 5=strongly agree.

Park Perceptions

In addition to gathering demographic and socio-economic information on park visitors, the survey asked respondents to state whether they agreed or disagreed with statements relating to visitation patterns, park management, and wildlife conservation. Over two-thirds (~69%) reported visiting ANP because of its proximity to their homes (ANP is 26 km outside of Arusha and 65 km outside of Moshi). Most park visitors (~86%) plan to visit other national parks in Tanzania. When asked if respondents agreed that the park was well managed, only 9 disagreed and over two-thirds (~70%) agreed. Over two-thirds also agreed that ANP offers a high quality nature experience. The large number of respondents that felt neutral to park management and the nature experience is most likely due the high number of first time visitors (n=127, 53%). Three quarters of respondents (75%) strongly agreed that protecting wildlife is important and over two-thirds (69%) felt that conservation should be taught in schools.

Table 4. Responses to Park Perceptions.

	Strongly Disagree	**Disagree**	**Neutral**	**Somewhat Agree**	**Agree**
I visit this park because it is close to home.	20 *(11%)*	27 *(15%)*	11 *(6%)*	65 *(35%)*	63 *(34%)*
I plan to visit other national parks in Tanzania.	12 *(7%)*	2 *(1%)*	11 *(6%)*	48 *(27%)*	104 *(59%)*
This park is well managed.	4 *(2%)*	5 *(3%)*	42 *(25%)*	54 *(32%)*	63 *(38%)*
This park offers a high quality nature experience.	8 *(5%)*	5 *(3%)*	39 *(24%)*	51 *(31%)*	59 *(36%)*
I believe that protecting wildlife is important.	4 *(2%)*	1 *(1%)*	5 *(3%)*	32 *(19%)*	127 *(75%)*
I believe that conservation should be taught in schools.	7 *(4%)*	6 *(3%)*	8 *(5%)*	32 *(19%)*	119 *(69%)*

Entrance Fees

In addition, TANAPA was interested in gathering information on the price sensitivity of respondents to park entrance fees. The proposed entrance fee increases are scheduled to take effect in July 2013 and TANAPA hoped to learn how these fee increases will impact demand. The results are mixed. Nearly one-third (29%) stated that the entrance fee does not play a factor in deciding to visit the park, and two thirds stated that they would visit the park less often if these fees were higher. Notable is the high percentage of respondents who strongly agreed to questions pertaining to price sensitivity. When asked directly how a change in the entrance fee will impact park visitation, over one-half strongly agreed to visiting the park more (if fees decreased) or less (if park fees increased). On average, multiple-day trip visitors were more price sensitive to the change in entrance fee than single-day trip visitors, although this finding is not statistically significant (p=0.116).

Table 5. Responses to Entrance Fee Questions.

	Strongly Disagree	**Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**
The entrance fee is a factor in deciding to visit parks.	24 *(14%)*	25 *(15%)*	16 *(9%)*	32 *(19%)*	72 *(43%)*
I would visit parks MORE often if the entrance fee was LOWER.	21 *(12%)*	18 *(10%)*	7 *(4%)*	24 *(14%)*	103 *(60%)*
I would visit parks LESS often if the entrance fee was HIGHER.	32 *(18%)*	20 *(11%)*	9 *(5%)*	27 *(15%)*	88 *(50%)*

It would make intuitive sense for visitors with lower income to be more price sensitive to changes in trip costs. Table 6 below shows the mean response of visitors by income. As expected, low income park visitors are more price sensitive to changes in park entrance fees (seen by a drop in mean value as income rises). At the higher income brackets (>$1,500/month), the responses do not follow the typical downward trend. With such a small sample, however, these findings may be idiosyncratic. The price sensitivity to entrance fees will be addressed again later in the analysis when marginal effects of changes in trip costs are estimated.

Table 6. Entrance Fee Responses by Income.

	The entrance fee is a factor in deciding to visit parks			*I would visit parks MORE often if the entrance fee was LOWER.*			*I would visit parks LESS often if the entrance fee was HIGHER*		
Monthly Income	**mean**	**sd**	**(n)**	**mean**	**sd**	**(n)**	**mean**	**sd**	**(n)**
<$100	4.2	1.1	43	4.4	1.2	45	3.6	1.7	46
$100-$500	3.6	1.5	58	4.0	1.4	58	3.9	1.5	59
$501-$1000	3.5	1.6	31	3.7	1.6	32	3.7	1.6	32
$1001 - $1500	3.0	1.6	15	3.6	1.9	16	3.6	1.7	17
$1501-$2000	1.0	0.0	1	5.0	0.0	1	5.0	0.0	1
>$2000	3.3	1.7	7	2.4	1.8	7	2.7	1.7	7
Total	**3.7**	**1.5**	**155**	**3.9**	**1.5**	**159**	**3.7**	**1.6**	**162**

Data Analysis

Total Trips

In order to specify a demand function, there must be adequate variation in the number of trips taken to a recreation site. Table 7 below provides a breakdown of number and percent of visitors by total number of trips taken within the past 12 months. Nearly 60% of the sample were on their first trip within the past 12 months, and of those, over 90% (n=127) were visiting the park as first time visitors. Ideally, more variation in the number of trips is preferred in order to adequately specify the parameters that determine trip frequency, but this data will suffice for a baseline estimate of use values.

Table 7. Frequency of Total Trips.

Total Trips	Number of Visitors	Percent of Visitors
1	139	59%
2	26	11%
3	26	11%
4	9	4%
5	12	5%
6	6	3%
7+	17	7%

Estimating Trip Costs

In order to estimate trip costs, both time and travel costs must be computed in addition to entrance fees.

Time Costs. Time costs are calculated using the time spent traveling from an individual's home to the park entrance and the opportunity cost of that time calculated from the respondent's income. The questionnaire collected respondents' average household monthly income. Rather than ask respondents to list their exact monthly income, six ranges were offered:

1) Less than $100
2) $100-$500
3) $501-$1,000
4) $1,001-$1,500
5) $1,501-$2,000
6) More than $2,000

The midpoint of the range was used for all but the lowest and highest income ranges, where $75 and $2,500 were used respectively. Monthly income was then divided by 173 to obtain an hourly wage rate (52 weeks at 40 hours per week divided by 12 months). The time cost of travel was then estimated as

$$Time\ Cost = Time\ Spent\ Traveling * Hourly\ Wage\ Rate * OC * 2 \quad (4)$$

where OC is the opportunity cost of travel time. The proper method to incorporate time costs is debated in the travel cost literature (Sohngen et al., 1999). Most studies today apply an opportunity cost of 30% or 33% to estimate the value of leisure time, as suggested in the literature (Cesario, 1976; Preez, 2011). A study in 2011, however, found the opportunity cost of time for South Africans visiting a recreational fishing site to be 28% (Preez, 2011). Considering the low range of time costs estimated in Table 3 below, I will apply a 30% opportunity cost of time to this study. As will be seen from the results (see Table 8), time costs accounted for a small fraction of total trip costs and therefore have little impact in the total consumer surplus of park visits.

Table 8. Average Time Cost Per Trip.

Variable	Obs	Mean	Std. Dev.	Min	Max
Time Cost (28%)	194	**$1.73**	$2.03	$0.06	$12.14
Time Cost (30%)	194	**$1.85**	$2.17	$0.07	$13.01
Time Cost (33%)	194	**$2.04**	$2.39	$0.07	$14.31

Travel Costs. In order to estimate travel costs, respondents were asked a number of questions regarding their mode of transportation to the park in addition to the time and distance traveled. Out of 240 respondents, 136 (58%) reported hiring a driver/guide and 152 (65%) reported hiring a vehicle. In order to only account for the travel cost associated with accessing the park and not time spent in the park, the proportion of time spent traveling was applied to the total driver and vehicle costs. For visitors who did not report hiring either a vehicle or driver, travel costs were estimated using a per kilometer vehicle operating cost of $0.66 (T. Binamungu, personal communication, January 23, 2013) . In addition, 89 respondents reported being on a multiple-day trip, and therefore costs must be adjusted. Of the 89 respondents on multi-day trips, 25 reported multiple-destinations including visits to Mt. Kilimanjaro, Ngorongoro Crater, Lake Manyara, Tarangire and Serengeti National Parks. Trip costs for these individuals on multi-day, multi-destination excursions were not calculated and therefore will not be included in the model. For individuals on multi-day visits exclusively to ANP (Mount Meru hikers), 100% of the reported vehicle and driver costs were allocated to the individual's travel cost. For all others on single – day trips, the below formulas were applied to estimate travel costs associated with access to ANP.

$$Travel\ Cost_{Vehicle} = Vehicle\ Cost * (Travel\ Time/Total\ Time\ Spent) \quad (5)$$

$$Travel\ Cost_{Driver} = Driver\ Cost * (Travel\ Time/Total\ Time\ Spent) \quad (6)$$

$$Travel\ Cost_{Self-Drive} = (Distance\ Traveled * 2 * \$0.66)/\text{GroupSize} \quad (7)$$

One limitation of the survey was it failed to adequately capture charter transportation details. Many people visited the parks in mini-buses and vans in groups ranging from a few to over 20 people. These visitors therefore also shared transportation costs. For those that reported hiring a driver or vehicle, those costs provided were associated solely with that respondent, so allocating those costs to transport is simple based on equations (5) and (6). Those that did not report sharing vehicle or driver expenses were allocated fuel costs per equation (7). Because the survey did not

capture group size, respondents were categorized by group size based on field notes. Those respondents who were traveling with a single-family household were allocated 100% of the vehicle operating costs. An effort was made to survey only one respondent per household. Those respondents in groups of fewer than 10 were allocated $1/5^{th}$ of the vehicle operating costs. Those respondents in groups of 10 or more were allocated $1/10^{th}$ of the vehicle operating costs. Over two-thirds of all respondents visited the park in large and small groups (n=103 and n=85 respectively), and the remainder as a single family households (n=52).

One difficulty with capturing time and travel costs associated with charter transportation is the time and travel costs incurred prior to boarding the charter transport. Since the survey did capture time spent traveling to the park, the time costs are sufficiently account for in the trip costs. Other travel costs prior to boarding the charter, however, may not have been included in this analysis and it is important to note for future research to account for the various modes of transportation and sizes of groups. Additional questions regarding group size, shared expenses and total transportation costs should be included to adequately estimate both time and travel costs associated with transportation to and from the recreation site. This analysis therefore may underestimate the travel costs.

Entrance Fees. Entrance fees consisted of an individual and a vehicle fee. Individual entrance fees were 1500 Tsh[8] (approx. $0.95) per adult and 500 Tsh (approx. $0.32) per child under the age of sixteen. In addition to the individual entrance fee, a vehicle fee of 10,000 Tsh (approx. $6.30) was also charged. Vehicle fees were allocated to respondents based on group size[9]. The results of this analysis will enable us to predict how visitation rates will change based on the individual and vehicle fee increases scheduled to take effect in the summer of 2013.

Total Trip Costs. The total trip costs were then calculated by adding a respondent's travel, time, and entrance costs, summarized in Table 5 below. The average trip cost for all respondents was $27.10. Trip costs were significantly higher for multiple-day trip visitors, owing to higher park fees (more days spent in the park) and travel costs (further distance traveled to the park). On

[8] An exchange rate of $1=1,585 Tsh (average exchange rate for duration of study) is used throughout this analysis.
[9] Respondents were allocated 1/5 the vehicle fee in small groups and 1/10 in large groups.

average, the time cost accounted for only 7% of total trip costs. Of note is the significantly larger travel cost for multiple-day trip visitors versus single-day trip ($27.97 versus $14.91; p-value 0.00). The entrance fees accounted for 21% of total trip costs. Previous studies have found the entrance fee to be a nominal component of trip costs and thus have made suggestions to increase park fees to generate additional revenue (Naidoo & Adamowicz, 2005). Here, however, we see that the entrance fees for local visitors account for a greater portion of the total trip costs, and thus may have a greater influence on demand when changed. This is not a surprising find as locals typically do not incur airfare, accommodations and other foreign-tourist expenses to access the park.

Table 9. Trip Costs for All Trips, Multiple-Day Trips, and Single-Day Trips

	Mean	Std. Dev.	Min	Max
All Trips				
Travel Cost	$18.85	$18.74	$1.10	$111.11
Time Cost	$1.85	$2.17	$0.07	$13.01
Entrance Fee	$5.68	$4.86	$1.26	$34.38
Total Trip Cost	$27.10	$21.22	$2.86	$121.68
Multiple-Day Trip				
Travel Cost	$27.97	$16.68	$2.24	$72.55
Time Cost	$1.93	$2.19	$0.13	$10.40
Entrance Fee	$8.11	$6.13	$1.26	$34.38
Total Trip Cost	$37.20	$17.17	$8.12	$78.25
Single-Day Trip				
Travel Cost	$14.91	$18.24	$1.10	$111.11
Time Cost	$1.81	$2.17	$0.07	$13.01
Entrance Fee	$4.26	$3.21	$1.58	$12.62
Total Trip Cost	$22.38	$21.34	$2.86	$121.68

In addition to travel costs, the survey captured the total cost of the visit reported by the respondent. On average, a household reported spending $91 per trip, of which nearly 30% ($27.10) of these dollars are spent on travel costs. The remainder, over 70%, goes to the local economy. Of the 65,000 visitors to Arusha National Park annually, approximately ½ are local resident. Direct expenditures by local residents into the local economy therefore could be as high as $1 million annually.

In addition, it is of interest to note the variation in group size between single-day and multiple-day trips. Over 80% of single-family households were visiting the park as a single-day trip, where multiple-day trip visitors consisted of mostly small and large groups.

Table 10. Number of Respondents by Group Size and Day Trip.

	Multiple-Day Trip	Single-Day Trip	Total
No Group	9	43	52
Small Group (<10 ppl)	37	47	84
Large Group (>10 ppl)	43	59	102
Total	**89**	**149**	**238**

One assumption of estimating the total use value for visitors is that a respondent's trip costs are approximately equal for each visit to the park. The high number respondents visiting the park in large groups using charter transportation modes may result in greater variation in the trip cost for each visit. The model below applies the trip cost of the last visit to the park (the visit surveyed for this study) to estimate a demand function that will provide the consumer surplus measure for the sample, thus ignoring any variation in trip costs. This limitation is likely inherent to conducting on-site surveys in developing countries in order to estimate use values, but should be taken into consideration when constructing the study design.

Specification of the Model

The purpose of this study is to estimate the access value, or consumer surplus, of East African visitors for each trip to Arusha National Park. First we must specify a model that explains the variation in the number of trips taken per visitor based on trip costs, demographic, socioeconomic and other factors. The number of trips taken to the park represents non-negative count data (0,1,2,3,…), and therefore ordinary least squares regression methods cannot be used. The Poisson regression model is well suited for basic count data and will be used here. Poisson regression estimates the probability of observing an individual taking r trips in a year by

$$P(r) = \frac{exp(-\lambda) * \lambda^r}{r!} \qquad (8)$$

where the parameter λ is the mean, or expected number of events (E(r)) and is a function of the variables specified earlier in the demand model (Parsons, 2003). Thus

$$\lambda = E(r) = exp\ (\beta_{tc_r} tc_r + \beta_y y + \ \beta_z z) \qquad (9)$$

Because the number of trips taken by an individual must always greater than 0, λ usually takes a log-linear form

$$\ln\ (\lambda) = \beta_{tc_r} tc_r + \beta_y y + \ \beta_z z \qquad (10)$$

and represents the Poisson form of the recreation demand specified in equation (1). The parameters in equation (10) are then estimated by maximum likelihood. Using the data known for each sample (number of trips, trip cost, income and other variables), the probability of observing the actual number of trips taken by the respondent is constructed for each person in the sample. Then, the likelihood of observing the actual pattern of visits for the entire sample is the product of these individual probabilities

$$L = \Pi_{n=1}^{N} \frac{exp(-\lambda) * \lambda^r}{r!} \qquad (11)$$

and the parameters are chosen to maximize L (Parsons, 2003). For each individual, n, the consumer surplus, or access value as represented in Figure 1 can be estimated by

$$CS_n = \frac{\lambda_n}{-\beta_{tc_r}} \qquad (12)$$

The Poisson distribution has one parameter, λ, which represents both the mean and the variance of the expected number of events. The data in this survey, however, reflects an over dispersion in the variance and therefore, robust estimations will be applied here. Robust estimation will correct the standard errors to appropriately fit this heteroskedastic model where constant variation in the error term cannot be assumed.

As discussed earlier, this on-site sample is truncated at one trip and endogenously stratified which, if not corrected for, will result in an overestimation of the sample mean willingness-to-pay. The endogenously stratified and truncated Poisson can be estimated by running a standard Poisson regression of r – 1 on the number of trips taken by an individual, thus correcting for overestimation of WTP (Haab & McConnell, 2002).

Estimating the demand function

Results from the travel cost demand function are represented in Table 11. The trip cost coefficients were negative, as expected, in all three models, but only significant in the first model that controlled for respondents who felt strongly that wildlife conservation was very important and should be taught in schools, based on responses to the Likert-scale park perception questions[10]. Additional expenditures were calculated by subtracting the trip costs from the total expenditures of the trip. This represents activities outside of those undertaken to access the site, including shopping for gifts, purchasing meals and other recreational activities and is significant across all three models. Total trips to other parks represents the total number of visits to parks other than ANP during the past 12 months and is again significant in all three models. This may represent people who have a strong affinity for park recreation and are avid visitors to all parks for a variety of purposes. Since Arusha National Park is only one of two recreation sites offering mountain hiking (the other Mt. Kilimanjaro), there may be a low level of substitutability among ANP and other parks. Neither monthly income nor education was a significant indicator of total trips in any model. This may reflect a demand for park recreation regardless of affluence. Visitors in the tourism industry were more likely to visit the park frequently than non-tourism visitors, an unsurprising find given their natural affinity for visiting parks as part of their occupation. The first two models controlled for visitors on single-day trips, where the third model controlled for the number of nights a visitor spent at the park (0 if single-day).

[10] A dummy variable was generated, coded as 1 for respondents reporting a 5 – strongly agree – to the question, and 0 otherwise.

Table 11. Results for the Arusha National Park TCM.

Variable	Model 1	Model 2	Model 3
Trip Cost	-0.016**	-0.006	-0.007
	(0.007)	(0.006)	(0.006)
Additional Expenditures	0.005**	0.004**	0.005**
	(0.002)	(0.002)	(0.002)
Monthly Income	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Total Trips – Other Parks	0.200**	0.125*	0.160**
	(0.083)	(0.075)	(0.071)
Student	0.358	0.307	0.384
	(0.428)	(0.390)	(0.423)
Tourism	1.344***	1.281***	1.072***
	(0.395)	(0.314)	(0.331)
College-level Education	0.246	0.394	0.418
	(0.310)	(0.256)	(0.283)
Household Size	0.221***	0.134	0.091
	(0.078)	(0.083)	(0.081)
Daytrip	-0.423	-0.240	
	(0.325)	(0.268)	
Wildlife Conservation	0.314		
	(0.424)		
Conservation Education	0.599		
	(0.457)		
NGO			-0.583
			(0.452)
Number of Nights			0.152**
			(0.071)
Age			0.241*
			(0.129)
Constant	-2.109***	-1.235***	-1.939***
	(0.558)	(0.394)	(0.515)
Observations	88	116	115
Pseudo R2	0.2836	0.2169	0.2472

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Results

The Recreational Use Value of Arusha National Park

The value of trips to Arusha National Park is estimated with consumer surplus based on the models specified above. The consumer surplus is the conventional economic measure of value,

and it represents the value *in addition* to the trip costs incurred from each trip to the park. These are the benefits not captured through traditional market-mechanisms. Estimates of consumer surplus are presented in Table 12 below.

Table 12. Consumer Surplus Estimates.

	Model 1	Model 2	Model 3
Sample Average Annual Trips	2.02	2.03	2.04
Consumer Surplus Per Household Per Trip	$62.50	$166.67	$142.86
Consumer Surplus Per Person Per Day	$13.28	$37.88	$32.92
Annual Consumer Surplus per household	$126.25	$338.34	$291.43
Average Price	$28.35	$28.45	$28.51

As the results show, the consumer surplus per person per day is estimated to be $13.28 - $37.88. The average household size per respondent was 2, and the average length of stay was 2 days. Therefore, one trip to the park generates $62.50-$166.67 in consumer surplus per household. Using these respondents as an estimate of the total number of local visitors to the park each year, total annual consumer surplus can be estimated at $0.9 - $2.7 million. This estimate assumes that all resident park visitors were on leisure travel, which is not likely given the high volume of foreign tourists that are accompanied by local guides, drivers, and others employed in the tourism industry. However, without knowing the percent of resident visitors that are leisure travelers, these estimates reflect the maximum predicted values.

Price Effects of Park Fee Increase

The demand functions specified above were then used to estimate how the proposed park entrance fee increase will impact the number of trips taken to the park and the change in park revenue as a result. On average, trip costs will increase by nearly $22 (67% of total trip costs). Multiple-day visitors' trip costs will nearly double with an average trip cost increase of $39, whereas single-day visitors will increase by just $9. The total trips is predicted to decline by only 7%, however, as a result of this fee increase. This effect is will likely have a stronger effect on

multiple-day trip visitors, reducing their total number of trips by 12%, compared to a 5% decline among single-day trip visitors.

Table 13. Impact of Proposed Park Fee Increase.[11]

	Change in Trip Cost	Change in Number of Trips
Total Trips	+67%	-7%
Single-Day Trips Only	+51%	-5%
Multiple-Day Trips Only	+94%	-12%

Overall, the model predicts that park revenue will increase by 253-321%, a more than three-fold increase of current revenue. Although one-half of Arusha National Park visitors are East African citizens, their park fee is considerably lower than foreign visitors ($1 versus $35 per day) and thus do not represent one-half of park revenue. I estimate that under 5% of park revenue is generated by local residents. Therefore, the maximum increase in revenue generated from these visitors will be approximately $0.4 million. This revenue increase includes all resident park visitors, both leisure and non-leisure visitors, assuming no decline in foreign tourism.

Discussion

The consumer surplus estimated here represents the social utility derived from the recreational use of Arusha National Park *in addition* to the costs incurred to access the site. On average, each local visitor derives $13-$38 in value per day spent in Arusha National Park ($60-$180 per year), in addition to the amount spent to access the park. In addition to accruing individual social welfare, park visitors also contributed to the local economy by an average of $55 per household per trip, in addition to trip costs incurred to access the site. This money is spent on gifts, meals, and other expenditures associated with the trip and accounts for as much as $1 million annually injected into the local economy. A decline in the number of trips taken by local residents will thus reduce this economic contribution from local tourism.

[11] The average impact across all three models is reported here.

These results demonstrate a strong, price inelastic demand for recreation by local citizens. Income was not significantly correlated with the number of trips a respondent took to the park. Although there may be a minimum income threshold before residents have discretionary income for park recreation, once they become park 'users', income does not influence the number of trips they make. This may reveal an opportunity to market the park's amenities to residents in areas with high numbers of park visitors, particularly the urban areas in close proximity to the park, to encourage increased visitation rates.

These estimates are useful for policy-makers, park officials and others interested in the management of national parks in Tanzania. The recreational use values estimated here can be applied to evaluate land-use policies that may affect the value derived from access to Arusha National Park's recreational offerings. ANP's Mount Meru along with Mount Kilimanjaro are the only parks in Tanzania that offer mountain hiking. Mount Kilimanjaro is a more expensive hike requiring more days to summit than Mount Meru, suggesting that the substitutability of ANP is low, particularly among multiple-day visitors. Over one-third of respondents in this survey were visiting the park on a multiple-day trip to hike Mount Meru within ANP.

Historical park data does not distinguish resident visitors as either leisure tourists or employees of the tourism industry, therefore the limitations to estimating the total annual consumer surplus may not provide an accurate figure. According to park entrance logs maintained by TANAPA, on average over the past five years, one-half of all park visitors were local residents. In 2011, ANP hosted over 65,000 visitors, up 25% from the year prior. If all of the local visitors in 2011 were leisure visitors, total annual consumer surplus is estimated at $0.9 - $2.7 million. In addition, these residents would inject $0.9 million into the local economy every year through expenditures included in their visit to the park.

The findings of this study reveal a strong and perhaps a growing demand for park recreation, relatively insensitive to the costs incurred to access the site. As Tanzania continues to urbanize and experience high rates of economic growth, the network of protected areas may become more valuable to its citizens. The revenue generated from local tourism could serve as a consistent,

reliable source of income to the national park system, not subject to the factors that influence foreign tourism such as the cost airfare and political instability. In Kenya, for instance, the 2008 post-election violence caused revenue from foreign tourism to plummet by over 50% during the first quarter, a loss of nearly $150 million (Reuters, 2008). Tourism makes up a significant portion of both Kenya and Tanzania's gross domestic product, 10% and 17% respectively (Kibara et al., 2012; "Tanzania Calls for Competitive Tourism", 2013). Over time, as economic growth in Tanzania continues to build a middle-class able to afford recreation activities, local tourism could grow to be a significant sector of the economy. This growth potential should be recognized and incorporated into long-term land-use planning that may irreversibly alter landscapes, rendering them no longer available for recreational use, in addition to the co-benefits of protected areas.

Limitations

Survey administration and data collection have unique challenges in developing regions. The picture of local tourism looks very different from the single-family households traditionally seen in developed countries. In Tanzania, visitors to the park consisted of mostly small to large groups, comprised of both friends and family members sharing the trip costs via charter transport vehicles. Due to the failure of the survey to capture group size, some assumptions had to be made in order to account for shared trip costs. Enumerators must be well trained to clarify the information in the survey to the respondents. This will ensure that trip costs are accurately measured. In addition, households with salaried employment in developing countries is typically low, and income may vary greatly over time. Therefore, the survey captured average monthly income rather than annual income. As a result, this data may more accurately represent current wage earnings at the time the survey was conducted, rather than averaged over time. These fluctuations are not captured in the travel cost model and thus may not accurately represent the recreational value across long time horizons. This is perhaps an inherent limitation with estimating wealth, and utility, in developing countries.

Conclusion

Tanzania is endowed with unique tourist attractions including diverse wildlife and habitat, geological features, archaeological sites, beaches, and a rich indigenous cultural heritage that

draw over one million visitors annually. Yet, Tanzania is also one of the world's poorest economies with over one-third of its population living below the poverty line (CIA, 2013). Tourism is an important sector; the revenue generated supplies 17% of total GDP, and is contributing to strong, sustained economic growth. This study demonstrates the clear value of access to protected areas by local residents. Although local residents represent a small segment of the total tourism population today, economic growth may contribute to this segment increasing in size over time, accounting for a larger proportion of tourism revenue. In addition, the price-inelastic demand for park access revealed here reflects a sector not likely to fluctuate with changing prices. Therefore, revenue from local tourism could be more consistent and reliable than foreign tourism, not subject to fluctuations in markets and the global economy. Local tourism has great potential to contribute to the Tanzanian economy, and should be adequately considered when evaluating development options that may impact this growing sector.

Further research is needed to more accurately value protected areas in developing countries. In addition to conducting non-market valuation on foreign visitors to these areas, studies should also include estimates of local use value. Although these estimates are likely to be low when compared to foreign visitors, the changes in these values over time will enable trends to be identified. Only then will we have a better understanding of how local residents value access to their own protected areas, and how that is changing over time as Tanzania's economy develops and population urbanizes. This same method could be applied throughout Tanzania to compare the value derived from different protected areas. This method could also be used to derive the value of the various activities protected areas offer, such as hiking, hunting, wildlife viewing, or camping. This information will better enable management authorities to make decisions on park use to benefit local citizens. As local tourism grows and contributes to a larger share of the revenue generated from these protected areas, so too does the local influence in wildlife and landscape conservation in Tanzania. Local conservation efforts are growing throughout East Africa at a time when protected areas are managed and influenced more by local rather than international policy makers. Ensuring these protected areas remain intact could be an important contribution to social welfare over time as Tanzania urbanizes and grows to be a more developed economy. The value derived from these parks will provide critical evidence for how these parks should be managed by, and for, the people of Africa.

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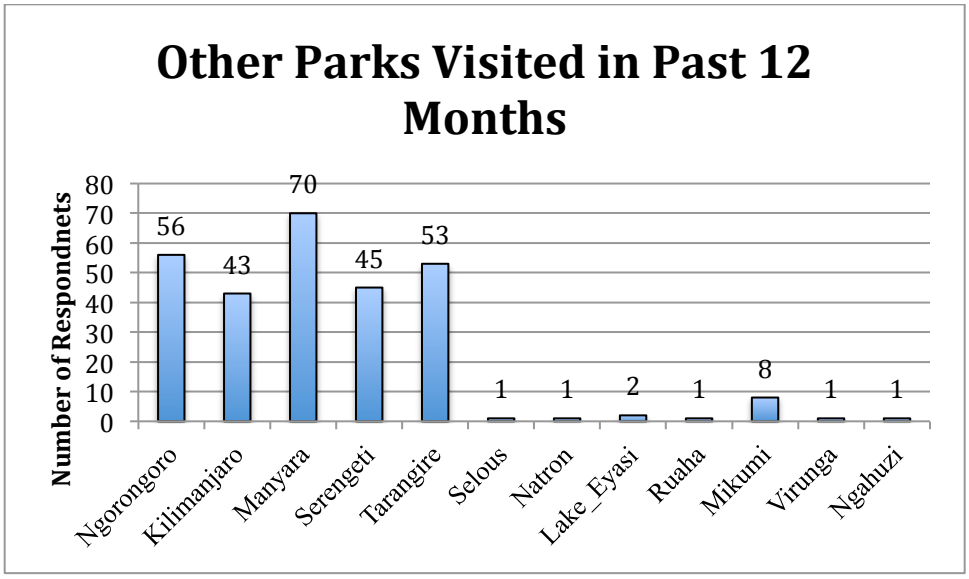
Appendix

Appendix 1. Other Parks Visited in Past 12 Months



Appendix 2. Recruitment and Consent Script

Hi, my name is _____ and I am with a team conducting a brief survey on park visitors. May I have a moment of your time?

If yes: Great. Thank you. We are here with Christina Van Winkle, a graduate student at Duke University. The student, in partnership with the African Wildlife Foundation, is interested in gathering park visitation information on East African citizens on behalf of the Tanzania National Park authorities.

Are you from Tanzania, Kenya, Uganda, or Rwanda?

If yes: Are you over the age of 18?

If yes: We would like to invite you to fill out this survey. The goal of this survey is to gather information about the motivations and experiences of East African citizens to Arusha National Park. The results of this study will assist the African Wildlife Foundation and the Tanzania National Park authorities in their work managing the park, but will also be used by the graduate student in her studies at her University.

If you do not want to fill out the survey that's fine and you are welcome to skip any questions you do not want to answer. The survey should only take between 5-10 minutes to complete.

Are you willing to complete this survey and assist us with our research?

Appendix 3. Survey Instrument

Survey of Visitors to Arusha National Park

Thank you for taking the time to complete this survey. This survey is being conducted by Christina Van Winkle, a graduate student at Duke University, and the African Wildlife Foundation on behalf of the Tanzania National Park authorities. The goal of this survey is to gather information about the motivations and experiences of East African citizens to Arusha National Park. Your participation is voluntary and your answers will be kept strictly confidential. Please answer the following questions and return this form to the interviewer. The interviewer can also answer any questions you may have about this study. You may skip any questions that you do not want to answer or stop filling out the survey at any time. Thank you for your time and assistance.

Part I – Park User Survey

1. Are you a citizen of a country in East Africa? (please check) ☐YES ☐NO

1a. If YES, please check: ☐Tanzania ☐Kenya ☐Uganda ☐Rwanda ☐Burundi

2. What city/town do you live in? _____

Household Information

3. What is your gender? ☐Male ☐Female

4. What is your age? ☐18-25 ☐26-35 ☐36-45 ☐46-55 ☐56 and over

5. What is the highest level of education you have completed? (check one)

☐Primary ☐Secondary ☐Undergraduate ☐Masters ☐PhD

6. Please check your MONTHLY household income:

☐ Less than $100 (160,000 TZS) ☐ $100-$500 (160,000-800,000 TZS)

☐ $501-$1000 (800,000-1.5 mill TZS) ☐ $1001-$1,500 (1.5 mill – 2.4 mill TZS)

☐ $1,501 - $2,000 (2.4 mill – 3.2 mill TZS) ☐ More than $2,000 (3.2 mill TZS)

7. On average, how much of your monthly household budget do you spend visiting parks?

☐Less than 5% ☐5%-10% ☐11%-15% ☐16%-20% ☐More than 20%

8. What is your current occupation?

☐ Student ☐ Agriculture/Livestock
☐ Retail Trade ☐ Healthcare Industry
☐ Wholesale Trade ☐ Professional/Financial Services
☐ Construction ☐ Hotel Management
☐ Transportation Services ☐ Not-for-Profit Organization

☐ Tourism ☐ Government Employee
☐ Education Industry ☐ Other:_____

The following questions refer to your visit to Arusha National Park today. For this survey, a trip is the total time you spent between leaving and returning to your home address. The trip includes all activities you may have done during that time period.

9. Check whether this is a one-day trip, or a multiple-day trip. (A one-day trip includes no overnight stays, while a multiple-day trip includes one or more overnight stays)

☐One-day trip (skip to question 10) ☐ Multiple-Day trip (see below)

9a. If this is a MULTIPLE-DAY trip, check the place(s) that best indicates where you will overnight:
☐ Hotel ☐ Friends/Family ☐ Campsite ☐ Rest House/Park Bandas

9b. How many nights will you stay on this trip? ☐1 ☐2 ☐3 ☐4 ☐5 or more

9c. If this is a MULTIPLE-DAY trip, please list other parks you will visit on this trip:

_____

10. Approximately how many hours will you spend in the park today? ☐1-3 ☐4-6 ☐7+

11. What other activities did you/will you engage in during your trip (please check all that apply)?

☐ Eat at local restaurant ☐ Purchase food from roadside stand
☐ Shop for gifts ☐ Visit family/friends
☐ Other (please list):_____

For the next two questions, please include only the time, or distance traveled, from your previous destination.

12. How much time did it take to travel to Arusha National Park today (one-way)?_____

13. How many kilometers did you drive to Arusha National Park today (one-way)? _____

14. How many people traveled with you on this trip from your household? _____

14a. Of those people, how many are children (under the age of 18)? _____

15. Is this the first time you have visited this park as a leisure visitor? ☐YES ☐NO

15a. If NO, how many times have you visited THIS park in the past 12 months (include today's visit)?
☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 or more

16. How many times have you visited OTHER parks in the last 12 months?
☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 or more

17. Please list other National Parks you have visited in the past 12 months:

_____

The next four questions refer to the cost of your trip. If costs are shared among a group, please only include the amount YOU contributed.

18. Did you hire a driver/guide for this trip? ☐YES ☐NO
20a. If YES, how much did you spend for the driver/guide? _____

19. Did you hire a vehicle for this trip? ☐YES ☐NO
19a. If YES, how much did you spend for the vehicle? _____

20. What component of your trip was the most expensive (check one)?

☐Park Entry Fee ☐Hiring Vehicle ☐Fuel
☐Hiring of Driver/Guide ☐Accommodations

21. Approximately how much money will you spend in total for this trip (including all activities)?

_____

Part II - Park Perception Survey

Use the following scale to rate your answers:
1=Strongly Disagree (SD); 2=Disagree (D); 3=Neutral (N); 4=Agree (A); 5=Strongly Agree (SA)

	SD	D	N	A	SA
1) I visit this park because it is close to home.	1	2	3	4	5
2) I plan to visit other national parks in Tanzania	1	2	3	4	5
3) This park is well managed.	1	2	3	4	5
4) This park offers a high-quality nature experience.	1	2	3	4	5
5) I believe that protecting wildlife is important.	1	2	3	4	5
6) I believe that conservation should be taught in schools.	1	2	3	4	5

7) The entrance fee is a factor in deciding to visit parks.	1	2	3	4	5
8) I would visit parks MORE often if the entrance fee was LOWER.	1	2	3	4	5
9) I would visit the parks LESS often if the entrance fee was HIGHER.	1	2	3	4	5