Public Support for Growth and Funding in Built Environments: Case of an Arboretum

Jerrod Penn[a], Nathanial U. Trull[b] & Wuyang Hu[c]
[a]**Ph.D. Student, University of Kentucky jerrod.penn@uky.edu**
[b]**Undergraduate Senior & Presenting Author, University of Kentucky**
[c]**Professor, University of Kentucky**

Selected Paper prepared for presentation at the Southern Agricultural Economics Association's 2015 Annual Meeting, Atlanta, Georgia, January 31-February 3, 2015

Abstract

This study uses a choice experiment to identify user values of potential structural improvements in a university arboretum. The survey was distributed to arboretum visitors (N=300) during Arbor Day weekend 2014. The six Choice Experiment attributes were the potential installation of a Pollinator Garden, Covered Picnic Tables, Vending Machines, and more controversially, a Perimeter Fence, a commuter Bike Path, with a monthly parking pass as the payment vehicle. These attributes were chosen to guide policy decisions for potential revenue generation (e.g. vending machines and parking) and to attract new visitors without alienating current users. It was important to choose attributes that were within the control of the arboretum. To date, we know of only one published study in the United States considering arboretum value by Downing and Roberts (1991), which used the Travel Cost Method to consider holistic values of another university's arboretum.

Results show the greatest positive WTP for the pollinator garden at $3.65 per user per month. While the bike path and perimeter fence are controversial issues in the surrounding neighborhoods, our results show a high WTP in favor of a bike path and a high WTP to avoid installing a perimeter fence. Surprisingly, respondents were also strongly against vending machines. These results provide evidence for the Arboretum leadership to make informed funding and infrastructure decisions most harmonious with public values.

Introduction

There are approximately 622 botanical gardens and arboretums across the United States (Morton Register).[1] Botanical gardens were established in medieval times to study the medicinal properties of plants and later progressed into being places of decoration and exhibition. Today, botanical gardens and arboreta serve as places to educate the public in plant sciences, garner support for conservation efforts, and protect endangered plant species, (The Arboretum at Penn State; Klehm Arboretum and Botanic Garden). More broadly, communities support their local arboreta and botanical gardens to serve as an aesthetically pleasing "Green Space" that can promote physical, emotional, and spiritual health (Klehm Arboretum and Botanical Garden).

Many of these arboretums are sponsored and maintained by universities and municipal governments. In these instances, these locations are often supported publicly via donations or public funds. At the same time, admission is often free for public arboreta, so understanding the public's valuation (via admission rates) such as is done in private botanical gardens can be difficult. Finding mechanisms for support and attraction are more difficult for public arboreta relative to private arboreta and botanical gardens. As such, efforts can be taken to generate funding and garner more attraction; hence the focus of our choice experiment is on attributes that potentially attract more funding and visitors.

Even with the contemporary and historical importance of arboreta and botanical gardens, a dearth of research exists on values associated with the services provided by arboreta and botanical gardens. To our knowledge, the last and only study on public values for arboreta in the United States was collected in 1987. The focus of our paper looks to begin to fill the void of information on public support of arboreta by examining a case study of potential improvements within a University Arboretum operated in the state of Kentucky.

[1] This number also includes cemeteries that double as arboretums.

The remaining structure of this paper will start with the literature review, which will highlight key aspects from a few select studies. Methods will describe the data collection process including the choice experiment. We present results of the sample and an analysis of the choice experiment, including estimates of WTP. Finally, we provide a brief conclusion and implications of our findings.

Literature Review

With minimal information and research available on user values of arboreta, obtaining existing evidence of consumer demand for services provided by arboreta and botanical gardens exist is difficult. However, consumer demand for services provided by botanical gardens and arboreta is evident through the existence of gardening and arboretum societies, topic-related private and industry publications, and foot traffic at arboretums annually (Downing and Roberts, 1991).

As far as we know, Downing and Roberts (1991) is the only published work in the United States regarding visitor use-values of arboreta and botanical gardens. Assessing the benefits of additional public horticulture programs or other new services for visitors, Downing and Roberts studied the University of Tennessee (UT) Arboretum over a 21-day period from March to April of 1987. Using the Travel-Cost Method, they estimated that the consumer use-value of the UT Arboretum was approximately $20.43 per person visit. And while they were originally motivated to identify visitor use value for "assessing the benefits of additional public horticulture programs or other new services for visitors," their approach yields total use value per trip to the University of Tennessee Arboretum, not specific programming or attributes. Understanding which individual augmentations to make is critical information to managers.

Outside of the United States, only a few more studies exist on user values of arboreta and botanical gardens. Two of these studies evaluate user values of arboreta in South Korea[2]. Hong, Kim,

[2] Only the abstracts were available in English, while the papers themselves were in Korean. We are unsure of the more specific details of the studies.

Jung and Tae (2010) estimated the economic value of a proposed arboretum in Sejong City, South Korea using a choice experiment. The arboretum attributes analyzed were preservation, education, recreation, facility, accessibility, and the entrance fee to the arboretum. The study found that preservation and recreation were significant and accordingly, had positive WTP among respondents. Kang, Ha and Lee (2011) also used a choice experiment to measure the economic value of an existing arboretum named Gyeongnam Arboretum in Jinju City, South Korea. The study found that respondents with higher income are more likely to pay to gain admittance into an arboretum if that arboretum provides a high educational value.

Multiple studies have also been conducted on arboreta and botanical gardens in the United Kingdom. Demir (2014) used the Travel-Cost Method to estimate the recreational value of the Royal Botanic Gardens (RBG) in Kew, England[3]. Demir found that the consumer surplus of the RBG, per visit, was approximately £165 per person. Garrod, Pickering, and Willis (1993) used the Travel-Cost Method to estimate the economic values of four separate botanical gardens[4] in the United Kingdom. Out of the 48 botanical gardens in the UK, they choose a university garden, a municipal garden, and two other government gardens (one conducts research, while the other one does not). They found that the benefits from consumer recreation could not offset the costs associated with running three[5] of the botanical garden.[6] Considering that our study looks potential attributes that could draw in more visitors, their findings are quite important to our study.

Review of the limited literature on arboreta makes it evident little information exists on user values. Published research in the United States has not occurred in nearly three decades, making it difficult to track any specific policy changes or new strategies by arboreta to attract higher attendance

3 It is important to note that the RBG does charge an admission fee to those looking to gain access to the facility.

4 Cambridge University Botanical Garden, Sheffield City Botanic Garden, Royal Botanic Garden in Edinburgh, and Westonbirt (which charged a £1.80 entrance fee at the time of the study in 1990).

5 Cambridge, Edinburgh, and Westonbirt

6 Garrod et al. mentions that with a larger sample size, estimated benefits could equal financial costs but that was outside the scope of their study.

and more funding. We look to begin to help find new policies and strategies for arboreta through a case study of The University of Kentucky-Lexington-Fayette Urban County Government Arboretum (UK-LFUCG)[7] (hereafter, "The Arboretum") located in Lexington, Kentucky.

The Arboretum is a 100-acre facility located on the southern end of the University of Kentucky campus. Much of the property shares boundaries with private residencies and graduate student housing. In addition to the main facility entrance, there is a second 'back' entrance that serves as a useful route for students, pedestrians and cyclists to commute to campus. Currently, there is no fence or any other means of controlling entrance to the premises.

Methods

Data Collection. A variety of useful methods exist to collect data for this work; we chose to do an on-site survey at The Arboretum. Before the survey was implemented, it went through two focus groups to ensure the quality of the survey. Surveys were collected over a three-day period (April 24, 2014 – April 26, 2014)[8] coinciding with The Arboretum's Arbor Day celebration on Saturday, April 26. On the weekdays, responses were collected from 3 p.m. to 7 p.m. to coincide when user traffic was highest, whereas Saturday's collection took place from 9 a.m. to 3 p.m. during the Arbor Day celebration. The survey was administered near the front entrance to The Arboretum. Enumerators approached and asked patrons as they entered The Arboretum's paved walking trail to participate in the survey.[9]

Respondents were asked a variety of questions in the survey, which began with their usage of The Arboretum, followed by the choice experiment, and concluded with general demographic information. Information gathered about individual use of the arboretum included typical length of visit, number of accompanying persons, method of travel to The Arboretum, reasons for visiting and

[7] The Arboretum began as a joint effort between the University of Kentucky and the Lexington-Fayette Urban County Government in 1991 and in March 2000, it was named as the "Official State Botanical Garden for the Commonwealth of Kentucky."

[8] There was an online version of the survey available to The Friends of The Arboretum roughly during this same time period.

[9] However, during the Arbor Day celebration, we were positioned in a tent with our own surveying stations so we could capture patrons, as they were moving around the tent looking at other displays.

how many times they visited during the peak season of operation[10]. Other questions asked in relation to the arboretum included willingness to purchase a monthly parking pass if required, rating current features offered at The Arboretum and rating future proposed features on a scale of "Strongly Disagree" to "Strongly Agree." Standard demographic information was obtained regarding gender, age, zip code, educational attainment, income, employment, etc. In total, 356[11] surveys were completed and used to generate our results for the demographic section.

Empirical Approach. There are multiple useful techniques to value goods where a market does not exist (i.e. a publicly supported arboretum) such as the contingent valuation and travel-cost methods. This paper uses a choice experiment, which is a type of stated preference approach commonly implemented in surveys. Choice experiments are a technique commonly used in economics and marketing to identify the relative value of different characteristics that could potentially come with a product or service. It is extremely useful to understand consumer behavior for goods and services not currently available on the market or potential public perception of policies, especially those that are difficult or costly to reverse after implementation.[12]

The characteristics of interest are typically known as 'attributes.' Critical aspects of a choice experiment include which attributes are included and how many categories or levels exist within each attribute. Six attributes[13] are considered in The Arboretum's Choice Experiment, outlined in Table 1. Pollinator Garden, Perimeter Fence, Bike Path and Vending Machines each had two levels, indicating the presence or absence of each attribute, while covered picnic tables and monthly parking pass each had 4 levels. A key aspect of an economic choice experiment is a price mechanism, in our case the monthly parking pass, which allows us to ascertain the dollar value of the other attributes. These attribute were

10 The survey defined peak season as April 1st to October 31st.

11 22 of the respondents were from a similar online survey made available to members of The Friends of the Arboretum.

12 For the interested reader, Orme (2009) is a recommended introductory text and Train (2009) is an advanced text.

13 Placards were available for respondents to view with images of the exact location for the proposed bike path as well as the proposed covered picnic areas.

chosen to help guide policy decisions in terms of potential revenue generation (e.g. vending machines and parking) and attracting visitors to The Arboretum (i.e. pollinator garden and covered picnic tables) and their potential alienation of current users.

These potential features are not without controversy and that was evident during the surveying process. A perimeter fence enclosing the property could mean future entry fees of the currently free Arboretum. The installation of a bike path could create a conflict, real or perceived, with the designed purpose and current users of The Arboretum. Avid users could see a bike path as a shift from the arboretum's designed purpose of observation and study to more like a public park. By adding controversial attributes into the choice experiment, we are able to better simulate the difficult decision making process of an arboretum manager and better understand users' true values of an arboretum's attributes rather than just their overall value.

Table 1: Attributes, Levels, and Descriptions

Attribute Name	Levels (#)	Description (Same text presented to respondents in survey)
Pollinator garden	Absent, Present (2)	A 2-acre space designed to attract and benefit butterfly species such as Monarchs and other native pollinators such as bees. The pollinator garden will be off the main path so visitors can decide if they prefer to walk through or avoid this area entirely.
Perimeter Fence	Absent, Present (2)	A fence around the entire arboretum property that restricts cars from entering The Arboretum without a pass (walkers and bikers can still enter freely).
Bike Path	Absent, Present (2)	Installs a concrete path for the currently worn down connector path used by walkers and bicyclists traveling between the UK campus and the Bellefonte Neighborhood.
Vending Machines	Absent, Present (2)	Snacks, drinks and ice cream machines located outside of the Visitor Center. All proceeds support The Arboretum.
Covered Picnic Tables	0, 1, 2, 3 (4)	Located near the Visitor Center. Free to use and can be reserved for special functions. Preference given to Friends of The Arboretum and monthly parking pass holders.

Monthly Parking Pass	$5, $10, $15, $20 (4)	A parking pass required for weekday afternoons from 4pm until dusk and all day on the weekends from April 1 through October 31. All proceeds support The Arboretum.

To minimize the amount of time needed from each respondent, each respondent completed 7 scenarios in the choice experiment. Within each scenario, there were two alternatives with varying levels of attributes, and one "status-quo/opt-out" alternative. This choice experiment design gives a d-efficiency of 94%. Further, the opt-out alternative is important since it mimics reality in that respondents can choose none of the new offerings if they dislike the price or attribute levels offered. A sample scenario is featured in Figure 1.

Figure 1: Example CE Scenario

Scenario 6

New Arboretum Features	Option 1	Option 2	Option 3
Pollinator Garden	Yes	No	
Perimeter Fence	No	Yes	
Connector Bike Path	No	Yes	**Prefer Neither-** I would rather keep current features.
Vending Machines	No	No	
Number of Covered Picnic Tables	2	0	
Monthly Parking Pass	$15	$10	
I choose (only one)	❑	❑	❑

Use of a choice experiment relies on the assumption that utility derived from a good or service is determined by the separate utilities derived from attributes, rather than the good/service itself, that make up the sum of total utility. The respondent selects the most preferred alternative of those presented. Choosing the utility maximizing option in each choice experiment follows random utility modeling (RUM). Based on McFadden (1974) and Train (2009), we can then implement conditional and mixed logit models, respectively, to model the preferences for the attributes in The Arboretum choice experiment. Using this approach also enables the recovery of an estimated Willingness to Pay (WTP) for

each proposed new feature. WTP is the dollar value respondents place on the new feature or in the case of opposed attributes, the value to avoid that attribute level.

Results

We first examine a breakdown of the demographic results of our survey sample compared to the Lexington-Fayette Metropolitan Statistical Area (MSA) as provided by the US Census, presented in Table 2. It is important to note that since The Arboretum is part of and in very close proximity to the University of Kentucky, some of the descriptive statistics of the sample may diverge due to the student population not considered in the Census. The sample may not necessarily be a mirror image of the MSA because users of The Arboretum may be different than the general population of the area.

Our sample is fairly representative compared to the Census' data on socioeconomic variables for the Lexington-Fayette MSA, especially in terms of income and employment characteristics. However, our sample consists of more females, young people, and college educated people.

Table 2: Demographics of Sample Compared to Census Data

	Sample (N = 356)	Lexington-Fayette MSA
Female	66.7%	50.8%
Age		
18 – 24	28.3%	14.3%
25 – 44	27.1%	29.6%
45 – 64	32.7%	24.2%
65+	11.9%	10.9%
Education		
High School (Equivalent)	99.4%	88.6%[14]
B.S. or Higher	63.4%	40.1%[15]
Income		
$0 - $24,999	32.5%	27.1%
$25,000 - $74,999	34.6%	40.8%
$75,000+	32.8%	32.1%
Employment Status		
Employed	57.6%	63.1%
Unemployed	3.4%	5.6%

[14] The Census reported statistics for age groups 25+, while our data includes 18+

[15] The Census reported statistics for age groups 25+, while our data includes 18+

Regarding preferences and uses of The Arboretum, people visit for a variety of reasons. According to our sample, the most frequently reported reason for visiting The Arboretum is to enjoy the botanical garden and outdoors (32% of respondents). The next most frequently reported reason for visiting The Arboretum was to run or walk on the paths (30% of respondents). Remaining reasons are as follows, 16% of respondents visit to use the native trails, 7% visit in order to let their children interact with nature, 6% visit to photograph the collections, 5% listed any other reason for visiting, and 4% visit to attend school or educational programs.

It is evident that a majority of respondents visit The Arboretum for reasons related to enjoying the botanical garden and outdoors to varying degrees. Exercise is the other determining factor in respondents' reasons for visiting The Arboretum. More than one-third of the sample uses The Arboretum for a recreational purpose rather than the intended use as an educational facility. That result should signal to management policies relating to The Arboretum as a multi-purpose facility should be considered. If they were to continually treat The Arboretum solely as an educational facility, they could alienate a significant portion of their users.

A majority of respondents expressed displeasure over the idea of the perimeter fence and vending machines when filling out the survey. Respondents provided their level of agreeability to certain proposed changes to The Arboretum: 54.5% disagreed with the installation of vending machines and 42.2% disagreed with the installation of a perimeter fence around The Arboretum. The bike paths and picnic tables had little opposition with 13.7% disagreeing with the installation of bike paths and 11.3% disagreeing with the installation of covered picnic tables. Accordingly, respondents' reactions with these proposed attributes should correlate to the magnitude and direction of WTP for those attributes in our Choice Experiment.

Model Results. In total, 300 respondents[16] completed 2071 out of 2492 scenarios. Of these, the third 'opt-out' alternative was selected 68.1% of the time, indicating that the various combinations of attributes offered were largely unattractive. Our choice experiment was run using two models: a conditional and mixed logit model. The results are expressed in Table 3.

Table 3: Conditional and Mixed Logit Model Results of Arboretum Choice Experiment

	Conditional	**Mixed**	
Attribute	**Coefficient**	**Coefficient**	**Std. Dev.**
Opt-Out	0.499**	0.393	3.273**
	(0.170)	(0.315)	(0.315)
Parking Pass	-0.101**	-0.195**	--
	(0.009)	(0.015)	--
Pollinator Garden	0.508**	0.712**	0.579*
	(0.091)	(0.128)	(0.228)
Perimeter Fence	-0.371**	-0.811**	1.168**
	(0.086)	(0.161)	(0.222)
Connector Bike Path	0.484**	0.618**	1.099**
	(0.090)	(0.148)	(0.217)
Vending Machines	-0.501**	-1.332**	1.760**
	(0.105)	(0.210)	(0.247)
Covered Picnic Tables	0.135**	0.303**	0.031
	(0.041)	(0.059)	(0.314)
Log-Likelihood	-1633.154	-1277.708	

****p-value<.01, *p-value<.05**
Standard Error reported in parentheses.
Note: The base category of each attribute is the current, status quo level.

After running both models, the mixed logit model better fits the data (indicated by its log-likelihood), so is the preferred and interpreted model. Overall, the signs and magnitudes are relatively similar in both models. However, one key difference is that all of the attributes in the conditional model are statistically significant while all but the opt-out option are statistically significant in the mixed model. Based on the magnitude and sign of the model coefficients, respondents preferred the pollinator garden to the bike path and first picnic table. Respondents disliked the idea of vending machines the most,

[16] 56 responses were dropped due to incomplete choice experiments

followed by costly parking passes and a perimeter fence. Parking Pass has the expected negative sign which means that respondents are less likely to select an alternative with a more costly monthly parking pass.

Table 4: Willingness To Pay for potential Arboretum Improvements[1]

Attribute	WTP	95% CI[2]
Opt-Out	$2.02	(-$1.29, $5.33)
Pollinator Garden	$3.65	($2.28, $5.03)
Perimeter Fence	-$4.16	(-$5.76, -$2.56)
Connector Bike Path	$3.17	($1.73, $4.61)
Vending Machines	-$6.84	(-$8.76, -$4.92)
Covered Picnic Tables	$1.56	($0.98, $2.13)

[1]Based on Mixed Logit Results from Table 3
[2]Confidence Intervals are based on Delta Method

By dividing the coefficient of each attribute by the coefficient of a price mechanism (in this case, the Parking Pass variable), we can infer Willingness to Pay. Results for Willingness to Pay for a certain attribute are based on the price of a monthly parking pass and are expressed in Table 4. The largest positive WTP was for the pollinator garden such that respondents are willing to pay $3.65 per month for the installation of a pollinator garden. The second highest positive WTP was for the bike path. Respondents are willing to pay $3.17 per month for the installation of a bike path. Participants were also receptive to installing covered, picnic tables, with a willingness to pay of $1.56 per picnic area for up to three areas.

Participants responded negatively to two of the attributes, vending machines and a perimeter fence. Both of these features generated a negative WTP. Respondents are willing to pay $6.84 to avoid the installation of vending machines and are willing to pay $4.16 to avoid the installation of a perimeter fence. These WTP results for vending and a perimeter fence are unsurprising since there was considerable dissent among respondents about these attributes in the previously mentioned results of our survey.

Most interestingly was the positive WTP for the opt-out alternative. The expected sign for a desirable good or service is negative, which can be interpreted as a loss of utility for forgoing a trip to The Arboretum. In this case, WTP is positive, which means respondents were willing to pay avoid The Arboretum. The crucial detail is that value is only based on the proposed features of the choice experiment. Since the choice experiment included the unfavorable fence and vending machine attributes, respondents are much more inclined to avoid the proposed 'new version' of The Arboretum.

Discussion and Implications

While arboreta and botanical gardens are quite prolific throughout the United States, they are often publically funded and can struggle to generate revenue. We hope to address this issue at least somewhat via a case study of The University of Kentucky Arboretum. By conducting a survey at The Arboretum, we hope to answer the questions of how The Arboretum could implement policy changes and new attributes that would attract more funding and new visitors.

Comparison of our results with the few previously mentioned studies is difficult since they examined users' holistic values of arboreta rather than user values of potential attributes. At same time, this means our results provide new insight into preferences for arboreta and guidance for management strategies. Through our choice experiment, we were able to estimate consumers' WTP for a potential attribute to The Arboretum in terms of a monthly parking pass. We found that respondents had a positive WTP for the picnic tables, bike path, and pollinator garden while having a negative WTP for the perimeter fence and vending machines.

The negative WTP for the perimeter fence should serve as a signal to The Arboretum management that privatization may not be a viable strategy. The installation of a perimeter fence could cause attendance to decline and have large negative effects on its perception among users, making the attempt to generate revenue through admission for naught. However, shifting the marketing focus of The Arboretum as a multi-use recreational facility may be an appropriate. The positive WTP for the bike

path and picnic tables should signal to The Arboretum management that consumers would be willing to pay for more recreational attributes to be added to The Arboretum.

From a policy perspective, The Arboretum should continue offering their current services and look to build on more recreational and observational attributes. Based on the results of our model, users would be willing to pay a monthly parking fee for the addition of covered picnic areas, pollinator gardens, and a bike path. These attributes add to the recreational and observational aspects of The Arboretum while drawing minimal controversy from users. It is important to keep in mind that all potential attributes should be soundly evaluated financially before implementation. The cost of installing the attribute should be lower than the expected gain from installation.

Acknowledgments

We would like to thank the University of Kentucky Student Sustainability Council for providing partial funding for this project. Thank you to the Arboretum Advisory Council for providing us with the report that guided our survey. Additionally we would like to thank Molly Davis for her contributions during survey development and overall support. We would also like to thank the members of the UK Ag Economics AEC 580 class for assisting in the creation and implementation of the survey.

References

Demir, A. (2014). "Determination of the Recreational Value of Botanic Gardens. A Case Study Royal Botanic Gardens, Kew, London." Revista de Cercetare şi Intervenţie Socială(44): 160-180.

Downing, M. and R. K. Roberts (1991). "Estimating Visitor Use-Value of Arboreta: The Case of the University of Tennessee Arboretum1, 2." J. Environ. Hort **9**(4): 207-210.

Garrod, G., et al. (1993). "The economic value of botanic gardens: a recreational perspective." Geoforum **24**(2): 215-224.

Hong, S. -K., et al. (2010). "An Economic Valuation of Arboretum Using Choice Experiments." Journal of the Korean Institute of Landscape Architecture **37**(6): 1-11.

Kang, K.-R., et al. (2011). "A Study on Measuring the Environmental value of Gyeongnam Arboretum Using the CVM." Journal of the Korean Institute of Landscape Architecture **39**(1): 46-55.

McFadden, D. (1999). "TO-PAY IN RANDOM UTILITY MODELS." Trade, Theory, and Econometrics: Essays in honour of John S. Chipman **15**: 253.

"Morton Register." Retrieved January 2, 2015, from http://arbnet.org/about-register.

Reeder, K. (March 7, 2014). The Arboretum at Penn State. "What is an Arboretum?". Retrieved January 12, 2015, from http://www.arboretum.psu.edu/faq/what.html.

Train, K. E. (2009). Discrete choice methods with simulation, Cambridge University Press.

"What is an Arboretum?". Klehm Arboretum & Botanical Garden Retrieved January 12, 2015, from htp://www.klehm.org/our-trees/about-the-arboretum/#.VLWNC4rf_iR.