Recreational Demand for Equestrian Trail-Riding

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Using data collected from a combination of on-site and on-line surveys, this study examines recreational demand for equestrian trail-riding in Kentucky. A truncated, negative binomial regression is applied to analyze individuals' visitation behavior consistent with a travel cost model. Results suggest that distance is the most significant determinant of average annual visits to a particular site. Various trail site characteristics, such as trail length, scenic overlooks, and trail markers, affect the number of visits an individual takes. Geographic information system (GIS) analysis permits the identification of equestrian population centers. Information obtained from this study offers a decision base for policymakers to use to manage existing equestrian trails and locate new ones.

Key Words: equestrian trail-riding, GIS analysis, truncated negative binomial, travel cost method

A recent report commissioned by the American Horse Council Foundation states that there are over 9 million horses in the United States, 40 percent of which are used for recreation (DeLoitte Consulting LLP 2005). Trail-riding is one of the most popular recreational uses of horses; riders use an extensive network of multi-use trails (accessible to a wide array of users including hikers as well as horse, ATV, and mountain bike riders) on both public and private lands. In general, equestrian trail-riding differs from other activities that make use of trails because of the care and logistics associated with the transportation, feeding, and watering of horses. Unfortunately, increasing demand by all users of the trail network is straining the park and forest resources and is challenging trail management. Thus to make appropriate maintenance and location decisions, administrators need a reliable estimate of the value of multi-use trails.

Several studies have measured the value of trails—most by specific activities conducted on those trails, such as hiking or mountain-biking (Englin and Shonkwiler 1995, Fix and Loomis 1997). The theoretical basis for doing so derives from the household production literature—it is the activities that are conducted on trails that generate utility and give rise to value, not the trails themselves. Furthermore, assessing values based on activities allows the researcher to capture differences in the importance of various trail attributes; those that are important to hikers may differ substantially from those that are important to bikers or equestrians.

A notable exception to measuring the value of trails vis-à-vis the household production model is the study by Betz, Bergstrom, and Bowker (2003). They estimate a recreational demand for general rail-trail use where site characteristics are not included as explanatory variables; they do not address the inherent conflicts among the various users nor the possible divergent assessments of preferred site characteristics. Upon closer scrutiny, however, their study appears to have implicitly assumed trail characteristics desired by mountain bikers, as hinted to by the brief description of the survey and the inclusion of a dummy variable for frequent bike-riding activities. If this is in fact the case, then the study should be categorized as one that is activity-specific.

Each one of the papers reviewed for this study uses a version of the travel cost method (TCM) for valuing trails—an analytical method that has

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been successfully applied in many recreation studies, such as Shaw and Jakus (1996) and Morey and Breffle (2006). The travel cost method captures the utility-maximizing behavior of recreationists, subject to income and time constraints, in the absence of a formal market. The "price" of recreational activities is measured in terms of the cost of a trip to the site; the TCM assumes that recreationists respond to changes in costs in the same way that they would respond to changes in recreational fees (Freeman 2003).

A review of the literature indicates that there have been no previous studies that have estimated the equestrian demand for trails. Thus this paper serves to fill that void. In particular, a participation demand equation for equestrian riders using public Kentucky trails is estimated**.** In it, the influences of travel costs and site characteristics are accounted for. Data are collected through a survey of trail-riders. From publicly available descriptions of the various recreational areas and associated system of trails, a site index of desirable characteristics is developed to distinguish the various trails. The geographic information system (GIS) is used to estimate the distance and time traveled based on information provided by survey respondents. Also considered are the various accommodations for overnight stays. The total cost of a single visit is assumed to be a positive function of travel distance, time, and overnight stays, and inversely related to the number of visits. Demographic factors, such as income, gender, age, and education, explain additional variation among individual trail-riders. In the sections below, data for a cross-section of equestrian trail-riders, collected over numerous trails, are used to estimate a travel cost model in order to analyze the average number of visits made annually to a particular trail system in Kentucky.

The Model and Covariates

The dependent variable to be explained and predicted is the number of trips the ith equestrian trail-rider will make in a year to a particular location, Y_i (i = 1,…,n). A trip may result in a single-day outing, or it may result in overnight stays. Even if the visitor stays for, say, three nights, and rides the trails three days, the visit is counted as a single trip. Defined as such, the dependent variable is a form of "count data"—it is discrete and there are theoretically an infinite but countable number of possible values, restricted to non-negative integers. Greene (2000) suggests an appropriate multinomial probability model as an estimator.

Following Shaw (1988), Fix and Loomis (1997), and Shaw and Jakus (1996), a Poisson probability distribution was initially considered for the number of visits an equestrian trail-rider makes annually, but a Poisson distribution requires equality of the conditional mean and variance of the number of visits to a particular site, which may or may not be supported by the data to be used. In fact, exploratory analysis of the data revealed that the conditional variance in the number of visits each year is much larger than its conditional mean, indicating an "over-dispersion" problem.[1]

Grogger and Carson (1991), Englin and Shonkwiler (1995), Greene (2000), and Betz, Bergstrom, and Bowker (2003) suggest accommodating the problem of over-dispersion by specifying a negative binomial II (NB) distribution for the number of visits. An NB is a generalization of the Poisson distribution; it introduces a stochastic, log-linear error term that is assumed to follow a gamma distribution with parameter α. This introduction of a stochastic error term allows the variance of the NB to exceed its conditional mean. Furthermore, the NB model that is employed in this study will be truncated at zero to reflect the fact that the data are collected on-site from participants or solicited from trail-riders who have engaged in the activity recently. Thus, in this study's model, the number of "participation events"—that is, the number of trips an individual makes to a particular horse trail each year—is at least one.

There are various approaches adopted in the literature to apply the NB distribution on participation data. Regardless of whether these approaches are based on implicit utility functions or built from the purely statistical point of view, they generate the same functional form. Using Grogger and Carson's (1991) notation, the truncated NB distribution of the number of annual trips made by the ith trail-rider to a particular location, Y_i, can be written as

[1] Over-dispersion occurs often in misapplications of the Poisson distribution. It may be the result of cross-section heterogeneity in the data, or it may be that initial selection of a recreation site is determined by factors that differ from those that determine the number of repeat visits.

(1)

$$\Pr\left(Y_i = y_i \mid Y_i > 0\right) = \frac{\Gamma\left(y+\frac{1}{\alpha}\right)}{\Gamma(y+1)\Gamma\left(\frac{1}{\alpha}\right)}\left(\alpha\lambda_i\right)^{y}\left[1+\alpha\lambda_i\right]^{-\left(y+\frac{1}{\alpha}\right)}\left[1-F_{NB}(0)\right]^{-1},$$

where y_i is the actual observed value of Y_i, and $\alpha > 0$ is the gamma parameter to be estimated. Furthermore, λ_i varies according to

$$\text{(2)} \qquad \lambda_i = \exp\left(\mathbf{X_i}\boldsymbol{\beta} + \varepsilon_i\right),$$

where the vector of coefficients, $\boldsymbol{\beta}$, is to be estimated along with α. Equation (2) essentially extends the NB model in equation (1) to the regression case where λ_i is explained by a vector of h observed covariates, $\mathbf{X_i}$ (e.g., travel costs, site characteristics, and demographic variables). Additionally, $\Gamma(\cdot)$ denotes a gamma function and $F_{NB}(0)$ is the cumulative NB distribution function for $y_i = 0$. This formulation implies that individual trail-riders have constant but unequal probabilities of the number of annual trips they make to a particular site (Cameron and Trivedi 1986).

Assuming a properly specified model, the maximum likelihood (ML) estimator of α and $\boldsymbol{\beta}$ will be consistent and asymptotically efficient. For a truncated NB regression, the log-likelihood function to be maximized is

$$\text{(3)} \quad \ln L = \sum_{i=1}^{M} \ln\left(\Gamma\left(y+\frac{1}{\alpha}\right)\right) - \ln\left(\Gamma(y+1)\right) - \ln\left(\Gamma\left(\frac{1}{\alpha}\right)\right) + y\ln(\alpha) + y\mathbf{X_i}\boldsymbol{\beta} - \left(y+\frac{1}{\alpha}\right)\ln\left(1+\alpha\lambda_i\right) - \ln\left(1-\left(1+\alpha\lambda_i\right)^{-\frac{1}{\alpha}}\right).$$

The conditional mean and variance are

$$\text{(4)} \qquad E\left(Y_i \middle| \mathbf{X_i}, Y_i > 0\right) = \lambda_i\left(1-F_{NB}(0)\right)^{-1},$$

and

(5)

$$Var\left(Y_i \middle| \mathbf{X_i}, Y_i > 0\right) = \frac{E\left(Y_i \middle| \mathbf{X_i}, Y_i > 0\right)}{F_{NB}(0)^{\alpha}}\left(1-\left(F_{NB}(0)\right)^{1+\alpha} E\left(Y_i \middle| \mathbf{X_i}, Y_i > 0\right)\right).$$

Note that $F_{NB}(0)$ appears in both the conditional mean and variance. This creates a certain degree of correlation between these two measures. Furthermore, the truncated mean is greater than the mean of the non-truncated NB, and its variance is smaller.

Grogger and Carson (1991) demonstrate that marginal effects can be obtained for a change in an explanatory variable upon the mean number of visits made by a trail-rider to a specific site. That is, the conditional marginal effects (i.e., those that are site-specific) are obtained by taking the first derivative of the conditional mean with respect to the hth explanatory variable:

$$\text{(6)} \qquad \frac{\partial E\left(Y_i \middle| \mathbf{X_i}, Y_i > 0\right)}{\partial X_{ih}} = \beta_h \lambda_i \left(\frac{1-F_{NB}(0)\left(1-\lambda_i F_{NB}(0)^{\alpha}\right)}{\left(1-F_{NB}(0)\right)^2}\right).$$

Equation (6) states that the marginal effects are for those equestrians who are already above the choice threshold (observed equestrian trail-riders at a specific site or those who have ridden trails recently). Unconditional marginal effects (i.e., those for the general population of recreationists) can be derived from equation (6) only if the underlying distribution of visits in the general population is identical to that which is observed for the user group. Since surveying current trail-riders reveals nothing about the general population of recreationists, it cannot be assumed that they have identical distributions, and thus unconditional marginal effects are not assessed (Shonkwiler and Shaw 1996).

Trip "Costs"

The covariates include those that are related to trip cost: the distance traveled, the time taken to travel to the recreation site, and the cost of staying at the site. Following Cameron (1992), Randall (1994), Englin and Shonkwiler (1995), and Betz, Bergstrom, and Bowker (2003), a fixed unit cost of travel is not assigned to distance, nor to time, nor to lodging. Instead, cost is simply measured in "miles" for travel distance, "number of overnight visits" for lodging, and "minutes" for time traveled. Given this formulation, the results can be scaled with an actual unit cost if the desire is to make welfare statements.[2] The analysis is conducted by using $1 as the unit cost.

Equestrian trail-riding involves a sizable logistical cost that should be included as part of the trip cost. For the most part, however, these costs are fixed for individuals; they include the cost of the horse trailer and costs associated with the health and general well-being of the horses. There are some variable components of the logistical costs, such as maintenance and repair of the horse trailer, but these costs will vary more with distance traveled than across trail-riders. Thus logistical costs are not included in the regression model.

Finally, Freeman (1993) pointed out that legitimate use of the TCM requires that travel costs be obtained from site visitors on a single-destination trip and that no net benefits or costs are derived from the travel process.

Index of Site Characteristics

Site characteristics in many recreational studies enter the analysis as individual variables. See, for example, Shaw and Jakus (1996), Englin and Shonkwiler (1995), and Betz, Bergstrom, and Bowker (2003). With additional data clearly differentiating the boundary of various recreational sites, some authors use site characteristics to analyze why one site is chosen over another. Site-specific choice models can then be estimated based on a random utility framework (e.g., Adamowicz, Louviere, and Williams 1994). This study, on the other hand, is not a site choice model, but rather a participation equation that attempts to identify factors that explain multiple visits. Similar studies, such as Cesario and Knetsch (1976), Ward and Loomis (1986), Parsons, Jakus, and Tomasi (1999), and Boxall and Adamowicz (2002), specify site characteristics in an index, although they operationalize the indices quite differently.

The index specified in this model attempts to capture the attractiveness of the trail to equestrians—it reflects the trail's inherent quality with respect to equestrian uses. To avoid the subjective nature of quantifying "desirable characteristics," no assumptions on the relative importance of the various characteristics are identified. Trail-riders, park managers, and academics are interviewed to arrive at a set of desirable characteristics. The index simply identifies whether a characteristic exists on a trail (such as the presence of water).

The index is constructed to reflect the existence of loop trails, trail length in excess of 15 miles, overlooks, trail markers, water on the trail, opportunities for primitive or back-country (wilderness) camping, and full-service camping and horse facilities at trailheads. Ward and Loomis (1986) and Boxall and Adamowicz (2002) indicate that an appropriate index would be fixed across trail-riders and would avoid introducing a stochastic independent variable.

Thus, the index is defined as follows. Let

$$A_{kj} = \begin{cases} 1 & \text{if characteristic } k \text{ exists on the } j\text{th trail} \\ 0 & \text{otherwise,} \end{cases}$$

where

A_{1j} = loop trails,

A_{2j} = trail length > 15 miles,

A_{3j} = scenic overlooks,

A_{4j} = trail markers,

A_{5j} = water along trail,

A_{6j} = back-country camping, and

A_{7j} = full service camping and horse facilities.

An index is formed for each of the J trails as the percentage of possible characteristics that exist on that trail:

$$(7)\quad \text{INDEX}_j = \sum_k \frac{A_{kj}}{7} \quad \text{for } k = 1,\ldots,7,\ j = 1,\ldots,J.$$

Income and Demographic Characteristics

As stated earlier, TCM captures the utility-maximizing behavior of recreationists, subject to income and time constraints. Intuitively, the choice to recreate as an equine trail-rider is influenced by demographic characteristics, such as gender, age, and education. Household income included

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[2] The respondents were asked about the cost of a visit, including travel, food, etc. The average cost reported was $210 per visit, with an additional $29 per night for lodging (where some camped on-site, others nearby, and others stayed in a hotel or cabin).

in this study should shed light on the budget constraint faced by the ith trail-rider, both with regard to capital investment possibilities and constraints on recreation trips. A capital investment in suitable horses should reveal a household preference for recreation that involves equine trail-riding; ability to make frequent trips should also be a function of available income.

The Survey

To estimate a participation demand equation from which policy evaluation of trail management decisions can be conducted, data are collected from multiple sites with differing characteristics and management regimes. On-site surveys of trail-riders at four different locations in Kentucky were conducted over selected weekends (Saturdays and Sundays) during the months of July 2007 through November 2007. Selection of the weekends was based on predicted moderate temperatures and the predicted absence of rain. The recreation sites were randomly selected from the complete set of trail systems within a 150-mile radius of Lexington, Kentucky (possible survey sites were restricted to within a 150-mile radius for cost considerations). Although respondents completed a written survey instrument on their own at the various sites, an administrator was always present while survey questions were being answered.

The same survey that was given on-site was also administered off-site, using two different techniques to elicit responses. The first technique solicited responses to the survey instrument from members of trail-riding clubs (they were asked to identify the system of trails they were evaluating). Some of these surveys were conducted at the club meetings with a survey administrator present; in other cases, club members distributed the surveys to trail-riders known to them and the respondents mailed the finished questionnaires back. All respondents had recent riding experiences of the trails they were evaluating.

The second technique solicited responses from equestrian trail-riders online, again asking respondents to identify the particular system of trails to which they were referring. The respondents were members of trail-riding clubs and were notified of the survey Internet site by club officials. The respondents submitted the surveys electronically. Again, it was ascertained that all respondents had recent riding experiences of the trails they were evaluating.

Sample Characteristics

Since this was a sample of opportunity, the response rate was 100 percent of those surveyed on-site or at meetings. Nothing is known about the subjects who were not administered the survey. Some responses were received online, but, again, nothing is known about those who did not respond. Self-selection is always possible in this type of survey. Respondents did not know what the study was about *a priori*; they knew only that it was "a study on trail-riding." There were a total of 188 respondents that visited 29 trail systems in Kentucky (i.e., $n = 188$ and $J = 29$).

The survey was designed to elicit the following trip information for a particular location: the zip code from which the ith respondent traveled to get to the site, the number of single-day trips made to the site over the past year, the number of overnight trips made to the site over the past year, and the number of nights stayed in each of a variety of possible accommodations: camping on-site ($CAMP_i$), camping nearby ($NEARBY_i$), staying in a cabin ($CABIN_i$), and staying in a hotel ($HOTEL_i$). The total number of trips taken to a particular site over a year was the sum of the number of day trips and the number of overnight trips taken annually ($TRIPS_i$). The average number of nights spent by the ith trail-rider per overnight trip was calculated as the sum of the nights spent in all accommodations over the year divided by the annual number of overnight trips made ($AVGON_i$). In addition, demographic information was collected on the respondent's gender ($GENDER_i$), age (AGE_i), highest level of education completed ($EDUCATION_i$), and median annual household income ($INCOME_i$).

Using the starting zip code information and the zip code at the main trailhead, the GIS system was employed to calculate the distance traveled, one way, in miles ($DISTANCE_i$) and the time in minutes it took to travel the distance ($TIME_i$). The GIS measures assume the most direct road system, account for differences in travel times between urban and rural areas, and calculate the distance between the centers of the zip codes provided. Information regarding site characteristics was gleaned from published data, including GIS maps of riding trails.

Based on exploratory data analysis (summarized in Table 1), a randomly selected trail-rider will more than likely be female (*GENDER*), averages 45.3 years in age (*AGE*), holds at least an associate's degree, and enjoys an average annual household income of $64,940 (*INCOME*). A typical trail-rider travels an average of 66.36 miles (*DISTANCE*) to get to the designated site and spends an average of 83.01 minutes to get there (*TIME*). Almost 57 percent of the survey respondents stayed overnight on at least one of their trips (*ONSTAY*); 31.39 percent of all trips resulted in overnight stays. The average number of trips that resulted in an overnight stay was 0.9; the average number of nights spent per overnight trip was 1.69. Nearly eight-three percent of the nights were spent camping on-site (*CAMP*), 9.06 percent were spent in a cabin (*CABIN*), 5.78 percent were spent camping nearby (*NEARBY*), and 2.34 percent were spent in a hotel (*HOTEL*). In addition, one-third of the respondents who stayed in a cabin were also owners of the cabin. The average annual number of trips to a particular site (*TRIPS*) was 10.85 (with a sample variance of 192.93).

The origination points clustered around the metropolitan areas of Louisville, Lexington, and northern Kentucky,[3] as well as three counties in the Daniel Boone National Forest: Pulaksi, Bath, and Morgan (Figure 1). The counties in the Daniel Boone National Forest contained many of the most popular trailheads.[4] Furthermore we find that from the 29 sites of the study, there are 8 sites that are in close proximity to the three metropolitan areas. These 8 sites have trails that are significantly shorter than 15 miles and have no water availability, and only two have a campsite.

Correlation analysis revealed that men exhibit a greater attraction to the various site characteristics than women. The men were also more inclined to spend a greater number of nights camping on-site. Women respondents tended to have completed a higher level of education, and higher education levels were inversely related to the importance of site characteristics and the number of nights a respondent was willing to camp on-site. Women also tended to spend fewer nights per visit. Significant correlation existed between median income, age, gender, and education.

Additionally, older respondents, those with higher median household incomes, and those who were more educated were willing to travel longer distances and spend more time traveling. Respondents tended to stay longer on each overnight trip the longer the distance traveled and the longer it took to get to the site. The equestrian trail-riders in the survey were more willing to travel long distances and spend more time getting to a site if it offered a wide range of characteristics. Finally, a high degree of collinearity exists between the distance traveled, the time to make the trip, and the average number of overnight stays per trip.

Estimation Results

The results of the truncated negative binomial regression are presented in Table 2. As anticipated (and consistent with other participation demand studies), a multicollinearity problem existed when distance traveled, travel time, and the average number of nights spent per overnight trip were included simultaneously. Thus travel time and the average number of nights spent per overnight trip were dropped from the equation, leaving distance as the sole "cost" variable (Englin and Shonkwiler 1995, Betz, Bergstrom, and Bowker 2003).

A multicollinearity problem was also encountered when median household income was included in the regression equation with age and education. Of these latter variables, only median household income remains. Dropping the collinear age and education variables is consistent with the myriad studies in labor economics that relate income to demographic variables. Median household income was the more appropriate, utility-theoretic variable for a travel cost model, and so it was retained.

Thus the truncated, negative binomial model of annual trips to a specific Kentucky equestrian trail, *TRIPS*, includes the following covariates: *DISTANCE, INDEX, INCOME*, and *GENDER*. The

[3] Scott, Fayette, and Jessamine Counties comprise the Lexington population area center; Oldham and Jefferson Counties form the Louisville population area center; and Boone, Kenton, and Campbell Counties belong to the northern Kentucky population center area.

[4] White Sulpher and Rudy's Ranch (Bath County), Carter Caves (Carter County), Yatesville Lake (Lawrence County), Logan Hubble (Lincoln County), Stampede Run, Bell Farm, Barren Fork, and Big South Fork (all in McCreary County), Murder Branch (Menifee County), Gambells Campground (Morgan County), Red Hill Horse Camp (Rockcastle County), and Cave Run (Rowan County).

Table 1. Descriptive Statistics of Selected Variables (n=188)

Variable	Description	Mean	Standard Deviation	Maximum Value	Minimum Value
TRIPS	(annual number of trips taken to a designated Kentucky equestrian trail, $y = 1, 2, \ldots$)	10.85	13.89	75	1
DISTANCE	(miles traveled, $x_1 \geq 0$)	66.36	52.77	235	0
TIME	(minutes traveled, $x_2 \geq 0$)	83.01	53.99	260	0
AVGON	(average number of overnights per visit, $x_3 \geq 0$)	0.90	1.41	13.33	0
INDEX	(percentage of desirable characteristics the site offers, $0 \leq x_4 \leq 100$)	69.81	16.20	100	14.3
GENDER	($x_5 = 1$ if male, 0 otherwise)	0.35	0.47	1	0
AGE	($x_6 \geq 18$ years)	45.30	12.93	71	18
EDUCATION	(highest level of education completed, $x_7 = 0$ if less than high school, 1 if high school, 2 if associate's degree, 3 if bachelor's degree, 4 if graduate degree, and 5 if professional degree)	2.19	1.26	5	0
INCOME	(midpoint of income class, $x_8 = 6$, 18.5, 32.5, 50, 70, 90, 120)	64.94	32.86	120	6
ONSTAY	($x_9 = 1$ if at least one visit resulted in an overnight stay, 0 otherwise)	0.57	0.50	1	0
CAMP	(number of nights spent camping on site, $x_{10} \geq 0$)	2.81	6.47	60	0
CABIN	(number of nights spent in a cabin, $x_{11} \geq 0$)	0.19	1.50	20	0
NEARBY	(number of nights spent camping nearby, $x_{12} \geq 0$)	0.30	2.95	40	0
HOTEL	(number of nights spent in a hotel, $x_{13} \geq 0$)	0.79	0.75	10	0

statistical package LIMDEP (Greene 2007) is used to estimate the model. Parameter estimates for *DISTANCE* and *INDEX* had the expected signs and were significant at the 1 percent level. Also significant at the 1 percent level was the dispersion parameter α, indicating that the negative binomial count model is a better fit to the data than the more limiting Poisson count model.

Distance traveled (*DISTANCE*) is the "cost" variable, and its negative parameter estimate is consistent with a downward-sloping demand curve. The index of site characteristics (*INDEX*) measures the attractiveness of the trail system, and a positive parameter estimate indicates increasing utility as more attributes are offered. As has been found in most recreation studies, annual household income (*INCOME*) is not a significant explanatory variable, and no importance is assigned to its magnitude or sign (Vaughn and Russell 1982, Fix and Loomis 1997, Betz, Bergstrom, and Bowker 2003). Gender is also found to be insignificant with respect to explaining variation in the annual number of trips taken to a particular site.

From the marginal effects of the significant explanatory variables (also presented in Table 2), we can make welfare statements. For example, if we were to decrease the distance traveled by as little as 8 miles, the average number of annual trips an individual would make to a site would increase by one. Thus, assuming a unit cost of traveling one mile to be \$1, a mean number of trips taken annually to a particular site of approxi-

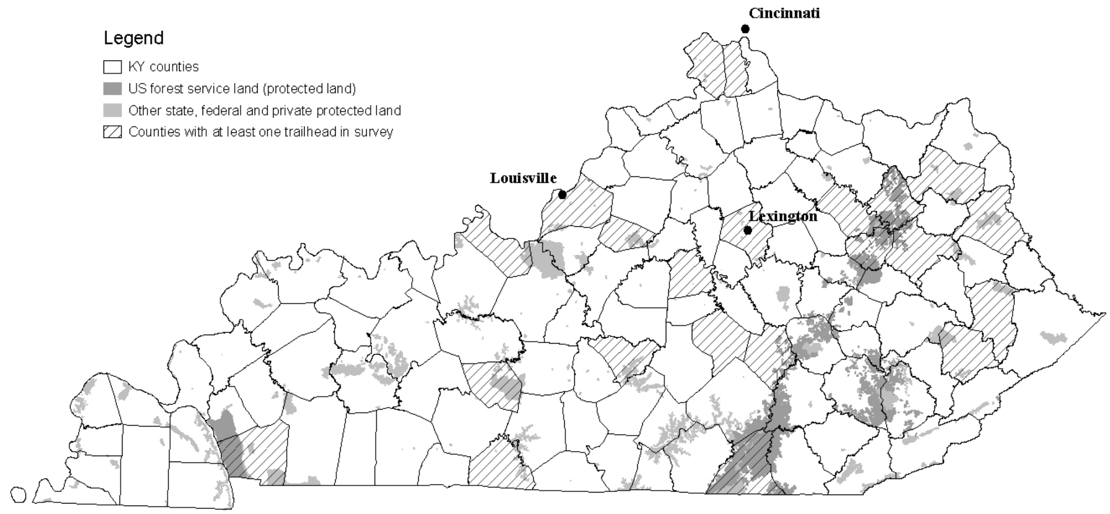

Figure 1. Map of Kentucky Counties Representing Surveyed Equestrians and Trailheads

Table 2. Truncated Negative Binomial Count Data Model of Trips to Kentucky Equestrian Trails[a]

Variable	Parameter Estimate	Asymptotic Standard Error	Marginal Effect[b]
Constant	.4761	.4568	4.6312
DISTANCE	- .0133 ***	.0018	-.1300
INDEX	.0329 ***	.0057	.3206
INCOME	- .0004	.0031	-.0047
GENDER	.2912	.2082	2.8329
Alpha (dispersion)	1.3201 ***	.2974	---

[a] n = 188, log-likelihood function = -577.26, McFadden R-square = .5025, χ-square = 1166.49.
[b] Partial derivatives of the expected values with respect to the explanatory variables; effects are averaged over observations and estimated at the means.

Note: *, **, and *** indicate significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

mately 11, and an average distance traveled to an equestrian trail of 66 miles, the current consumer surplus associated with equestrian trails averages $484 per trail-rider.[5] Decreasing the distance a trail-rider must travel by 8 miles would result in an increase of consumer surplus of $92. Similarly, adding an attribute to an existing trail would increase the index value by approximately 15 points and result in 4 additional trips made by a typical equestrian each year. The current consumer surplus would increase by an average of $416 dollars.

Policy Implications and Conclusions

Policy implications, in addition to welfare statements, can be made from the estimated marginal effects reported in Table 2. If managers of Kentucky's multi-use trails wish to increase the number of equestrian trail-riding trips, they should

[5] Consumer surplus is measured as the area below the marginal benefit curve for equestrian trail-riding trips and above the average "cost" of a single trip. From the marginal effects, we obtain a linear marginal benefit curve equating "cost" (*$miles*) and number of trips: *$miles* = 154 – 8 (number of trips).

consider enhancing the attributes of existing trails—each additional attribute adds approximately 15 points to a site's index value, and the typical trail-rider will increase his or her average number of annual visits to that site by more than 4. Furthermore, the trail-rider is enjoying considerable increases in consumer surplus and thus could more than likely be persuaded to pay for at least part of the improvements. This includes making the trail system at least 15 miles in length, ensuring that loop trails are available, placing trails near water sources, marking trails, providing full-service camping facilities near trailheads, allowing back-country camping, and offering open views on the trails.

In our previous discussion of the survey data, we identified 8 trails that are in close proximity to the three metropolitan areas. We noted that these trails had significantly lower index values than other trails in our data set. It is obvious that these 8 trails would be candidates for the enhancement of characteristics that we mention above; if managers want to increase the number of equestrian riding trips an individual makes to one of these 8 trails, then they should consider making water available, providing loops in the trail system, and lengthening the trails to over 15 miles.

Given the importance of the distance and characteristic index variables, we search for new land that is suitable for trails and that is close to the three metropolitan areas from which most trips originate. Analysis of land availability reveals three such tracts of public land that exceed 200 acres and that are within the triangular region formed by Lexington, Louisville, and northern Kentucky. These tracts of land are designated Wildlife Management Areas and they have all the amenities listed in the index (availability of water, possibility of loop trails that exceed 15 miles in length, elevation gains sufficient to provide scenic overlooks, and the possibility of campsite development). Referring to Figure 2, the existing 8 trails that we mentioned earlier in the study (and that are part of the survey data) are indicated with a cross, and the public lands that are possible candidates for new trails are shaded accordingly.

Upgrading existing or creating new trails will involve costs, and these costs could be substantial. This study nevertheless provides a basis for more informed cost-benefit analyses. For example, county governments often maintain fairly detailed information on land values. They can compare this information to the areas given as potential trail regions in Figure 2. A careful calculation can help determine a development strategy that involves the least cost but achieves the highest consumer surplus. Equestrian trail-riding associations could also use the demand and welfare information in this study to lobby for additional public investments in trails. Finally, popularity of trail-riding and highly valued trails may also justify charging fees to users in order to recover public funds at a faster rate. This type of study may help explain how much trail-riding activities may be affected, in terms of consumer welfare, through the increased cost involved.

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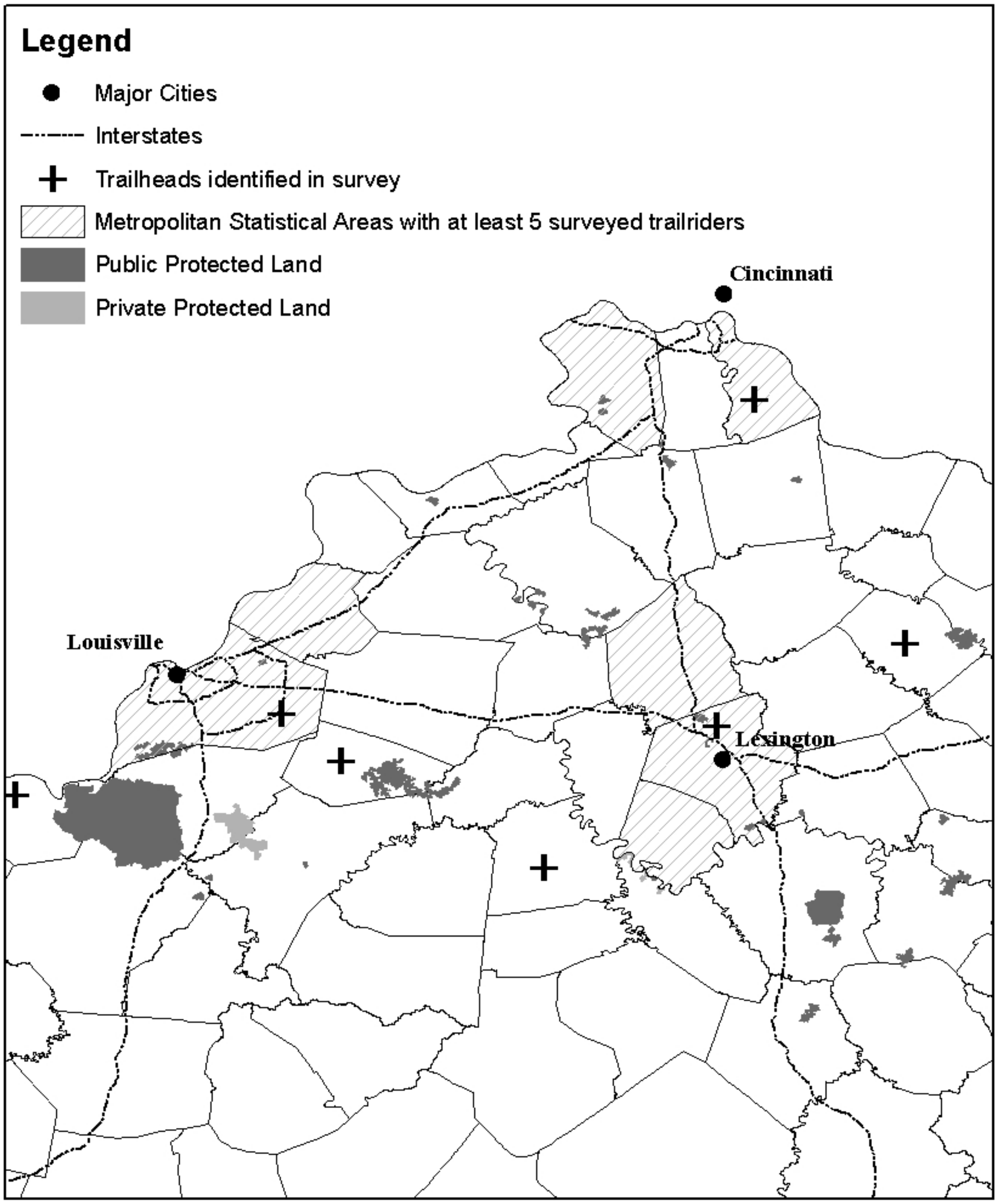

Figure 2. Potential Land for Future Trail Development

Note: Potential land for future trail development within 66 road miles of at least one of the metropolitan areas of northern Kentucky (Cincinnati, Ohio), Lexington, Kentucky, and Louisville, Kentucky. Potential land is at least 200 acres.

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