LAND USE PLANNING

The Calumet Area Ecological Management Strategy: Measuring the Non-Market Economic Benefits

Abstract

This research estimates the recreational value of single-day visits to two nature centers within Metropolitan Chicago. The motivation for this research is the proposed Ford Calumet Environmental Center in the City's Calumet region -- a public investment on the order of $10 million. To provide an estimate of the possible public benefits accruing from this public investment and to assist in prioritizing the restoration of natural areas in the Calumet, individuals visiting the North Park Village Nature Center and the Sand Ridge Nature Center were surveyed during the summer and fall of 2005. The visitor survey results were used to estimate travel-cost demand functions for urban nature center visits and to identify that the consumer surplus accruing to visitors of nature centers in metropolitan Chicago. The accruing aggregate consumer surplus from the existing nature centers is quite high – between $1,200 and $1,500 per visitor per year, depending on the methodology employed, with a per visit value of approximate $322. When aggregated over potential users, these results provide evidence to suggest that accessible urban ecosystem fragments are highly valuable public resources in the metropolitan Chicago region. Benefits transfer estimates to the City of Chicago's investment in the Ford Calumet Environmental Center identify potential welfare gains that greatly the cost of restoration. On a per-acre basis the likely public benefits from further natural area restorations are on the order several hundred thousand dollars.

Introduction

The Calumet Region in Coastal Illinois and Indiana, despite a century of intense exploitation, surprisingly remains one of North America's most biologically diverse wetland eco-regions. To begin the preservation and restoration of the remaining 5000+ acreas of wetland and dune-and-swale habitat fragments of the region, the City of Chicago Department of Environment (CDOE), in collaboration with numerous private and public entities from the bi-state region, is promoting the Calumet Area Environmental Management Strategy (CAEMS). One important element of the CAEMS is the public development of the Ford Calumet Environmental Center (FCEC) at Hegewisch Marsh, a significant 128-acre wetland site and bird habitat at the confluence of Lake Calumet and the Calumet River. Certainly, the FCEC will provide an important opportunity for citizens of the region to visit and experience the Calumet Region's uniquely combined ecological and industrial heritage. However, more importantly, the development of the FCEC project exemplifies a remarkable shift in a municipal governments are responding to urban environmental challenges and are exploring of how to turn the loose concept of sustainability into a reality.

The ecological importance of the Calumet region is widely recognized. The CAEMS and the FCEC are important manifestations of this recognition. However, a significant problem that remains is the development of an objective way to quantify spatially the relative ecological significance of the remaining sites in the region. Given the severe state and local budgetary constraints, the amount of preservation and restoration work vastly exceeds available public resources. Public officials and other decision-makers in the region are searching for ways to assess the importance of environmental assets so as to prioritize and target future public investments for preservation and restoration. Since the FCEC is still in the developmental stage and not yet completed and open for use, the necessary valuation information was gathered through a survey instrument at two proxy sites that most resemble the FCEC in key aspects: a functioning ecosystem fragment within the urban core with facilities for education and nature interpretation.

This research outlined here stems from the assertion that estimating monetary values of non-market economic benefits that accrue from the remaining wetlands and other critical habitats in the Calumet region will be an effective, science-based method to quantify the relative significance of the spatial ecological elements that require evaluation from a public policy perspective. This resulting valuation information will support such decision-making by providing a range of monetary values for the remaining wetland ecosystem components on a dollars per-acre basis facilitating a comparison of sites for future public intervention. From a methodological point of view, to estimate the non-market economic benefits that will accrue to the Chicago metropolitan region's residents through the development and construction of the FCEC, this proposal will employ a modified individual site travel cost valuation approach to estimate the use-value. This research will collect survey information from two proxy sites: the City of Chicago Park District's North Park Village Nature Center (NPVNC) and the Cook County Forest Preserve Sand Ridge Nature Center (SRNC).

In a travel cost study, site visitation data, gathered through the survey instrument, is utilized for the estimation of a trip-generating function, which serves as a model of a site's use. This is an estimated expression for the number of trips based on trip costs and other demographic information. The trip-generating function will be determined statistically through multiple regressions of the site visitation survey data. Specific data to be collected on site will the number of visits originating from each identified zone within the region and other demographic information of survey respondents. From the collected data, round-trip mileage from trips originating in each zone is calculated which allows for the estimation of travel costs per mile as well as the value of time spent traveling (opportunity cost) to the recreational site. Once a trip-generating function is determined, it is used to define a demand curve for the site. This is accomplished by estimating the impact that unit price increases would have on the aggregate demand for the site, thus tracing out a demand curve or function in the process. Once a demand function is established, the aggregate consumer surplus may be determined.

Measuring Non-Market Environmental Benefits

The proposed redevelopment of the Hegewisch Marsh site as the Ford Calumet Environmental Center (FCEC) is envisioned to provide a new and unique resource to the Calumet region, providing recreational and educational opportunities to Chicago's underserved citizens in a south-side location that is currently inaccessible to the public. The City of Chicago's Department of Environment efforts to expend public resources to reclaim this fragment of Southern Lake Michigan wetland ecosystem represents a path-breaking investment by a municipal government in its own urban natural capital. Current estimates identify the total restoration and site development costs to be around $10 million (City of Chicago Department of Environment) with operational costs estimated to be at least $500,000 per year. However, what is critical to determine, though much less certain, are the societal benefits that may accrue from this particular public investment. Additionally, will understanding the societal environmental benefits from this particular investment provide insight into future public investments in natural capital within the Chicago's urban core.

The economic value of a restored Hegewisch Marsh would be a measure of the maximum amount individuals in the region would be willing to forego in other goods and services to obtain an improved wetland site. This measure of human welfare is formally expressed by the term "willingness to pay" (WTP). However, WTP is not the same as "price." The price of any good, whether it be traded in markets such as the land market or whether it be a non-market good such as environmental quality, is generally the minimum amount one would be willing to pay. Thus, the value of a good in a market (i.e., its price) is not equivalent to the good's total economic value. Economists' measure for total economic value that society would derive from any good or service is represented by the concept of consumer surplus. When a good is exchanged in a competitive market, the market price, determined by the equilibrium of supply and demand, measures the marginal willingness to pay for the last unit purchased in the market. However, the marginal willingness to

pay over what consumers actually do pay for a good purchased is called consumer surplus. It represents the good's value to consumers in terms of their net willingness to pay and is graphically represented as the area under the demand curve for the good.

Conceptually, there are two separate components explaining how citizens might value an environmental good such as a restored Hegewisch Marsh: (1) the site's use value; and (2) its non-use value. First, the economic value that will accrue to citizens of the region from their visiting and enjoying the new FCEC at Hegewisch Marsh is understood as the site's use value. However, since the value for this or any environmental amenity will not be traded in any market, one has to look at the costs that are indirectly incurred in money and time by people to visit and enjoy an environmental asset or amenity to estimate the site's use value. The specific technique to estimate peoples' WTP through the assessment of the indirect costs they incur by use of the site is called the travel cost valuation (TCV) method. While the non-use value of urban natural capital is an important aspect of its economic impact within the urban region, the expense and complexity of measuring this value places it outside the scope of this initial attempt at the economic valuation of the FCEC. Therefore, this proposal will however concentrate on estimating only the site's use value, therefore it will employ only the travel cost valuation model.

While there is a growing number of environmental economic valuation studies that identify the WTP for many urban environmental and ecological assets in the Great Lakes region (Jaworski & Raphael, 1978; Jones & Sung, 1993; Lupi, et al., 1997; Sohngen, et al., 1999; Murray & Sohngen, 2001; Stumburg, et al., 2001), those specific to the environmental assets within the Chicago metropolitan region are noticeably few (Kosobud, 1998) . There is only one existing empirical study investigating the economic value of a city park (Lockwood & Tracy, 1995). A strong case can be made that this limits the accuracy of a benefits transfer analysis that could provide an estimate of the regional willingness to pay for the restoration of a site in the Calumet region. Indeed, the existing environmental valuation studies focusing on Chicago's environmental assets and amenities have been benefits transfer analyses that infer values from empirical valuation research done on sites elsewhere (Coursey & Noonan, 2000; Cooper & McGrath, 2000).

One specific example of original valuation research that bears mention is a contingent valuation study undertaken by Dr. Richard Kosobud for Chicago Wilderness (Kosobud, 1998) that focused measuring the regional WTP for increased wilderness space. Kosobud's findings conclude that there is indeed unmet demand for increased wilderness areas throughout the region and that the market forces that determine land use are, as expected, undersupplying this amenity. According to this study, the total regional WTP for increased wilderness space within the Chicago metropolitan region is nearly $59 million per year (in Yr 2000 dollars) – a significant value when thought of in present value terms. Additionally, respondents' WTP increased significantly with income and educational attainment, indicating that wilderness recovery has some of the characteristics of a superior good and lending support to the accuracy of the estimate.

While Kosobud's previous findings present strong evidence of the welfare benefits resulting from additional "wilderness" recreational areas within the Chicago region, it would be difficult to determine how much of this estimated total non-market value would represent the WTP for a restored for the Calumet region as a whole (or the FCEC) that could reliably support any land use decision-making in the area. The survey did not ask about the WTP for any specific acreage of increased habitat, nor about the restoration of any specific sites. Additionally, the non-random sample is an issue of concern. Lastly, and importantly, it is not clear what portion of the measured value is unmet use value or unmet non-use value.

Methodology

The central research question that this research aims to illuminate is: **Given the growing governmental and stakeholder commitment to the preservation and restoration of the Calumet region's remaining wetland ecosystem fragments, will the City's investment in the FCEC provide net social benefits and, the related question, can standard non-market economic valuation of these wetland ecosystems**

provide a science-based approach for prioritizing public investment? The critical first step is to estimate the use value of a typical restored accessible wetland site within Chicago. The estimation of this use value is estimated via travel cost methodology. In a travel cost (TCV) study, the use value of an environmental amenity is revealed through the investigation of the investment people make of both time and money to use the goods and services of the amenity. The application of the Travel Cost Method (TCM) is generally recognized to have been originally developed Clawson & Knetch (1966) and by Burt & Brewer (1971) and is widely recognized as the standard method for valuing environmental and recreational amenities that people visit and use. For a thorough survey of the TCV methodology, its applications and limitations see Bockstael et al. (1991) and Parsons (2003). The estimated aggregate consumer surplus accruing to the citizens of metropolitan Chicago from the public investment in the FCEC was determined via a benefits transfer exercise of the estimated recreational values of the two proxy sites.

The data for this research was gathered through an onsite interview format survey of adult recreational single-day users of two proxy sites: the North Park Village in Chicago, IL (managed by the City of Chicago Park District) and the Sand Ridge Nature Center in South Holland, IL (managed by the Forest Preserve District of Cook County). The interview surveys were collected with full cooperation of the leadership of both nature centers. The two proxy sites share fundamental ecosystem and functional similarities with the proposed FCEC. Both are functioning ecosystem fragments inside the urban core completely surrounded by intense urban development. Both share similar ecosystem types: mesic marsh, oak savannah, and black soil prairie fragments. Both share very similar wildlife populations, such as obligate marshland bird species. The likelihood of observing wildlife is very high in both proxy sites, which is an important motivation for site visitation. Both proxy sites are remarkable for the nature experience they provide despite being within the urban core, though close proximity to the larger Cook County Forest Preserve lands facilitates the high likelihood of wildlife observation.

Discussion of the Model

The single-site travel cost model is a demand model for trips to a given recreational site by a user over a recreational season. The number of trips a user makes will depend of cost of accessing the site (i.e. travel cost) as well as other factors such as income, age, experience level, and proximity to other sites. The equation to be estimated in its most general form is:

$$r = f(tc_r, tc_s, y, \mathbf{z}) \qquad (1)$$

where *r* is the number of trips taken by the user of the recreational site in a given season, *tcr* is the travel and time cost expended to reach and utilize the recreational site, *tcs* is a vector of trip costs to other recreational sites, *y* is income, and ***z*** is a vector of other demographic variables believed to influence the number of trips (also called "demand shifts"). These can include variables such as age, gender, occupation, education level, and often experiential and attitudinal information.

In this situation, we have two sites that serve as a substitute site for the other – the North-side North Park Village Nature Center and the South-side Sand Ridge Nature Center. A cursory review of the visitor statistics show that the usage of each site is highly localized, and that we interested most in the deriving the general demand for use of a nature center in Chicago, not the demand of one center over the other. The two nature centers, while not identical in size, are fundamentally identical in function and both represent very similar ecosystem types, albeit in different parts of the metro region. The experience of the nature center is fundamentally the same. We will assume that the same factors that determine the usage of one center also determine the choice to use the other. The overall goal of the demand estimation is to produce a meaningful measure of the access-value value of a natural area in Chicago that can be applied to a yet-to-be-developed natural area – Hegewich Marsh in the Calumet area of the city. Therefore, we will apply to the single-site model to include visitation to the two sites, with each site functioning as the other site's substitute. The inclusion of the two sites into the dataset will help to determine if there are any north-south differences.

Trip cost is defined as the total monetary and time costs required to make usage of the designated recreational site possible. This research will model day trips for both the NPVNC and the SRNC. It is anticipated that most trips to these two sites will be principally via car or by foot, but also possible by bicycle or public transport. Additional time traveling to the site as well as time on-site will be included in the necessary calculation for time cost. This is an area for considerable researcher judgment, and it is important that the survey be complete enough to allow multiple methods of cost calculation. Once travel costs are calculated, equation (1) can be estimated. As is common in most single-site travel cost applications, the model is estimated as a count data model. That is, the dependent variable of the model is a count figure, in this case the expected number of trips taken annually to the nature center. The most common count data model is the Poisson regression model. The number of annual trips is assumed to be genterated by a Poisson process (Parsons, 2003, page 286), and the probability of observing r trips by an individual I in the sample is expressed as:

$$\Pr(r_i) = \frac{e^{-\lambda_i}\lambda_i^{r_i}}{r_i!}, \qquad (2)$$

where λ_i is the expected number of trips determined by the model $\lambda_i = e^{\beta X i + \varepsilon i}$, to ensure non-negative probabilities. ***X*** is the combined vector of variables that determines in equation (1).

Again, for this analysis, an on-site sample was adopted to ensure that users of the nature center would actually be sampled, as well as due to the lower cost to execute the survey. However, using an on-site survey imposes some significant biases in the estimation that require consideration. The most important of these is that of a truncated sample. With an on-site sample, only individuals who actually use the site are observed. Individuals that do not visit the nature center are "truncated" from the true sample population. These are the individuals who never visit the nature center or people who simply did not visit this year. Thus, *ri* > 0 for all observations.

In general, if one assumes that a function, *f(ri),* is the probability density function for trips to the nature center, then according to Greene (1993, page 683) the density function of a truncated random variable, *g(ri)*, truncated at a constant value of one is expressed as:

$$g(r_i \mid r_i > 0) = \frac{f(r_i)}{\Pr(r_i > 0)}, \quad \textbf{for } r_i > 0 \qquad (3)$$

A second issue is one of endogenous stratification of the sample. Sine we are deriving our observations from on on-site sample, individuals who use the nature center more often are more likely to be interviewed. Thus, the average number of trips observed in the sample will be higher than the true mean. Haab and McConnell (2002, p 178) present the derivation of the density function, *h(xi)*, corrected for both truncation and endogenous stratification. This is expressed generally as:

$$h(r_i \textbf{ and interview} \mid r_i > 0) = \frac{r_i \cdot g(r_i \mid r_i > 0)}{E_P(r_i)} \qquad (4)$$

and Haab and McConnell (2002, p. 178) specifically derive the functional form for the corrected Poisson model as:

$$h(r_i \textbf{ and interview} \mid r_i > 0) = \frac{e^{-\lambda_i}\lambda_i^{(r_i-1)}}{(r_i-1)!} \qquad (5)$$

Again, where the parameter, *l*, is the expected value of the number of trips and is assumed to be function of the combined vector of variables, ***X***, that specify the demand function in equation (1) and takes the following log-linear form to ensure non-negative probability values:

$$\ln(\lambda_i) = \beta \mathbf{X}_i + \varepsilon_I \qquad (6)$$

Equation (5) has a conveniently simple form in that if we let *wi = ri – 1*, then right hand side of equation (5) is simply the standard Poisson distribution identified in equation (2) for the variable, *wii.* This make the model very easy to estimate by simply transforming the dependent count variable by *(ri– 1)* and then running a standard Poisson regression.

There is one final statistical issue to control for: that is, censoring in the sample. In this specific interview process, the number of trips take was capped at the choice: "greater than 10 trips." Thus, individuals were allowed only to respond that they took 10 trips or more. Therefore, the sample is said to be censored at 11 trips. This is a non-trivial issue in that greater that 36% of our sample identified using the nature center greater than 10 times. Therefore, if we let *wi = ri – 1*, then the probability functions of observing the transformed number of trips, wi, are expressed as:

$$\begin{cases} \Pr(0 \le w_i \le 9 \textbf{ and interview} \mid w_i \ge 0) = \dfrac{e^{-\lambda_{ii}} \lambda_i^{w_i}}{w_i!} \\ \Pr(w_i \ge 10 \textbf{ and interview} \mid w_i \ge 0) = 1 - \sum_{k=1}^{9} \left[\dfrac{e^{-\lambda_{ii}} \lambda_i^{k_i}}{k_i!} \right] \end{cases} \qquad (7)$$

Under this arrangement, the likelihood function takes on the following form:

$$L = \prod_{\substack{i=1 \\ 0 \le w_i \le 9}}^{N} \left[\frac{e^{-\lambda_i} \lambda_i^{w_i}}{w_i!} \right] \cdot \prod_{\substack{i=1 \\ w_i \ge 10}}^{N} \left[1 - \sum_{k=1}^{9} \frac{e^{-\lambda_i} \lambda_i^{k_i}}{k_i!} \right] \qquad (8)$$

Taking the log of the equation (8) yields the log-likelihood function to be estimated:

$$\ln L = \sum_{\substack{i=1 \\ 0 \le w_i \le 9}}^{N} \left[-\lambda_i + w_i \ln(\lambda_i) - \ln(w_i!) \right] + \sum_{\substack{i-1 \\ w_i \ge 10}}^{N} \ln \left[1 - \sum_{k=1}^{9} \frac{e^{-\lambda_i} \lambda_i^{k_i}}{k_i!} \right] \qquad (9)$$

The log-likelihood function expressed in equation (9) captures the censoring of the actual observations above 11, the truncation that arises from sampling only those who actually visited the nature center, and the possible endogenous stratification of the sample. Again, *l* is determined by the expression, *l = eb**X+** e*, where ***X*** is the vector of variables that determine both nature center visitation and the number of annual visits.

Estimation Results – The Value of a Trip to the Nature Center

The set of parameters, *b*, in equation (6) that maximizes equation (9) were found through maximum likelihood estimation using the Berdt, Hall, Hall & Hausman (BHHH) method utilizing the RATS econometrics software. These results are presented in Table 1. Model 2 differs from Model 1 in the inclusion of a quadratic income variable, INCOME^2. The dependent variable for both models is the natural log of the stated number of expected annual trips by the interview respondent, ln(*ri*).

The coefficient on the travel cost to the visited site in both Model 1 and Model 2 is negative, as expected, and significant. Similarly the coefficient for the substitute site is negative and significant, which is an encouraging result of the robustness of both Models. The significance of the travel cost variable suggests that there is

indeed a demand function for nature center visitation in the Chicago metropolitan region. The user population for both nature centers is quite localized, which implies a strong spatial nature of the welfare generated by the nature center. It is important to emphasize that the general psuedo R-squared values, which is an approximate measure of the variation in the data explained by the model is low in both Model 1 and Model 2. This is common in count data but requires further investigation.

Table 2

Truncated and Censored Poisson Model with Endogenous Stratification
Maximum Likelihood Estimation Results
Dependent Variable: W = EXPTRIPS - 1

Parameter	Model 1	Model 2
Intercept	1.7762 (24.44)	1.4612 (16.09)
TRVLCOST Travel Cost to Site	-0.0028 (3.21)	-0.0031 (3.66)
COSTOTHR Travel Cost to substitute site	-0.0052 (2.7)	-0.0045 (2.17)
INCOME Income/1000	-0.0011 (2.84)	0.0092 (6.01)
INCSQRD (INCOME^2)/10		-0.0006 (7.02)
FEMALE Dummy variable = 1 if female	-0.3096 (9.85)	-0.3366 (10.47)
EDLEVEL Education Level, 6=highest	0.0849 (7.08)	0.0830 (6.75)
WHITE Dummy Variable = 1 if white	0.0470 (1.3)	0.0475 (1.33)
AGEGRP Age Grouping by decade	0.0309 (2.97)	0.0324 (3.03)
SOUTHD Dummy Variable = 1 if SRNC	-0.6823 (17.66)	-0.6560 (16.73)
N	338	338
Log-liklihood Function Value:	-879.5	-870.0
Psuedo R^2:	0.083	0.093

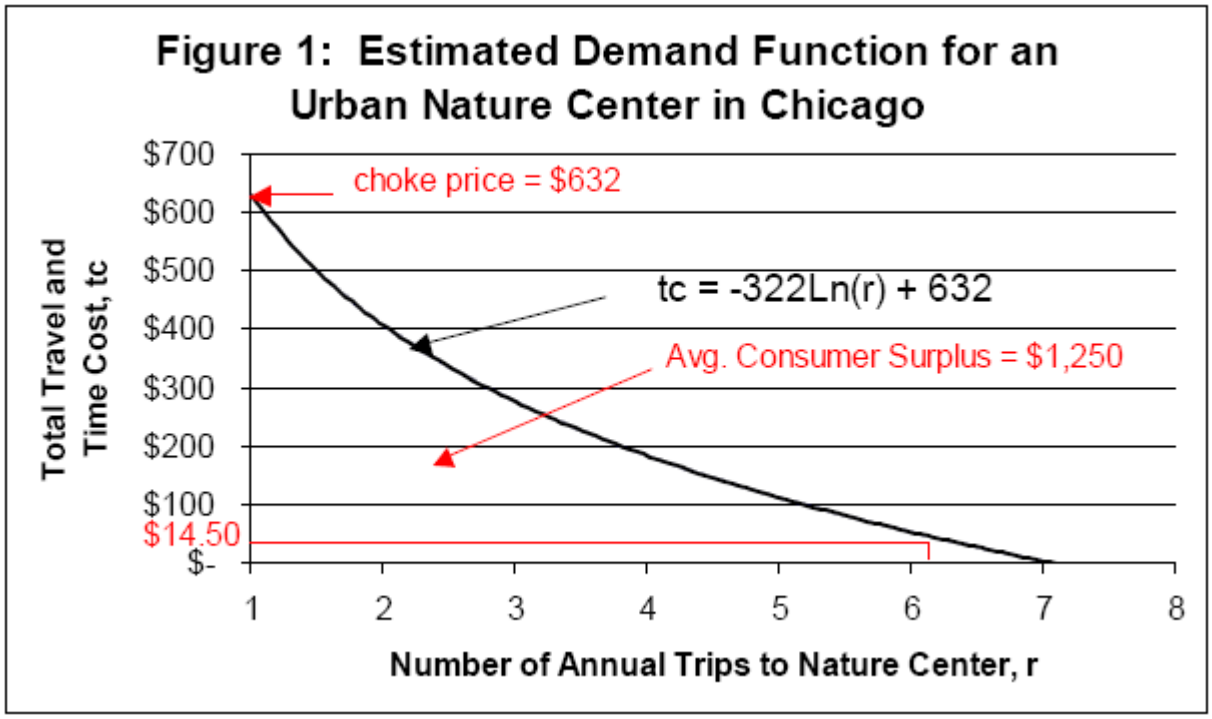
Note: Absolute values of t-statistic in parentheses

The value of a single-day trip to a nature center in Chicago is interpreted as the consumer surplus accruing to an individual visiting the site. Graphically, consumer surplus is the area below the demand curve (the relationship between the total cost to visit the site and the annual visits to the site), less the actual cost incurred to the individual for the trip in both monetary and time costs. Mathematically, this is estimated by integrating the demand function over price – the price being the combined travel and time costs incurred to

utilize the nature center – from price of taking the trip to the choke price. The choke price is the maximum price above which individuals will opt to not visit the nature center. Mathematically, the expression for consumer surplus is:

$$CS_i = \int_{tc_r^O}^{tc_r^{CHOKE}} f_i(tc_r, tc_s, y, z)dtc_r \qquad (10)$$

Figure one represents an approximation of the aggregate individual consumer surplus evaluated at the sample means:



On average, the recreational value of a nature center in the City of Chicago over the course of a recreational season is approximately $1,250, with a choke price of about $632. However, the above graph is only a simplified representation of the consumer surplus of a Chicago nature center, and a more accurate calculation of the consumer surplus is required. The consumer surplus (recreational access value) of individual i has an explicit form in the Poisson model (Parsons, 2003, p. 287):

$$CS_i = \lambda_i / \hat{\beta}_{tc_r}, \qquad (11)$$

where *li* is the expected number of trips in equation (6) and *btcr* is our estimated travel costs parameter. The above expression would then be aggregated across the sample. However, according to Parsons (p. 290), a simple average of the individual consumer surplus would be incorrect. Estimating a Poisson model with an on-site sample requires a correction in the aggregation of consumer surplus, because the more frequent visitors to the site are oversampled. The corrected form for average consumer surplus across the sample is:

$$CS_{on} = \left(\frac{1}{N^*}\right)\sum_{i=1}^{N}\frac{\left(\lambda_i/\beta_i\right)}{r_n}, \quad \textbf{where } N^* = \sum_{j=1}^{R} n_j/j \qquad (12)$$

Dividing the individual surpluses by *rn* and then dividing by *N** are the corrective weights to compensate for the selection bias in the sample. The term *nj* is the number of persons in the sample taking j trips and R is the largest number of trips by a person in the sample.

These welfare estimates are calculated using equation (12) based the parameters of Model 2. The sample average trips to a nature center in Chicago is 6.8. The predicted number, identified by Model 2 evaluated at the sample means, is about 5.1. The results show that consumer surplus generated by a visit to a nature center within Chicago is surprisingly high. The average seasonal consumer surplus per visitor is $1,562, with a per visit value of $322. The average "price" of a trip, the average travel and time costs to utilize a nature center site, is about $14.50.

Applying the Welfare Values: The Value of the Ford Calumet Environmental Center

There is considerable uncertainty in the benefits transfer exercise of applying the measured values to the FCEC. The North Park Village Nature Center receives about 15,000 adult visitors per season. The Sand Ridge Nature Center receives about 10,000 adult visitors per season. Both these figures are very conservative estimates based on personal interviews with the respective center's administrative staff. Assuming that these annual visitor-ship totals are accurate, the median total consumer surplus accruing from these two centers is on the order of $6.8 million dollars annually. The combined acreage of these two nature centers is about 285 acres of accessible natural area. This yields a per acre annual consumer surplus figure of approximately $24,100.

The proposed FCEC at Hegewisch marsh is a 128-acre development. The proposed site development plans call for full access over the 128-acre site via engineered trails and boardwalks. Potential visitor-ship to the site has not yet been estimated by the City of Chicago. The best estimate of the consumer surplus accruing from the site's development is on a per acre basis. This approach identifies an annual consumer surplus value of the FCEC of approximate $3.1 million.

This estimate of consumer surplus can be used to determine the short-term value of this public investment. To do this analysis, one would assume a 7-year time horizon at the public discount rate of 4%. Also it is assumed that once development of the center is completed in year 2, adult recreational visitation reaches and is stable at a rate to support the annual per acre value of $24,100. Working backwards this visitation figure is roughly 18,000 adult visits per year, or about 3,000 adult individuals utilizing the site an average of 6 time per season. This estimates is reasonable for a site of this type.

Does the investment at FCEC support itself in terms of the generated consumer surplus? No estimates of the capital and operational costs are yet available. The City has publicly announced the site will cost about $7 million. To be conservative, it is assumed the development costs for the FCEC are $10 million over two years, with an annual operational cost of $500,000. At the assumed public discount rate of 4% over a very short 7-year time horizon, the accruing public consumer surplus values do support the public investment. Assuming a stable visitation rate and an annual consumer surplus value of $3.1 million, the net present value of the public investment in the FCEC is a positive figure at approximately $3 million. Another, however controversial, measure of the value of the proposed FCEC would be to assume a constant stream of consumer surplus into a very long time horizon and divide the annual consumer surplus value by an appropriate discount rate. To be conservative, at the maximum public discount rate of 7%, the value of the FCEC comes to approximately $44 million, well above the net present value of all capital and operational costs for the Center (approximate $18 million at the same discount rate).

It is important to emphasize that the estimate of economic value of the FCEC are considered only with potential accruing social benefits. Excluded are any possible expenditures by visitors to the site which would have, over time, positive welfare effects from the direct and indirect economic activity due to these expenditures (Persky et al. 2005). The bottom line is that there is convincing evidence to support the assertion that the public benefits accruing from the development of the FCEC at Hegewisch Marsh supports the capital and operational costs of the development.

References

Boardman, Anthony E., David H. Greenberg, Aidan R. Vining, and David L. Wiemer. 2001. Cost Benefit Analysis: Concepts and Practice, 2nd Edition. New Jersey: Prentice Hall.

Bockstael, E. Nancy, I E. Strand, and W. M. Hanemann. 1987. "Time and the Recreational Demand Model" in *American Agricultural Economics Association*. 69: 293-302.

Bockstael, N., K. McConnell, and I. E. Strand. 1991. "Recreation" in Measuring Demand for Environmental Quality, J. Braden & C. Kolstad, eds., Amsterdam: Elsevier.

Burt, O. and D. Brewer. 1971. "Estimation of Net Social Benefits from Outdoor Recreation," *Econometrica*, 39: 813 – 837.

Clawson M. and J. Knetch. (1964) Economics of Outdoor Recreation, Baltimore: John Hopkins Press.

Cooper, A. and D. McGrath. (2000) "The Natural Capital of the Southern Lake Michigan Coastal Zone: First Steps Toward Valuation", Report to the Lake Michigan Federation.

Coursey, D. and D. Noonan. (2000) "Valuing the Environmental Resources in the Palos-Orland Region: A Report to the Palos-Orland Conservation Committee" Working Paper 00.7, Irving B. Harris Graduate School of Public Policy Studies, University of Chicago

Feather, Peter and W. Douglas Shaw. 1999. "Estimating the Cost of Leisure Time for Recreation Demand Models" in *Journal of Environmental Economics and Management*. 38: 49-65.

Freeman, A. M. (1993) The Measurement of Environmental and Resource Values: Theory and Methods, Washington DC: Resources for the Future.

Haab, C. Timothy and Kenneth E. McConnell. 1996. "Count Data Models and the Problem of Zeros in Recreation Demand Analysis" in *American Journal of Agricultural Economics*. 78(1 or 2?): 89-102.

Haab, C. Timothy and Kenneth E. McConnell. 2002. Valuing Environmental and Natural Resources: The Econometrics of Non-Market Valuation, Northhampton, MA: Edward Elgar.

Hensher D. and W. Hotchkiss. (1965) "Choice of Mode and the Value of Travel Time Savings for the Journey to Work," in Australian Transport Economics: A Reader, G. Webb & J. McMaster, eds., Sydney, Australia: New Zealand Book Co.

Jaworski, E. and C. N. Raphael. 1978. "Fish, Wildlife and Recreational Values of Michigan's Coastal Wetland." Report prepared for Great Lakes Shorelands Section, Division of Resource Programs, Michigan Department of Natural Resources.

Jones C., and Y. D. Sung. 1993. "Valuation of Environmental Quality at Michigan Recreation Sites: Methodological Issues and Policy Applications." Report CR-8 16247-01-2. Washington, DC: US Environmental Protection Agency.

Kosobud, R. F. (1998) "Urban Deconcentration and Biodiversity Valuation in the Chicago Region," Report to the Chicago Wilderness Project Coalition.

Lockwood, M. and K. Tracy (1995) "Non-Market Economic Valuation of an Urban Recreation Park," *Journal of Leisure Research*, 27 (2): 155 – 167.

Lupi F., J. P. Hoehn, C. Heng, and T. Tomasi. 1997. "The Michigan Recreational Demand Model. Agricultural Economics Staff Paper 97-58. East Lansing, MI: Michigan State University.

McConnell, E. Kenneth and Ivar Strand. 1981. "Measuring the Cost of Time in Recreation Demand Analysis: An application to sportfishing" in *American Journal of Agricultural Economics*. 63: 153-156.

Murray, C. and B. Sohngen. 2001. “Valuing Water Quality Advisories and Beach Amenities in the Great Lakes.” *Water Resources Research*. [need number]

Parsons, G. 2003. “The Travel Cost Model.” In A Primer on Nonmarket Valuation. P. Champ, K. J. Boyle, and T. C. Brown (eds.) Dordrecht, the Netherlands: Kluwer Academic Publishers.

Persky, J., D. Felsenstein, and V. Carlson. 2004. *Does TRichard L.le Down Work: Economic Development Strategies and Job Chains in Local Labor Markets*. Kalamazoo, MI: Upjohn Institute for Employment Research.

Pfaff, A. & R. Stavins. 1999. “Readings in the Field of Natural Resource and Environmental Economics” Association of Environmental and Resource Economists, www.aere.org.

Shaw, Daigee. 1988. “On-Site Samples’ Regression: Problems of non-negative integers, truncation, and endogenous stratification” in *Journal of Econometrics*. 37: 211-223.

Sohngen, B., F. Lichtkoppler, and M. Bielen. 1999. " The Value of Day Trips to Lake Erie Beaches." Technical Bulletin TB-039. Columbus, OH: Ohio Sea Grant Extension.

Stumborg, B. E., K. A. Baerenklau, and R. C. Bishop. 2001. “Non-point Source Pollution and Present Values: A Contingent Valuation of Lake Mendota”. *Review of Agricultural Economics*. 23(1):120-132.

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