FS 97-01 January 1997

FACULTY SERIES

An Ecoregional Approach to Benefit Transfer

Gajanan Bhat
John C. Bergstrom
J. Micheal Bowker

The authors are Gajanan Bhat and John C. Bergstrom, Department of Agricultural and Applied Economics, University of Georgia, Athens, GA, and J. Michael Bowker, U.S. Forest Service, Green Street, Athens, GA.

Dept. Of Agricultural and Applied Economics
College of Agricultural and Environmental Sciences
University of Georgia

An Ecoregional Approach to Benefit Transfer

Gajanan Bhat*
John C. Bergstrom*
J. Micheal Bowker[#]

* Department of Agricultural and Applied Economics
University of Georgia, Athens, GA 30602

U.S. Forest Service, 320 Green Street, Athens, GA 30602

gbhat@agecon.uga.edu
jbergstrom@agecon.uga.edu
mbowker@uga.cc.uga.edu

Abstract

This study has examined the transferability of consumer's surplus estimates (fixed value transfer) and transferability of benefit functions from the Southern Appalachian Mountain ecoregion to a local site within the ecoregional level. Given data used in this study, it is found that tranferability of benefit estimated are possible in 50% of the activities, whereas benefit functions can be transferred in all of the activities considered in this study. The results are compared to previous studies. Different problems in testing benefit estimates tranfer are disussed.

Key words: Benefit Transfer, Ecoregion, Travel Cost Method

An Ecoregional Approach to Benefit Transfer

Introduction

Government agencies and private organizations often need information on economic values of outdoor recreation and how the values change with changes in the quality and quantity of site characteristics. Benefit transfer is an approach to the estimation of economic values based on existing secondary valuation data. Benefit transfer, in fact, has been ongoing for years in legal proceedings and government policy analysis where timely benefits are critically dependent on the use of existing data. The U.S.D.A. Forest Service (1989) has used benefit transfer for the development of economic values for individual national forests to use in their long range planning processes to meet the requirements of the National Forest Management Act.

Benefit transfer is defined as the transfer of existing estimates of nonmarket values to a new study that is different from the study for which the values were originally estimated (Boyle and Bergstrom, 1992). In other words, it is simply an application of secondary data to a new policy. Several authors define benefit transfer in different ways. Desvouges et al. (1992) call the use of existing studies or the transfer of findings of study site(s) to a policy site as benefit transfer. Smith (1992) suggests the process of a benefit transfer involves focusing on measuring how much people affected by some policy will gain from it. Benefits estimates are derived by focusing on the effects of the conditions assumed to be changed by the policy. Atkinson et al. (1992) define the meaning of a benefit transfer by confronting the policymaker's choices. They said that the policymakers must decide whether to extrapolate the results of benefit assessments done elsewhere or commission a new assessment study. Brookshire and Neill (1992) characterizes benefit transfer as an application of a data set that was developed for a particular use to a quite distinct alternative application.

The benefit transfer issue has evoked many arguments, both for and against. Some researchers have argued that the process of benefit transfer is complex and potentially intractable. On the other hand, several papers published in Water Resources Research, March, 1992 gave different meaningful explanations as why benefit transfer process should be considered as an important research method used for policy applications. McConnell (1992) argues that since experienced researchers use judgement at every stage of research process, researchers should use the same kind of judgement for benefit transfer applications. He also argues that potential errors arise in demand and benefit estimation due to poor measurement of variables and misspecified models. Loomis (1992) and Loomis et al. (1995) attempted benefit transfer application with the use of function transfer rather than the transfer of unit value estimates.

An area of current research inquiry and debate is determination of the limits and conditions under which benefit transfer can be attempted and also the protocol associated with the benefit transfers against whether benefit transfer should be accomplished. The primary purpose of this paper is test the transferability of ecoregional estimates to a local site and also discuss future directions for testing benefit transfer protocols.

Benefit Transfer: Conceptual Framework

Benefit transfer applications can be divided into three classes: (1) estimates based upon expert opinion, (2) the value estimator method, and (3) the fixed value transfer (Bergstrom, 1996). Estimates based on expert opinion may involve either unit day approach or measurement by proxy. Walsh et al. (1992) characterized this unit day approach as an approximation of the average willingness to pay for recreation activities. Measurement by proxy enables researchers to use alternative values from related goods. This process, as suggested by McConnell (1992), often happens within the confines of courtrooms. The natural damage realm also uses assignment by proxy. A second class of benefit transfer applications is called the value estimator methods. In this class, estimator models derived from study site data are used with explanatory variables data collected at the policy site to estimate both value per unit and total units at the policy site.

With fixed value transfer methods, total benefits at the policy site are estimated by aggregating existing standard values per unit derived from the study site data. For example, the total benefits of fishing at the policy site may be estimated as the product of some standard value per fishing day at the study site and total fishing days at the policy site. Studies such as Walsh et al. (1992) and Sturtevant et al. (1996) used meta-analysis in this direction.

Boyle and Bergstrom (1992), in their review of White water rafting in Maine, identified five potential study sites for the Kennebec river to examine benefit transfer method. They proposed three criteria for a researcher to follow when considering using an existing study. First, the nonmarket commodities need to be the same. Second, population characteristics should be similar for the policy site as well as the study site. Third, a researcher cannot switch welfare measurements from willingness to pay to willingness to accept. Measurement error arises if any one of the three criteria is not met in carrying out benefit transfer process. To perform a benefit transfer, analysts must make a number of subjective professional judgements such as the selection of study sites. These professional judgements are another potential sources of measurement error.

Loomis (1992), through a set of empirical tests, concludes that a researcher needs to transfer an entire demand function to avoid biases. He conducted a statistical test to see if the demand coefficients were similar for the policy and the study sites by performing a Chow test upon salmon fishing data from Oregon and Washington states as well as freshwater steelhead fishing from Oregon and Idaho states. The analysis rejects the hypothesis that the demand coefficients are equal because the transfers of equations provide inaccurate estimates.

Atkinson et al. (1992) argue that the benefit transfer estimates have a prior distribution. The distribution is not normal because the errors and estimates are dependent, thus requiring Bayesian estimation. They argue that a Bayesian estimation process will increase the efficiency of estimates over other least square techniques.

The potential sources of error shown by Boyle and Bergstrom (1992) contribute to skepticism over the feasibility of using benefit transfer as an economic valuation technique for such applications as benefit-cost analysis and natural resource damage assessment. Studies conducted empirically to test the feasibility of benefit transfer fall into two general categories: convergent validity tests and value surface tests (Boyle and Bergstrom, 1992).

1. Convergent Validity tests

Two types of convergent validity tests have been conducted in previous studies (Bergstrom, 1996). First type is to test the difference in means. This test can be stated in hypothesis form as:

(1) $$H^o: Y^{ss} = Y^{ps}$$

$$H^A: Not\ H^o$$

where Y^{ss} is the mean value for the commodity of interest at the study site and Y^{ps} is the mean value for the commodity of interest at the policy site. A second type is a difference in model coefficient test. This test can be stated in hypothesis form as:

$$(2) \qquad H^o: B_i^{ss} = B_i^{ps}, \qquad \forall i,$$

$$H^A: Not\ H^o.$$

where B_i^{ss} is a vector of value estimator model coefficients at the study site and B_i^{ps} is a vector of value estimator model coefficients at the policy site. This type of convergent validity test was used by Loomis et al. (1995) for 26 study sites at U.S. Army Corps of Engineers reservoirs.

2. Value Surface Tests

Unlike convergent validity tests, these tests begin with the assumption that there exists a grand valuation model that ultimately drives valuation behavior at the study site(s) and the policy site (Boyle and Bergstrom, 1992; Bergstrom, 1996). To conduct tests, the study site(s) data are combined either by pooling raw data across sites as with a regional TCM model, or by aggregating reported results across sites, such as mean WTP and site attributes, as is done in metaanalysis studies. After study site data are combined, multivariate regression equation specifications are tested to determine the nature of the value surface. The results of this regression analysis suggest how different factors may cause values to vary across sites, providing guidance to adjustments needed to make a valid transfer of value estimates from the study site(s) to the policy site. Studies by Vaughn and Russel (1982) and Smith et al. (1986) have used this test.

Benefit Function Transfer: Interchangeability of Demand Models

Several authors have studied the transfer of demand functions to perform benefit transfer. Loomis (1992), Desvousges et al. (1992) and Loomis et al. (1995) argued for entire demand equation transfer from the study site(s) to a policy site. Loomis et al. (1995) indicated two forms of benefit function transfer. If the recreation behavior for a particular activity is the same in the study site(s) and the policy site, then the entire demand function can be transferred. On the other hand, if an agency has a reasonable estimate of current total recreation use at the policy site and needs only a benefit estimate per visit, only the price coefficient can be transferred.

The results of the studies by Loomis (1992) and Loomis et al. (1995) have rejected the equality of demand function coefficients across states. However, transferring the demand equations within a state yielded a percentage difference of total recreation benefits between 5-15%. Loomis suggested that an important avenue for evaluation of benefit transfer methodologies is to perform more cross-state evaluations of benefit equations. The results of Downing and Ozuna (1996) indicate that benefit function transfer approach tends to overestimate benefits. They used anglers data across eight contiguous Texas Gulf Coast bay regions over three distinct time periods. Empirical studies to date suggest that more sophisticated techniques are needed to improve the acceptability of benefit transfer techniques.

Transferring Ecoregional Values and Functions: Methods and Tests

The main objective of benefit transfer tests in this study is to explore the possibility of transferring estimates obtained at the ecoregional level to a specific local site. The ecoregional classification considered in this study refers ecoregions as geographical zones that represent geographical groups or associations of similarly functioning ecosystems. A given ecoregion contains many sites that provide various recreational activities to visitors. Recreational values at the ecoregional level were estimated using individual travel cost method (ITCM). By focusing on individual observations, the individual approach allows for more statistically efficient and theoretically consistent analysis of the individual recreation consumption behavior.

Boyle and Bergstrom (1992) and Desvousges et al. (1992) suggest that an important research endeavor would be to compare site-specific benefit estimates with those derived from benefit transfers. This approach suggests comparing site-specific benefit estimates with those derived at ecoregional level. The process would be accomplished by employing an empirical test of equality of demand function coefficients as well as benefit estimates as illustrated below.

Policy Site Value to be estimated

Following nomenclature used by Desvousges et al. (1992) and several other papers later, the policy site is the site for which estimates of recreation values are contemplated for certain policy issues. Study site(s) refer to the site(s) or the existing studies for which estimates are available and offer potential for benefit transfer using some criteria.

The first step in conducting a benefit transfer study is to specify the theoretical definition of the value(s) to be estimated at the policy site. Using an indirect utility function, Hicksian compensating willingness to pay measure for a recreation activity trip can be defined as

$$V(P_{tc},\ Q^{1},\ P,\ Y-WTP;\ S)\ =\ V(P_{tc},\ Q^{0},\ P,\ Y;\ S), \tag{3}$$

where P_{tc} is the price of recreation activity trips, P is the vector of prices of other goods, Q^0 is the initial quantity of recreation trips, Q^1 is the subsequent quantity of recreation trips, Y is income, and S is a vector of socioeconomic characteristics (Randall and Stoll, 1980).

Identification of Study Sites and Transferability of Values

The first step in this process is to conduct a thorough literature search through various sources. However, this step may be difficult because as the number and diversity of valuation studies increases, many relevant study sites may not be identified via traditional search procedures. Potential study site values must be examined to determine whether they are transferrable. Transferability needs to be evaluated using objective criteria. As mentioned previously, Boyle and Bergstrom (1992) proposed three general criteria for benefit transfer. The first criterion for a benefit transfer is that the nonmarket commodity valued at the study site must be identical to the nonmarket commodity to be valued at the policy site. As the objective of the benefit transfer in this study is to test the transferability of ecoregional values to a local site within that ecoregion, the first criterion would be met.

An ecoregion contains similarly functioning smaller systems. An assumption in this study is that the site characteristics and the population characteristics among various sites within an ecoregion are similar. Thus, a hypothesis in this study is that benefit transfer can be accomplished at the intra-ecoregional level, by transferring ecoregion demand function to local sites within that ecoregion. Therefore, tests of transferability of benefit estimates and benefit function will be conducted in this study.

In general, benefit transfer tests can be undertaken in two ways: (1) testing the equality of consumer surplus (mean net economic value per recreation trip) and (2) testing benefit function transfer from the study site(s) to the policy site.

1. Testing the Equality of Consumer Surplus

This study employs the individual travel cost method to estimate consumer surplus (net economic value per trip) using ecoregional level data on various recreation activities. Truncated count data models were chosen because the dependent variable, the number of trips taken over the season or a year, is a nonnegative integer (Creel and Loomis, 1990). The statistical model fitted using the truncated Poisson is given by

(4)
$$P(Y_i = y_i | Y_i > 0) = \frac{\exp(-\lambda_i)\lambda_i^{y_i}}{y_i![1-\exp(-\lambda_i)]},$$
$$y_i = 1,2,..., \qquad i = 1,2,...,n$$

λ_i is parameterized for estimation as

(5)
$$\ln \lambda_i = X_i\beta + u_i$$

where Y_i is a random variable, trip taken by a visitor. X_i represents the vector of explanatory variables, β is the parameter vector and u_i is random disturbance. Using semi-log functional form the consumer's surplus estimates are given as:

(6)
$$\hat{CS}_1 = \frac{1}{\hat{\beta}_1},$$

where, β_1 is the price coefficient of the ecoregion demand equation. The site level consumer's surplus is given as:

(7)
$$\hat{CS}_2 = \frac{1}{\hat{\beta}_2},$$

where, β_2 is the price coefficient of the site level demand equation.

Equality of consumer surplus can be tested as:

$$(8) \qquad H_O:\ \hat{CS}_1 = \hat{CS}_2, \qquad H_A:\ \hat{CS}_1 \neq \hat{CS}_2.$$

2. Benefit Function Transfer

In this case, like the previous method, the ecoregional level demand function is given as:

$$(9) \qquad \ln T_{ij}^{k} = \beta_0 + \beta_1 AVINC_i + \beta_2 TC_{ij} + \beta_3 AVSUB_i + \beta_4 NON + e_1,$$

where, T_{ij}^{k} is annual recreation trips by individual i to site j for activity k in ecoregion e. $AVINC_i$ is annual household income of individual i, TC_{ij} is travel cost per trip from individual i to site j, $AVSUB_j$ is the price of a logical substitute, and NON is dummy variable to classify observations into local or nonlocal. This classification is based on round trip distance of 100 miles. The site level equation is given as:

$$(10) \qquad \ln\ T_{ij}^{k} = \alpha_0 + \alpha_1 AVINC_i + \alpha_2 TC_{ij} + \alpha_3 AVSUB_i + \alpha_4 NON + e_2,$$

where, α_i are the coefficients of the site level demand functions, and the explanatory variables are the same as with equation (9) but at the site level.

Testing the equality of model coefficients in this case, will be done as follows:

$$(11) \qquad H_O:\ \alpha_i = \beta_i \quad for\ i = 0,1,2,3, \qquad H_A:\ \alpha_i \neq \beta_i \quad for\ i = 0,1,2,3.$$

Data and Estimation Procedure

Testing benefit transfer from the ecoregional level to the local site is accomplished using data from the Southern Appalachians Mountain ecoregion and Cherokee National Forest site in the Western North Carolina for a selected number of activities. The Southern Appalachians Mountain ecoregion covers parts of Alabama, Georgia, Tennessee, South Carolina, North Carolina, Kentucky, Virginia and West Virginia. Data for the study were obtained from the Public Area Recreation Visitors Study (PARVS) and the CUSTOMER survey for the Southern Appalachian sites. PARVS and CUSTOMER are ongoing multi-agency efforts to collect data on the use of public areas for outdoor recreation (Bergstrom and Cordell, 1991). The major component of these efforts is on-site interviews of recreationists conducted at public recreation areas. Information regarding number of trips visitors took to any site in this ecoregion, household income of the visitors, distance traveled (in miles), number of hours traveled (stated hours), quality of sites etc. were obtained from these surveys.

The maintained hypothesis for accurate benefit transfer is that the correct demand model has been estimated in the surveyed region. To test the transferability of the benefit function, a likelihood ratio test was used to test structural change in the restricted and unrestricted truncated Poisson maximum likelihood models. The test statistic has a chi-square distribution.

Results and Discussion

The ITCMs were estimated using a maximum likelihood routine for the truncated Poisson models. Truncated negative binomial estimation was attempted but not presented as the maintained hypothesis of no overdispersion could not be rejected. Models were estimated for both restricted and unrestricted models for activities including Camping, Whitewater Rafting, Picnicking, and Coldwater Fishing. In this study, restricted models are the models with data for the whole Southern Appalachian ecoregion. The Cherokee National Forest models and the out of sample Southern Appalachian ecoregion models are unrestricted models. The results of parameter estimates, standard errors, consumer surplus estimates and likelihood ratio statistics for restricted and unrestricted models with number of observations in the parenthesis are given in tables 1 through 4. In semi-log models, consumer's surplus is the negative reciprocal of the price coefficient.   Testing the equality of consumer's surplus is done using a t-test to test the equality of TC coefficients. A likelihood ratio test is used to test the equality of regression equations at the ecoregion level and the site level. The Likelihood ratio test statistic is twice the difference between the likelihood function value of the restricted model and sum of the likelihood function values of the unrestricted models.

In the results given in tables 1 through 4, t-ratios indicate that that the consumer's surplus estimates at the ecoregion level and the site level are significantly equal for picnicking and coldwater fishing whereas they are significantly different for camping and whitewater rafting. However, likelihood ratio statistics, distributed as χ^2 show that the benefit function regression equations are the same for all activities considered in this study.

Table 1. Ecoregion and Site Models for Camping

Parameters	Restricted (1025)		Out of sample (911)		Cherokee NF (114)	
	estimate	t-ratio	estimate	t-ratio	estimate	t-ratio
intercept	1.7069	43.66	1.8424	43.79	0.9593	9.72
income	-0.16e-05	-1.44	-0.44e-05	-3.47	0.11e-04	4.82
travel cost	-0.56e-02	-9.75	-0.55e-02	9.32	-0.11e-02	-0.69*
substitute	-0.80e-02	-2.97	-0.10e-01	-3.72	0.23e-01	1.73
NON	-0.4615	-10.06	-0.4573	-9.68	-1.3107	-5.79
per trip estimate	178.39		179.51		989.00*	
Testing equality of consumer's surplus t-statistic			4.29#			
Testing equality of regression models LR statistic			63.57#			

Note:

* indicates that coefficient is not significant,

\# indicates rejection of null hypothesis of equality of estimates or regression models.

These results suggest that benefit functions can be transferred from the ecoregion level to a local site within the modeling framework and assumptions considered in this study. It is observed that failures to achieve the equality of coefficients are found in activities where there are markedly unequal number of observations for the out of sample ecoregional models and the Cherokee NF site models. This can be observed in activities such as camping and whitewater rafting. Also, the price coefficients are not significant in the site models for these activities.

Table 2. Ecoregion and Site Models for Whitewater Rafting

Parameters	Restricted (225)		Out of sample (171)		Cherokee NF (54)	
	estimate	t-ratio	estimate	t-ratio	estimate	t-ratio
intercept	3.4799	73.22	3.5463	64.13	2.9696	26.71
income	-0.17e-04	-13.32	-0.25e-04	-13.46	-0.33e-05	-1.53
travel cost	-0.54e-02	-7.24	-0.83e-02	-8.52	-0.19e-02	-2.13
substitute	0.42e-01	11.33	0.61e-01	13.65	-0.63e-02	-0.83
NON	-1.1972	-21.09	-1.2243	-19.08	-0.7416	-6.05
per trip estimate	182.10		119.23		520.88	
Testing equality of consumer's surplus t-statistic			4.50#			
Testing equality of regression models LR statistic			34.24#			

Note:

* indicates that coefficient is not significant,
# indicates the rejection of null hypothesis of equality of estimates or regression models,
$ indicates the failure to reject null hypothesis of equality of estimates or regression models.

Table 3. Ecoregion and Site Models for Picnicking

Parameters	Restricted (315)		Out of sample (200)		Cherokee NF (115)	
	estimate	t-ratio	estimate	t-ratio	estimate	t-ratio
intercept	2.6112	52.03	2.7336	49.46	1.9864	20.13
income	-0.26e-04	-14.98	-0.41e-04	-18.84	0.97e-05	3.67
travel cost	-0.57e-02	-6.46	-0.36e-02	-3.95	-0.85e-02	-4.73
substitute	0.24e-01	4.66	0.56e-01	10.17	-0.1485	-7.20
NON	-0.3795	-5.05	-0.8526	-9.87	1.6601	10.58
per trip estimate	173.35		270.66		116.49	
Testing equality of consumer's surplus t-statistic			1.94 [$]			
Testing equality of regression models LR statistic			28.38 [$]			

Table 4. Ecoregion and Site Models for Coldwater Fishing

Parameters	Restricted (198)		Out of sample (127)		Cherokee NF (71)	
	estimate	t-ratio	estimate	t-ratio	estimate	t-ratio
intercept	2.8129	55.37	2.9358	53.67	2.5960	29.21
income	-0.46e-05	-2.95	-0.55e-05	-3.04	-0.14e-05	-0.54
travel cost	-0.18e-01	-10.52	-0.21e-01	-10.93	-0.98e-02	-2.00
substitute	-0.14e-01	-4.64	-0.17e-01	-5.40	0.20e-01	1.05
NON	0.3661	5.49	0.4497	6.27	-0.4866	-3.10
per trip estimate	53.97		46.35		101.10	
Testing equality of consumer's surplus t-statistic			1.48 $			
Testing equality of regression models LR statistic			45.21 $			

Note:

* indicates that coefficient is not significant,

# indicates rejection of null hypothesis of equality of estimates or regression models,

$ indicates failure to reject null hypothesisof equality of estimates or regression models.

Summary and Implications

This study has examined the transferability of consumer's surplus estimates (fixed value transfer) and transferability of benefit functions from the Southern Appalachian Mountain ecoregion level to a local site within the ecoregional level. Given data used in this study, it is found that transferability of benefit estimates are possible in 50% of the activities, whereas benefit functions can be transferred in all of the activities considered here.

Previous empirical tests of benefit transfer have raised serious questions about the reliability of benefit transfer (Loomis, 1992; Loomis et al., 1995; Downing and Ozuna, 1996). The results of this study generally support the argument made by Loomis (1992) that transfer of benefit functions is preferable to fixed value transfer. The results also generally support Downing and Ozuna's (1996) observation that benefit transfer within sites located in a similar natural area or region (in their case, sites located within a given Bay or Estuary) appears feasible.

In fixed value transfer used in this study and many previous studies, transferability of values from study site (s) to a policy site depends only on the price coefficient. The attribute and socioeconomic vectors that relate to the visitation patterns represent key aspects of the policy site that must be considered when determining the transferability of values from a study site. An analogy can be given with an example of determining height of a new graduate student based on the average height of all existing graduate students. This can be done only by incorporating other socioeconomic attributes of all students. This information allows the investigator to learn whether the objects of valuation, and the user group, are the same, or at least similar, at both the policy and the study site(s). If differences exist, knowledge of these variables may allow for systematic manipulation of the study site values so that they will be applicable at the policy site.

Problem of higly unequal sample sizes of the policy site model and the study site model is another reason for the failure to achieve equality of price coefficients found in this study. This is found to have an effect on the test statistics. Low sample sizes of the site models often result in insignificant parameters and higher standard errors. Berger and Sellke (1987), compared t-test to Bayesian measures to test a point null hypothesis and showed how to improve the test procedure by using Bayesian equal prior probability to both null and alternate hypotheses. They concluded that t-test is not uniformly most powerful (UMP) and *P*-values obtained from t-test can be misleading measures of the evidence provided by the data against the null hypothesis of parameter equality. One should be cautious to use these procedures for the benefit transfer.

There are many issues to be addressed in the future through more research both in estimation procedures and accounting for site attributes. Accurate measurement of explanatory variables is an important step toward estimating a well-specified recreation demand function. Error in an explanatory variable such as travel distance results in corresponding parameter biased toward zero and other parameters biased in unknown directions (Greene, 1993).

Combining tests of benefit function transfer at the individual level models and at the aggregate (zonal) level models may be another attempt toward better benefit transfer practice. Individual models explain consumption behaviors of only the visitors whereas aggregate models explain the aggregate recreation visitation pattern of the sites under consideration.

References

Atkinson, Scott E., Thomas D. Crocker, and Jason F. Shogren. "Bayesian Exchangeability, Benefit Transfer, and Research Efficiency." *Water Resources Research.,* 28(1992): 715-722.

Berger, James O. and Thomas Sellke. "Testing a Null Hypothesis: The Irreconcilability of *P* values and evidence." *Journal of the American Statistical Association,* 82(1987):112-128.

Bergstrom, John C. "Current Status of Benefits Transfer in the U.S.: A Review" Department of Agricultural and Applied Economics, University of Georgia, Athens, GA. Faculty Series, FS 96-9, April, 1996.

Bergstrom, John C. And H. Ken Cordell. "An Analysis of the Demand for and Value of Outdoor Recreation in the United States." *Journal of Leisure Research.,* 23(1991): 67-86.

Boyle, Kevin J. And John C. Bergstrom. "Benefit Transfer Studies: Myths, Pragmatism, and Idealism." *Water Resources Research.* 28(1992): 657-663.

Brookshire, David S. And Helen R. Neill. "Benefits Transfer: Conceptual and Empirical Issues." *Water Resources Research.* 28(1992): 651-655.

Creel M.D. and John B. Loomis. "Theoretical and Empirical Advantages of Truncated Count Data Estimators for Analysis of Deer Hunting in California., *Am. J. Agric. Econ.*, 72(1990): 434-441.

Desvousges, William H., Michael C. Naughton, and George R. Parsons. "Benefit Transfer: Conceptual Problems in Estimating Water Quality Benefits using Existing Studies." *Water Resources Research.* 28(1992): 675-683.

Downing Mark and T. Ozuna. "Testing the Reliability of the benefit Function Transfer Approach.", *Journal of Environmental Economics and Management,* 30(1996): 316- 322.

Greene, W.H. *Econometric Analysis,* Macmillan Publishing Company, New York, NY, 1993.

Grogger J.T. and R.T. Carson. "Models for Counts from Choice Based Samples." Dep. Econ.Work paper. University of California, 1988.

Loomis, John B. "The Evolution of a More Rigorous Approach to Benefit Transfer: Benefit Function Transfer." *Water Resources Research.* 28(1992): 701-705.

Loomis, John B., Cindy F. Sorg and Dennis M. Donnely. “Evaluating Regional Demand Models for Estimating Recreation Use and Economic Benefits: A Case Study.” *Water Resources Research.* 31(1995):721-730.

McConnell, K.E. “Model Building and Judgement: Implications for Benefit Transfers with Travel Cost Methods,” *Water Resources Research.* 28(1992):695-700.

Randall, Alan and J.R. Stoll, “Consumer’s Surplus in commodity Space,” *American Economic Review.*, 70(1980): 449-455.

Smith, Kerry. “On Separating defensible Benefit Transfers from ‘Smoke and Mirrors’.” *Water Resources Research*, 28(1992): 685-694.

Smith, Kerry, and B.H. Desvousges. *Measuring Water Quality Benefits.* Kluwer-Nijhoff Publishing, Boston. 1986.

Sturtevant, L.A., F.R. Johnson, and W.H. Desvousges. “A Meta-analysis of Recreational Fishing” W-133 Ninth Interim Report. 1996.

U.S. Department of Agriculture, Forest Service. Resource Pricing and Valuation Guidelines for the 1990 RPA Program: Report of the Chief’s Technical Coordinating Committee on resource values for the 1990 RPA program. Washington D.C. USDA, Forest Service (unpublished report). 1989, 38p.

Vaughn, W.J. and C.S. Russell. “Valuing a Fishing Day: An Application of a Systematic Varying Parameter Model.” *Land Economics*. 58(1982): 450-463.

Walsh, R.G., D.M. Johnson, and J.R. McKean. “Benefit Transfer of Outdoor Recreation Demand Studies, 1968-1988.” *Water Resources Research.* 28(1992): 707-713.