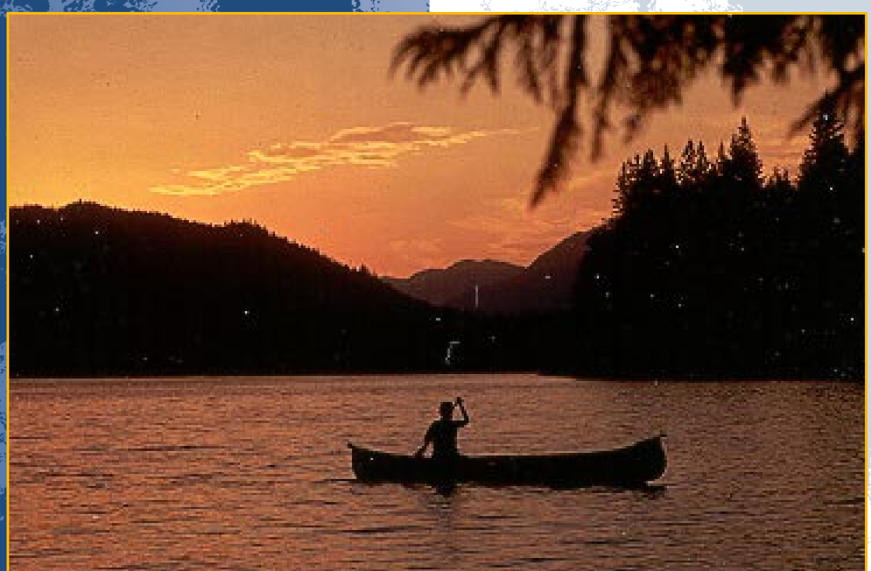
Benefit Transfer of Outdoor Recreation Use Values

Randall S. Rosenberger and John B. Loomis



A Technical Document Supporting the Forest Service Strategic Plan (2000 Revision)

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Abstract

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We present an annotated bibliography that provides information on and reference to the literature on outdoor recreation use valuation studies. This information is presented by study source, benefit measures, recreation activity, valuation methodology, and USDA Forest Service region. Tables are provided that reference the bibliography for each activity, enabling easy location of studies. The literature review spans 1967 to 1998 and covers 21 recreation activities plus a category for wilderness recreation. There are 163 individual studies referenced, providing 760 benefit measures. Guidelines are provided for applying the various benefit transfer methods. Benefit transfer is the use of past empirical benefit estimates to assess and analyze current management and policy actions. Several theoretical and empirical issues to applying benefit transfers are identified for use in judging the relevance and credibility of transferring specific measures. Four benefit transfer models are discussed, including value transfers (single point estimates, average values) and function transfers (demand and benefit functions and meta analysis benefit function). A simple example application is followed throughout the discussion of the various benefit transfer methods. A decision tree is provided as a framework for determining how to obtain benefit measures for recreation activities.

Keywords: Benefit transfer, meta-analysis, outdoor recreation use values

Authors

Randall S. Rosenberger is Assistant Professor, Regional Research Institute and Division of Resource Management, West Virginia University, Morgantown, WV 26506.

John B. Loomis is Professor, Department of Agricultural and Resource Economics, Colorado State University, Fort Collins, CO 80523.

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Contents

Executive Summary

This document serves four purposes: (1) it provides access to the literature on recreation use values; (2) it provides guidelines for conducting benefit transfers; (3) it provides a review of benefit transfer approaches; and (4) it provides a meta analysis of the recreation use value literature for use in benefit transfers. Benefit transfer is the application of data from a study site to a policy site. A study site is a place for which we have recreation value data collected through primary research. Primary research provides content- and context-specific estimates of recreation value for a site. A policy site is a place for which there is little or no data available on the economic value of recreation. When circumstances such as insufficient funding or time make primary research infeasible, benefit transfer provides a means by which the value of recreation at an unstudied site can be estimated using information about recreation values at other sites. Benefit transfer provides content- and context-relevant estimates of recreation value for policy sites.

Access to the outdoor recreation use value literature is provided via an annotated bibliography and cross-referencing of studies by recreation activity. The literature reviewed is comprised of outdoor recreation use value studies conducted from 1967 to 1998 in the United States and Canada. This includes 760 value measures estimated from 163 separate empirical research efforts covering 21 recreation activities.

Guidance is provided by identifying necessary conditions for and limitations to effective benefit transfers. Necessary conditions include issues concerning policy site needs, the quality of study site data, and the correspondence between the study site and the policy site. Several factors can affect benefit transfers and limit the accuracy of value estimation. These factors are categorized as data issues, methodological issues, site correspondence issues, temporal issues, and spatial issues. A decision tree is developed that guides field personnel and resource managers through a framework on how to obtain measures of recreation use value.

Four benefit transfer approaches are reviewed. An example application of each of the approaches is provided. Value transfers focus on measures of value. The use of single point measures and measures of central tendency for recreation values are discussed. Function transfers focus on statistical models estimated in primary research. These models relate value measures with measures of study site characteristics such as demographics of the user population, attributes of the recreation site or area, among others. The functions are adapted to characteristics of the policy site in order to estimate recreation values for the policy site. Demand or willingness to pay functions and meta analysis functions are discussed.

A meta analysis of the recreation use valuation literature is provided. Meta analysis is the statistical summarization of research outcomes. A meta analysis model is developed that can be applied to benefit transfers. It is based on 701 use value estimates from 131 separate primary research studies. A backward elimination procedure was used to optimize the meta analysis benefit transfer function by retaining only those 34 variables significant at the 80 percent level or better. The variables in the model include methodological factors, Forest Service regions, physical and political characteristics, and several recreation activities. The meta analysis benefit transfer function is used to estimate use values for 21 recreation activities for each of the Forest Service assessment regions and for the United States. This meta analysis benefit transfer function provides field personnel and resource managers with another tool for estimating use values for outdoor recreation activities.

Acknowledgments

This project was supported by funds provided by the Washington Office/Strategic Planning and Resource Assessment and the Rocky Mountain Research Station, Forest Service, U.S. Department of Agriculture. The authors acknowledge the assistance of Dennis Black in the literature search process, Shauna Page in the coding of the studies, Ram Shrestha for maintenance of the database, and Ross Arnold, George Peterson, and Dan McCollum for their valuable feedback and useful suggestions in analyzing the data. This report has benefited from a peer review by Linda Langner, Earl Ekstrand, and Jonathan Platt, and the USDA Forest Service General Technical Report review process, all of whom provided insightful comments. Any shortcoming of this report is the sole responsibility of the authors.

Introduction

The Renewable Resources Planning Act of 1974 has an assessment component and a program analysis component (SPRA 2000). First, the act requires an assessment of the supply of and demand for renewable resources on the nation's forests and rangelands. Second, it requires an analysis of the costs and benefits associated with the USDA Forest Service's programs including the National Forest System (superceded by the Government Performance and Results Act [GPRA] of 1993). These requirements create the need for credible measures of benefits. In this case, we are interested in developing credible measures of benefits for outdoor recreation. To this end, Strategic Planning and Resource Assessment (SPRS) staff (formerly RPA staff) supported the use of average values for various outdoor recreation activities based primarily on empirical estimates reported in past studies.

This report serves two functions. First, it provides information from a literature review of economic studies spanning 1967 to 1998 in the United States and Canada. These studies estimated outdoor recreation use values. A guide to this literature is provided through reference to the original studies in an annotated bibliography (appendix A). Second, this report provides guidelines on performing benefit transfers in the context of recreation use valuation. The review of the literature and benefit transfer methods in this report should increase the defensibility of benefit estimates transfers when management and policy impacts on outdoor recreation are evaluated.

We begin by discussing the source and coding of the data collected in the literature review. Issues and concerns surrounding benefit transfers are presented. The obstacles to performing critical benefit transfers highlight the need for a pragmatic approach to benefit transfer. Later we discuss theoretical aspects of the benefit estimates in the literature, including what the numbers mean and how they were estimated. We give a full account of the data collected from the literature review while examining different benefit transfer methods.

This report is not intended to be a cookbook for performing benefit transfers, but as a guide to the empirical estimates available. Along the way, various methods of benefit transfer will be discussed. An example transfer will be followed across all of the different methods. However, the many nuances of an actual benefit transfer cannot be illustrated with a simple example. Therefore, any plausible benefit transfer must involve the practicioner's use of judgment and insight when transferring values.

Data

Literature Review Efforts, Past and Present

We provide data on outdoor recreation use values based on empirical research conducted from 1967 to 1998 in the United States and Canada. This data is the compilation of four literature reviews conducted at the bequest and under the direction of the USDA Forest Service. The first review covered the literature on outdoor recreation and forest amenity use value estimation from the mid-1960s to 1982, collecting 93 benefit estimates in all (Sorg and Loomis 1984). The second review covered outdoor recreation use valuation studies from 1968 to 1988, building on the first review, but focusing primarily on the 1983 to 1988 period (Walsh and others 1988). This second review increased the number of benefit estimates to 287 estimates.

A third literature review on the subject covered the period 1968 to 1993 (MacNair 1993). This review formally coded information on the composition of the studies. While the database developed by MacNair (1993) includes 706 different benefit estimates, many of the studies in the previous reviews were not included in this effort. For example, only 64 out of the 120 studies included in the second review are included in the third review. However, the total number of benefit estimates has significantly increased. For example, 491 estimates from the lesser 64 studies included in this third review is larger than the total 287 estimates from all 120 studies as reported in the second review. This is due to the use of different criteria for including benefit estimates.

We conducted a fourth literature review on outdoor recreation use valuation, focusing on studies reported from 1988 to 1998 (Loomis and others 1999). We then merged the results of the fourth review with the MacNair (1993) database. Our main emphasis was to improve on coding procedures used in the past review efforts and to focus on obtaining use value estimates for all recreation activity categories identified by USDA Forest Service documents. We did not emphasize fishing benefit studies since this is the effort of a separate review sponsored by the U.S. Fish and Wildlife Service, which should be available by year 2001 (Markowski and others 1997). We did, however, include those fishing studies coded in the MacNair (1993) database that were from the Walsh and others (1988) review, as generally these were sufficient in number and coverage of fishing studies for statistical purposes. Therefore, our database includes 163 studies providing 760 benefit estimates, covering all recreation activity categories.

Data Sources and Coding Procedures

The focus of our literature review effort was for outdoor recreation use valuation studies conducted since 1988 in the United States and Canada. We concerted our efforts to locate studies on activities that were not previously investigated, such as rock climbing, snowmobiling, and mountain biking. Computerized databases, such as American Economic Association's ECONLIT, were searched for published literature along with the University of Michigan's Dissertation and Master's Thesis Abstracts. Gray literature was located by using conference proceedings, bibliographies on valuation studies (Carson and others 1994), and access to working papers. Details of studies conducted from 1967 to 1988 were obtained primarily from MacNair's (1993) database that coded the Walsh and others (1988) literature review. A few study details were obtained directly from the Walsh and others (1988) review that were not included in the MacNair (1993) database.

A master coding sheet was developed that contains 126 fields. The main coding categories include reference citation to the research, benefit measure(s) reported, methodology used, recreation activity investigated, recreation site characteristics, and user or sample population characteristics. Study reference citation details include, in part, author identification, year of study, and source of study results. Benefit measure(s) details include, in part, the monetary estimate provided by the study (converted to activity day units using information provided by the study), the units in which the estimate is reported (e.g., day, trip, season, or year), and temporally adjusted benefit measures for inflationary trends to fourth-quarter 1996 dollars using the implicit price deflator. An activity day is the typical amount of time pursuing an activity within a 24-hour period. This unit was chosen because of its ease in being converted to other visitation/participation units (e.g., recreation visitor days, trips, seasons). Table 1 provides summary statistics for the 21 recreation activities included in the database. All of the benefit measures reported in table 1 are adjusted to activity day units and fourth-quarter 1996 dollars.

Methodology details include survey mode (e.g., mail, telephone, in-person, use of secondary data), response rate for primary data collection studies, and sample frame (e.g., onsite users, general population). Methodology details are further divided between the application of revealed preference (RP) and stated preference (SP) modeling when appropriate. Details of RP modeling include, in part, identifying the model type (e.g., individual travel cost, zonal travel cost, random utility models), use of travel time or substitute sites in the model specification, and functional form (double log, linear, semi-log, log-linear). Details of SP modeling include, in part, identifying the model type (e.g., conjoint analysis, contingent valuation models), the elicitation technique for contingent valuation models (e.g., open ended, dichotomous choice, iterative bidding, payment card), and functional form.

Details of the recreation site include, in part, its geographic location, whether it was on public or private land, the type of public land (e.g., National Park, National Forest, State Park, State Forest), the state, the USDA Forest Service Region, and land type (e.g., lake, forest, wetland, grassland, river). In many cases, specific details about the recreation site were not provided either because of incomplete reporting or the activity was not linked with a specific site. Details of the user population characteristics include, in part, average age, average income, average education, and proportion female.

The details of each study were coded to the extent that they could be gleaned from the research-reporting venue. However, not every study could be fully coded according to the coding sheet. This was either because information was not reported or was not collected for a study. For example, coding each study for user characteristics was severely restricted in that very few of the studies in the literature review reported any details about the user population. This and other factors are indicative of the lack of consistent and complete data reporting, which further limits the ability to perform critical benefit transfers.

Benefit Transfer: Issues

What Is a Benefit Transfer?

Benefit transfer is a colloquial term referring to the use of existing information and knowledge to new contexts. For our present purposes, benefit transfer

Table 1—Summary statistics on average consumer surplus values per activity day per person from recreation demand studies—1967 to 1998 (fourth-quarter, 1996 dollars).

Activity	Number of studies	Number of estimates	Mean of estimates	Median of estimates	Std. error of mean	Range of estimates
Camping	22	40	$30.36	$24.09	5.50	$1.69 – 187.11
Picnicking	7	12	35.26	24.21	9.66	7.45 – 118.95
Swimming	9	12	21.08	18.19	4.46	1.83 – 49.08
Sightseeing	9	20	35.88	21.13	9.41	0.54 – 174.81
Off-road driving	3	4	17.43	15.85	6.27	4.37 – 33.64
Motorized boating	9	14	34.75	18.15	11.65	4.40 – 169.68
Nonmotorized boating	13	19	61.57	36.42	13.76	15.04 – 263.68
Hiking	17	29	36.63	23.21	7.87	1.56 – 218.37
Biking	3	5	45.15	54.90	8.40	17.61 – 62.88
Downhill skiing	5	5	27.91	20.90	7.07	12.54 – 52.59
Cross-country skiing	7	12	26.15	26.73	2.84	11.70 – 40.32
Snowmobiling	2	2	69.97	69.97	33.74	36.23 – 103.70
Big game hunting	35	177	43.17	37.30	2.21	4.74 – 209.08
Small game hunting	11	19	35.70	27.71	9.56	3.47 – 190.17
Waterfowl hunting	13	59	31.61	18.21	4.06	2.16 – 142.82
Fishing[a]	39	122	35.89	20.19	3.42	1.73 – 210.94
Wildlife viewing	16	157	30.67	28.26	1.38	2.36 – 161.59
Horseback riding	1	1	15.10	15.10	0	15.10 – 15.10
Rock climbing	2	4	52.96	48.14	11.80	29.82 – 85.74
General recreation	12	31	24.26	10.03	7.48	1.18 – 214.59
Other recreation	11	16	40.58	33.78	9.64	4.76 – 172.34

[a]Fishing includes all types of fishing such as cold water, warm water, and salt water fishing. The number of estimates for fishing is under-representative of the entire body of knowledge since fishing studies were not a primary focus of the literature review.

is the adaptation and use of economic information derived from a specific site(s) under certain resource and policy conditions to a site with similar resources and conditions. The site with data is typically called the "study" site, while the site to which data are transferred is called the "policy" site. Benefit transfer is a practical way to evaluate management and policy impacts when primary research is not possible or justified because of:

1. budget constraints,
2. time limitations, or
3. resource impacts that are expected to be low or insignificant.

Primary research is the "first-best" strategy in which information is gathered that is specific to the action being evaluated, including the spatial and temporal dimensions, expected impacts, and the extent and inclusion of affected human populations and environmental resources. However, when primary research is not possible or plausible, then benefit transfer, as a "second-best" strategy, is important to evaluating management and policy impacts. The "worst-best" strategy in economic evaluation is to not account for recreation values, thus implying recreation has zero value in an evaluation or assessment model.

Conditions for Performing Benefit Transfers

Several necessary conditions should be met to perform effective and efficient benefit transfers (Desvousges and others 1992). First, the policy context should be thoroughly defined, including:

1. Identifying the extent, magnitude, and quantification of expected site or resource impacts from the proposed action.
2. Identifying the extent and magnitude of the population that will be affected by the expected site or resource impacts.
3. Identifying the data needs of an assessment or analysis, including the type of measure (unit, average, marginal value), the kind of value (use, nonuse, or total value), and the degree of certainty surrounding the transferred data (i.e., the accuracy and precision of the transferred data).

Second, the study site data should meet certain conditions for critical benefit transfers:

1. Studies transferred must be based on adequate data, sound economic method, and correct empirical technique (Freeman 1984).
2. The study contains information on the statistical relationship between benefits (costs) and socioeconomic characteristics of the affected population.
3. The study contains information on the statistical relationship between the benefits (costs) and physical/environmental characteristics of the study site.
4. An adequate number of individual studies on a recreation activity for similar sites have been conducted in order to enable credible statistical inferences concerning the applicability of the transferred value(s) to the policy site.

And third, the correspondence between the study site and the policy site should exhibit the following characteristics:

1. The environmental resource and the change in the quality (quantity) of the resource at the study site and the resource and expected change in the resource at the policy site should be similar. This similarity includes the quantifiability of the change and possibly the source of that change.
2. The markets for the study site and the policy site are similar, unless there is enough usable information provided by the study on own and substitute prices. Other characteristics should be considered, including similarity of demographic profiles between the two populations and their cultural aspects.
3. The conditions and quality of the recreation activity experiences (e.g., intensity, duration, and skill requirements) are similar between the study site and the policy site.

Most primary research was not conducted for future benefit transfer applications. The information requirements expressed in the above conditions are not always met in the reporting of data and results from primary research. In addition to weighing the benefits of more information from expensive primary research, the implicit cost of performing benefit transfers under conditions of incomplete information should be accounted for. Therefore, benefit transfer practitioners are required to be pragmatic in their applications of the method when considering the many limitations imposed upon them by primary research.

Potential Limitations of Benefit Transfers

Several factors can be identified that affect the reliability and validity of benefit transfers. A parallel effect that interacts with the following factors is the benefit transfer practitioner's judgment concerning empirical studies, including how to code the data reported by each study. One group of factors affect benefit transfers generally:

1. The quality of the original study greatly affects the quality of the benefit transfer process. This is the garbage-in, garbage-out factor.
2. Some recreation activities have a limited number of studies investigating their economic value, thus restricting the pool of estimates and studies from which to draw information.
3. Another data limitation is the documentation of data collected and reported. This increases the difficulty of demand estimation and benefit transfer.
4. As we have already noted, most primary research is not designed for benefit transfer purposes.

A second group of factors is related to methodological issues:

1. Different research methods may have been used across study sites for a specific recreation activity, including what question(s) was asked, how it was asked, what was affected by the management or policy action, how the environmental impacts were measured, and how these impacts affect recreation use.
2. Different statistical methods for estimating models can lead to large differences in values estimated. This also includes issues such as the overall impact of model mis-specification and choice of functional form (Adamowicz and others 1989).
3. Substitution in recreation demand is an important element when determining the potential impacts of resource changes. However, there is often a lack of data collection and or reporting on the availability of substitute sites, substitute site prices, and the substitution relationship across sites and among activities.
4. There are different types of values that may have been measured in primary research, including use values and/or passive- or non-use values. While this report focuses on use values, the benefit transfer practitioner should be aware of what is being measured in original research.

A third group of factors affecting benefit transfers is the correspondence between the study site and the policy site:

1. Some of the existing studies may be based on valuing recreation activities at unique sites and under unique conditions.
2. Characteristics of the study site and the policy site may be substantially different, leading to quite distinct values. This can include differences in quality changes, site quality, and site location.

A fourth factor is the issue of temporality or stability of data over time. The existing studies occurred at different points in time. The relevant differences between then and now may not be identifiable nor measurable based on the available data. A fifth factor is the spatial dimension between the study site and the policy site. This includes the extent of the implied market, both for the extent and comparability of the affected populations and the resources impacted between the study site and the policy site.

The above listed factors can lead to bias or error in and restrict the robustness of the benefit transfer process. An overriding objective of the benefit transfer process is to minimize mean square error between the "true" value and the "tailored" or transferred value of impacts at the policy site. However, the original or true values are themselves approximations and are therefore subject to error. As such, any information transferred from a study site to a policy site is accomplished with varying degrees of confidence in the applicability and precision of the information. Therefore, National Forest decisionmaking involving tradeoffs of recreation, commodity production, and nature preservation can often be improved by inclusion of even approximate estimates of nonmarket recreation values. Complete omission of recreation value estimates in economic analytic aids to decisionmaking implies a zero value for recreation, in which case the error of omission can be greater than the error of commission in benefit transfers procedures.

Validity and Reliability of Benefit Transfers

Several recent studies have tested the convergent validity and reliability of different benefit transfer methods (Loomis and others 1995; Downing and Ozuna 1996; Kirchhoff and others 1997; Desvousges and others 1998; Rosenberger and Loomis 2000). The methods tested, which we will presently discuss, include single point estimate, average value, demand function, and meta regression analysis transfers. While the above studies show that some of the methods are relatively more valid and reliable than other methods, the general indication is that benefit transfer cannot replace original research, especially when the costs of being wrong are high. In some tests of the benefit transfer methods, several cases produced tailored values very similar to the true values (as low as a few percentage points difference). In other cases, the disparity between the true value and the tailored value was quite large (in excess of 800% difference). Therefore, the policy context and process will most often dictate the acceptability of transferred data.

Benefit Transfer Methods

There are two broad approaches to benefit transfer: (1) value transfer and (2) function transfer (figure 1). Value transfers encompass the transfer of a single (point) benefit estimate from a study site, or a measure of central tendency for several benefit estimates from a study site or sites (such as an average value), or administratively approved estimates. Administratively approved value estimates will be discussed in conjunction with the measure of central tendency discussion. Function transfers encompass the transfer of a benefit or demand function from a study site, or a meta regression analysis function derived from several study sites. Function transfers then adapt the function to fit the specifics of the policy site such as socioeconomic characteristics, extent of market and environmental

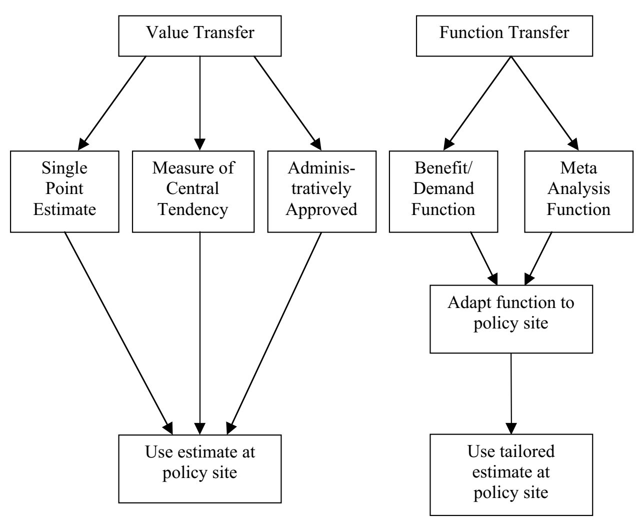

Figure 1. Benefit transfer approaches.

impact, and other measurable characteristics that systematically differ between the study site(s) and the policy site. The adapted function is then used to forecast a benefit measure for the policy site.

We will discuss each of these methods in the following sections, including a simple example application for each. However, we will first define and identify what the benefit measures are, what they mean, and how they were estimated.

Benefit Estimates

What Are They and What Do They Mean?

All of the benefit estimates provided by this report, either recorded from the literature review or forecasted by adapting benefit functions, are average consumer surplus per person per activity day. In the case of a single study, the estimate is the average consumer surplus for the average individual in the study. In the case of several studies, the estimate is the average of the study samples' average consumer surpluses from all included studies.

Consumer surplus is the value of a recreation activity beyond what must be paid to enjoy it.[1] Figure 2 illustrates the concept of consumer surplus. Looking just at current conditions when demand is D_0, consumer surplus is the area below the demand function (D_0) and above the expenditure line (E), or area CFH. Consumer surplus is also referred to as net willingness to pay, or willingness to pay in excess of the cost of the good. Total economic use value is consumer surplus plus the costs of participation, or area 0HFA in figure 2 when demand is D_0 and A is the number of days of participation.

When the change in recreation supply or days is small and localized, consumer surplus is equivalent to a virtual market price for a recreation activity (Rosenthal and Brown 1985). A general assumption when applying the benefit estimates is that the estimates are constant across all levels of resource impacts and perceived changes for an individual. This assumption may be plausible for small changes in visitation, but it may be unrealistic for large changes (Morey 1994). However, this assumption is necessary for the practical application of benefit transfers.

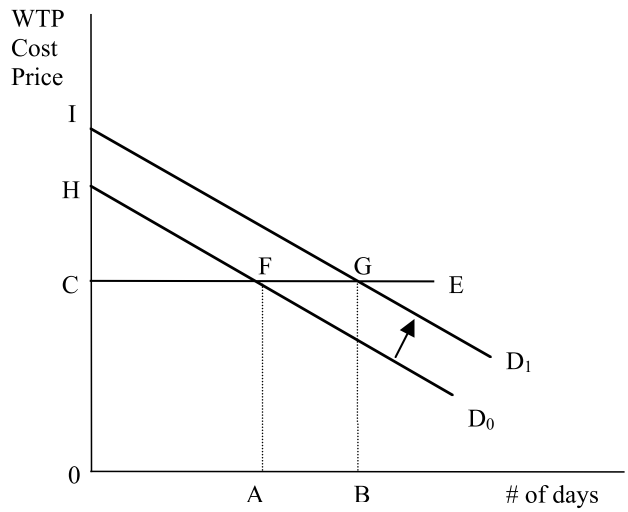

Figure 2. Consumer surplus measures for a quality-induced change in demand.

The valuation of management and policy impacts on recreation can be formally described as equation (1), following Smith and others (1999) nomenclature:

$$CS_P = \frac{CS_S}{\Delta d_S}(d_1 \cdot N_1 - d_0 \cdot N_0), \qquad (1)$$

where CS_P = consumer surplus estimate for evaluating management or policy impacts on recreation;

CS_S = consumer surplus gain measure reported in the literature;

d_i = the amount of recreation use in activity days before ($i = 0$) and after ($i = 1$) the management or policy action;

N_i = the number of people participating in the recreation activity before ($i = 0$) and after ($i = 1$) the management or policy action; and

Δd_S = measured change in recreation participation or affected resource in the literature providing CS_S.

Simply stated, the benefit transfer estimate of a management- or policy-induced change in recreation is the average consumer surplus estimate for the average

[1]There are two prominent types of consumer surplus estimated using slightly different definitions of the demand function: Marshallian consumer surplus based on an ordinary demand function, and Hicksian consumer surplus based on either a compensated demand function or elicited directly using hypothetical market techniques. The difference between these measures is due to the income effect (Willig 1976). Since outdoor recreation expenditures are a relatively small percentage of total expenditures (income), differences between the two measures are expected to be negligible.

individual from the literature aggregated to the change in use of the natural resource. The change in recreational use of a resource may be induced either through a price change in participating in an activity (e.g., fee change or location of the site) or through a quality change in the recreation site.

The benefit estimates in the literature can vary according to many factors such as differences in recreation site and user population characteristics, extent of the market, temporal and spatial differences, and methodologically induced differences. Returning to figure 2, the potential range in benefit estimates provided in the literature can be illustrated. If the demand shift from D_0 to D_1 is due to a measurable increase in the quality of a recreation site, then three consumer surplus areas are identifiable: (1) CFH (existing level), (2) CGI (improved level), and (3) IHFG (net gain). Thus, another potential source for variability in benefit estimates provided is the context of the benefit estimate reported. For example, study A may provide a value for the creation of a new recreation site (area 1 or 3, depending upon expected demand level). Study B, by contrast, may provide an estimate of the current value of an activity with no implied change (area 1 or 3, depending on implied demand). Study C may provide an estimate of the value of a change in demand due to a management- or policy-induced change in implied cost or resource quality (area 2). Therefore, benefit estimates for the same activity reported in the literature can range from area 1 to area 3. All estimates provided in this report are of the first two types (studies A and B) above (we are not providing incremental or marginal values).

In any case, the benefit estimate provided in the literature will be treated as a constant per unit value applicable to all possible levels of resource use, with no accounting made for congestion. For example, the same benefit measure will be used whether recreation is affected by an increase (decrease) of 2 percent or 98 percent, measured as total activity days. Critical transfers would use estimates from a study site that best matches the policy site context as identified in the last section. However, because primary research is not typically conducted for the purpose of future benefit transfers and because of the limitations of study site data reporting listed above (especially incomplete and inconsistent reporting), the best match may not be a very good match at all. This is why benefit transfers must be pragmatic in application (some value may be better than no value at all). By being aware of the challenges to performing critical benefit transfers and what the estimates in the literature represent, practitioners of benefit transfer can better defend their transferred measures. There may be times when values or functions in the literature are used to arrive at a base value. These base values can then be adjusted up or down based on professional judgment to account for factors (like congestion) not accounted for in the benefit transfer. Such adjustments, if made, should be documented by the analyst.

How Are the Study Site Values Estimated?

There is an array of techniques used to estimate the economic use value of outdoor recreation.[2] These approaches are traditionally called nonmarket valuation, basically because not all of the resources important to the quantity and quality of recreation experiences are traded in markets. When market prices are not available, economic techniques may be employed that indirectly or directly estimate virtual market prices (as average consumer surplus or marginal willingness to pay). Revealed preference techniques are indirect methods for estimating consumer surplus and rely on the weak complementary between recreation participation and market-purchased goods necessary to recreation participation. Stated preference techniques are direct methods to estimating consumer surplus via constructed hypothetical markets through which people express their willingness to pay for environmental resources or recreation opportunities. Depending on the structure of a stated preference survey, it can also elicit information for use in indirectly estimating consumer surplus.

The most frequently used revealed preference technique is the travel cost method. Other methods included under the revealed preference technique heading are hedonic property and random utility methods. The travel cost method uses the variable costs of recreation participation (travel, lodging, entrance fees, equipment rentals, travel time) as a proxy for the price of recreating in deriving a demand function. The benefit of recreation is then the consumer surplus estimated from the demand function as shown in figure 2.

The most frequently used stated preference technique is the contingent valuation method. Another

[2]There are several accessible sources to issues in nonmarket valuation. For example, see Freeman (1993), Loomis and Walsh (1997), Champ and others (in preparation), and the website http://www.ecosystemvaluation.org (prepared under a cooperative agreement between U.S. Department of Agriculture, Natural Resource Conservation Service, U.S. Department of Commerce, NOAA-Sea Grant Office, and University of Maryland, Center for Environmental Science).

SINGLE POINT ESTIMATE TRANSFER

1. Identify the resources affected by a proposed action.
2. Translate resource impacts to changes in recreational use.
3. Measure recreation use changes.
4. Search the literature for relevant study sites.
5. Assess relevance and applicability of study site data.
6. Select a benefit measure from a single relevant study or a range of benefit measures if more than one study is relevant.
7. Multiply benefit measure by total change in recreation use.

Figure 3. Steps to performing a single point estimate transfer.

stated preference approach is conjoint analysis—a multi-attribute, multi-objective based method. The contingent valuation method directly solicits information from people by asking them their maximum willingness to pay or minimum compensation demanded for a recreation opportunity or change in a recreation experience, all within the confines of a hypothetical market.

While revealed preference approaches have typically resulted in slightly larger benefit measures than stated preference approaches, the approaches yield measures that are highly correlated (Carson and others 1996). Several studies comparing revealed and stated preference techniques for the same good have found the two measures not to be statistically different, providing evidence that the two techniques to nonmarket valuation exhibit convergent validity.

Benefit Transfer: Methods and Application

This section will discuss four different benefit transfer methods—single point estimate, average value, demand and benefit function, and meta regression analysis function. A simple example of each transfer will be presented. Specific information about the literature on outdoor recreation benefit measures will be provided.

Value Transfers

Single point estimate transfer

A single point estimate benefit transfer is based on using an estimate from a single relevant primary research study (or range of point estimates if more than one study is relevant). The primary steps to performing a single point estimate transfer include identifying and quantifying the management- or policy-induced changes on recreation use, and locating and transferring a "unit" consumer surplus measure. The text box (figure 3) provides a more detailed list of the steps involved in single point estimate transfers.

We provide information in this report that aids in identifying study site benefit measures from the literature.[3] An annotated bibliography of outdoor recreation use valuation studies is provided as appendix A, with additional information on some studies in appendix B. The bibliography includes studies conducted from 1967 through 1998 in the United States and Canada. There are 163 studies and 760 benefit measures identified (there is a total of 786 benefit measures provided, however, 26 of these are for wilderness recreation, some of which are a subset of other various activities). The bibliography includes information on:

1. reference to each study,
2. identification of the recreation activity investigated,
3. geographic location of the study (Forest Service region and RPA region),
4. original benefit measure(s) reported (adjusted to activity day units),
5. time adjusted benefit measure (to fourth-quarter 1996 dollars), and
6. valuation methodology used to measure benefits.

[3]Another database that contains recreation use values in addition to other values for the environment is the Environmental Valuation Reference Inventory™ (EVRI™). This is a subscription database and can be found at http://www.evri.ec.gc.ca/evri/.

Appendix C provides reference codes by recreation activity to the annotated bibliography (appendix A) for ease in locating potentially relevant studies.

It is important to note that all unit benefit measures provided in this report are in consumer surplus per activity day per person. Therefore, when translating resource impacts into recreation use changes, these impacts should be expressed in a comparable index as changes measured in activity days or convert the activity day measures into the relevant units.

The simplicity with which the steps to performing a single point estimate transfer are presented may be misleading. The steps involved in finding a valid and reliable benefit measure can be complex if taken to their theoretical extreme. This should become apparent when the information on the conditions for and limitations to benefit transfers are taken into account as previously identified. See Boyle and Bergstrom (1992) for an example of critically filtering existing research for applicability to a policy site context. In their example, they located five studies that measured the benefit of white water rafting. They then filtered the studies by three idealized technical considerations:

> (1) the nonmarket commodity of the site must be identical to the nonmarket commodity to be valued at the policy site; (2) the populations affected by the nonmarket commodity at the study site and the policy site have identical characteristics; and (3) the assignment of property rights at both sites must lead to the same theoretically appropriate welfare measure (e.g., willingness to pay versus willingness to accept compensation) (p. 659).

Their filtering of each study based on these considerations left them with no ideal benefit measures to transfer to their policy site. They state that this is likely to be the case for many transfer scenarios in which "a small number of potential study sites are available and the value(s) estimate at these study sites may not be applicable to the issue at the policy site" (p. 660). Therefore, when performing critical single point estimate benefit transfers, the original reporting of the study results must be obtained in order to determine its applicability to the evaluation issue at hand.

Another potentially critical aspect of benefit transfer is the defensibility of transferred values. Defensibility can be defined on two feasibility dimensions—technical and political. Technical feasibility is inversely related to the degree of technical and theoretical consistency between the study site context and the policy site context. Political feasibility is highly context- and scale-dependent, accounting for an array of social and cultural factors. The context surrounding each benefit transfer can be unique, meaning there is no single set of protocols that can be objectively followed. Benefit transfer is as much an art as it is a science. However, quite often information can be transferred with varying levels of confidence. A confidence interval for transferred point estimates can be calculated if the original study reports the standard error of the estimate. This confidence interval provides the statistical range in which we would expect the estimate to be some large percentage of the time (e.g., a 95% confidence interval means the estimate would be within the calculated range 95% of the time).

Example application: Background. The example that we will follow throughout the remainder of this report is hypothetical. We will be using this example to illustrate some of the issues when performing benefit transfers using the various approaches as they are discussed. Since this report is not intended to be a short course in nonmarket valuation, judgments concerning the validity, applicability, and quality of the valuation methodology used in each of the empirical studies are left to the benefit transfer practitioner.

The example application we will use to illustrate each of the transfer methods is to provide a per person activity day use value estimate for mountain biking in the Allegheny National Forest in north central Pennsylvania. The estimate can be used to either value current use on an existing trail or to value predicted use for a proposed trail. The total value of mountain biking in the forest can then enter into a resource allocation decision, assessment of a proposed forest plan, or accounting of the value of forest outputs. We will assume that this use of the national forest is important, but due to budgetary restrictions primary research is precluded. Therefore, we will attempt to use benefit transfer to provide a credible measure of the net benefits of an activity day of mountain biking in the forest. All measures will be reported in fourth-quarter 1996 dollars. Inflationary indexing such as the implicit price deflator can be used to adjust benefit measures to current dollars.

Example of a single point estimate transfer. We assume that the information requirements for steps 1 through 3 of figure 3 have been fulfilled. We will therefore begin with step 4, which is "search the literature for relevant study sites." Using appendix C, table C9, we find three biking studies referenced. Based on cross-referencing with the annotated bibliography, these three studies are Bergstrom and Cordell (1991), Fix and Loomis (1998), and Siderelis and Moore (1995).

Bergstrom and Cordell (1991) provide national zonal travel cost models for several recreation activities.

Their models were primarily developed using PARVS (Public Area Recreation Visitors Study) data. The authors identify several limitations of their models based on assumptions they have made in developing these models from the data. In particular, they have provided a benefit measure for biking. However, biking within the context of their study is a conglomerate of touring, leisure riding, and mountain biking, among others. Therefore, the benefit measure they provide is not specific to mountain biking, but to bicycling in general.

Siderelis and Moore (1995) investigate the net benefits of bicycling and walking on abandoned railroad beds that have been recycled to a rail-trail for recreation and transportation purposes. Their investigation used an onsite interview with followup mail questionnaire. Their research sites included the Heritage Trail that traverses a rural area in Iowa, the St. Marks Historic Railroad Trail that traverses a rural area with small towns in Florida, and the Lafayette/Moraga Trail that traverses a dense urban to suburban area in California. Bicycling on these trails was the dominant use of the trail for the Iowa and Florida trails, while walking was the dominant use of the California trail. Therefore, the reported values for the first two trails are primarily measures of biking value. Biking in this study was for leisure and transportation, not specifically mountain biking.

Fix and Loomis (1998) provide us with two estimates specifically for mountain biking. They use the individual travel cost and the contingent valuation methods to provide benefit estimates for mountain biking at the famed Slickrock Trail in Moab, Utah. Their data was collected using onsite surveys.

Each of the above studies should be assessed for relevance and applicability to the policy site issue. Several factors that can be assessed have been listed previously. For instance, the Bergstrom and Cordell (1991) study provides a general benefit measure for a generic bicycling day anywhere in the nation. Siderelis and Moore (1995) provide benefit measures for bicycling rail-trails for a specific region of the United States. And Fix and Loomis (1998) provide benefit measures for mountain biking, but in a high-profile, world-class site in Moab, Utah. Each study has positive and negative context-dependent aspects affecting their perceived relevance and applicability. However, for this example, we will assume each study is relevant, providing us with credible benefit measures.

Therefore, according to the annotated bibliography (appendix A), the three studies provide five estimates we could use for benefit transfer (table 2). We may conclude that the benefit of mountain biking on the proposed trail ranges from $18 to $63 per activity day. We do not know where in this range, if at all, the actual benefit of the proposed trail would be without conducting primary research. However, we may be able to use expert judgment concerning where in this range we believe a defensible measure would be given the context of the policy site and proposed action. For example, the Allegheny National Forest site is probably closer in composition to the Iowa trail than to the sandstone Slickrock Trail in Moab. Thus, the best single point estimate would be in the $34 range. Whether it would be slightly more or less than this estimate depends on the similarity of characteristics of the trail in the Allegheny National Forest and the confidence interval surrounding this estimate (which is not recorded in the study report, but may be available from the authors).

Average value transfer

An average value transfer is based on using a measure of central tendency of all or subsets of relevant and applicable studies as the transfer measure for a policy site issue. The primary steps to performing an average value transfer include identifying and quantifying the management- or policy-induced changes on recreation use, and locating and transferring a "unit" average consumer surplus measure. The text box (figure 4) provides a more detailed list of the steps involved in average value transfers.

It is a common practice for federal public land agencies to use administratively approved average values in assessing management and policy actions. The USDA

Table 2. Single point estimates from the literature for the hypothetical mountain biking transfer.

Measure	95% Confidence Interval	Source
$17.61	Not available	Bergstrom and Cordell
$34.11	Not available	Siderelis and Moore (Iowa trail)
$56.27	Not available	Siderelis and Moore (Florida trail)
$54.90	$33–$161	Fix and Loomis (Travel cost method)
$62.88	$54–$77	Fix and Loomis (Contingent valuation method)

AVERAGE VALUE TRANSFER

1. Identify the resources affected by a proposed action.
2. Translate resource impacts to changes in recreational use.
3. Measure recreation use changes.
4. Search the literature for relevant study sites.
5. Assess relevance and applicability of study site data.
6. Use average value provided in table 3 for that region or use an average of a subset of study measures.
7. Multiply benefit measure by total change in recreation use.

Figure 4. Steps to performing an average value transfer.

Forest Service has used RPA (Resources Planning Act) values since 1980 (USDA Forest Service 1989)[4]. These RPA values have been provided for groups of activities and Forest Service regions of the country. Along a similar vein, the U.S. Bureau of Reclamation and the U.S. Army Corps of Engineers have relied upon the U.S. Water Resources Council's "unit day values" for decades (U.S. Water Resources Council 1973, 1979, 1983). While some of the unit day values may not have been based directly on the emerging literature on outdoor recreation use values and measures, they have all been influenced to a certain degree by this literature. Past RPA average values were provided for each USDA Forest Service Region. However, this segregation results in two problems: (1) very small sample sizes per activity/region cell, and (2) numerous activity/region cells with no average value (because of the lack of primary research). To address both of these problems, the Forest Service regions are aggregated into RPA assessment regions with the Pacific Coast Area and Alaska being separately reported.

Table 3 provides measures of central tendency (mean, median, and 95% confidence intervals) of consumer surplus per activity day per person for 21 primary recreation activities, plus values for wilderness recreation, as defined by the USDA Forest Service (1989). These activity day values are provided for various regions of the United States and Canada. We report both mean and median values for all regional estimates, and confidence intervals for recreation activity estimates based on all activity-specific data. Under conditions of a normal distribution, mean and median estimates will be equal. Large divergences between these two measures indicate that the distribution of the estimates is skewed. That is, the average value is affected by large or small estimates. The effect of "outlier" estimates can be large when the total number of estimates is small. In addition, it is evident that margin of error is related to sample size.

In addition to the average values provided in table 3, subset average values can be calculated. For example, upon reviewing the literature behind the average values in table 3 the benefit transfer practitioner may determine that one or more of the inclusive studies is not applicable or may be influenced by atypically large values. The practitioner can then recalculate an average value based on the individual estimates that are judged applicable or use a rigorous statistical test to identify potential outlier values (Barnett and Lewis 1994).

Example of an average value transfer. To continue with our example transfer for mountain biking benefits of a trail in Allegheny National Forest, let us assume that none of the point estimates previously gathered match perfectly. Instead, maybe a benefit measure that is based on all three studies would be preferable. Using table 3, we search the northeast for an average value for biking. The average value is $34.11; however, it is based on a single estimate—the Siderelis and Moore (1995) estimate for Iowa. A measure that is based on all three studies would be the total U.S. studies column of table 3. The average of all five studies is $45.15. Alternatively, an average of the most closely matching studies ($34.11 for Iowa, $56.27 for Florida, and $17.61 for the nation) would be $36.00. Professional judgment determines which average value is most appropriate for the Allegheny National Forest site.

[4]The Resources Planning Act office of the USDA Forest Service is now the Strategic Planning and Resource Assessment office. However, reference to published value estimates and objectives of this group will be located under RPA. We will use RPA when referring to its history.

Table 3. Recreation activity day values per person by various geographic locations.

Activity	Northeast Area studies[a] RPA1			Southeast Area studies[a] RPA2			Intermountain Area studies[a] RPA3			Pacific Coast Area studies[a] RPA4			Alaskan studies[a] RPA5		
	n	Mean	Median	n	Mean	Median	n	Mean	Median	n	Mean	Median	n	Mean	Median
Camping	7	$24.34	$6.50	10	$21.90	$5.14	18	$25.87	$24.09	4	$86.96	$77.27			
Picnicking	2	47.04	42.11	2	30.52	30.52	4	22.95	24.09	3	53.52	28.95			
Swimming	3	16.37	3.52	3	22.87	16.75	1	24.62	24.62	4	22.74	18.41			
Sightseeing	2	101.19	101.19	5	60.85	67.10	10	13.22	12.23	1	50.64	50.64	1	$13.20	$13.20
Off-road diving				1	4.37	4.37	1	11.76	11.76	1	33.64	33.64			
Motor boating	1	66.75	66.75	2	8.40	8.40	6	47.93	29.31	4	21.69	11.48			
Float boating	4	52.99	39.85	3	45.86	26.93	10	77.68	40.36				1	15.13	15.13
Hiking	3	62.65	70.54	5	61.47	17.39	5	31.85	29.66	14	26.71	22.87	1	12.93	12.93
Biking	1	34.11	34.11	1	56.27	56.27	2	58.89	58.89						
Downhill skiing							3	33.02	33.93	1	20.90	20.90			
Crosscountry skiing	3	28.83	28.83				7	24.90	22.79	1	40.32	40.32			
Snowmobiling							2	69.97	69.97						
Big game hunting	54	45.46	39.00	29	35.89	32.23	72	43.56	36.40	12	40.76	29.42	5	52.40	48.47
Small game hunting	3	36.73	30.46				13	25.75	27.71	1	27.37	27.37			
Waterfowl hunting	23	32.09	18.21	11	17.70	15.41	19	37.18	18.21	5	33.19	30.82	1	60.08	60.08
Fishing[b]	43	31.16	15.41	13	27.74	18.21	42	40.82	21.68	15	36.97	22.41	1	39.22	39.22
Wildlife viewing	56	26.06	25.61	39	29.13	27.80	39	36.10	32.22	15	29.74	31.65	7	42.12	52.92
Horseback riding															
Rock climbing	1	85.74	85.74				3	42.04	45.34						
General recreation[c]	5	14.06	7.47	7	19.66	7.25	11	42.09	14.04	2	22.27	22.27	3	8.92	10.03
Other recreation[d]				4	25.06	23.91	10	46.96	35.23	1	62.06	62.06			
Wilderness recreation	4	19.64	20.20	3	81.95	17.39	8	49.24	29.30	13	31.29	22.53	1	12.98	12.98
Total # cases (N)[e]	211			135			277			84			20		

[a]*Forest Service Regions per area are: Northeast Area = R9; Southeast Area = R8; Intermountain Area = R1, R2, R3, R4; Pacific Coast Area = R5, R6; and Alaskan Area = R10.*

[b]*Fishing values include different species, different bodies of water, and different angling techniques. The majority of the fishing benefit measures are from studies conducted between 1979 and 1988. Fishing was not a primary target of the literature review since it is the focus of a different project. Updated fishing values will be provided at the completion of the other project.*

[c]*General recreation is defined as a composite of recreation opportunities at a site with measure for site, not a specific activity.*

[d]*Other recreation is defined as sites with recreation opportunities that are undefined or obscure, such as cliff diving and mountain running.*

[e]*Total number of cases excludes Wilderness recreation as some of these estimates are a subset of other various recreation activities (see bibliography for identification of sources).*

[f]*Margin of error is calculated at the 95% confidence limit based on standard error of mean estimates (table 1). Confidence range illustrates magnitude of the range based on the data in which a mean estimate would lie with 95% confidence.*

Average value estimates, however, are no better than the data they are based on. All of the issues that could be raised concerning the credibility of any single measure are also relevant for an average value based in part on that measure.

Benefit Function Transfers

Benefit function transfers entail the use of a model that statistically relates benefit measures with study factors such as characteristics of the user population and the resource being evaluated. Benefit function transfers usually come from two sources. First, a benefit function or demand function has been estimated and reported for a recreation activity in a geographic location through primary research. Second, meta regression analysis functions can be estimated from several independent primary research projects. In either case, the transfer process entails adapting the function to the characteristics and conditions of the policy site, forecasting a tailored benefit measure based on this adaptation of the function, and use of the forecast measure for evaluating the policy site.

Demand function transfer

The transfer of an entire demand function is conceptually sounder than value transfers. This is because the benefit estimates and use rates in recreation are a complex function of site characteristics, user characteristics, and different spatial and temporal dimensions of recreation site quality and site choice. When transferring a point estimate from a study site to a policy site, it is assumed or is implied that the two sites are identical across the various factors that determine the level of benefits derived in recreational use of the two sites. In the case of an average value transfer, it is assumed that the benefits of the policy site are around the mid-level of benefits measured for the study sites incorporated into the average value calculation. However, based on different validity and reliability assessments of point estimate and average value transfers, this is not always the case. The invariance surrounding the transfer of benefit measures alone makes these transfers insensitive or less robust to significant differences between the study site(s) and the policy site. Therefore, the main advantage of transferring an entire demand function to a policy site is the increased precision of tailoring a benefit measure to fit the characteristics of the policy site. It is in the adaptation stage of forecasting a benefit measure from a study site demand function that the additional value of the transfer method is realized (figure 5).

Disadvantages of the method are primarily due to data collection and model specification in the original research effort. Factors in the demand function may be relevant to the study site but not to the policy site. Also, factors that are important to demand at the policy site may not have been collected at the study site or were not significant in determining demand at the study site. These factors can have distinct effects on the tailored benefit measures at a policy site. This is evident in validity tests of benefit function transfers in which error in the tailored value ranged from as low as a few percentage points to as high as 800% (Loomis and others 1995; Downing and Ozuna 1996; Kirchhoff and others 1997). In comparative validity tests, demand function transfers were found to outperform (lower error) point estimate transfers. Therefore, demand function transfers may be an improvement over point estimate transfers but are still a second-best strategy to recreation valuation.

DEMAND AND BENEFIT FUNCTION TRANSFER

1. Identify the resources affected by a proposed action.
2. Translate resource impacts to changes in recreational use.
3. Measure recreation use changes.
4. Search the literature for relevant study sites.
5. Assess relevance and applicability of study site data and whether demand or benefit function is specified.
6. Adapt demand or benefit function to policy site characteristics and forecast benefit measure.
7. Multiply tailored benefit measure by total change in recreation use.

Figure 5. Steps to performing a demand function transfer.

We have not identified those studies in the literature review that reported demand or benefit equations (functions). The applicability of demand functions to policy site transfers requires an intimate knowledge of the policy site. In addition, the specification of individual demand functions can have significant effects on the reliability of their use under varying circumstances. If a demand function transfer is sought, then the transfer practitioner will have to use insight and expert judgment concerning the applicability of potentially transferable demand functions, the details of which are well beyond the scope of this report. Good illustrative examples of benefit function transfers are provided by Loomis and others (1995), Downing and Ozuna (1996), and Kirchhoff and others (1997).

Example of a demand function transfer. The adaptation of a demand function from a study site to a policy site can be complex and lead to a large error. This error can be influenced by dissimilarities between site and user population characteristics of the study site and policy site. Critical demand/benefit function transfer requires strong knowledge of economic methodology and estimation of consumer surplus. Therefore, it is highly recommended that when attempting to perform a demand function transfer you either have the requisite knowledge or solicit the aid of someone who does.

A demand function relates the number of occasions of an activity (typically as trips or days) to the price paid (travel costs including direct variable costs and travel time costs) (TC), characteristics of a site (SC), socioeconomic characteristics of the user population (SEC), and substitute site information (SubTC). This demand function would look something like:

$$\#\text{ of Occasions} = \beta_0 + \beta_1{*}TC + \beta_2{*}SubTC + \beta_k{*}SC + \beta_m{*}SEC. \quad (2)$$

The adaptation entails substituting equivalently measured information relevant to the policy site for the variables in the demand function. This adaptation then forecasts the lefthand side of the demand equation or number of occasions. Based on this adapted demand function, consumer surplus per day can be calculated. In some cases, this estimation of consumer surplus and conversion to per activity day is difficult.

For direct methods to estimating consumer surplus via stated preference, a bid or willingness to pay function is typically defined. The bid function relates consumer surplus or willingness to pay to quantity and/or quality of the activity or environmental resource (Q), characteristics of a site (SC), and socioeconomic characteristics of the user population (SEC). This function would look something like:

$$WTP = b_0 + b_1{*}Q + b_k{*}SC + b_m{*}SEC. \quad (3)$$

Returning to our mountain biking example, we have several demand functions that could be transferred to our policy site. It can be argued that Siderelis and Moore's (1995) Iowa trail demand function is the best for our purposes. This is because the Fix and Loomis (1998) mountain biking study, although activity-specific, has noncomparable site characteristics between their site and our policy site. Siderelis and Moore's (1995) Florida trail model is neither activity-specific nor of comparable site characteristics. And Bergstrom and Cordell's (1991) national model for biking is not activity specific or site specific. Therefore, Siderelis and Moore's (1995) Iowa model is the closest to matching the issue for our hypothetical policy site—dirt-trail biking.

Siderelis and Moore (1995) estimate an individual travel cost model of the form:

$$\ln Trips = 3.62 + 1.511 - 0.033TC + 0.70W - 0.16A1 \quad (4)$$

where the dependent variable ($\ln Trips$) is the natural logarithm of the number of trips, *TC* is the virtual price or travel costs (including direct variable costs of travel and wage rate value of travel time), *W* is whether the individual was using the Iowa trail for walking (versus bicycling), and *A*1 is the percentage of a group who is 26 years of age or less.[5] Average consumer surplus per trip is the area below the demand function and above the average price line (figure 2). For a semi-log function form, an approximation of average per trip consumer surplus is $-(1/\beta_{TC})$, where β_{TC} is the travel cost parameter (Adamowicz and others 1989). Thus, average consumer surplus per trip is $34.25 (adjusted to 1996 dollars).[6] We are not provided with information necessary to calculate a 95% confidence interval for this measure.

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[5] *Siderelis and Moore (1995) estimate six different models for the Iowa trail. They use this model to estimate consumer surplus per trip, which is subsequently the estimate recorded throughout this document and the database. Therefore, we will restrict our transfer exercise to this model.*

The model estimated is a count data model using a negative binomial regression technique. Count data models are suggested for trip data in which the dependent variable is reported in integers (no partial trips) and restricted to be nonnegative (no negative trips). Negative binomial specifications automatically take the natural log of the dependent variable. For more information on count data travel cost models, see the discussion by Siderelis and Moore (1995) or Creel and Loomis (1990).

[6] *The difference between this estimate and Siderelis and Moore's (1995) estimate of $34.11 (in comparable dollars) is that the authors of the original research used Simpson's rule for approximating integrals for calculating consumer surplus.*

One of the disadvantages to transferring a demand function of the semi-log functional form is that consumer surplus is invariant in (or exogenous to) the demand model. That is, changes in the levels of the explanatory variables in the model are captured in the predicted use levels, but not in the estimate of average consumer surplus per trip. Adamowicz and others (1989) identify demand specifications in which quantity and price measures endogenously determine consumer surplus measures. Applying a benefit function with endogenously determined consumer surplus is similar to the application of the meta analysis benefit function discussed in the next section. However, one use of the Iowa trail model would be to predict the market area and use levels for the Pennsylvania trail.

Meta regression analysis benefit function transfer

Meta regression analysis is the statistical summarizing of relationships between benefit measures and quantifiable characteristics of studies. The data for a meta analysis is typically summary statistics from study site reports and includes quantified characteristics of the user population, study site's environmental resources, and valuation methodology used. Coding of the studies included in the literature review (as previously described) lends itself directly to the estimation of a meta analysis benefit function. However, interpretation of original study results can be a source of error in meta analysis databases.

Advantages and disadvantages

Meta analysis has been traditionally concerned with understanding the influence of methodological and study-specific factors on research outcomes and providing summaries and syntheses of past research. A more recent use of meta analysis is the systematic utilization of the existing value estimates from the literature for the purpose of benefit transfer. Essentially, meta analysis regression models can be used to forecast benefits at policy sites. Meta analysis has several conceptual advantages over other benefit transfer methods such as point estimate and demand function transfers:

- Meta analysis utilizes information from a greater number of studies, thus providing more rigorous measures of central tendency that are sensitive to the underlying distribution of the study site measures.
- Methodological differences can be controlled when calculating a value from the meta analysis function.
- By setting the independent variables (adapting the function) at levels specific to the policy site, the transfer practitioner is potentially accounting for differences between the study sites and the policy site.
- Multi-activity, multi-site meta analyses can provide estimates for regions in which no studies were conducted for an activity. That is, meta analysis can forecast estimates for new or unstudied sites.

Many of the same limitations to performing benefit transfers in general are applicable to meta analysis (Desvousges and others 1998):

- There should be enough original studies conducted so that statistical inferences can be made and relationships modeled.
- A meta analysis can only be as good as the quality of past research efforts. This quality includes the scientific soundness of the original research and the reporting of results and summary statistics on original data samples that are rich in detail.
- The studies should be similar enough in content and context that they can be combined and statistically analyzed.

Similar to demand function transfers, the main advantage of forecasting measures for a policy site via a meta analysis benefit function is the increased sensitivity of the tailored benefit measure to characteristics of the policy site. It is in the adaptation stage of forecasting a benefit measure from meta analysis benefit function that the additional value of the transfer method is realized (figure 6). An additional advantage of the meta analysis approach over a demand function approach is its ability to discern the effect of different factors on the level of benefit estimates provided in the literature.

An outdoor recreation meta analysis benefit function

As stated previously, a master coding sheet was developed that contains 126 fields. The main coding categories include study reference, benefit measure(s), methodology used, recreation activity investigated, recreation site characteristics, and user population characteristics. Table 4 lists and defines the variables

META ANALYSIS FUNCTION TRANSFER

1. Identify the resources affected by a proposed action.
2. Translate resource impacts to changes in recreational use.
3. Measure recreation use changes.
4. Adapt meta regression analysis benefit function (table 5) to policy site characteristics and forecast benefit measure or select appropriate forecast measure from meta forecasted measures (table 6)
5. Multiply tailored benefit measure by total change in recreation use.

Figure 6. Steps to performing a meta regression analysis function transfer.

Table 4. Description of variables tested in the meta analysis.

Variable	Description
Dependent variable	
CS	Consumer surplus (CS) per person per activity day (1996 dollars)
Method variables	
METHOD	Qualitative variable: 1 if stated preference (SP) valuation approach used; 0 if revealed preference (RP) approach used
DCCVM	Qualitative variable: 1 if SP and dichotomous choice elicitation technique was used; 0 if otherwise
OE	Qualitative variable: 1 if SP and open-ended elicitation technique was used; 0 if otherwise
ITBID	Qualitative variable: 1 if SP and iterative bidding elicitation technique was used; 0 if otherwise
PAYCARD	Qualitative variable: 1 if SP and payment card elicitation technique was used; 0 if otherwise
CONJOINT	Qualitative variable: 1 if SP and conjoint analysis technique was used; 0 if otherwise
SPRP	Qualitative variable: 1 if SP and RP used in combination; 0 if otherwise
ZONAL	Qualitative variable: 1 if RP and a zonal travel cost model was used; 0 if otherwise
INDIVID	Qualitative variable: 1 if RP and an individual travel cost model was used; 0 if otherwise
RUM	Qualitative variable: 1 if RP and a random utility model was used; 0 if otherwise
HEDONIC	Qualitative variable: 1 if RP and a hedonic travel cost model was used; 0 if otherwise (omitted category for METHOD) [0.024, 0.15][a]
TTIME	Qualitative variable: 1 if RP model included travel time; 0 if otherwise
SUBS	Qualitative variable: 1 if RP model included substitute sites; 0 if otherwise
ONSITE	Qualitative variable: 1 if sample frame was on-site; 0 if otherwise
MAIL	Qualitative variable: 1 if primary data collection used mail survey type; 0 if otherwise
PHONE	Qualitative variable: 1 if primary data collection used phone survey type; 0 if otherwise
INPERSON	Qualitative variable: 1 if primary data collection used in-person survey type; 0 if otherwise
SECOND	Qualitative variable: 1 if secondary data was used (omitted category for data collection) [0.063, 0.24][a]
LINLIN	Qualitative variable: 1 if functional form was linear on both dependent (d.v.) and independent variables (i.v.); 0 if otherwise
LOGLIN	Qualitative variable: 1 if functional form was log d.v. and linear i.v.; 0 if otherwise
LOGLOG	Qualitative variable: 1 if functional form was log on both d.v. and i.v.; 0 if otherwise
LINLOG	Qualitative variable: 1 if functional form was linear on d.v. and log on i.v.; 0 if otherwise (omitted category for functional form) [0.003, 0.05][a]
VALUNIT	Qualitative variable: 1 if CS was originally estimated as per day; 0 if otherwise (e.g., trip, season, or year)
TREND	Qualitative variable: year when data was collected, coded as 1967 = 1, 1968 = 2,…, 1996 = 30

(cont.'d)

Table 4 (Cont.'d)

Variable	Description
Site variables	
RECQUAL	Qualitative variable: site quality variable coded as 1 if the author stated site was of high quality or the site was either a National Park, National Recreation Area, or Wilderness Area; 0 if otherwise
FSADMIN	Qualitative variable: 1 if the study site(s) were National Forests (i.e., administered by the U.S. Forest Service [FS]); 0 if otherwise
R1	Qualitative variable: 1 if study sites were in FS Region 1 (Montana, No. Idaho); 0 if otherwise
R2	Qualitative variable: 1 if study sites were in FS Region 2 (Wyoming, Colorado); 0 if otherwise
R3	Qualitative variable: 1 if study sites were in FS Region 3 (Arizona, New Mexico); 0 if otherwise
R4	Qualitative variable: 1 if study sites were in FS Region 4 (Nevada, Utah, So. Idaho); 0 if otherwise
R5	Qualitative variable: 1 if study sites were in FS Region 5 (California); 0 if otherwise
R6	Qualitative variable: 1 if study sites were in FS Region 6 (Oregon, Washington); 0 if otherwise
R8	Qualitative variable: 1 if study sites were in FS Region 8 (Southern United States east of Rocky Mountains); 0 if otherwise
R9	Qualitative variable: 1 if study sites were in FS Region 9 (Northern United States east of Rocky Mountains); 0 if otherwise
R10	Qualitative variable: 1 if study sites were in FS Region 10 (Alaska); 0 if otherwise
NATL	Qualitative variable: 1 if study sites were the entire United States; 0 if otherwise
CANADA	Qualitative variable: 1 if study sites were in Canada; 0 if otherwise (omitted category for geographic location of study site) [0.015, 0.12][a]
LAKE	Qualitative variable: 1 if the recreation site was a lake; 0 if otherwise
RIVER	Qualitative variable: 1 if the recreation site was a river; 0 if otherwise
FOREST	Qualitative variable: 1 if the recreation site was a forest; 0 if otherwise
OCEAN	Qualitative variable: 1 if the recreation site was an estuary or bay of an ocean; 0 if otherwise (omitted category for site type) [0.169, 0.37][a]
PUBLIC	Qualitative variable; 1 if ownership of the recreation site was public; 0 if otherwise.
DEVELOP	Qualitative variable: 1 if the recreation site had developed facilities, such as picnic tables, campgrounds, restrooms, boat ramps, ski lifts, etc.; 0 if otherwise.
NUMACT	Quantitative variable: the number of different recreation activities the site offers.
Recreation activity variables	
CAMP . . . OTHERREC	Qualitative variables: 1 if the relevant recreation activity was studied; 0 if otherwise. Where CAMP is camping, PICNIC is picnicking, SWIM is swimming, SISEE is sightseeing, OFFRD is off-road driving, NOMTRBT is float boating, MTRBOAT is motor boating, HIKE is hiking backpacking, BIKE is biking, DHSKI is downhill skiing, XSKI is cross-country skiing, SNOWMOB is snowmobiling, BGHUNT is big game hunting, SMHUNT is small game hunting, WATFOWL is waterfowl hunting, FISH is fishing, WLVIEW is wildlife viewing, HORSE is horseback riding, ROCKCL is rock climbing, GENREC is general recreation (defined as a composite of recreation activity opportunities at a site), and OTHERREC is other recreation (for sites with recreation opportunities undefined or obscure—omitted category for recreation activity) [0.015, 0.12][a]

[a]*Mean and standard deviation for omitted categories reported in square brackets; N = 701.*

tested in developing a meta regression analysis benefit transfer function. The majority of the variables are qualitative dummy variables coded as 0 or 1, where 0 means the study does not have a characteristic and 1 means that it does. For example, if a study was conducted on a lake in New York, then R9 and LAKE would be coded as 1 while all other FS regions, FOREST, and RIVER would be coded as 0. The variables are grouped in table 4 according to whether they are methodological, site, or activity specific variables.

The user population characteristics were rarely reported with the results of a study. Other means for obtaining data on user population characteristics, such as contacting the researchers of the study, were not feasible given the financial and time constraints of the project. We did attempt to proxy user population characteristics by using 1990 U.S. Census average values for income, gender, education, age, and race, for the state in which the study was conducted, but found in preliminary analysis that these proxies were broadly insensitive to differences in benefit measures provided. Using U.S. Census average values at the county level and for the period in which the original study data was collected may be a viable alternative for future investigations. However, the lack of user population characteristics will be an additional limitation on the validity and reliability of the meta analysis function.

The meta analysis model is of the basic form:

$$y_i = \alpha + \beta' x_i + \varepsilon_i, \quad (5)$$

where *i* indexes each observation, *y* is the dependent variable (consumer surplus per person per activity day adjusted to 1996 dollars), α and β are parameters to be estimated and are respectively the intercept and slope coefficients for the model, *x* is a matrix of explanatory variables including methodology, site, and activity characteristics, and *e* is the classical error term with mean zero and variance σ^2_ε.

Some of the studies are not included in the meta analysis because of the lack of reporting of key information that would enable their full coding. Therefore, the meta analysis database consists of 701 estimates from 131 separate studies. The number of estimates per study ranged from 1 to 134. As identified in previous meta-analyses, the panel nature of the data can lead to econometric problems. If there is correlation among these multiple observations for each study, then a classical ordinary least-squares regression will be inefficient and inconsistent in estimated parameters. We tested for panel effects using various forms of stratifying the data (including the most obvious stratification by study) (Rosenberger and Loomis 2000). However, panel effects were not discernible with these tests. Therefore, we use classical ordinary least-squares with the robust Newey-West version of White's consistent covariance estimator to estimate the model (Smith and Kaoru 1990; Driscoll and Kraay 1998).

There is no precedent for choice of functional form when conducting meta-analyses. The functional form of the meta analysis models are linear in the dependent variable and the quantitatively defined variables, with the majority of the variables being qualitative dummy variables as previously noted. We tested and rejected logarithmic transformations of the quantitatively defined variables, finding the linear specification to be most efficient.

The meta analysis benefit transfer model (table 5) was optimized by retaining only those variables that were significant at an 80% level of confidence or better based on *t*-statistics. This optimization is necessary in order to reduce over-specification of the model when retaining variables whose coefficients are not significantly different than zero. A backward elimination procedure was used to optimize the benefit transfer model. The procedure began with the full specification of the model using all coded variables and sequentially eliminated the least significant variable until all remaining variables are significant at the 80% confidence level or better ($p = 0.20$).

The meta analysis benefit transfer model (table 5) has an adjusted R^2 of 0.27, meaning that 27% of the variance in the benefit measures is explained by the model. This is consistent with other meta analyses of recreation valuation studies (Walsh and others 1992; Smith and Kaoru 1990). A full meta regression analysis of the data investigating methodological, site, and activity factor effects and other nuances of the data can be found in Rosenberger and others (unpublished paper). Both models (the full and optimized meta regression models) have a standard error of 1.22, which means that at a 95% confidence limit they have a 7% margin of error in prediction.

For the most part, the signs of the methodology variables are consistent with past scientific results. *METHOD* is negative, meaning that stated preference (SP) methods yield lower benefit estimates than revealed preference (RP) methods, which is consistent with previous meta analysis results (Walsh and others 1992) and the bulk of travel cost/contingent valuation comparison studies (Carson and others 1996). Open-ended (*OE*), iterative bidding (*ITBID*), combined stated and revealed preference (*SPRP*), payment card (*PAYCARD*), and conjoint analysis (*CONJOINT*) contingent valuation elicitation techniques tend to further increase the difference between SP and RP value estimates, which is consistent with comparison studies (Brown and others 1996). For RP estimates, individual and zonal travel cost methods (*INDIVID* and *ZONAL*, respectively) and random utility models (*RUM*) produce relatively lower benefit estimates than hedonic property and travel cost methods (*HEDONIC*). The inclusion of substitute sites in a demand model (*SUBS*) lowers the benefit estimate (Rosenthal 1987). The use of phone surveys (*PHONE*) yields lower benefit estimates than either in-person or mail surveys. *VALUNIT* is negative, suggesting that if the original study estimated benefits in units such as per trip or per season, then this tended to yield higher per day estimates than those already reported in activity day units. Therefore, either (1) there may be a recall bias introduced when requesting values per trip, season, or year as compared to per day estimates, (2) per day estimates understate the total trip or season value when aggregated, or (3) our estimate of number of days per trip or season are understated. The *TREND* variable shows that benefit estimates generally have been increasing at a greater

Table 5. Optimized meta analysis national benefit transfer model.

Variable	Coefficient	White's standard error[a]	Mean of variable
Constant	81.273*	15.97	—
METHOD	–21.586*	10.12	0.636
DCCVM	–36.981*	10.44	0.177
OE	–51.762*	11.01	0.354
ITBID	–46.399*	10.89	0.096
SPRP	–57.796*	17.31	0.006
PAYCARD	–83.192*	17.85	0.006
CONJOINT	–74.028*	14.44	0.001
PHONE	–15.253*	4.28	0.495
INDIVID	–40.147*	12.71	0.153
ZONAL	–55.699*	11.29	0.185
RUM	–58.422*	11.82	0.027
SUBS	–17.619*	6.33	0.264
VALUNIT	–9.072*	3.92	0.412
TREND	0.980*	0.47	19.331
FSADMIN	–17.822*	3.70	0.127
R1	11.407*	5.41	0.053
R4	5.529	3.32	0.111
R6	–10.838*	4.01	0.058
R8	–5.128*	2.53	0.187
LAKE	–18.294*	6.06	0.048
RIVER	16.788*	8.09	0.041
FOREST	–9.165	4.98	0.292
PUBLIC	13.311*	4.42	0.960
SWIM	–15.513	8.14	0.010
OFFRD	–17.336	12.23	0.004
NOMTRBT	13.808	8.26	0.014
BIKE	–14.306	8.54	0.007
XSKI	–5.937	3.72	0.006
SNOWMOB	–20.919*	9.31	0.001
BGHUNT	15.387*	3.72	0.252
WATFOWL	9.894*	4.29	0.084
FISH	7.057	4.31	0.174
ROCKCL	62.027*	17.66	0.006
Adjusted R^2	0.27		
F-stat [33, 667]	8.76*		
N	701		

**Variable is statistically significant at the p < 0.05 level or better. Overall margin of error is ±7% based on a standard error of 1.22 and 95% confidence limits.*

[a]Standard errors are corrected for heteroskedasticity and serial correlation using the robust Newey-West version of White's covariance consistent estimator and 11 periods (Smith and Karou 1990; Driscoll and Kraay 1998).

rate than inflation over time, or annually about one dollar per activity day per person.

USDA Forest Service administered sites (*FSADMIN*) yield lower benefit estimates. These sites, however, are juxtaposed to sites designated to be of higher quality (e.g., National Parks, State Parks, and National Wildlife Refuges). Therefore, it is plausible that USDA Forest Service sites would have somewhat lower recreation value than these other sites. Relatively speaking, estimates for recreation activities for Forest Service regions 1 and 4 are higher, while estimates for Forest Service regions 6 and 8 are lower than the composite base of the remaining estimates for other regions, the nation, and Canada.

LAKE has a negative sign, meaning that lake recreation has lower values than recreation activities in bays/oceans. This makes more sense when we consider that reservoirs were coded as lakes in this analysis. River recreation (*RIVER*) yields higher values than bay/ocean recreation. Estimates for recreation activities on forested lands (*FOREST*) are lower than bay/ocean recreation estimates, which is consistent with the *FSADMIN* variable. *PUBLIC* lands provide higher valued recreation than private areas, in general. One possible explanation is that private areas charge substantially more for access and onsite facilities and services than public areas. Therefore, private areas extract some of the consumer surplus from visitors, while visitors to public areas are charged much lower prices, retaining most of their consumer surplus (figure 2).

The recreation activities significant in the model are self-explanatory. Some activities (*SWIM, OFFRD, BIKE, XSKI, SNOWMOB*) provide relatively lower benefits than the composite recreation activity (composed of all omitted or insignificant activity variables), while other activities (*NOMTRBT, BGHUNT, WATFOWL, FISH, ROCKCL*) yield relatively higher values.

Variables that were tested but not found significant in the national meta analysis benefit transfer model are listed in figure 7. Any variables definitive of the user populations are necessarily left out of the model due to the lack of data.

Convergent validity of meta analysis benefit transfer model

We tested the meta analysis benefit function model for in-sample convergent validity. That is, we tested the accuracy of the benefit function model in forecasting the raw average values for each activity in all regions where data existed. We found the model performed well. While the forecast values ranged from 73% to 319% of the raw average values, the median difference was only 1%. The model forecasted within 50% of the raw average values primarily for those activities with a relatively large amount of data (*BGHUNT, FISH, WLVIEW*). Conversely, the model forecasted in excess of 100% difference from the raw average values for activities with relatively little data (*SWIM, NOMTRBT, MTRBOAT, XSKI, GENREC*).

We also tested regional models based on assessment region aggregation of the data and use of national mean values versus RPA assessment region mean values for adaptation of the models when forecasting regional average values (Rosenberger and Loomis 2000). The national model we are presenting is more robust to different adaptations of the model than all other models tested.

Example of a meta analysis benefit function transfer. The meta regression analysis benefit function is derived from information on all studies in the database. Theoretically, if a factor is significant in explaining the variation in outdoor recreation benefit measures, then the variable reflecting this factor will be significant in the model (table 5). As stated earlier, the overall model performance results in a grand mean ±7% margin of error. Thus, the meta regression

VARIABLES INSIGNIFICANT IN META ANALYSIS MODEL

Methodology	Site characteristics	Recreation activity
HEDONIC	RECQUAL	CAMP
TTIME	R2	PICNIC
ONSITE	R3	SISEE
MAIL	R5	MTRBOAT
INPERSON	R6	HIKE
SECOND	R10	DHSKI
LINLIN	NATL	SMHUNT
LOGLIN	CANADA	WLVIEW
LOGLOG	OCEAN	GENREC
LINLOG	DEVELOP	OTHERREC
	NUMACT	

Figure 7. Variables that were insignificant in developing the optimized meta analysis national benefit transfer model.

analysis model provides more robust estimates than an average value transfer (table 3 confidence range).

The application of the meta analysis benefit function can provide three different measures of the benefit of mountain biking (forecast national and regional average values—table 6; and policy site specific forecast average value). However, it should be noted that the data behind the meta analysis is mostly not specific to mountain biking. Therefore, each of the values forecast is really an estimate for a generic biking activity. Many of the estimates that are provided in table 6 are the same. This is due to the lack of any statistically discovered variability across these activities (i.e., the activity-specific variable was not significant in the optimized national model [figure 7]).

Each of the three benefit measures forecast from the meta analysis function differ by degree of specificity to the policy site. The adaptation of the meta analysis function is essentially to substitute relevant values for the independent variables in the regression model, which then forecasts a benefit measure based on the specificity of these variable values. The specificity of each benefit measure will be identified as each of the measures is presented.

The first measure forecasted from the meta analysis function is the national average value. In table 6, this is the measure reported for the United States in the last column. For biking, this forecast value is $15.27 with a 95% confidence range of $14.20 to $16.34. The meta analysis function was adapted by holding all independent or explanatory variables constant at their national mean values (last column, table 5), with the exception of the activity variables. This means that each coefficient is multiplied by the relevant national mean value for each variable, providing the incremental consumer surplus due to that variable. In the case of biking, the variable BIKE was set at 1, while all other activity variables were set to 0. This adapts the function to

Table 6. Forecasted average values using meta analysis benefit function[a].

Activity	Northeast Area[b]	Southeast Area[b]	Intermountain Area[b]	Pacific Coast Area[b]	Alaska[b]	United States
Camping	$29.95	$24.82	$34.18	$24.53	$29.95	$29.57
Picnicking	29.95	24.82	34.18	24.53	29.95	29.57
Swimming	14.44	9.31	18.67	9.02	14.44	14.06
Sightseeing	29.95	24.82	34.18	24.53	29.95	29.57
Off-road driving	12.61	7.48	16.85	7.19	12.61	12.24
Motor boating	29.95	24.82	34.18	24.53	29.95	29.57
Float boating	43.76	38.63	47.99	38.34	43.76	43.38
Hiking	29.95	24.82	34.18	24.53	29.95	29.57
Biking	15.64	10.51	19.88	10.22	15.64	15.27
Downhill skiing	29.95	24.82	34.18	24.53	29.95	29.57
Cross country skiing	24.01	18.88	28.25	18.59	24.01	23.64
Snowmobiling	9.03	3.90	13.26	3.61	9.03	8.65
Big game hunting	45.34	40.21	49.57	39.92	45.34	44.96
Small game hunting	29.95	24.82	34.18	24.53	29.95	29.57
Waterfowl hunting	39.84	34.72	44.08	34.42	39.84	39.47
Fishing[c]	37.01	31.88	41.24	31.59	37.01	36.63
Wildlife viewing	29.95	24.82	34.18	24.53	29.95	29.57
Horseback riding	29.95	24.82	34.18	24.53	29.95	29.57
Rock climbing	91.98	86.85	96.21	86.56	91.98	91.60
General recreation[d]	29.95	24.82	34.18	24.53	29.95	29.57
Other recreation[e]	29.95	24.82	34.18	24.53	29.95	29.57

[a]Benefit estimates are calculated from the meta analysis benefit function by holding each variable constant at its mean value except for regional and activity specific variables, which are either turned on (1) or off (0) where relevant. For the United States average value forecast, all variables are held at their national mean value except for activity variables.

[b]Forest Service Regions per area are: Northeast Area = R9; Southeast Area = R8; Intermountain Area = R1, R2, R3, R4; Pacific Coast Area = R5, R6; and Alaskan Area = R10.

[c]Fishing values include different species, different bodies of water, and different angling techniques. The majority of the fishing benefit measures are from studies conducted between 1979 and 1988. Fishing was not a primary target of the literature review since it is the focus of a different project.

[d]General recreation is defined as a composite of recreation opportunities at a site with measure for site, not a specific activity.

[e]Other recreation is defined as sites with recreation opportunities that are undefined or obscure, such as cliff diving and mountain running.

specifically reflect biking at the national level. All incremental consumer surplus values are then summed to provide the estimated consumer surplus for the activity of interest.

The second measure forecasted from the meta analysis function is the regional average value. In table 6, this is the measure reported for the Northeast Area. For biking, this forecast value is $15.64 with a 95% confidence range of $14.55 to $16.73. The meta analysis function was adapted by holding all independent variables at their national mean values (last column, table 5), with the exception of the activity and region variables. In the case of biking, the variable BIKE was set to 1, while all other activity and region variables were set to 0. This adapts the function to specifically reflect biking at the regional level.

The third measure forecasted from the meta analysis function is the average value that is most specific to the policy site. Table 7 shows the adaptation of the function to the policy site. All methodological variables were held at their national mean values (last column, table 5). These variables include *METHOD, DCCVM, OE, ITBID, SPRP, PAYCARD, CONJOINT, PHONE, INDIVID, ZONAL, RUM, SUBS, PHONE*, and *VALUNIT*. *TREND* is set to 30 to reflect 1996 dollars. All Forest Service region variables are set to 0. *FSADMIN* is set to 1 to reflect National Forest land. *LAKE* and *RIVER* are each set to 0, reflecting that the activity and/or policy site does not include a lake or a river, while *FOREST* is set to 1 to reflect a forested setting. *PUBLIC* is set to 1 to reflect that the policy site is on public land. *BIKE* is set to 1 to specify biking as the target activity, while all other activity variables are set to 0. After adapting the model specifically to the policy site, a benefit measure of $4.77 per activity day is forecasted, with a 95% confidence range of $4.44 to $5.10.

Estimates forecast from adapting the meta analysis benefit function at the national, regional, and site-specific levels ranged from about $6 to $16. This range in estimates is based on information from the entire database, including methodological, study site, and activity factors. However, the estimated measures are for a generic bicycling activity. Consumer surplus, or net willingness to pay, from mountain biking at exceptional sites may be significantly larger than this generic value, as evidenced by the measures reported in Fix and Loomis (1998). In addition, not all relevant information about a recreation site is available in the recreation database and therefore is not reflected in the meta analysis benefit function. Because of these two factors, we may conclude that meta analysis forecast values for biking are conservative measures.

Table 7. Example adaptation of meta analysis benefit function for mountain biking.

Variable	Coefficient	Adaptation value	Incremental consumer surplus
Constant	81.273	1	81.27
METHOD	–21.586	0.636	–13.73
DCCVM	–36.981	0.177	–6.54
OE	–51.762	0.354	–18.32
ITBID	–46.399	0.096	–4.45
SPRP	–57.796	0.006	–0.35
PAYCARD	–83.192	0.006	–0.50
CONJOINT	–74.028	0.001	–0.07
PHONE	–15.253	0.495	–7.55
INDIVID	–40.147	0.153	–6.14
ZONAL	–55.699	0.185	–10.30
RUM	–58.422	0.027	–1.58
SUBS	–17.619	0.264	–4.65
VALUNIT	–9.072	0.412	–3.74
TREND	0.980	30	29.40
FSADMIN	–17.822	1	–17.82
R1	11.407	0	0
R4	5.529	0	0
R6	–10.838	0	0
R8	–5.128	0	0
LAKE	–18.294	0	0
RIVER	16.788	0	0
FOREST	–9.165	1	–9.16
PUBLIC	13.311	1	13.31
SWIM	–15.513	0	0
OFFRD	–17.336	0	0
NOMTRBT	13.808	0	0
BIKE	–14.306	1	–14.31
XSKI	–5.937	0	0
SNOWMOB	–20.919	0	0
BGHUNT	15.387	0	0
WATFOWL	9.894	0	0
FISH	7.057	0	0
ROCKCL	62.027	0	0
Total consumer surplus			$4.77

Example application: Summary. Figure 8 provides the different benefit measures derived from applying the various benefit transfer methods. The different measures are relatively consistent, being within a factor or two of each other. This is not surprising given that all of the benefit measures are essentially based on the same data or subsets of data.

Which estimate is best, if any, depends on a number of factors identified earlier. In addition to the factors built into the stock of knowledge concerning recreation use values (e.g., data collection, reporting, study site, methodology), judgments of the benefit transfer

Single point estimate transfer	$17.61 to $62.88
Average value transfer	
National	$45.15
Regional	$34.11
Demand function transfer	$34.25
Meta analysis transfer	
National	$15.27
Regional	$15.64
Site	$4.77

Figure 8. Summary of example benefit transfers.

practitioner can affect overall transfer results. All judgments regarding a benefit transfer framework affect the outcome of the process. Judgments about the policy context frame the entire evaluation process, including what is affected and by how much. Judgments concerning the quality and extent of the scientific body of knowledge can affect the availability of data. Judgments concerning the gathering, coding, and interpretation of data can affect its applicability and relevance to the policy context. And judgments concerning which benefit transfer approach should be used can affect confidence in and credibility of transferred data and policy evaluations. Smith (1992) compares the Luken et al. (1992) and Desvousges et al. (1992) uses of benefit transfer to assess the pulp and paper industry, illustrating the affect researcher judgment can have on policy recommendations.

Recommendations and Guidance to Field Users

We have discussed several different methods to using existing information for benefit transfers when primary research is prohibitive. First, single point estimates or an average of a subset of available point estimates are available through their listing in the annotated bibliography (appendix A). Second, measures of central tendency for recreation activity values provided in table 3 can be transferred to a policy site. Third, a demand or benefit function for a study site can be adapted to the policy site. Fourth, the national values (last column of table 3) can be transferred to a policy site, providing a measure of central tendency for an activity based on all empirical research. However, locational factors are greatly ignored with this approach. Fifth, the meta regression analysis forecasted average values (table 6) can be transferred to a policy site. And sixth, the meta regression analysis benefit transfer function (table 5) can be adapted to specific characteristics of a policy site in order to forecast a site-specific benefit measure for use in evaluating a policy site. Regardless of which method is chosen, the measure(s) transferred have a certain level of confidence surrounding them.

Figure 9 provides a flow chart of the decision process to aid in deriving a benefit measure for recreation. We do not intend to imply that any path in the flow chart is preferred to any other. Instead, the flow chart illustrates possible pathways to determining if and how recreation benefit measures are to be obtained. Depending on the context of the choice among the different methods, one method may be preferable to another. As Desvousges and others (1998) remind us, an important component in any benefit transfer is the involvement and judgment of the transfer practitioner.

The conceptual framework provided in figure 9 shows potential paths to choosing a method for obtaining recreation values when assessing management and policy actions. The first decision to make is whether recreation is affected by the proposed action (figure 9, step I). If recreation is affected, then the second decision is whether the impact on recreation is expected to be major (figure 9, step II). If the impact on recreation is expected to be major, then path A may be followed. If the impact on recreation is expected to be minor, then path B may be preferred. A preliminary benefit transfer could be conducted at this stage to determine the expected magnitude of recreation impacts. A major impact on recreation probably warrants consideration

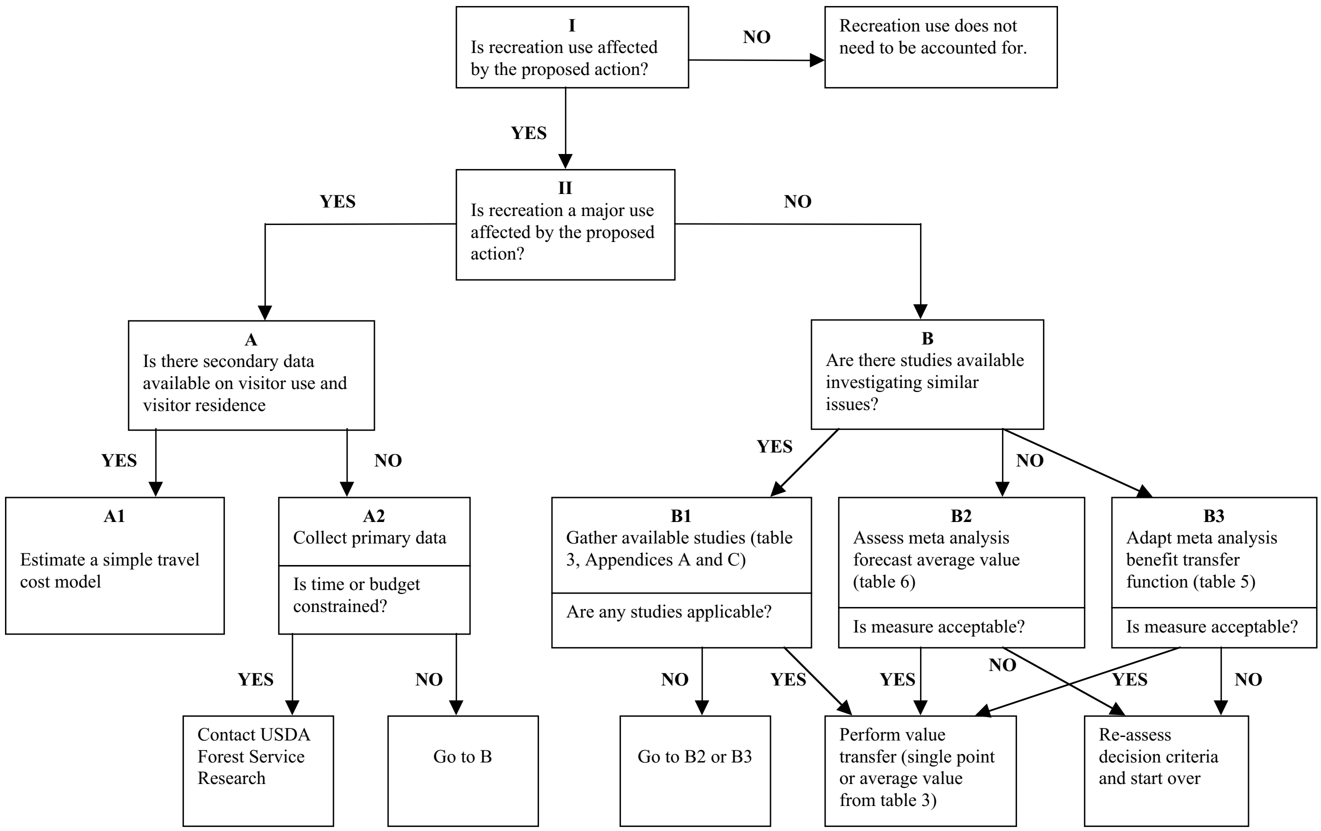

Figure 9. Framework for obtaining benefit measures for recreation.

of doing primary research either through analysis of secondary data (figure 9, step A1) or the collection of original data through survey research (figure 9, step A2). Step A1 is placed prior to step A2 because it typically requires lower budget and time inputs.

Path B would be followed if either of the following conditions exist: (1) the impact on recreation is major, but there is no good secondary data available or budget and time constraints are prohibitive to doing primary research, or (2) the impact on recreation is minor, thus not warranting the expense of primary analysis. Also note, however, that benefit transfers can be as tedious and time consuming as some primary research. A decision criterion for all benefit transfer derived measures is their degree of defensibility in light of political and theoretical feasibility. We cannot determine this feasibility *a priori* since feasibility criteria are specific to the context of the decision.

Following path B in figure 9, the first step is to determine if there are any studies available that resemble the recreation issue at hand. If there are, then these studies should be gathered and filtered for applicability and acceptability of benefit transfer measures (figure 9, step B1; studies can be located through table 3 and appendices A and C). If there are available studies that are applicable and acceptable, then the value transfer can be performed either as a single point estimate or average value transfer (table 3). If there are no studies available or the available studies are not applicable or acceptable, then steps B2 or B3 can be pursued.

In step B2 of figure 9, the forecast average values from the meta regression analysis model (table 6) can be used. If the forecast measure is acceptable, then use this measure for benefit transfer. However, if these values are not acceptable, then step B3 of figure 9 may be pursued. Step B3 adapts the meta regression analysis benefit transfer model (table 5) to a policy site via characteristics specific to that site. One then will have to determine if this tailored benefit measure is acceptable. If the tailored measure is acceptable, then use this measure for benefit transfer. If the measure is not acceptable, we have then exhausted the various sources of benefit measures based on the recreation valuation literature. At this point, one should go back to the beginning and reassess the criteria used in making decisions about the different methods of obtaining benefit measures. This is definitely a judgment call and it may seem that defensibility of an accepted benefit measure will be decreased. However, recall that benefit transfer should be pragmatic in the sense that when benefit measures are sought, tradeoffs are necessary in choosing the best in a "second best" world. A rough estimate of the dollar value of recreation in economic analysis or assessment of planning and policy objectives is better than implying a zero value for recreation by leaving recreation out of the economic model.

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Appendix A: Annotated Bibliography of Outdoor Recreation Use Valuation Studies, 1967 to 1998

Key:
Reference # . Author. Year Publication. Title. Source.

- Recreation Activity / Forest Service Region (FS), RPA Region where RPA1=Northeast Area, RPA2=Southeast Area, RPA3=Intermountain Area, RPA4=Pacific Coast Area, RPA5=Alaska / Original $ per person per activity day [year] / Inflation-adjusted $ for fourth Quarter, 1996 / Valuation Method (CV=contingent valuation, TC=travel cost, RUM/MNL=random utility model/multinomial logit model). Note: an asterik (*) prior to lead author's name identifies studies not included in the meta-regression analysis.

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- GENERAL RECREATION / Canada / $1.45 [1991] / $1.64 / RUM/MNL
- GENERAL RECREATION / Canada / $5.94 [1991] / $6.71 / Conjoint
- GENERAL RECREATION / Canada / $1.46 [1991] / $1.65 / Combined conjoint and RUM/MNL

2. Adamowicz, W., S. Jennings, and D. Coyne. 1990. A sequential choice model of recreation behavior. *Western Journal of Agricultural Economics* 15:91-99.

- BIG GAME HUNTING / Canada / $24.07 [1981] / $40.11 / RUM/MNL

3. Adamowicz, W.L., and W.E. Phillips. 1983. A comparison of extra market benefit evaluation techniques. *Canadian Journal of Agricultural Economics* 31:401-412.

- FISHING / Canada / $4.18 [1975] / $10.92 / Individual TC
- FISHING / Canada / $13.99 [1975] / $36.56 / CV
- FISHING / Canada / $39.44 [1975] / $103.07 / CV

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- SMALL GAME HUNTING / FS6, RPA4 / $20.05 [1986] / $27.37 / CV

5. Baker, J.C. 1996. A nested Poisson approach to ecosystem valuation: An application to backcountry hiking in California. Reno, NV: University of Nevada, Reno. 26 p.

- HIKING / FS5, RPA4 / $25.29 [1996] / $25.24 / Zonal TC
- HIKING / FS5, RPA4 / $22.57 [1996] / $22.53 / Zonal TC
- HIKING / FS5, RPA4 / $27.12 [1996] / $27.07 / Zonal TC
- HIKING / FS5, RPA4 / $11.35 [1996] / $11.33 / Zonal TC
- HIKING / FS5, RPA4 / $14.63 [1996] / $14.60 / Zonal TC
- HIKING / FS5, RPA4 / $9.88 [1996] / $9.86 / Zonal TC
- HIKING / FS5, RPA4 / $29.59 [1996] / $29.53 / Zonal TC
- WILDERNESS / FS5, RPA4 / $25.29 [1996] / $25.24 / Zonal TC
- WILDERNESS / FS5, RPA4 / $22.57 [1996] / $22.53 / Zonal TC
- WILDERNESS / FS5, RPA4 / $27.12 [1996] / $27.07 / Zonal TC
- WILDERNESS / FS5, RPA4 / $11.35 [1996] / $11.33 / Zonal TC
- WILDERNESS / FS5, RPA4 / $14.63 [1996] / $14.60 / Zonal TC
- WILDERNESS / FS5, RPA4 / $9.88 [1996] / $9.86 / Zonal TC
- WILDERNESS / FS5, RPA4 / $29.59 [1996] / $29.53 / Zonal TC

6. Balkan, E., and J.R. Kahn. 1988. The value of changes in deer hunting quality: A travel cost approach. *Applied Economics* 20:533-539.

- BIG GAME HUNTING / National / $106.30 [1980] / $193.82 / Zonal TC
- BIG GAME HUNTING / National / $104.30 [1980] / $190.17 / Individual TC

7. Barrick, K. 1986. Option value in relation to distance effects and selected user characteristics for the Washakie Wilderness, northeast Wyoming. In R.C. Lucas [comp.], Proceedings — National Wilderness Research Conference: Current Research. Ogden, UT: USDA Forest Service, Intermountain Research Station, General Technical Report INT-212: 411-422.
   - WILDLIFE VIEWING/ FS2, RPA3/ $5.95 [1982]/ $9.33/ CV
   - WILDERNESS/ FS2, RPA3/ $5.95 [1982]/ $9.33/ CV
8. Bergstrom, J.C., and H.K. Cordell. 1991. An analysis of the demand for and value of outdoor recreation in the United States. *Journal of Leisure Research* 23:67-86.
   - See Appendix B Table B1. VARIOUS ACTIVITIES, 16 ESTIMATES.
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   - See appendix B table B2. VARIOUS ACTIVITIES, 50 ESTIMATES.
10. Bergstrom, J.C., J.R. Stoll, J.P. Titre, and V.L. Wright. 1990. Economic value of wetlands-based recreation. *Ecological Economics* 2:129-147.
    - GENERAL RECREATION/ FS8, RPA2/ $15.19 [1986]/ $20.74/ CV
11. Bishop, R.C., C.A. Brown, M.P. Welsh, and K.J. Boyle. 1989. Grand Canyon recreation and Glen Canyon Dam operations: An economic evaluation. In K.J. Boyle and T. Heekin, Western Regional Research Project W-133, Benefits and Costs in Natural Resource Planning, Interim Report 2. Orono, ME: Department of Agricultural and Resource Economics, University of Maine: 407-435.
    - FLOAT BOATING/ FS3, RPA3/ $78.00 [1985]/ $109.26/ CV
12. Bishop, R., T. Heberlein, and M.J. Kealy. 1983. Contingent valuation of environmental assets: Comparisons with a simulated market. *Natural Resources Journal* 23:619-633.
    - WATERFOWL HUNTING/ FS9, RPA1/ $11.00 [1978]/ $23.78/ CV
    - WATERFOWL HUNTING/ FS9, RPA1/ $21.00 [1978]/ $45.39/ CV
    - WATERFOWL HUNTING/ FS9, RPA1/ $32.00 [1978]/ $69.17/ Zonal TC
13. Bishop, R., T. Heberlein, M. Welsh, and R. Baumgartner. 1984. Does contingent valuation work? Results of the Sandhill experiment. Paper presented at the joint meetings of AERA and AAEA.
    - BIG GAME HUNTING/ FS9, RPA1/ $32.00 [1983]/ $48.11/ CV
14. Bouwes, N., and R. Schneider. 1979. Procedures in estimating benefits of water quality change. *American Journal of Agricultural Economics* 61:535-539.
    - GENERAL RECREATION/ FS9, RPA1/ $2.54 [1979]/ $5.06/ Individual TC
15. *Bowes, M.D., and J.B. Loomis. 1980. A note on the use of travel cost models with unequal zonal populations. *Land Economics* 56:465-470.
    - FLOAT BOATING/ FS4, RPA3/ $19.00 [1978]/ $41.07/ Zonal TC
16. Bowes, M., and J. Krutilla. 1989. Multiple-use management: The economics of public forestlands. Washington, DC: Resources for the Future: 177-247.
    - FISHING/ FS9, RPA1/ $5.03 [1981]/ $8.37/ Zonal TC
17. Boyle, K.J., M.L. Phillips, S.D. Reiling, and L.K. Demirelli. 1988. Economic values and economic impacts associated with consumptive uses of Maine's fish and wildlife resources. Orono, ME: Department of Agricultural and Resource Economics, University of Maine. 41 p.
    - BIG GAME HUNTING/ FS 9, RPA1/ $74.00 [1987]/ $98.00/ CV
    - SMALL GAME HUNTING/ FS 9, RPA1/ $23.00 [1987]/ $30.46/ CV
    - WATERFOWL HUNTING/ FS 9, RPA1/ $72.00 [1987]/ $95.35/ CV

18. Boyle, K., M. Welsh, and R. Bishop. 1988. Analyzing the effects of Glen Canyon Dam releases on Colorado river recreation using scenarios of unexperienced flow conditions. In J.B. Loomis (comp.), Western Regional Research Publication W-133, Benefits and Costs in Natural Resources Planning, Interim Report. Davis, CA: University of California, Davis: 111-130.

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- SMALL GAME HUNTING/ FS 9, RPA1/ $2.83 [1989]/ $3.47/ CV
- WATERFOWL HUNTING/ FS 9, RPA1/ $3.90 [1989]/ $4.78/ CV

20. Boyle, K., S. Reiling, M. Teisel, and M. Phillips. 1990. A study of the impact of game and nongame species on Maine's economy. Orono, ME: Department of Agricultural and Resource Economics, University of Maine.

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- BIG GAME HUNTING/ FS9, RPA1/ $37.47 [1989]/ $45.94/ CV
- BIG GAME HUNTING/ FS9, RPA1/ $68.45 [1989]/ $83.92/ CV
- SMALL GAME HUNTING/ FS9, RPA1/ $62.20 [1989]/ $76.26/ CV
- WATERFOWL HUNTING/ FS9, RPA1/ $116.49 [1989]/ $142.82/ CV
- WATERFOWL HUNTING/ FS9, RPA1/ $59.62 [1989]/ $73.10/ CV
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- BIG GAME HUNTING/ FS1, RPA3/ $54.55 [1985]/ $76.40/ Zonal TC
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22. Brown, G., and J. Hammack. 1972. A preliminary investigation of the economics of migratory waterfowl. In J.V. Krutilla (ed.), Natural Environments: Studies in Theoretical and Applied Analysis. Baltimore, MD: Johns Hopkins University Press: 171-204.

- WATERFOWL HUNTING/ FS4, RPA3/ $25.46 [1969]/ $96.77/ CV

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- See Appendix B Table B3. BIG GAME and WATERFOWL HUNTING, and FISHING/ 134 ESTIMATES

24. *Brown, G., and M. Plummer. 1979. Recreation valuation: An economic analysis of nontimber uses of forestland in the Pacific Northwest. Pullman, WA: Forest Policy Project, Washington State University.

- HIKING/ FS6, RPA4/ $9.40 [1976]/ $23.21/ Zonal TC
- HIKING/ FS6, RPA4/ $43.75 [1976]/ $108.02/ Zonal TC
- WILDERNESS/ FS6, RPA4/ $43.75 [1976]/ $108.02/ Zonal TC

25. Brown, T., T. Daniel, M. Richards, and D. King. 1989. Recreation participation and the validity of photo-based preference judgments. *Journal of Leisure Research* 21:40-60.

- CAMPING/ FS3, RPA3/ $18.05 [1985]/ $25.28/ CV

26. Brown, W., D.M. Larson, R.S. Johnston, and R.J. Wahle. 1979. Improved economic evaluation of commercially and sport caught salmon and steelhead of the Columbia River. Corvallis, OR: Oregon State University.

- FISHING/ FS6, RPA4/ $21.77 [1974]/ $62.25/ Individual TC

27. Cameron, T., and M. James. 1987. Efficient estimation methods for close-ended contingent valuation surveys. *Review of Economics and Statistics* 69:269-276.

- FISHING/ Canada/ $48.33 [1984]/ $70.03/ CV

28. Capel, R.E., and R.K. Pandey. 1972. Estimation of benefits from deer and moose hunting in Manitoba. *Canadian Journal of Agricultural Economics* 21:6-15.

- BIG GAME HUNTING/ Canada/ $7.04 [1968]/ $28.02/ Zonal TC
- BIG GAME HUNTING/ Canada/ $9.31 [1967]/ $26.49/ Zonal TC

29. Casey, J.F., T. Vukina, and L.E. Danielson. 1995. The economic value of hiking: Further considerations of opportunity cost of time in recreational demand models. *Journal of Agricultural and Applied Economics* 27:658-668.

- HIKING/ FS8, RPA2/ $213.92 [1995]/ $218.37/ Individual TC
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30. *Chicetti, C.J., A.C. Fisher, and V.K. Smith. 1976. An econometric evaluation of a generalized consumer surplus measure: The Mineral King controversy. *Econometrica* 44:1259-1275.

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31. Connelly, N., and T. Brown. 1988. Estimates of nonconsumptive wildlife use on Forest Service and BLM lands. Ithaca, NY: USDA Forest Service and Cornell University.

- See appendix B table B4. WILDLIFE VIEWING/ 42 ESTIMATES.

32. Connelly, N., and T. Brown. 1991. Net economic value of the freshwater recreational fisheries of New York. *Transactions of the American Fisheries Society* 120:770-775.

- FISHING/ FS9, RPA1/ $13.68 [1988]/ $17.48/ CV

33. Cooper, J., and J. Loomis. 1991. Economic value of wildlife resources in the San Joaquin Valley: Hunting and viewing values. In A. Dinar and D. Zilberman (eds.), The Economic and Management of Water and Drainage in Agriculture. Boston, MA: Kluwer Academic Publishers: 447-463.

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34. Cooper, J., and J. Loomis. 1993. Testing whether waterfowl hunting benefits increase with greater water deliveries to wetlands. *Environment and Resource Economics* 3:545-561.

- WATERFOWL HUNTING/ FS5, RPA4/ $26.21 [1989]/ $32.13/ Zonal TC

35. Cordell, H.K., and J. Bergstrom. 1992. Comparison of recreation use values among alternative reservoir water level management scenarios. *Water Resources Research* 29:247-258.

- OTHER RECREATION/ FS8, RPA2/ $3.88 [1989]/ $4.76/ CV

36. Cory, D.C., and W.E. Martin. 1985. Valuing wildlife for efficient multiple use: Elk vs. cattle. *Western Journal of Agricultural Economics* 10:282-293.

- BIG GAME HUNTING/ FS3, RPA3/ $8.04 [1979]/ $16.02/ CV

37. Crandall, K.B. 1991. Measuring the economic benefits of riparian areas. Master's Thesis, University of Arizona.

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38. Creel, M.D., and J.B. Loomis. 1990. Theoretical and empirical advantages of truncated count data estimators for analysis of deer hunting in California. *American Journal of Agricultural Economics* 72:434-441.

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- CAMPING/ FS1, RPA3/ $8.71 [1984]/ $12.62/ Zonal TC

40. Daubert, J.T., and R.A. Young. 1981. Recreational demands for maintaining instream flows: A contingent valuation approach. *American Journal of Agricultural Economics* 63:666-676.

- FISHING / FS2, RPA3 / $28.60 [1978] / $61.82 / CV

41. Donnelly, D., J. Loomis, C. Sorg, and L. Nelson. 1983. Net economic value of recreational steelhead fishing in Idaho. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Resource Bulletin RM-9.

- FISHING / FS6, RPA4 / $20.29 [1982] / $31.81 / CV
- FISHING / FS6, RPA4 / $14.29 [1982] / $22.40 / Zonal TC
- FISHING / FS6, RPA4 / $10.20 [1982] / $15.99 / Zonal TC

42. Donnelly, D., and L. Nelson. 1983. Net economic value of deer hunting in Idaho. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Resource Bulletin RM-13.

- BIG GAME HUNTING / FS6, RPA4 / $19.18 [1983] / $28.84 / CV
- BIG GAME HUNTING / FS6, RPA4 / $26.86 [1983] / $40.39 / Zonal TC
- BIG GAME HUNTING / FS6, RPA4 / $23.39 [1983] / $35.17 / Zonal TC

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- OTHER RECREATION / FS1, RPA3 / $6.09 [1981] / $10.14 / Zonal TC

44. Duffield, J. 1988. The net economic value of elk hunting in Montana. Helena, MT: Report for Montana Department of Fish, Wildlife, and Parks.

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- WATERFOWL HUNTING / FS1, RPA3 / $89.29 [1989] / $109.47 / CV
- WATERFOWL HUNTING / FS1, RPA3 / $100.15 [1989] / $122.79 / CV

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- WILDERNESS/ FS6, RPA4/ $16.02 [1985]/ $22.44/ Individual TC
- WILDERNESS/ FS6, RPA4/ $24.42 [1985]/ $34.21/ Individual TC

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- CROSS COUNTRY SKIING/ FS2, RPA3/ $21.03 [1986]/ $28.71/ CV
- CROSS COUNTRY SKIING/ FS2, RPA3/ $10.94 [1986]/ $14.93/ CV
- CROSS COUNTRY SKIING/ FS2, RPA3/ $28.38 [1986]/ $38.74/ CV
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- CAMPING/ FS8, RPA2/ $1.89 [1973]/ $5.88/ Zonal TC
- CAMPING/ FS8, RPA2/ $0.88 [1973]/ $2.75/ Zonal TC
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- BIG GAME HUNTING/ FS4, RPA3/ $19.12 [1982]/ $29.97/ Zonal TC
- BIG GAME HUNTING/ FS4, RPA3/ $27.80 [1982]/ $43.58/ Zonal TC
- BIG GAME HUNTING/ FS4, RPA3/ $38.58 [1982]/ $60.48/ Zonal TC
- BIG GAME HUNTING/ FS4, RPA3/ $48.00 [1982]/ $75.25/ Zonal TC
- BIG GAME HUNTING/ FS4, RPA3/ $14.83 [1982]/ $23.25/ Zonal TC
- BIG GAME HUNTING/ FS4, RPA3/ $31.16 [1982]/ $48.85/ Zonal TC
- BIG GAME HUNTING/ FS4, RPA3/ $10.24 [1982]/ $16.05/ Zonal TC

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- BIG GAME HUNTING/ FS1, RPA3/ $14.24 [1986]/ $19.44/ CV

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- BIG GAME HUNTING/ FS5, RPA4/ $13.18 [1987]/ $17.45/ Individual TC
- WILDLIFE VIEWING/ FS5, RPA4/ $5.10 [1987]/ $6.76/ CV

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- BIG GAME HUNTING/ FS3, RPA3/ $3.21 [1970]/ $11.60/ Individual TC
- BIG GAME HUNTING/ FS3, RPA3/ $3.49 [1970]/ $12.60/ Individual TC
- SMALL GAME HUNTING/ FS3, RPA3/ $1.45 [1970]/ $5.24/ Individual TC
- WATERFOWL HUNTING/ FS3, RPA3/ $0.60 [1970]/ $2.17/ Individual TC
- FISHING/ FS3, RPA3/ $12.22 [1970]/ $44.09/ Individual TC
- FISHING/ FS3, RPA3/ $5.56 [1970]/ $20.08/ Individual TC

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- BIG GAME HUNTING/ FS9, RPA1/ $42.80 [1984]/ $62.01/ Zonal TC
- BIG GAME HUNTING/ FS9, RPA1/ $40.04 [1984]/ $58.01/ Zonal TC
- BIG GAME HUNTING/ FS9, RPA1/ $42.80 [1984]/ $62.01/ Zonal TC
- BIG GAME HUNTING/ FS9, RPA1/ $69.70 [1984]/ $100.99/ Zonal TC
- BIG GAME HUNTING/ FS9, RPA1/ $35.11 [1984]/ $50.87/ Zonal TC

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- BIG GAME HUNTING/ FS10, RPA5/ $42.88 [1991]/ $48.47/ CV
- BIG GAME HUNTING/ FS10, RPA5/ $49.35 [1991]/ $55.78/ CV
- BIG GAME HUNTING/ FS10, RPA5/ $41.88 [1991]/ $47.34/ CV
- WILDLIFE VIEWING/ FS10, RPA5/ $46.82 [1991]/ $52.92/ CV
- WILDLIFE VIEWING / FS10, RPA5/ $53.63 [1991]/ $60.62/ CV
- WILDLIFE VIEWING / FS10, RPA5/ $62.22 [1991]/ $70.33/ CV

104. McConnell, K. 1979. Values of marine recreational fishing: Measurement and impact of management. *American Journal of Agricultural Economics* 61:921-925.

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- FISHING/ FS9, RPA1/ $19.03 [1976]/ $46.99/ Zonal TC
- FISHING/ FS9, RPA1/ $17.52 [1976]/ $43.26/ Zonal TC

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- CAMPING/ FS4, RPA3/ $9.00 [1971]/ $30.88/ Individual TC
- FLOAT BOATING/ FS4, RPA3/ $10.36 [1971]/ $35.55/ Individual TC
- FLOAT BOATING/ FS4, RPA3/ $76.85 [1971]/ $263.68/ Zonal TC

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- BIG GAME HUNTING/ FS9, RPA1/ $35.00 [1980]/ $63.82/ Individual TC
- SMALL GAME HUNTING/ FS2, RPA3/ $30.00 [1980]/ $54.70/ Individual TC
- FISHING/ FS9, RPA1/ $23.00 [1980]/ $41.94/ Individual TC
- FISHING/ FS3, RPA3/ $35.00 [1980]/ $63.82/ Individual TC
- FISHING/ FS9, RPA1/ $29.00 [1980]/ $52.88/ Individual TC
- FISHING/ FS4, RPA3/ $27.00 [1980]/ $49.23/ Individual TC
- FISHING/ FS8, RPA2/ $30.00 [1980]/ $54.70/ Individual TC

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112. Morey, E. 1985. Characteristics, consumer surplus, and new activities. *Journal of Public Economics* 26:221-236.

- DOWNHILL SKIING/ FS2, RPA3/ $3.15 [1968]/ $12.54/ RUM/MNL

113. Morey, E., R. Rowe, and M. Watson. 1991. An extended discrete-choice model of Atlantic salmon fishing: With theoretical and empirical comparisons to standard travel-cost models. Boulder, CO: Department of Economics, University of Colorado.

- FISHING/ FS9, RPA1/ $78.36 [1988]/ $100.12/ RUM/MNL

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- FISHING/ FS9, RPA1/ $20.98 [1976]/ $51.80/ Zonal TC

115. Palm, R., and S. Malvestuto. 1983. Relationships between economic benefit and sport-fishing effort on West Point reservoir, Alabama-Georgia. *Transactions of the American Fisheries Society* 112:71-78.

- FISHING/ FS8, RPA2/ $8.90 [1980]/ $16.23/ Individual TC

116. Park, T., J. Loomis, and M. Creel. 1991. Confidence intervals for evaluating benefits estimates from dichotomous choice contingent valuation studies. *Land Economics* 67:64-73.

- BIG GAME HUNTING/ FS1, RPA3/ $29.73 [1986]/ $40.61/ CV

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- OTHER RECREATION/ FS2, RPA3/ $36.51 [1984]/ $52.90/ Zonal TC
- OTHER RECREATION/ FS2, RPA3/ $18.48 [1984]/ $26.78/ Zonal TC

118. *Peterson, G.L., R.G. Walsh, and J.R. McKean. 1988. The discriminatory impact of recreation price. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Unpublished paper.

- CAMPING/ FS9, RPA1/ $6.34 [1980]/ $11.56/ Zonal TC
- CAMPING/ FS9, RPA1/ $19.64 [1980]/ $35.81/ Zonal TC
- WILDERNESS/ FS9, RPA1/ $6.34 [1980]/ $11.56/ Zonal TC
- WILDERNESS/ FS9, RPA1/ $19.64 [1980]/ $35.81/ Zonal TC

119. *Prince, R. 1988. Estimating recreation benefits under congestion, uncertainty, and disequilibrium. Harrisonburg, VA: Department of Economics, James Madison University.

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- FISHING/ FS5, RPA4/ $2.21 [1981]/ $3.69/ RUM/MNL
- FISHING/ FS5, RPA4/ $51.76 [1981]/ $86.25/ RUM/MNL
- FISHING/ FS6, RPA4/ $42.11 [1981]/ $70.17/ RUM/MNL
- FISHING/ FS6, RPA4/ $48.62 [1981]/ $81.03/ RUM/MNL
- FISHING/ FS6, RPA4/ $5.41 [1981]/ $9.02/ RUM/MNL

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- WILDLIFE VIEWING/ FS9, RPA1/ $2.64 [1988]/ $3.37/ CV
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- FISHING/ FS4, RPA3/ $26.20 [1982]/ $41.07/ Zonal TC
- FISHING/ FS4, RPA3/ $14.25 [1982]/ $22.34/ CV
- FISHING/ FS4, RPA3/ $12.95 [1982]/ $20.30/ CV
- FISHING/ FS4, RPA3/ $25.55 [1982]/ $40.06/ Zonal TC

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- BIG GAME HUNTING/ FS4, RPA3/ $35.15 [1982]/ $55.10/ Zonal TC
- BIG GAME HUNTING/ FS4, RPA3/ $22.57 [1983]/ $33.94/ CV
- BIG GAME HUNTING/ FS4, RPA3/ $22.24 [1982]/ $34.87/ Zonal TC

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- CAMPING/ FS3, RPA3/ $0.51 [1972]/ $1.69/ CV
- FISHING/ FS3, RPA3/ $15.85 [1972]/ $52.18/ Individual TC
- FISHING/ FS3, RPA3/ $8.43 [1972]/ $27.75/ Individual TC
- FISHING/ FS3, RPA3/ $16.15 [1972]/ $53.14/ Individual TC

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- FISHING/ National/ $16.03 [1979]/ $31.93/ Individual TC
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- SWIMMING/ FS5, RPA4/ $35.04 [1985]/ $49.08/ Zonal TC
- MOTOR BOATING/ FS3, RPA3/ $34.64 [1985]/ $48.52/ Zonal TC
- MOTOR BOATING/ FS3, RPA3/ $24.28 [1985]/ $34.01/ Zonal TC

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- GENERAL RECREATION/ FS2, RPA3/ $8.37 [1980]/ $15.26/ Zonal TC
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- CAMPING/ FS2, RPA3/ $7.99 [1980]/ $14.57/ CV
- PICNICKING/ FS2, RPA3/ $6.22 [1980]/ $11.34/ CV
- OFF ROAD DRIVING/ FS2, RPA3/ $6.45 [1980]/ $11.76/ CV
- HIKING/ FS2 RPA3/ $9.51 [1980]/ $17.34/ CV

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- GENERAL RECREATION/ FS2, RPA3/ $24.00 [1983]/ $36.09/ CV
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- SIGHTSEEING/ FS2, RPA3/ $10.31 [1979]/ $20.53/ CV
- WILDERNESS/ FS2, RPA3/ $18.29 [1979]/ $36.42/ CV
- WILDERNESS/ FS2, RPA3/ $10.31 [1979]/ $20.53/ CV

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- CAMPING/ FS2, RPA3/ $22.00 [1978]/ $47.55/ CV
- PICNICKING/ FS2, RPA3/ $10.90 [1978]/ $23.56/ CV
- HIKING/ FS2, RPA3/ $13.72 [1978]/ $29.66/ CV

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- FLOAT BOATING/ FS2, RPA3/ $10.94 [1978]/ $23.65/ CV

158. *Walsh, R.G., R. Gillman, and J. Loomis. 1981. Wilderness resource economic: Recreation use and preservation values. Fort Collins, CO: Department of Economics, Colorado State University.

- OTHER RECREATION/ FS2, RPA3/ $14.00 [1980]/ $25.53/ Individual TC
- WILDERNESS/ FS2, RPA3/ $14.00 [1980]/ $25.53/ Individual TC

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- PICNICKING/ FS3, RPA3/ $11.39 [1978]/ $24.62/ Individual TC
- SWIMMING/ FS3, RPA3/ $11.39 [1978]/ $24.62/ Individual TC
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- SMALL GAME HUNTING/ FS4, RPA3/ $28.50 [1982]/ $44.68/ Zonal TC
- SMALL GAME HUNTING/ FS4, RPA3/ $22.45 [1982]/ $35.20/ CV
- SMALL GAME HUNTING/ FS4, RPA3/ $19.02 [1982]/ $29.82/ Zonal TC

163. Ziemer, R., W. Musser, and C. Hill. 1980. Recreation demand equations: Functional form and consumer surplus. *American Journal of Agricultural Economics* 62:136-141.

- FISHING/ FS8, RPA2/ $26.46 [1971]/ $90.79/ Individual TC

Appendix B: Summary of Multi-Estimate Studies in Appendix A, Annotated Bibliography

Appendix B Table B1. Bibliography Entry #8, Bergstrom, J.C., and H.K. Cordell, 1991, An analysis of the demand for and value of outdoor recreation in the United States.

Activity	Regions[a]	$ Original [1987][b]	$ Adjusted [1996][b]	Method[c]
Camping	National	$8.70	$11.52	Zonal TC
Picnicking	National	11.85	15.69	Zonal TC
Swimming	National	14.82	19.63	Zonal TC
Sightseeing	National	11.22	14.86	Zonal TC
Off Road Driving	National	15.06	19.94	Zonal TC
Motor Boating	National	21.62	28.63	Zonal TC
Float Boating	National	21.40	28.34	Zonal TC
Hiking	National	15.76	20.87	Zonal TC
Biking	National	13.30	17.61	Zonal TC
Downhill Skiing	National	14.81	19.61	Zonal TC
Cross Country Skiing	National	9.57	12.67	Zonal TC
Big Game Hunting	National	12.07	15.98	Zonal TC
Small Game Hunting	National	11.98	15.87	Zonal TC
Wildlife Viewing	National	12.88	17.06	Zonal TC
Horseback Riding	National	11.40	15.10	Zonal TC
Other Recreation	National	13.11	17.36	Zonal TC

[a]*FS=USDA Forest Service Region, CR=Census Region.*
[b]*Values in per person per activity day.*
[c]*TC=travel cost method, CV=contingent valuation method.*

Appendix B Table B2. Bibliography Entry #9, Bergstrom, J.C., et al., 1996, Ecoregional estimates of the net economic values of outdoor recreational activities in the United States.

Activity	Regions[a]	$ Original [1992][b]	$ Adjusted [1996][b]	Method[c]
Camping	FS9, RPA1	$43.25	$47.58	Individual TC
Camping	FS9, RPA1	31.65	34.82	Individual TC
Camping	FS8, RPA2	34.29	37.72	Individual TC
Camping	FS8, RPA2	47.03	51.73	Individual TC
Camping	FS8, RPA2	46.62	51.28	Individual TC
Camping	FS6, RPA4	57.03	62.73	Individual TC
Camping	FS5, RPA4	170.10	187.11	Individual TC
Picnicking	FS9, RPA1	78.75	86.63	Individual TC
Picnicking	FS8, RPA2	33.85	37.24	Individual TC
Picnicking	FS8, RPA2	21.64	23.80	Individual TC
Picnicking	FS2, RPA3	29.36	32.30	Individual TC
Picnicking	FS6, RPA4	26.32	28.95	Individual TC
Picnicking	FS5, RPA4	108.14	118.95	Individual TC
Swimming	FS8, RPA2	36.81	40.49	Individual TC
Swimming	FS6, RPA4	4.59	5.05	Individual TC
Sightseeing	FS9, RPA1	158.92	174.81	Individual TC
Sightseeing	FS8, RPA2	85.38	93.92	Individual TC
Sightseeing	FS8, RPA2	75.70	83.27	Individual TC
Sightseeing	FS8, RPA2	34.75	38.23	Individual TC
Sightseeing	FS8, RPA2	19.75	21.73	Individual TC
Sightseeing	FS6, RPA4	46.04	50.64	Individual TC
Off Road Driving	FS8, RPA2	3.97	4.37	Individual TC
Off Road Driving	FS6, RPA4	30.58	33.64	Individual TC
Motor Boating	FS2, RPA3	154.25	169.68	Individual TC
Float Boating	FS9, RPA1	46.23	50.85	Individual TC
Float Boating	FS9, RPA1	105.04	115.54	Individual TC
Float Boating	FS8, RPA2	86.93	95.62	Individual TC
Float Boating	FS8, RPA2	24.48	26.93	Individual TC
Float Boating	FS2, RPA3	91.91	101.10	Individual TC
Hiking	FS9, RPA1	69.02	75.92	Individual TC
Hiking	FS8, RPA2	12.82	14.10	Individual TC
Hiking	FS8, RPA2	50.85	55.94	Individual TC
Hiking	FS2, RPA3	57.39	63.13	Individual TC
Hiking	FS6, RPA4	11.22	12.34	Individual TC
Downhill Skiing	FS6, RPA4	19.00	20.90	Individual TC
Big Game Hunting	FS8, RPA2	29.30	32.23	Individual TC
Big Game Hunting	FS8, RPA2	4.31	4.74	Individual TC
Big Game Hunting	FS2, RPA3	43.52	47.87	Individual TC
Big Game Hunting	FS5, RPA4	18.56	20.42	Individual TC
Big Game Hunting	FS6, RPA4	4.74	5.21	Individual TC
Wildlife Viewing	FS8, RPA2	13.74	15.11	Individual TC
Wildlife Viewing	FS2, RPA3	58.05	63.86	Individual TC
General Recreation	FS9, RPA1	35.37	38.91	Individual TC
General Recreation	FS8, RPA2	6.59	7.25	Individual TC
General Recreation	FS8, RPA2	15.16	16.68	Individual TC
General Recreation	FS8, RPA2	70.80	77.88	Individual TC
General Recreation	FS2, RPA3	90.00	99.00	Individual TC
General Recreation	FS5, RPA4	39.41	43.35	Individual TC
Other Recreation	FS8, RPA2	29.42	32.36	Individual TC
Other Recreation	FS6, RPA4	56.42	62.06	Individual TC

[a]FS=USDA Forest Service Region, CR=Census Region.
[b]Values in per person per activity day.
[c]TC=travel cost method, CV=contingent valuation method.

Appendix B Table B3. Bibliography Entry #23, Brown, G., and M. Hay, 1987, Net economic recreation values for deer and waterfowl hunting and trout fishing.

Activity	Regions[a]	$ Original [1985][b]	$ Adjusted [1996][b]	Method[c]
Big Game Hunting	FS9, RPA1	$22.00	$30.82	CV
Big Game Hunting	FS9, RPA1	15.00	21.01	CV
Big Game Hunting	FS9, RPA1	14.00	19.61	CV
Big Game Hunting	FS9, RPA1	20.00	28.01	CV
Big Game Hunting	FS9, RPA1	18.00	25.21	CV
Big Game Hunting	FS9, RPA1	13.00	18.21	CV
Big Game Hunting	FS9, RPA1	15.00	21.01	CV
Big Game Hunting	FS9, RPA1	21.00	29.42	CV
Big Game Hunting	FS9, RPA1	14.00	19.61	CV
Big Game Hunting	FS9, RPA1	18.00	25.21	CV
Big Game Hunting	FS9, RPA1	21.00	29.42	CV
Big Game Hunting	FS9, RPA1	22.00	30.82	CV
Big Game Hunting	FS9, RPA1	19.00	26.61	CV
Big Game Hunting	FS9, RPA1	20.00	28.01	CV
Big Game Hunting	FS9, RPA1	15.00	21.01	CV
Big Game Hunting	FS9, RPA1	17.00	23.81	CV
Big Game Hunting	FS9, RPA1	20.00	28.01	CV
Big Game Hunting	FS9, RPA1	18.00	25.21	CV
Big Game Hunting	FS9, RPA1	20.00	28.01	CV
Big Game Hunting	FS9, RPA1	16.00	22.41	CV
Big Game Hunting	FS8, RPA2	17.00	23.81	CV
Big Game Hunting	FS8, RPA2	16.00	22.41	CV
Big Game Hunting	FS8, RPA2	17.00	23.81	CV
Big Game Hunting	FS8, RPA2	21.00	29.42	CV
Big Game Hunting	FS8, RPA2	19.00	26.61	CV
Big Game Hunting	FS8, RPA2	15.00	21.01	CV
Big Game Hunting	FS8, RPA2	18.00	25.21	CV
Big Game Hunting	FS8, RPA2	20.00	28.01	CV
Big Game Hunting	FS8, RPA2	14.00	19.61	CV
Big Game Hunting	FS8, RPA2	26.00	36.42	CV
Big Game Hunting	FS8, RPA2	16.00	22.41	CV
Big Game Hunting	FS8, RPA2	15.00	21.01	CV
Big Game Hunting	FS8, RPA2	15.00	21.01	CV
Big Game Hunting	FS4, RPA3	28.00	39.22	CV
Big Game Hunting	FS4, RPA3	20.00	28.01	CV
Big Game Hunting	FS4, RPA3	20.00	28.01	CV
Big Game Hunting	FS3, RPA3	24.00	33.62	CV
Big Game Hunting	FS3, RPA3	28.00	39.22	CV
Big Game Hunting	FS2, RPA3	18.00	25.21	CV
Big Game Hunting	FS2, RPA3	22.00	30.82	CV
Big Game Hunting	FS2, RPA3	23.00	32.22	CV
Big Game Hunting	FS2, RPA3	16.00	22.41	CV
Big Game Hunting	FS2, RPA3	24.00	33.62	CV
Big Game Hunting	FS1, RPA3	23.00	32.22	CV
Big Game Hunting	FS1, RPA3	25.00	35.02	CV
Big Game Hunting	FS6, RPA4	17.00	23.81	CV
Big Game Hunting	FS6, RPA4	15.00	21.01	CV
Big Game Hunting	FS5, RPA4	25.00	35.02	CV
Big Game Hunting	FS10, RPA5	28.00	39.22	CV
Waterfowl Hunting	FS9, RPA1	7.00	9.81	CV
Waterfowl Hunting	FS9, RPA1	8.00	11.21	CV
Waterfowl Hunting	FS9, RPA1	12.00	16.81	CV
Waterfowl Hunting	FS9, RPA1	10.00	14.01	CV

(cont'd.)

Appendix B Table B3. (Cont'd.)

Activity	Regions[a]	$ Original [1985][b]	$ Adjusted [1996][b]	Method[c]
Waterfowl Hunting	FS9, RPA1	19.00	26.61	CV
Waterfowl Hunting	FS9, RPA1	10.00	14.01	CV
Waterfowl Hunting	FS9, RPA1	9.00	12.61	CV
Waterfowl Hunting	FS9, RPA1	15.00	21.01	CV
Waterfowl Hunting	FS9, RPA1	11.00	15.41	CV
Waterfowl Hunting	FS9, RPA1	16.00	22.41	CV
Waterfowl Hunting	FS9, RPA1	13.00	18.21	CV
Waterfowl Hunting	FS9, RPA1	17.00	23.81	CV
Waterfowl Hunting	FS9, RPA1	8.00	11.21	CV
Waterfowl Hunting	FS9, RPA1	8.00	11.21	CV
Waterfowl Hunting	FS9, RPA1	8.00	11.21	CV
Waterfowl Hunting	FS8, RPA2	13.00	18.21	CV
Waterfowl Hunting	FS8, RPA2	9.00	12.61	CV
Waterfowl Hunting	FS8, RPA2	11.00	15.41	CV
Waterfowl Hunting	FS8, RPA2	9.00	12.61	CV
Waterfowl Hunting	FS8, RPA2	10.00	14.01	CV
Waterfowl Hunting	FS8, RPA2	11.00	15.41	CV
Waterfowl Hunting	FS8, RPA2	12.00	16.81	CV
Waterfowl Hunting	FS8, RPA2	19.00	26.61	CV
Waterfowl Hunting	FS8, RPA2	18.00	25.21	CV
Waterfowl Hunting	FS8, RPA2	16.00	22.41	CV
Waterfowl Hunting	FS8, RPA2	11.00	15.41	CV
Waterfowl Hunting	FS4, RPA3	20.00	28.01	CV
Waterfowl Hunting	FS4, RPA3	13.00	18.21	CV
Waterfowl Hunting	FS4, RPA3	10.00	14.01	CV
Waterfowl Hunting	FS2, RPA3	12.00	16.81	CV
Waterfowl Hunting	FS2, RPA3	15.00	21.01	CV
Waterfowl Hunting	FS2, RPA3	13.00	18.21	CV
Waterfowl Hunting	FS2, RPA3	10.00	14.01	CV
Waterfowl Hunting	FS2, RPA3	15.00	21.01	CV
Waterfowl Hunting	FS1, RPA3	11.00	15.41	CV
Waterfowl Hunting	FS1, RPA3	13.00	18.21	CV
Waterfowl Hunting	FS6, RPA4	13.00	18.21	CV
Waterfowl Hunting	FS6, RPA4	10.00	14.01	CV
Waterfowl Hunting	FS5, RPA4	22.00	30.82	CV
Fishing	FS9, RPA1	17.00	23.81	CV
Fishing	FS9, RPA1	9.00	12.61	CV
Fishing	FS9, RPA1	9.00	12.61	CV
Fishing	FS9, RPA1	10.00	14.01	CV
Fishing	FS9, RPA1	14.00	19.61	CV
Fishing	FS9, RPA1	13.00	18.21	CV
Fishing	FS9, RPA1	7.00	9.81	CV
Fishing	FS9, RPA1	7.00	9.81	CV
Fishing	FS9, RPA1	9.00	12.61	CV
Fishing	FS9, RPA1	10.00	14.01	CV
Fishing	FS9, RPA1	9.00	12.61	CV
Fishing	FS9, RPA1	8.00	11.21	CV
Fishing	FS9, RPA1	13.00	18.21	CV
Fishing	FS9, RPA1	20.00	28.01	CV
Fishing	FS9, RPA1	8.00	11.21	CV
Fishing	FS9, RPA1	11.00	15.41	CV
Fishing	FS9, RPA1	9.00	12.61	CV
Fishing	FS9, RPA1	11.00	15.41	CV
Fishing	FS9, RPA1	9.00	12.61	CV
Fishing	FS9, RPA1	7.00	9.81	CV

(cont'd.)

Appendix B Table B3. (Cont'd.)

Activity	Regions[a]	$ Original [1985][b]	$ Adjusted [1996][b]	Method[c]
Fishing	FS8, RPA2	10.00	14.01	CV
Fishing	FS8, RPA2	13.00	18.21	CV
Fishing	FS8, RPA2	9.00	12.61	CV
Fishing	FS8, RPA2	20.00	28.01	CV
Fishing	FS8, RPA2	15.00	21.01	CV
Fishing	FS8, RPA2	11.00	15.41	CV
Fishing	FS8, RPA2	24.00	33.62	CV
Fishing	FS8, RPA2	8.00	11.21	CV
Fishing	FS8, RPA2	20.00	28.01	CV
Fishing	FS8, RPA2	12.00	16.81	CV
Fishing	FS4, RPA3	10.00	14.01	CV
Fishing	FS4, RPA3	11.00	15.41	CV
Fishing	FS4, RPA3	11.00	15.41	CV
Fishing	FS3, RPA3	11.00	15.41	CV
Fishing	FS3, RPA3	14.00	19.61	CV
Fishing	FS2, RPA3	17.00	23.81	CV
Fishing	FS2, RPA3	13.00	18.21	CV
Fishing	FS2, RPA3	13.00	18.21	CV
Fishing	FS2, RPA3	12.00	16.81	CV
Fishing	FS2, RPA3	15.00	21.01	CV
Fishing	FS1, RPA3	12.00	16.81	CV
Fishing	FS1, RPA3	12.00	16.81	CV
Fishing	FS6, RPA4	11.00	15.41	CV
Fishing	FS6, RPA4	12.00	16.81	CV
Fishing	FS5, RPA4	16.00	22.41	CV
Fishing	FS10, RPA5	28.00	39.22	CV

[a]FS=USDA Forest Service Region, CR=Census Region.
[b]Values in per person per activity day.
[c]TC=travel cost method, CV=contingent valuation method.

Appendix B Table B4. Bibliography Entry #31, Connelly, N., and T. Brown, 1988, Estimates of nonconsumptive wildlife use on Forest Service and Bureau of Land Management lands.

Activity	Regions[a]	$ Original [1985][b]	$ Adjusted [1996][b]	Method[c]
Wildlife Viewing	FS9, RPA1	$35.30	$49.45	CV
Wildlife Viewing	FS9, RPA1	37.18	52.07	CV
Wildlife Viewing	FS9, RPA1	16.84	23.59	CV
Wildlife Viewing	FS9, RPA1	11.93	16.70	CV
Wildlife Viewing	FS9, RPA1	21.73	30.44	CV
Wildlife Viewing	FS9, RPA1	24.38	34.15	CV
Wildlife Viewing	FS9, RPA1	15.41	21.59	CV
Wildlife Viewing	FS9, RPA1	15.13	21.19	CV
Wildlife Viewing	FS9, RPA1	11.99	16.80	CV
Wildlife Viewing	FS9, RPA1	14.06	19.69	CV
Wildlife Viewing	FS9, RPA1	20.07	28.11	CV
Wildlife Viewing	FS9, RPA1	14.46	20.26	CV
Wildlife Viewing	FS9, RPA1	11.53	16.15	CV
Wildlife Viewing	FS8, RPA2	18.20	25.50	CV
Wildlife Viewing	FS8, RPA2	15.02	21.04	CV
Wildlife Viewing	FS8, RPA2	19.85	27.80	CV
Wildlife Viewing	FS8, RPA2	19.46	27.26	CV
Wildlife Viewing	FS8, RPA2	21.48	30.09	CV
Wildlife Viewing	FS8, RPA2	21.37	29.94	CV
Wildlife Viewing	FS8, RPA2	22.22	31.12	CV
Wildlife Viewing	FS8, RPA2	29.62	41.50	CV
Wildlife Viewing	FS8, RPA2	19.26	26.98	CV
Wildlife Viewing	FS8, RPA2	19.05	26.68	CV
Wildlife Viewing	FS8, RPA2	20.83	29.18	CV
Wildlife Viewing	FS8, RPA2	15.41	21.58	CV
Wildlife Viewing	FS8, RPA2	16.27	22.79	CV
Wildlife Viewing	FS4, RPA3	24.36	34.12	CV
Wildlife Viewing	FS4, RPA3	27.68	38.78	CV
Wildlife Viewing	FS4, RPA3	37.64	52.72	CV
Wildlife Viewing	FS3, RPA3	28.93	40.52	CV
Wildlife Viewing	FS3, RPA3	16.32	22.86	CV
Wildlife Viewing	FS2, RPA3	12.68	17.76	CV
Wildlife Viewing	FS2, RPA3	11.64	16.31	CV
Wildlife Viewing	FS2, RPA3	16.53	23.15	CV
Wildlife Viewing	FS2, RPA3	21.22	29.72	CV
Wildlife Viewing	FS2, RPA3	24.46	34.27	CV
Wildlife Viewing	FS1, RPA3	15.16	21.24	CV
Wildlife Viewing	FS1, RPA3	21.67	30.35	CV
Wildlife Viewing	FS6, RPA4	20.04	28.06	CV
Wildlife Viewing	FS6, RPA4	25.52	35.75	CV
Wildlife Viewing	FS5, RPA4	31.27	43.80	CV
Wildlife Viewing	FS10, RPA5	9.34	13.09	CV

[a]FS=USDA Forest Service Region, CR=Census Region.
[b]Values in per person per activity day.
[c]TC=travel cost method, CV=contingent valuation method.

Appendix B Table B5. Bibliography Entry #68, Hansen, C., 1977, A report on the value of wildlife.

Activity	Regions[a]	$ Original [1975][b]	$ Adjusted [1996][b]	Method[c]
Big Game Hunting	FS4, RPA3	$8.30	$21.68	CV
Big Game Hunting	FS4, RPA3	5.10	13.32	CV
Big Game Hunting	FS4, RPA3	4.29	11.22	CV
Big Game Hunting	FS4, RPA3	45.84	119.81	CV
Big Game Hunting	FS4, RPA3	4.36	11.38	CV
Big Game Hunting	FS4, RPA3	9.47	24.75	CV
Big Game Hunting	FS4, RPA3	9.30	24.32	CV
Big Game Hunting	FS4, RPA3	17.54	45.85	CV
Big Game Hunting	FS4, RPA3	9.03	23.60	CV
Big Game Hunting	FS4, RPA3	32.22	84.21	CV
Big Game Hunting	FS4, RPA3	16.20	42.33	CV
Big Game Hunting	FS2, RPA3	2.95	7.70	CV
Big Game Hunting	FS2, RPA3	9.37	24.50	CV
Big Game Hunting	FS2, RPA3	6.17	16.13	CV
Big Game Hunting	FS2, RPA3	14.40	37.63	CV
Small Game Hunting	FS4, RPA3	10.60	27.71	CV
Small Game Hunting	FS4, RPA3	4.96	12.96	CV
Small Game Hunting	FS4, RPA3	6.51	17.02	CV
Small Game Hunting	FS4, RPA3	16.41	42.88	CV
Small Game Hunting	FS4, RPA3	7.86	20.54	CV
Small Game Hunting	FS2, RPA3	3.23	8.43	CV
Small Game Hunting	FS2, RPA3	11.11	29.04	CV
Waterfowl Hunting	FS4, RPA3	6.88	17.97	CV
Waterfowl Hunting	FS4, RPA3	10.78	28.16	CV
Waterfowl Hunting	FS4, RPA3	3.21	8.39	CV
Waterfowl Hunting	FS2, RPA3	14.92	39.00	CV
Fishing	FS2, RPA3	3.08	8.05	CV
Fishing	FS4, RPA3	5.32	13.91	CV
Fishing	FS4, RPA3	4.01	10.47	CV
Fishing	FS4, RPA3	4.79	12.53	CV
Fishing	FS4, RPA3	2.86	7.47	CV

[a]*FS=USDA Forest Service Region, CR=Census Region.*
[b]*Values in per person per activity day.*
[c]*TC=travel cost method, CV=contingent valuation method.*

Appendix B Table B6. Bibliography Entry #73, Hay, J.M., 1988, Net economic values of non-consumptive wildlife-related recreation.

Activity	Regions[a]	$ Original [1985][b]	$ Adjusted [1996][b]	Method[c]
Wildlife Viewing	FS9, RPA1	19.00	26.61	CV
Wildlife Viewing	FS9, RPA1	25.00	35.02	CV
Wildlife Viewing	FS9, RPA1	13.00	18.21	CV
Wildlife Viewing	FS9, RPA1	14.00	19.61	CV
Wildlife Viewing	FS9, RPA1	28.00	39.22	CV
Wildlife Viewing	FS9, RPA1	21.00	29.42	CV
Wildlife Viewing	FS9, RPA1	24.00	33.62	CV
Wildlife Viewing	FS9, RPA1	10.00	14.01	CV
Wildlife Viewing	FS9, RPA1	20.00	28.01	CV
Wildlife Viewing	FS9, RPA1	20.00	28.01	CV
Wildlife Viewing	FS9, RPA1	14.00	19.61	CV
Wildlife Viewing	FS9, RPA1	18.00	25.21	CV
Wildlife Viewing	FS9, RPA1	28.00	39.22	CV
Wildlife Viewing	FS9, RPA1	16.00	22.41	CV
Wildlife Viewing	FS9, RPA1	13.00	18.21	CV
Wildlife Viewing	FS9, RPA1	24.00	33.62	CV
Wildlife Viewing	FS9, RPA1	21.00	29.42	CV
Wildlife Viewing	FS9, RPA1	18.00	25.21	CV
Wildlife Viewing	FS9, RPA1	15.00	21.01	CV
Wildlife Viewing	FS9, RPA1	17.00	23.81	CV
Wildlife Viewing	FS8, RPA2	13.00	18.21	CV
Wildlife Viewing	FS8, RPA2	12.00	16.81	CV
Wildlife Viewing	FS8, RPA2	16.00	22.41	CV
Wildlife Viewing	FS8, RPA2	26.00	36.42	CV
Wildlife Viewing	FS8, RPA2	15.00	21.01	CV
Wildlife Viewing	FS8, RPA2	10.00	14.01	CV
Wildlife Viewing	FS8, RPA2	12.00	16.81	CV
Wildlife Viewing	FS8, RPA2	14.00	19.61	CV
Wildlife Viewing	FS8, RPA2	11.00	15.41	CV
Wildlife Viewing	FS8, RPA2	34.00	47.63	CV
Wildlife Viewing	FS8, RPA2	34.00	47.63	CV
Wildlife Viewing	FS8, RPA2	24.00	33.62	CV
Wildlife Viewing	FS8, RPA2	21.00	29.42	CV
Wildlife Viewing	FS4, RPA3	21.00	29.42	CV
Wildlife Viewing	FS4, RPA3	25.00	35.02	CV
Wildlife Viewing	FS4, RPA3	41.00	57.43	CV
Wildlife Viewing	FS3, RPA3	29.00	40.62	CV
Wildlife Viewing	FS3, RPA3	30.00	42.02	CV
Wildlife Viewing	FS2, RPA3	11.00	15.41	CV
Wildlife Viewing	FS2, RPA3	13.00	18.21	CV
Wildlife Viewing	FS2, RPA3	14.00	19.61	CV
Wildlife Viewing	FS2, RPA3	23.00	32.22	CV
Wildlife Viewing	FS2, RPA3	26.00	36.42	CV
Wildlife Viewing	FS1, RPA3	22.00	30.82	CV
Wildlife Viewing	FS1, RPA3	29.00	40.62	CV
Wildlife Viewing	FS6, RPA4	15.00	21.01	CV
Wildlife Viewing	FS6, RPA4	20.00	28.01	CV
Wildlife Viewing	FS5, RPA4	27.00	37.82	CV
Wildlife Viewing	FS5, RPA4	32.00	44.82	CV
Wildlife Viewing	FS10, RPA5	24.00	33.62	CV

[a]*FS=USDA Forest Service Region, CR=Census Region.*
[b]*Values in per person per activity day.*
[c]*TC=travel cost method, CV=contingent valuation method.*

Appendix B Table B7. Bibliography Entry #101, McCollum, D.W., G.L. Peterson, J.R. Arnold, D.C. Markstrom, and D.M. Hellerstein, 1990, The net economic value of recreation on the national forests: Twelve types of primary activity trips across nine Forest Service regions.

Activity	Regions[a]	$ Original [1986][b]	$ Adjusted [1996][b]	Method[c]
Camping	FS9, RPA1	4.11	5.61	Zonal TC
Camping	FS8, RPA2	3.07	4.19	Zonal TC
Camping	FS3, RPA3	4.26	5.82	Zonal TC
Camping	FS6, RPA4	4.55	6.21	Zonal TC
Picnicking	FS9, RPA1	5.46	7.45	Zonal TC
Swimming	FS8, RPA2	8.33	11.37	Zonal TC
Swimming	FS5, RPA4	10.72	14.63	Zonal TC
Sightseeing	FS9, RPA1	20.19	27.56	Zonal TC
Sightseeing	FS10, RPA5	9.67	13.20	Zonal TC
Hiking	FS9, RPA1	30.40	41.50	Zonal TC
Big Game Hunting	FS8, RPA2	7.56	10.32	Zonal TC
Big Game Hunting	FS1, RPA3	4.61	6.29	Zonal TC
Big Game Hunting	FS2, RPA3	4.18	5.71	Zonal TC
Big Game Hunting	FS4, RPA3	4.35	5.94	Zonal TC
Big Game Hunting	FS6, RPA4	5.56	7.59	Zonal TC
Fishing	FS9, RPA1	8.35	11.40	Zonal TC
Fishing	FS1, RPA3	24.08	32.87	Zonal TC
Fishing	FS2, RPA3	10.44	14.25	Zonal TC
Fishing	FS4, RPA3	7.47	10.20	Zonal TC
Wildlife Viewing	FS10, RPA5	6.53	8.91	Zonal TC
General Recreation	FS9, RPA1	5.47	7.47	Zonal TC
General Recreation	FS8, RPA2	4.33	5.91	Zonal TC
General Recreation	FS1, RPA3	7.30	9.97	Zonal TC
General Recreation	FS2, RPA3	9.49	12.95	Zonal TC
General Recreation	FS3, RPA3	6.90	9.42	Zonal TC
General Recreation	FS4, RPA3	4.83	6.59	Zonal TC
General Recreation	FS5, RPA4	7.35	10.03	Zonal TC
General Recreation	FS6, RPA4	3.20	4.37	Zonal TC
General Recreation	FS10, RPA5	9.06	12.37	Zonal TC
Wilderness	FS8, RPA2	7.40	10.10	Zonal TC
Wilderness	FS2, RPA3	13.47	18.39	Zonal TC
Wilderness	FS5, RPA4	3.09	4.22	Zonal TC
Wilderness	FS10, RPA5	9.51	12.98	Zonal TC

[a]*FS=USDA Forest Service Region, CR=Census Region.*
[b]*Values in per person per activity day.*
[c]*TC=travel cost method, CV=contingent valuation method.*

Appendix B Table B8. Bibliography Entry #145, Waddington, D.G., K.J. Boyle, and J. Cooper, 1991, 1991 Net economic values for bass and trout fishing, deer hunting, and wildlife watching.

Activity	Regions[a]	$ Original [1991][b]	$ Adjusted [1996][b]	Method[c]
Big Game Hunting	FS9, RPA1	$25.00	$28.26	CV
Big Game Hunting	FS9, RPA1	50.00	56.51	CV
Big Game Hunting	FS9, RPA1	22.00	24.87	CV
Big Game Hunting	FS9, RPA1	48.00	54.25	CV
Big Game Hunting	FS9, RPA1	38.00	42.95	CV
Big Game Hunting	FS9, RPA1	61.00	68.95	CV
Big Game Hunting	FS9, RPA1	53.00	59.91	CV
Big Game Hunting	FS9, RPA1	27.00	30.52	CV
Big Game Hunting	FS9, RPA1	41.00	46.34	CV
Big Game Hunting	FS9, RPA1	55.00	62.17	CV
Big Game Hunting	FS9, RPA1	61.00	68.95	CV
Big Game Hunting	FS9, RPA1	63.00	71.21	CV
Big Game Hunting	FS9, RPA1	52.00	58.78	CV
Big Game Hunting	FS9, RPA1	45.00	50.86	CV
Big Game Hunting	FS9, RPA1	33.00	37.30	CV
Big Game Hunting	FS9, RPA1	49.00	55.38	CV
Big Game Hunting	FS9, RPA1	47.00	53.12	CV
Big Game Hunting	FS9, RPA1	39.00	44.08	CV
Big Game Hunting	FS9, RPA1	31.00	35.04	CV
Big Game Hunting	FS9, RPA1	36.00	40.69	CV
Big Game Hunting	FS8, RPA2	45.00	50.86	CV
Big Game Hunting	FS8, RPA2	50.00	56.51	CV
Big Game Hunting	FS8, RPA2	41.00	46.34	CV
Big Game Hunting	FS8, RPA2	44.00	49.73	CV
Big Game Hunting	FS8, RPA2	58.00	65.56	CV
Big Game Hunting	FS8, RPA2	36.00	40.69	CV
Big Game Hunting	FS8, RPA2	35.00	39.56	CV
Big Game Hunting	FS8, RPA2	36.00	40.69	CV
Big Game Hunting	FS8, RPA2	47.00	53.12	CV
Big Game Hunting	FS8, RPA2	34.00	38.43	CV
Big Game Hunting	FS8, RPA2	32.00	36.17	CV
Big Game Hunting	FS8, RPA2	53.00	59.91	CV
Big Game Hunting	FS8, RPA2	33.00	37.30	CV
Big Game Hunting	FS4, RPA3	45.00	50.86	CV
Big Game Hunting	FS4, RPA3	45.00	50.86	CV
Big Game Hunting	FS4, RPA3	95.00	107.38	CV
Big Game Hunting	FS3, RPA3	66.00	74.60	CV
Big Game Hunting	FS3, RPA3	81.00	91.55	CV
Big Game Hunting	FS2, RPA3	34.00	38.43	CV
Big Game Hunting	FS2, RPA3	36.00	40.69	CV
Big Game Hunting	FS2, RPA3	44.00	49.73	CV
Big Game Hunting	FS2, RPA3	66.00	74.60	CV
Big Game Hunting	FS2, RPA3	72.00	81.38	CV
Big Game Hunting	FS2, RPA3	83.00	93.81	CV
Big Game Hunting	FS1, RPA3	56.00	66.72	CV
Big Game Hunting	FS6, RPA4	59.00	66.69	CV
Big Game Hunting	FS6, RPA4	52.00	58.78	CV
Big Game Hunting	FS10, RPA5	63.00	71.21	CV
Wildlife Viewing	FS9, RPA1	27.00	30.52	CV
Wildlife Viewing	FS9, RPA1	23.00	26.00	CV
Wildlife Viewing	FS9, RPA1	12.00	13.56	CV
Wildlife Viewing	FS9, RPA1	32.00	36.17	CV
Wildlife Viewing	FS9, RPA1	23.00	26.00	CV

(cont'd.)

Appendix B Table B8. (Cont'd.)

Activity	Regions[a]	$ Original [1991][b]	$ Adjusted [1996][b]	Method[c]
Wildlife Viewing	FS9, RPA1	14.00	15.82	CV
Wildlife Viewing	FS9, RPA1	21.00	23.74	CV
Wildlife Viewing	FS9, RPA1	29.00	32.78	CV
Wildlife Viewing	FS9, RPA1	22.00	24.87	CV
Wildlife Viewing	FS9, RPA1	29.00	32.78	CV
Wildlife Viewing	FS9, RPA1	36.00	40.69	CV
Wildlife Viewing	FS9, RPA1	28.00	31.65	CV
Wildlife Viewing	FS9, RPA1	23.00	26.00	CV
Wildlife Viewing	FS9, RPA1	26.00	29.39	CV
Wildlife Viewing	FS9, RPA1	17.00	19.21	CV
Wildlife Viewing	FS9, RPA1	16.00	18.08	CV
Wildlife Viewing	FS9, RPA1	27.00	30.52	CV
Wildlife Viewing	FS9, RPA1	12.00	13.56	CV
Wildlife Viewing	FS9, RPA1	59.00	66.69	CV
Wildlife Viewing	FS9, RPA1	71.00	80.25	CV
Wildlife Viewing	FS8, RPA2	37.00	41.82	CV
Wildlife Viewing	FS8, RPA2	67.00	75.73	CV
Wildlife Viewing	FS8, RPA2	39.00	44.08	CV
Wildlife Viewing	FS8, RPA2	27.00	30.52	CV
Wildlife Viewing	FS8, RPA2	24.00	27.13	CV
Wildlife Viewing	FS8, RPA2	30.00	33.91	CV
Wildlife Viewing	FS8, RPA2	28.00	31.65	CV
Wildlife Viewing	FS8, RPA2	25.00	28.26	CV
Wildlife Viewing	FS8, RPA2	21.00	23.74	CV
Wildlife Viewing	FS8, RPA2	31.00	35.04	CV
Wildlife Viewing	FS8, RPA2	41.00	46.34	CV
Wildlife Viewing	FS4, RPA3	22.00	24.87	CV
Wildlife Viewing	FS4, RPA3	29.00	32.78	CV
Wildlife Viewing	FS4, RPA3	45.00	50.86	CV
Wildlife Viewing	FS3, RPA3	34.00	38.43	CV
Wildlife Viewing	FS3, RPA3	50.00	56.51	CV
Wildlife Viewing	FS2, RPA3	23.00	26.00	CV
Wildlife Viewing	FS2, RPA3	28.00	31.65	CV
Wildlife Viewing	FS2, RPA3	34.00	38.43	CV
Wildlife Viewing	FS2, RPA3	49.00	55.38	CV
Wildlife Viewing	FS1, RPA3	10.00	11.30	CV
Wildlife Viewing	FS1, RPA3	21.00	23.74	CV
Wildlife Viewing	FS1, RPA3	21.00	23.74	CV
Wildlife Viewing	FS6, RPA4	27.00	30.52	CV
Wildlife Viewing	FS6, RPA4	28.00	31.65	CV
Wildlife Viewing	FS5, RPA4	28.00	31.65	CV
Wildlife Viewing	FS5, RPA4	29.00	32.78	CV
Wildlife Viewing	FS10, RPA5	49.00	55.38	CV

[a]FS=USDA Forest Service Region, CR=Census Region.
[b]Values in per person per activity day.
[c]TC=travel cost method, CV=contingent valuation method.

Appendix C: References to Appendix A Annotated Bibliography Entries by Recreation Activity

Appendix C Table C1. CAMPING: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	9, 78, 101, 105, 118
RPA2	FS8	9, 61, 86, 87, 101
RPA3	FS1	39
	FS2	150, 156
	FS3	25, 83, 98, 101, 122, 141, 159
	FS4	56, 108, 109
RPA4	FS5	9
	FS6	9, 52, 101
RPA5	FS10	—
NATIONAL		8
CANADA		—

Appendix C Table C2. PICNICKING: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	9, 101
RPA2	FS8	9
RPA3	FS1	—
	FS2	9, 150, 156
	FS3	159
	FS4	—
RPA4	FS5	9, 85
	FS6	9
RPA5	FS10	—
NATIONAL		8
CANADA		—

Appendix C Table C3. SWIMMING: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	78, 120, 134
RPA2	FS8	9, 66, 101
RPA3	FS1	—
	FS2	—
	FS3	159
	FS4	—-
RPA4	FS5	101, 146
	FS6	9
RPA5	FS10	—
NATIONAL		8
CANADA		—

Appendix C Table C4. SIGHTSEEING: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	9, 101
RPA2	FS8	9, 60
RPA3	FS1	—
	FS2	77, 152, 153
	FS3	71
	FS4	95
RPA4	FS5	—
	FS6	9
RPA5	FS10	101
NATIONAL		8
CANADA		—

Appendix C Table C5. OFF ROAD DRIVING: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	—
RPA2	FS8	9
RPA3	FS1	—
	FS2	150
	FS3	—
	FS4	—
RPA4	FS5	—
	FS6	9
RPA5	FS10	—
NATIONAL		8
CANADA		—

Appendix C Table C6. MOTOR BOATING: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	78
RPA2	FS8	132
RPA3	FS1	—
	FS2	9, 124
	FS3	146, 159
	FS4	—
RPA4	FS5	—
	FS6	142
RPA5	FS10	—
NATIONAL		8
CANADA		—

Appendix C Table C7. FLOAT BOATING: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	9, 74, 125
RPA2	FS8	9, 84
RPA3	FS1	—-
	FS2	9, 157
	FS3	11, 18, 81
	FS4	15, 108, 125
RPA4	FS5	—
	FS6	—
RPA5	FS10	72
NATIONAL		8
CANADA		—

Appendix C Table C8. HIKING: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	9, 78, 101
RPA2	FS8	9, 29, 69, 119
RPA3	FS1	—
	FS2	9, 126, 150, 155, 156
	FS3	—
	FS4	—
RPA4	FS5	5, 133
	FS6	9, 24, 51, 62
RPA5	FS10	72
NATIONAL		8
CANADA		—

Appendix C Table C9. BIKING: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	133
RPA2	FS8	133
RPA3	FS1	—
	FS2	—
	FS3	—
	FS4	58
RPA4	FS5	—
	FS6	—
RPA5	FS10	—
NATIONAL		8
CANADA		—

Appendix C Table C10. DOWNHILL SKIING: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	—
RPA2	FS8	—
RPA3	FS1	—
	FS2	112, 148, 154
	FS3	—
	FS4	—
RPA4	FS5	—
	FS6	9
RPA5	FS10	—
NATIONAL		8
CANADA		—

Appendix C Table C11. CROSS COUNTRY SKIING: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	63, 100
RPA2	FS8	—
RPA3	FS1	—
	FS2	63, 149, 155
	FS3	—
	FS4	80
RPA4	FS5	30
	FS6	—
RPA5	FS10	—
NATIONAL		8
CANADA		—

Appendix C Table C12. SNOWMOBILING: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	—
RPA2	FS8	—
RPA3	FS1	—
	FS2	99
	FS3	—
	FS4	80
RPA4	FS5	—
	FS6	—
RPA5	FS10	—
NATIONAL		—
CANADA		—

Appendix C Table C13. BIG GAME HUNTING: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	913, 17, 19, 20, 23, 55, 57, 102, 110, 145
RPA2	FS8	9, 23, 101, 145
RPA3	FS1	21, 23, 44, 45, 92, 93, 101, 116, 145
	FS2	9, 23, 68, 101, 145, 161
	FS3	23, 36, 98, 145
	FS4	23, 59, 68, 89, 90, 101, 138, 145
RPA4	FS5	9, 23, 38, 91, 94
	FS6	9, 23, 42, 101, 145
RPA5	FS10	23, 103, 145
NATIONAL		6, 8
CANADA		2, 28

Appendix C Table C14. SMALL GAME HUNTING: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	17, 19, 20
RPA2	FS8	—
RPA3	FS1	—
	FS2	65, 68, 110
	FS3	98
	FS4	68, 162
RPA4	FS5	—
	FS6	4
RPA5	FS10	—
NATIONAL		8
CANADA		—

Appendix C Table C15. WATERFOWL HUNTING: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	12, 17, 19, 20, 23, 64
RPA2	FS8	23
RPA3	FS1	23, 46
	FS2	23, 68
	FS3	98
	FS4	22, 23, 68
RPA4	FS5	23, 33, 34
	FS6	23
RPA5	FS10	72
NATIONAL		—
CANADA		—

Appendix C Table C17. WILDLIFE VIEWING: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	31, 67, 73, 130, 145
RPA2	FS8	9, 31, 73, 139, 145
RPA3	FS1	31, 73, 145
	FS2	7, 9, 31, 73, 145
	FS3	31, 37, 73, 145
	FS4	31, 73, 145
RPA4	FS5	31, 33, 73, 91, 94, 135, 145
	FS6	31, 73, 145
RPA5	FS10	31, 73, 101, 103, 145
NATIONAL		8
CANADA		—

Appendix C Table C16. FISHING: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	16, 20, 23, 32, 75, 76, 79, 101, 104, 106, 107, 110, 113, 114, 128, 130, 160
RPA2	FS8	23, 110, 115, 163
RPA3	FS1	23, 47, 48, 101
	FS2	23, 40, 68, 70, 101
	FS3	18, 23, 82, 97, 98, 110, 121, 141
	FS4	23, 68, 101, 110, 137
RPA4	FS5	23, 127, 136
	FS6	23, 26, 41, 127, 140
RPA5	FS10	23
NATIONAL		144
CANADA		3, 27

Appendix C Table C18. HORSEBACK RIDING: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	—
RPA2	FS8	—
RPA3	FS1	—
	FS2	—
	FS3	—
	FS4	—
RPA4	FS5	—
	FS6	—
RPA5	FS10	—
NATIONAL		8
CANADA		—

Appendix C Table C19. ROCK CLIMBING: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	131
RPA2	FS8	—
RPA3	FS1	—
	FS2	50
	FS3	—
	FS4	—
RPA4	FS5	—
	FS6	—
RPA5	FS10	—
NATIONAL		—
CANADA		—

Appendix C Table C20. GENERAL RECREATION: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	9, 14, 49, 101, 130
RPA2	FS8	9, 10, 101, 143
RPA3	FS1	101
	FS2	9, 96, 101, 147, 151
	FS3	101
	FS4	88, 101
RPA4	FS5	9, 101, 111
	FS6	101
RPA5	FS10	101
NATIONAL		—
CANADA		1

Appendix C Table C21. OTHER RECREATION: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	—
RPA2	FS8	9, 35, 54, 123
RPA3	FS1	43, 47
	FS2	117, 129, 158
	FS3	—
	FS4	—
RPA4	FS5	—
	FS6	9
RPA5	FS10	—
NATIONAL		8
CANADA		—

Appendix C Table C22. WILDERNESS RECREATION: Empirical Studies Estimating Economic Use Values.

RPA Region	Forest Service Region	Bibliography Reference Number
RPA1	FS9	67, 74, 118
RPA2	FS8	29, 101, 119
RPA3	FS1	—
	FS2	7, 101, 151, 153, 158
	FS3	—
	FS4	88
RPA4	FS5	5, 101, 135
	FS6	24, 51, 52
RPA5	FS10	101
NATIONAL		—
CANADA		—

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