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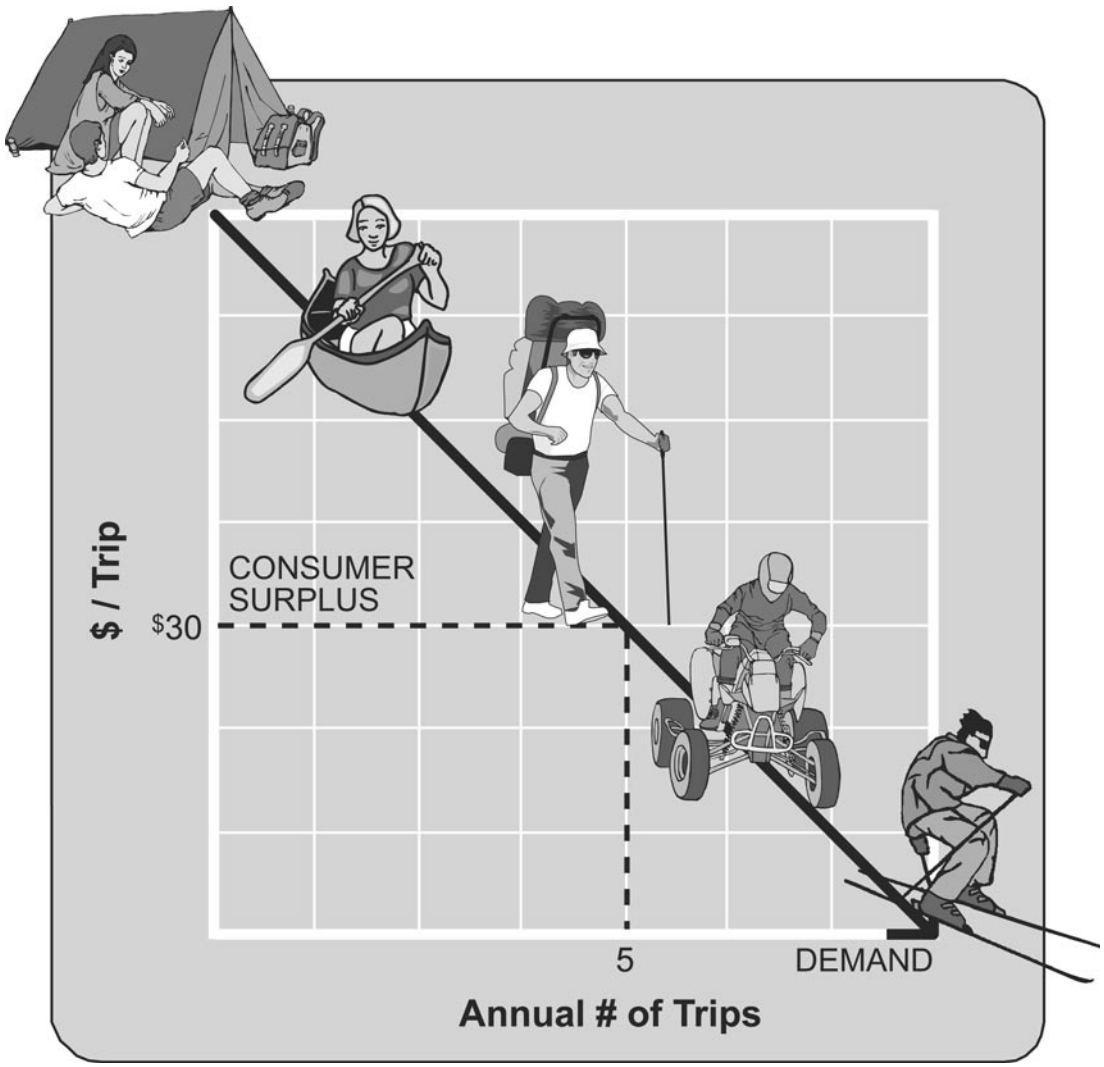
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Updated Outdoor Recreation Use Values on National Forests and Other Public Lands

John Loomis



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Abstract

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This report summarizes more than 30 years of the literature on net economic value of outdoor recreation on public lands. The report provides average net willingness to pay or consumer surplus per day for 30 recreation activities at the national level. Values per day by recreation activity are also presented by census region of the United States. Detailed tables provide the average value per day as well as the standard error for calculating confidence intervals. Guidance for using these values in performing benefit transfer to unstudied sites is also provided. The report provides a link to a Web site where the spreadsheet that underlies the averages calculated in this report is available.

Keywords: Benefit transfer, consumer surplus, recreation use values, willingness to pay.

Executive Summary

This report presents updated average values per visitor-day of outdoor recreation opportunities commonly found at national forests, with emphasis on the Pacific Northwest region. The use of past valuation information for current policy analysis is called benefit transfer (Brookshire and Neill 1992). In this report, the term "value" is used to mean net willingness to pay or consumer surplus, a measure commonly used for benefit-cost analysis or economic efficiency analysis by federal agencies such as the U.S. Army Corps of Engineers, Bureau of Reclamation (U.S. Water Resources Council 1979, 1983) and U.S. Environmental Protection Agency.

This report updates past USDA Forest Service-sponsored reviews of the literature on outdoor recreation use valuation by including recent analyses and estimates through the year 2003. Adding studies from this period to past reviews results in a database on outdoor recreation use valuation that spans 1967 to 2003; 1,239 estimates obtained from the literature provide values for 30 outdoor recreation activities. This update includes new recreation activities such as snorkeling, scuba diving, and birdwatching that were not part of the Rosenberger and Loomis (2001) report. The values presented in this report are averages of values per day from original or primary Contingent Valuation Method or Travel Cost Method studies (see Loomis and Walsh 1997 for more details on these two valuation methods). To standardize the units of recreation use, average values are reported per visitor-day. The average visitor-day value is reported for each activity by census region when available, and specifically broken out into greater detail for the Pacific Northwest. The complete spreadsheet providing the results of the individual studies is available at: http://www.fs.fed.us/pnw/data/RecValues.htm.

Although the report provides average values for all regions of the United States, the values for the Pacific Northwest are separated out. Based on the existing literature, hunting on public lands in the Pacific Northwest has an average value of $35 per day, fishing averages $42 per day, and wildlife viewing is $35 per day. Hiking has a value of $24 per day in the Pacific Northwest.

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Introduction

The USDA Forest Service and other federal land management agencies including the National Park Service, U.S. Fish and Wildlife Service, and USDI Bureau of Land Management require information on values of recreation. Whether for land management planning or Government Performance and Results Act (GPRA) of 1993, these requirements feed directly into a need for credible measures of benefits. In this case, we are interested in developing credible measures of benefits for outdoor recreation.

This report is intended to serve two functions. First, it provides information from a literature review of economic studies conducted in the United States, spanning 1967 to 2003, that estimated outdoor recreation use values. Second, this report provides some basic guidelines on performing benefit transfers in the context of recreation use valuation. This report is not a cookbook for benefit transfers, but instead it is to be used as a guide to the empirical estimates available (a more complete discussion of benefit transfer protocols can be found in Rosenberger and Loomis 2001). Per federal government benefit-cost guidelines (U.S. Water Resources Council 1979, 1983), economic value is defined as visitor's net willingness to pay or consumer surplus (Freeman 1993). The values summarized in this report are averages of original or primary Contingent Valuation Method (CVM) or Travel Cost Method (TCM) studies (see Loomis and Walsh 1997 for more details on these two valuation methods). The values reported in this publication are unweighted or simple averages where each study and each estimate from each study is given equal weight. This is the same approach used by Rosenberger and Loomis (2001). However, by using the spreadsheet, an analyst could construct a weighted average by using any reasonable criteria such as study sample size or survey response rate, etc. To standardize the units of recreation use, average values are reported per visitor-day.

Data

Literature Review Efforts, Past and Present

We provide data on outdoor recreation use values based on empirical research conducted from 1967 to 2003 in the United States. This data is the compilation of five literature reviews conducted over the last 20 years. 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 1983–88 period (Walsh et al. 1988, 1992). That second review increased the number of benefit

estimates to 287 estimates. A third literature review on the subject covered the period 1968–93 (MacNair 1993). A fourth literature review on outdoor recreation use valuation, focusing on studies reported from 1988 to 1998 (Loomis et al. 1999). Rosenberger and Loomis (2001) then merged the results of the fourth review with the MacNair (1993) database. The main emphasis was to improve on coding procedures used in the past review efforts to focus on use value estimates for all recreation activity categories identified by USDA Forest Service documents. Fishing benefit studies were not emphasized, as this was the focus of a separate review sponsored by the U.S. Fish and Wildlife Service, and published by Industrial Economics, Inc. (Markowski et al. 1997). Fishing studies coded in the MacNair (1993) database that were from the Walsh et al. (1988) review were sufficient in number and coverage for valuation of fishing for statistical purposes. This report represents the fifth literature review, adding new studies from 1998 through 2003. In this new review, we were able to obtain 479 new observations.

Data Sources and Coding Procedures

A concerted effort was made to locate studies on activities that were not previously investigated and recreation activities of particular interest to the USDA Forest Service, especially the Pacific Northwest Region. Computerized databases, such as American Economic Association's ECONLIT and Thomson's ISI Web of Science 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 et al. 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 et al. (1988, 1992) literature review. A few study details were obtained directly from the Walsh et al. (1988) review that were not included in the MacNair (1993) database.

Coding fields include reference citation to the research, benefit measure(s) reported, methodology used, recreation activity investigated, recreation site characteristics, and user or sample population characteristics.

For consistency and to allow merging of the new studies with studies compiled by Rosenberger and Loomis (2001), the same master coding sheet was used for the base. The spreadsheet dataset and code sheet contains 126 fields. The main coding fields 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, 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 by using information provided in the study report), the units in which the estimate is reported (e.g., day, trip, season, or year), and benefit measures temporally adjusted for inflationary trends to 2004 dollars. An activity-day represents

the typical amount of time a person pursues 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).

Value-Per-Day Tables by Activity and Region

New data were combined with old data to create a database of 1,239 observations spanning 1967 through 2003. This table (table 1) presents data for the 30 activities. Information that can be observed includes the number of studies, number of estimates, mean/average, standard error, and range of values. In brief, the activities most commonly found include hunting, fishing, wildlife viewing, and camping. The average estimate of consumer surplus is $47.64 per person per day across all 1,239 observations.

Table 1—Summary statistics on average consumer surplus values per person per day by activity from original recreation benefit studies, 1967–2003

Activity	Studies	Estimates	Mean	Standard error	Range of estimates	
	- - - Number - - -		*- - - - - - - - - - - 2004 dollars - - - - - - - - - - -*			
Backpacking	1	6	52.10	9.29	26.82	80.34
Birdwatching	4	8	29.60	8.35	5.80	78.46
Camping	29	48	37.19	5.77	2.03	224.53
Cross-country skiing	8	12	31.38	3.41	14.05	48.38
Downhill skiing	5	5	33.49	8.48	15.05	63.11
Fishing	129	177	47.16	4.81	2.08	556.82
Floatboating/rafting/canoeing	20	81	100.91	9.56	2.70	394.82
General recreation	15	39	35.10	8.69	1.42	257.51
Going to the beach	5	33	39.43	5.06	3.78	117.82
Hiking	21	68	30.84	4.33	0.40	262.04
Horseback riding	1	1	18.12		18.12	18.12
Hunting	192	277	46.92	2.20	2.60	250.90
Motorboating	15	32	46.27	7.43	3.78	203.62
Mountain biking	7	32	73.78	12.11	20.86	295.69
Off-road vehicle driving	4	10	22.92	3.95	5.24	40.86
Other recreation	15	16	48.70	11.57	5.71	206.82
Picnicking	8	13	41.46	10.69	8.94	142.74
Pleasure driving (which may include sightseeing)	4	11	59.23	18.84	3.02	167.74
Rock climbing	4	27	56.26	6.86	26.62	135.82
Scuba diving	2	24	32.36	11.21	2.81	250.04
Sightseeing	15	28	36.84	8.80	.65	209.77
Snorkeling	1	9	30.31	15.36	5.23	135.29
Snowmobiling	3	8	36.29	13.24	10.79	124.44
Swimming	11	26	42.68	6.14	2.20	134.34
Visiting environmental education centers	1	1	6.01		6.01	6.01
Visiting arboretums	1	1	13.54		13.54	13.54
Visiting aquariums	1	1	28.31		28.31	28.31
Waterskiing	1	4	49.02	12.72	15.13	70.07
Wildlife viewing	69	240	42.36	2.64	2.40	347.88
Windsurfing	1	1	395.47		395.47	395.47

Table 2 breaks down the information further by subdividing the activities by region. Six regions are used that roughly follow U.S. Census Regions: Alaska, Intermountain, Northeast, Pacific Coast (USDA Pacific Southwest and Pacific Northwest Regions [R5 and R6]), Southeast, and our own construct, Multiple Area. Multiple Area was included, as several of the studies spanned more than one region. Figure 1 illustrates the geographic regions used for this analysis. This update provides 354 observations in the Intermountain area, 306 in the Northeast, 281 in the Southeast, 186 in the Pacific Coast, 26 in Alaska, and only 86 in the Multiple Area studies. Deciding upon the best degree of geographic aggregation is a tradeoff between greater geographic specificity, which enhances accuracy in benefit transfer, and smaller sample sizes within each region, which reduces accuracy. Considering this tradeoff, it was desirable to use regions broader than Forest Service administrative regions. This increased the sample size in each cell. Second, for some recreation activities, if smaller administrative regions were used it would lead to numerous blank cells, indicating no values for that activity in that region. Finally, the larger censuslike regions correspond to the Resources Planning Act (RPA) assessment regions, so there is some connection to Government Performance and Results Act and RPA regions.

Table 2 also presents average recreation values of empirical studies conducted in wilderness areas by region. Of the 1,239 total studies, 108 were found to be in wilderness areas.

Table 3 provides more detail about each activity in each region, including standard error and minimum and maximum values for each activity. The region with the least amount of activity values was Alaska, with eight recreation activities having values. None of the regions had values for all 30 recreation activities.

Table 4 presents averages specific to the Pacific Northwest Region (R6), Oregon and Washington. As can be seen, there are relatively few studies, although they produce a large number of benefit estimates for the different sites and variants of valuation techniques used in each study. There are quite a few fishing, hiking, hunting, and wildlife viewing studies and estimates.

Many of the estimates in table 4 (specifically, camping, off-road vehicles, picknicking, sightseeing, and swimming) are from a USDA Forest Service-commissioned study by Bergstrom et al. (1996). Many of the hunting and fishing studies are from Brown and Hay (1987) from the USFWS hunting and fishing survey, and from Rowe et al. (1985). Most of the hiking value estimates came from Hilger's (1998) master's thesis on wilderness day hikers, and Englin and Shonkwiler (1995).

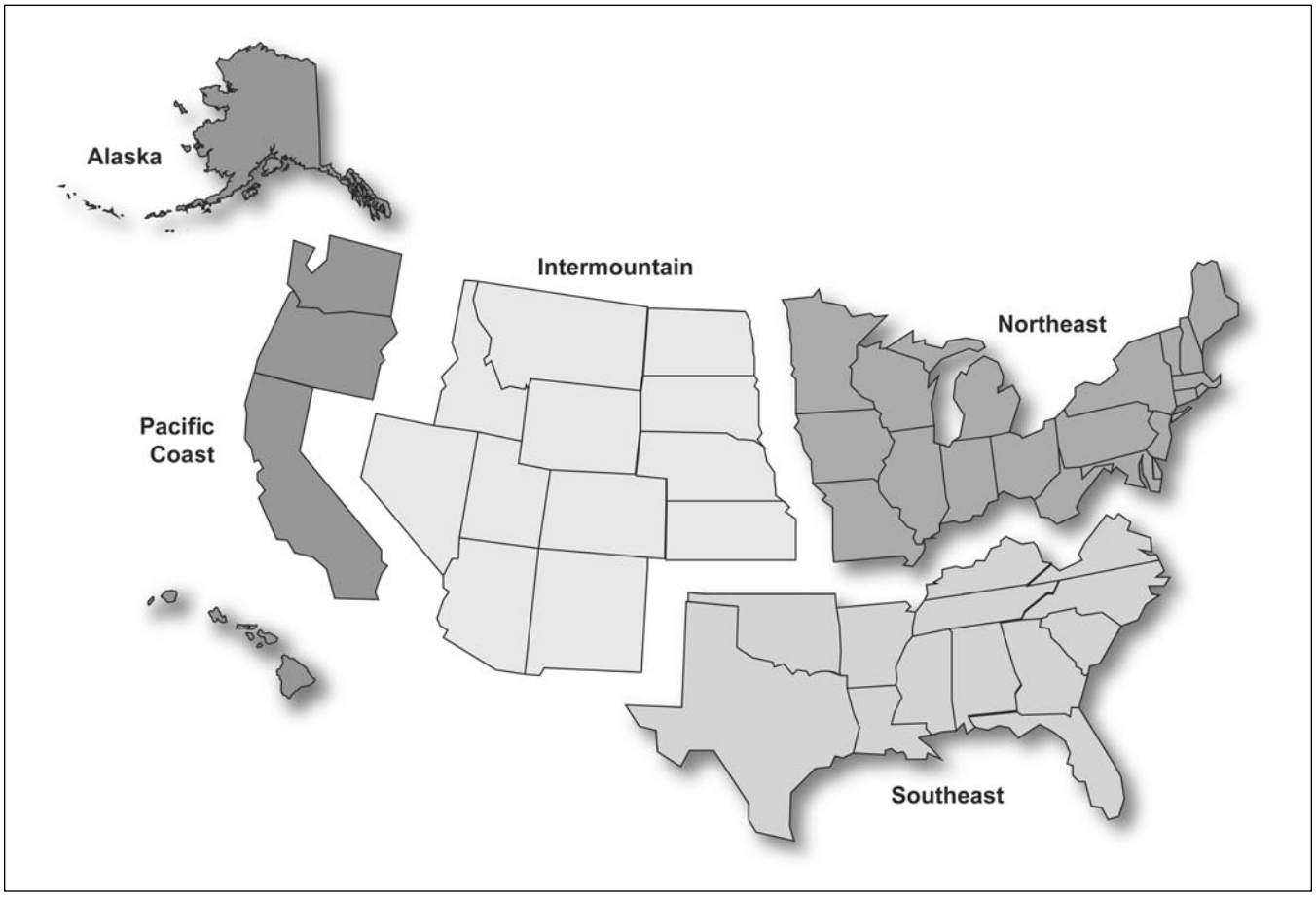


Figure 1—Study regions.

Tables 1, 3, and 4 present the standard error of the mean. This statistic is calculated from the standard deviation and the square root of sample size. The standard error of the mean is used to construct the confidence interval around the population mean. For example, a 95-percent confidence interval around the population mean is formed by adding and subtracting 1.96 standard errors from the mean. Thus in table 1 for camping, the mean is $37.19, and the standard error is $5.77. The 95-percent confidence interval is $25.88 to $48.50. We expect that there is only a 5 percent chance, given the data we have, that the true population mean for camping lies outside of this range.

Tables 1 and 3 contain maximum and minimum values for each activity and region. Although some of these maximum values may appear quite large or minimum values appear quite small, these study values were checked against the original study as were our calculations. Thus, all the values included in the report were used in calculating the averages. The user can access the spreadsheet data to calculate averages with what they consider to be outliers removed if they wish.

Table 2—Summary statistics on average consumer surplus values per person per day by activity and region, 1967 to 2003

	Alaska		Inter-mountain		Multiple area studies		Northeast		Pacific Coast		Southeast		Total	
Activity	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**
		2004 dollars		*2004 dollars*		*2004 dollars*		*2004 dollars*		*2004 dollars*		*2004 dollars*		*2004 dollars*
Backpacking									6	52.10				
Birdwatching							3	34.86			5	26.46		
Camping			21	34.72	2	11.82	10	33.11	4	104.35	11	25.79		
Cross-country skiing			7	29.88	1	15.20	3	34.60	1	48.38				
Downhill skiing			3	39.62	1	23.53			1	25.08				
Fishing	4	61.99	48	49.57	14	47.53	69	32.60	15	44.36	27	79.21		
Floatboating/rafting/canoeing	1	18.16	22	67.70	1	34.01	6	88.32	4	27.84	47	127.46		
General recreation	1	14.84	12	48.46	3	4.00	5	16.87	9	32.35	9	42.77		
Going to the beach							22	42.60			11	33.12		
Hiking	1	15.52	7	38.53	1	25.04	3	75.18	49	23.24	7	60.38		
Horseback riding					1	18.12								
Hunting	7	65.68	109	48.55	12	61.69	87	47.45	18	45.49	44	35.36		
Motorboating			7	53.68	1	34.36	3	29.68	8	26.94	13	58.92		
Mountain biking			6	184.48	1	21.13	1	40.93	16	49.68	8	49.62		
Off-road vehicle driving			7	22.81	1	23.93			1	40.37	1	5.24		
Other recreation			10	56.35	1	20.83			1	74.47	4	30.07		
Picnicking			5	28.27	1	18.83	2	56.45	3	64.22	2	36.62		
Pleasure driving	3	8.41	4	69.74	1	36.46	1	21.35			2	144.78		
Rock climbing			3	50.45	12	26.82	1	102.89			11	85.70		
Scuba diving							14	17.92	10	52.60				
Sightseeing	1	15.84	11	23.58	1	17.83	2	121.43	4	20.27	9	46.06		
Snorkeling									9	30.31				
Snowmobiling			8	36.29										
Swimming			1	29.54	1	23.56	7	22.21	4	27.29	13	60.92		
Visiting environmental education centers							1	6.01						
Visiting arboretums											1	13.54		
Visiting aquariums											1	28.31		
Waterskiing			2	56.96	1	67.00	1	15.13						
Wildlife viewing	8	49.33	61	37.24	29	56.36	65	31.30	23	72.48	54	40.10		
Windsurfing											1	395.47		
All activities in wilderness			32	41.68	17	28.46	8	25.48	46	26.22	5	118.67	108	35.38

Table 3—Detailed descriptive statistics on average consumer surplus values per person per day by activity and region, 1967 to 2003

Area and activity	N	Mean	Standard error	Minimum	Maximum
			2004 dollars		
Alaska region:					
Fishing	4	61.99	9.22	45.60	81.94
Floatboating/rafting/canoeing	1	18.16		18.16	18.16
General recreation	1	14.84		14.84	14.84
Hiking	1	15.52		15.52	15.52
Hunting	7	65.68	4.81	47.06	85.45
Pleasure driving	3	8.41	3.67	3.02	15.43
Sightseeing	1	15.84		15.84	15.84
Wildlife viewing	8	49.33	9.49	10.69	84.40
Intermountain area studies:					
Camping	21	34.72	6.64	2.03	116.66
Cross-country skiing	7	29.88	4.58	14.05	46.49
Downhill skiing	3	39.62	13.88	15.05	63.11
Fishing	48	49.57	6.96	8.96	227.28
Floatboating/rafting/canoeing	22	67.70	14.33	2.70	316.42
General recreation	12	48.46	20.92	7.91	257.51
Hiking	7	38.53	7.84	12.85	75.76
Hunting	109	48.55	3.35	2.60	169.31
Motorboating	7	53.68	25.93	5.29	203.62
Mountain biking	6	184.48	41.05	65.88	295.69
Off-road vehicle driving	7	22.81	4.31	7.96	40.86
Other recreation	10	56.35	17.36	12.17	206.82
Picnicking	5	28.27	4.09	13.61	38.76
Pleasure driving	4	69.74	33.23	26.41	167.74
Rock climbing	3	50.45	7.58	35.78	61.14
Sightseeing	11	23.58	8.65	.65	100.73
Snowmobiling	8	36.29	13.24	10.79	124.44
Swimming	1	29.54		29.54	29.54
Waterskiing	2	56.96	13.09	43.87	70.07
Wildlife viewing	61	37.24	3.30	5.26	193.91
Multiple area studies:					
Camping	2	11.82	2.00	9.82	13.82
Cross-country skiing	1	15.20		15.20	15.20
Downhill skiing	1	23.53		23.53	23.53
Fishing	14	47.53	10.49	2.40	126.00
Floatboating/rafting/canoeing	1	34.01		34.01	34.01
General recreation	3	4.00	2.03	1.97	8.05
Hiking	1	25.04		25.04	25.04
Horseback riding	1	18.12		18.12	18.12
Hunting	12	61.69	23.05	6.00	232.58
Motorboating	1	34.36		34.36	34.36
Mountain biking	1	21.13		21.13	21.13
Off-road vehicle driving	1	23.93		23.93	23.93
Other recreation	1	20.83		20.83	20.83
Picnicking	1	18.83		18.83	18.83
Pleasure driving	1	36.46		36.46	36.46

Table 3—Detailed descriptive statistics on average consumer surplus values per person per day by activity and region, 1967 to 2003 (continued)

Area and activity	N	Mean	Standard error	Minimum	Maximum
			2004 dollars		
Rock climbing	12	26.82	.04	26.62	26.92
Sightseeing	1	17.83		17.83	17.83
Swimming	1	23.56		23.56	23.56
Waterskiing	1	67.00		67.00	67.00
Wildlife viewing	29	56.36	12.38	3.00	313.99
Northeast area:					
Birdwatching	3	34.86	22.20	5.80	78.46
Camping	10	33.11	6.32	6.73	66.44
Cross-country skiing	3	34.60	2.82	29.70	39.49
Fishing	69	32.60	5.46	2.08	253.13
Floatboating/rafting/canoeing	6	88.32	22.93	20.08	143.50
General recreation	5	16.87	8.08	1.97	46.69
Going to the beach	22	42.60	7.03	3.78	117.82
Hiking	3	75.18	12.83	49.80	91.10
Hunting	87	47.45	4.03	4.16	250.90
Motorboating	3	29.68	25.21	3.78	80.10
Mountain biking	1	40.93		40.93	40.93
Picnicking	2	56.45	47.51	8.94	103.96
Pleasure driving	1	21.35		21.35	21.35
Rock climbing	1	102.89		102.89	102.89
Scuba diving	14	17.92	3.43	2.81	45.00
Sightseeing	2	121.43	88.36	33.07	209.77
Swimming	7	22.21	6.14	2.20	50.10
Visiting environmental education centers	1	6.01		6.01	6.01
Waterskiing	1	15.13		15.13	15.13
Wildlife viewing	65	31.30	2.18	2.40	96.30
Pacific coast area studies:					
Backpacking	6	52.10	9.29	26.82	80.34
Camping	4	104.35	45.38	7.45	224.53
Cross-country skiing	1	48.38		48.38	48.38
Downhill skiing	1	25.08		25.08	25.08
Fishing	15	44.36	8.68	4.43	103.50
Floatboating/rafting/canoeing	4	27.84	1.01	25.21	29.58
General recreation	9	32.35	14.38	1.42	125.57
Hiking	49	23.24	2.65	.40	129.62
Hunting	18	45.49	7.73	6.25	111.36
Motorboating	8	26.94	5.90	12.48	64.08
Mountain biking	16	49.68	2.74	31.70	78.74
Off-road vehicle driving	1	40.37		40.37	40.37
Other recreation	1	74.47		74.47	74.47
Picnicking	3	64.22	39.66	15.19	142.74
Scuba diving	10	52.60	25.86	5.23	250.04
Sightseeing	4	20.27	13.51	5.23	60.77
Snorkeling	9	30.31	15.36	5.23	135.29
Swimming	4	27.29	11.35	6.06	58.90
Wildlife viewing	23	72.48	16.90	7.09	347.88

Table 3—Detailed descriptive statistics on average consumer surplus values per person per day by activity and region, 1967 to 2003 (continued)

Area and activity	N	Mean	Standard error	Minimum	Maximum
			2004 dollars		
Southeast area studies:					
Birdwatching	5	26.46	6.41	9.44	43.27
Camping	11	25.79	8.09	3.30	65.02
Fishing	27	79.21	23.65	3.60	556.82
Floatboating/rafting/canoeing	47	127.46	13.45	18.05	394.82
General recreation	9	42.77	20.51	5.02	189.46
Going to the beach	11	33.12	5.76	6.79	53.83
Hiking	7	60.38	34.46	1.87	262.04
Hunting	44	35.36	2.86	5.69	82.80
Motorboating	13	58.92	9.59	6.91	134.34
Mountain biking	8	49.62	5.39	20.86	67.52
Off-road vehicle driving	1	5.24		5.24	5.24
Other recreation	4	30.07	11.33	5.71	57.19
Picnicking	2	36.62	8.06	28.56	44.69
Pleasure driving	2	144.78	21.72	123.06	166.49
Rock climbing	11	85.70	9.78	39.28	135.82
Sightseeing	9	46.06	13.70	7.92	112.70
Swimming	13	60.92	9.00	13.64	134.34
Visiting arboretums	1	13.54		13.54	13.54
Visiting aquariums	1	28.31		28.31	28.31
Wildlife viewing	54	40.10	3.20	2.86	134.34
Windsurfing	1	395.47		395.47	395.47

Table 4—Pacific Northwest (Oregon and Washington) consumer surplus per person per day

Activity	Average value	Number of estimates	Number of studies	Standard error
	2004 dollars			
Camping	92.72	2	2	17.44
Downhill skiing	25.08	1	1	
Fishing	41.98	11	5	9.42
Hiking	23.98	40	5	3.14
Hunting	35.27	8	5	9.22
Motorboating	12.48	1	1	
Mountain biking	49.68	16	1	2.73
Off-road vehicle driving	40.37	1	1	
Picknicking	34.74	1	1	
Sightseeing	60.77	1	1	
Swimming	6.06	1	1	
Wildlife viewing	35.00	6	3	2.40

Using Value Tables and Database for Benefit Transfer to Unstudied Recreation Sites on National Forests

Benefit transfer is a term referring to the application of existing valuation information to new sites or unstudied national forests. The two simplest types of benefit transfer involve either using the simple average consumer surplus or value-per-day information from the previous tables, or selecting from the spreadsheet data to more closely match the available studies to the features of the recreation site or national forest for which values are needed. In the nomenclature of benefit transfer, the site with existing valuation data is typically called the "study" site, and the site to which values are transferred is called the "policy" site. It would be preferable to value recreation at the policy site by using that site's specific data (from campground fee receipts, wilderness permits, trail registers, etc.) to estimate a site-specific Travel Cost Method (TCM) demand model to calculate consumer surplus, but this is often not possible. Therefore, benefit transfer can be used, as a "second-best" strategy, for evaluating management and policy impacts. Including a well-prepared benefit transfer is much better than not including recreation economic values in the economic analysis. Some decisionmakers tend to overlook resources that have been omitted from economic analysis and incorrectly assume that those that have been included are more economically important when it may only mean that those included in the analysis are easier to measure.

Benefit transfer can be used, as a "second-best" strategy, for evaluating management and policy impacts. Including a well-prepared benefit transfer is much better than not including recreation economic values in the economic analysis.

Thus, benefit transfer is a practical way to evaluate management and policy impacts when primary research is not possible or justified because of limited time or budget constraints.

Benefit Transfer Methods

There are two broad approaches to benefit transfer: (1) value transfer, and (2) function transfer (fig. 2). Value transfers encompass the transfer of (1-a) a single (point) benefit estimate from a study site, or (1-b) a measure of central tendency (such as an average value) for several benefit estimates from a study site or sites, or (1-c) administratively approved estimates. Administratively approved value estimates will be discussed in conjunction with the measure of central tendency discussion (hereafter average-value transfer will refer to both (1-b) and (1-c)). Function transfers encompass the transfer of (2-a) a function for benefit, willingness to pay, or demand from a study site, or (2-b) a meta-regression analysis function statistically estimated from several study sites. Benefit function transfers tailor the function to fit the specifics of the policy site by setting the values of independent variables such as socioeconomic characteristics, extent of market and environmental impact, and

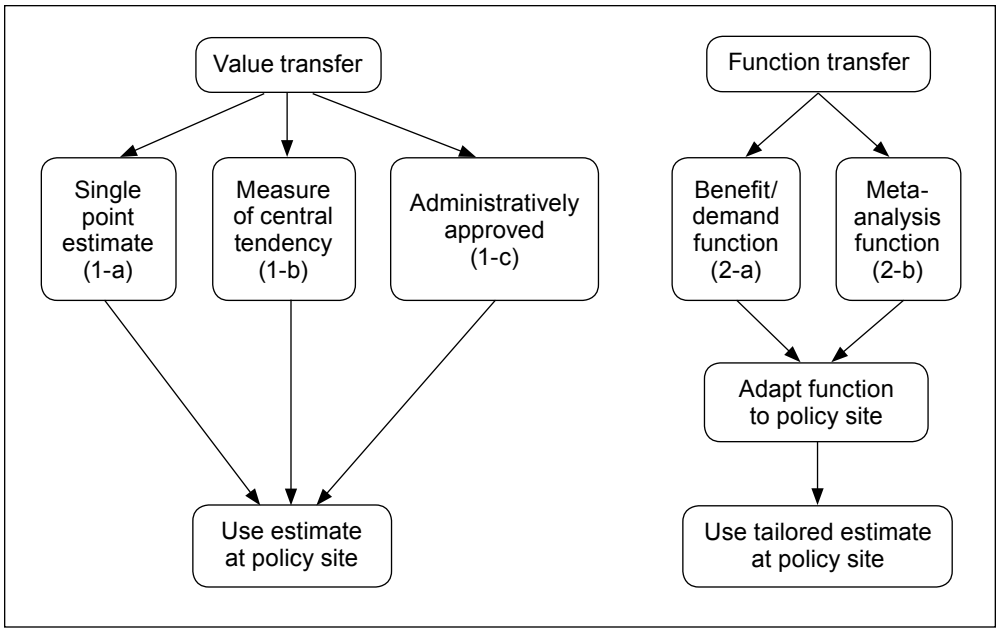


Figure 2—Benefit transfer approaches (from Rosenberger and Loomis 2001).

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

In this section we define and identify what the benefit measures are, what they mean, and how they were estimated.

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) obtained from the spreadsheet data. The primary steps to performing a single-point estimate transfer include identifying and quantifying the effect of management- or policy-induced changes on recreation use, and locating and transferring a "unit" consumer surplus measure. The detailed list of the steps involved in single-point estimate transfers were given by Rosenberger and Loomis (2001) as:

1. Identify the resources affected by a proposed action or alternative.
2. Translate resource impacts to changes in recreational use.
3. Estimate recreation use changes.
4. Search the spreadsheet data 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.

We provide information in this report that aids in identifying study site benefit measures from the literature.[1] [2] The spreadsheet includes studies conducted from 1967 through 2003 in the United States and Canada. There are 593 studies and 1,239 benefit measures identified. The spreadsheet includes a full reference, recreation activity, geographic region, methodology used, etc., for each observation.

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 activity days.

The simplicity with which the steps to performing a single-point estimate transfer are presented may be misleading. This will become apparent when the information on the conditions for benefit transfers are taken into account as identified below. See Boyle and Bergstrom (1992) for an example of how to critically filter 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 (Boyle and Bergstrom 1992: 659):

> (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).

Their filtering of each study based on these considerations left them with no ideal benefit measures to transfer to their policy site. They stated 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.

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[1] 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/.

[2] Use of trade or firms names in this publication is for reader information and does not imply endorsement by the U.S. Department of Agriculture of any product or service.

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. 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. Rosenberger and Loomis (2001) provided a detailed list of the steps involved in average-value transfers:

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

Guidance for Performing an Accurate Benefit Transfer

There are several conditions required for performing an accurate benefit transfer (Desvousges et al. 1992). This section illustrates the application of these conditions for a hypothetical benefit transfer. For each condition we provide the name of the relevant variables in the spreadsheet. The exact definition of each of these variables is given in table 5.

The purpose of checking the correspondence of variables for the candidate studies to be transferred against the policy site in need of values is to ensure they are reasonably similar in most characteristics that affect the value of recreation (e.g., determinants of demand and supply). Accuracy in benefit transfer would be improved if there is a good match between the natural environment (e.g., forest) at the sites with values and the sites for which you need values (e.g., forest). This point can best be illustrated by an example. If one only had values in the spreadsheet for mountain biking in the high desert of Moab, Utah, and needed values for mountain biking in the evergreen forests of the El Dorado National Forest near Sacramento in northern California, there would be a mismatch between the natural environment (as well as differences between a small rural town of Moab versus a large urban city of Sacramento, on the demand side). The following factors or variables are worth checking in the spreadsheet to determine whether the average value from the table can be transferred or whether the analyst should select a subset of studies from

Table 5—Variable definitions in spreadsheet

Code #	Variable	Coding
General study characteristics		
V000	STUDYID	Study number
V001	ORIGDATA	1,0; 1 = This is the first study to use this data
V002	AUTHOR(s)	Name(s)
V003	STUDY TITLE	Text
V004	SOURCE/VOL/PAGES	Text
V005	PUBDATE	Month (if available) and year of publication
V005A	DATAANAL	Year of publication
V006	PUBLISHER	Text
V007	DOCUMENT TYPE	1 = journal; 2 = book; 3 = proceedings; 4 = report; 5 = thesis or dissertation; 6 = working paper
V008	CTRY NAME	USA, Canada
Benefit measures		
V009	BENMEAS	1 = willingness to pay (WTP); 2 = willingness to accept (WTA)
V010	MEAN/MED	1,0; 1 = mean, 0 = median (mean should be reported where possible)
V011	DOLVALUE	Value converted to per person per day in 2004 dollars
V011org	ORIGVAL	Original value printed in report
V012	YEARVAL	Year of data
V012a	YEARVALUSED	Year that the given values are based on
V013	ORIGVALUNITS	1 = day; 2 = trip; 3 = year; 4 = season
V013a	AVGTRIP	Average days per trip
V013aa	REPESTASK	Reported, estimated, or asked author
V013b	ORIGNUM	Original number of people per group for ORIGVAL
V014	STD ER	Standard error of mean/median WTP for $ value or study average value
V015	CI'S	1,0; 1 = confidence interval included in report
V016	NATIONAL	1,0; 1 = national
V017	MULTI-STATE	1,0; 1 = multistate
V018	STATE	1,0; 1 = state
V019	ST NAMES	Type in two-letter state abbreviation (e.g., CO for Colorado).
V019b	REGION	U.S. Forest Service Regions 1 thru 10 (11 is all regions); 100 for U.S. national, 101 for Canada
V019cc	Region for Tables	1 = NE (Forest Service area R9); 2 = SE (R8); 3 = Intermountain (R1, R2, R3, R4); 4 = Pacific Coast (R5, R6); 5 = Alaska (R10); 6 = Multiple area studies (R11); there is no region 7
V019ccc	Region for Category	1 = Northeast; 2 = Southeast; 3 = Intermountain; 4 = Pacific Coast; 5 = Alaska; 6 = Multiple area studies (R11)
V19b1	CENSUSREG	Census regions of the USA, 1 thru 5 (and 6 is all regions); 100 is U.S. National, 101 is for Canada
V020	ESTSELEC	1 = author recommendation; 0 = other
V021	AVGSITIME	Average onsite time per trip, in hours (convert multiple days by using 12 hours/day)
V022	GROUPSIZE	Average number of people in group
V023	TOTSITEVIS	Number of visits to the area/site per year in total or per person
V023a	TOTSITDES	Description of the units of number of visits data
V024	SEASLNGTH	Season length converted to days (e.g., hunting period allowed)
V025	ALL/NO-SQ	1,0; 1 = Yes, valued for existing condition; 0 = No

Table 5—Variable definitions in spreadsheet (continued)

Code #	Variable	Coding
V026	CHGVAL	1,0; 1 = Yes, valued for change in quality; 0 = No
V026b	DOLVALCHG	$ value of change
V027	CHGDESCRIP	Text description of change
V028	CHGSIZE	% change, absolute change
V029	STDYSPONSOR	0 = industry; 1 = university; 2 = government; 3 = environmental/ conservation; 4 = multiple category of sponsors; 5 = others
V030	NUMSVYSRET	Number of surveys returned
V030a	NUMUSE	Number of usable surveys
V031	RESPRATE	Response rate percentage
V0331a	RESUSE	Response rate of usable surveys
V032	MAILSVY	1,0; 1 = some studies will have more than 1 survey mode; mail survey includes those mailed out to people but also those that were given to people and needed to be mailed back
V033	PHONESVY	1,0; 1 = phone survey used in the study
V034	INPERSON	1,0; 1 = in person used in the study
V035	SAMPFRAME	1 = on-site; 2 = user list; 3 = general population; 4 = others;
V036	VALMETHOD	1 = contingent valuation method, 0 =travel cost method, 2 = both
V037	GEOGAREA	Geographic area of visitor origin (average one-way distance in miles
Details of CVM application		
V038	PAYVEHICLE	1 = trip cost; 2 = entrance fee/license; 3 = annual pass; 4 = others
V039	OECVM	1,0; 1 = open-ended CVM question
V040	ITBID	1,0; 1 = iterative bidding used
V041	CONJOINT	1,0; 1 = conjoint (rating scale approach)
V042	ST&RP	1,0; 1 = combined stated and revealed preference
V043	PAYCARD	1,0; 1 = payment card
V044	MIDPTS	1 = midpoint; 2 = amount circled (refers to payment card)
V045	PCCAMHUPLF	1,0; 1 = Cameron-Huppert likelihood function (refers to payment card)
V046	DCCVM	1,0; 1 = dichotomous choice or referendum
V047	SB	1 = (SB) single bound; 2 = (DB,MB) double bound or multiple bound
V048	DCSTAT	1 = logit; 2 = probit; 3 = nonparametric; 4 = semi-nonparametric
V049	CVWTPEQ	1,0; 1 = WTPEQ, if equation estimate for any CVM, 0 = no; equation (refers to open-ended CVM)
V050	CVEQTYPE	1 = OLS; 2 = 2SLS; 3 = TOBIT; 4 = others (refers to open-ended CVM)
V051	HNNEGMEAN	1 = no neg (log of Bid or 1/B*(ln(1+expBo)); 2 = neg allowed.
V052	CVUPTRUNC	1,0; 1 = upper limit; 0 = no upper limit of integration
V053	CVOUTLIE	1,0; 1 = removed or “trimmed” outliers; 0 = if not or full sample
V054	PROTESTR	1,0; 1 = protest responses removed; 0 = all observations used
Details of TCM application		
V055	TCMTYPE	1 = zonal; 2 = individual; 3 = RUM/MNL
V056	TCMEQTYPE	1 = OLS; 2 = 2SLS or SUR; 3 = TOBIT; 4 = count data (POISSON, neg binomial); 5 = others (includes MNL, NMNL, when TCMTYPE = 3)
V057	TRUNCADJ	1,0; 1 = truncation adjustment
V058	ENDOGSTRT	1,0; 1 = corrected for endogenous stratification
V059	TRAVTIMEVAR	1,0; 1 = separate variable given for travel time
V060	OPCOSTIME	Wage rate in percent

Table 5—Variable definitions in spreadsheet (continued)

Code #	Variable	Coding
V060a	OPCTINC	1,0; 1 = V060 has value coded; 0 otherwise
V061	COSTMILE	$ per mile used in study year
V061a	COSTKM	$ per km used in study year
V062	SUBS	1,0; 1 = price of substitute or availability of substitute variable included in demand function
V063	SITEQUAL	1,0; 1 = site quality or facility (indicated by author)
V064	HEDTCM	1,0; 1 = hedonic TCM
V065	LHSFUNCFRM	1 = linear; 2 = log; Poisson, negative binomial; 3 = other
V066	RHSFUNCFRM	1 = linear; 2 = log; 3 = other
V067	EXPENDAT	1,0; 1 = expenditure data included in the study/report (e.g., lodging, food, equipment, etc.)
V068	TCMWTPTRUNC	1,0; 1 = upper limit of integration truncated, at max observed TC
V069	TCMOUTLIE	1,0; 1 = outliers or multidestination trips explicitly removed
Study location		
V070A	GENDES	General description of area studied
V070	COUNTY	1,0; 1 = county
V071	CTY NAME	County name
V072	SITE NAME	Name of site
V073	LAKE/RESERVOIR	1,0; 1 = lake/reservoir
V074	LAKE NAME	Text
V075	ESTBAY	1,0; 1 = site is estuary or bay
V076	OCEAN	0 if not ocean; 1 = Atlantic; 2 = Pacific; 3 = Gulf of Mexico
V077	RIVER	1,0; 1 = recreation site is river based
V078	RIVNAME	Name of the river
V079	GREAT LAKES	1,0; 1 = great lakes
V080	AREASIZE	Size of recreation area in acres
V081	NAT FOREST	1,0; 1 = national forest
V082	NFNAME	Name of national forest
V083	NATPARK	1,0; 1 = national park
V084	N.P.NAME	Name of national park
V084bbb	NP,NF,Other	Whether in national park, national forest, or other
V085	NRAREA	1,0; 1 = national recreation area
V086	NRANAME	Name of national recreation area
V087	W/L AREA	1,0; (1 = wildlife refuge or game management area)
V088	W/L AREA NAME	Name of refuge or mgmt area
V089	WILDERNESS	1,0; 1 = recreation use is in wilderness area
V090	WILDNAME	Name of wilderness area
V091	STPARKFOR	1,0; 1 = recreation use is in state park or state forest
V092	STPKNAME	Name of state park
V093	PUBLIC	1,0; 1 = public land including federal, state, county/city
V094	PRIVATE	1,0; 1 = private land
V095	W/L SPECIES	1 = BGAME (deer, elk, etc.); 2 = SGAME (rabbit, quail, dove, etc.); 3 = WTRFWL (duck, geese); 4 = threatened and endangered; 5 = songbirds; 6 = raptors, hawks, eagles, etc.; 7 = fish; 8 = general wildlife
V095a	W/L SPECIES 2	
V095b	W/L SPECIES 3	
V095c	W/L SPECIES 4	

Table 5—Variable definitions in spreadsheet (continued)

Code #	Variable	Coding
V096	FOREST	1,0; 1 = recreation area in forest; 0 = otherwise
V097	ENV TYPE	1 = wetland, 2 = riparian; 0 = otherwise
V098	WATERQUAL	1,0; 1 = water quality was valued or focus of study
V099	AIRQUAL	1,0; 1 = air quality was valued or focus of study
V100	DEVELOP	1,0; 1 = site studied had developed recreation facilities (such as arranged tables etc., e.g., camping, boating, etc.)
V101	DISPERSED	1,0; 1 = site studied was dispersed recreation with no formal site or facilities (e.g., hunting, hiking, etc.)
V102	ROSCLASS	1 = primitive; 2 = SPNM (semiprimitive nonmotorized); 3 = SPM (semiprimitive motorized); 4 = RN (roaded natural); 5 = rural; 6 = urban; 7 = various
V103	ACT TYPE 1	1 = camping; 2 = picnicking; 3 = swimming; 4 = sightseeing; 5 = off-road vehicle driving; 6 = motorboating; 7 = floatboating/rafting/canoeing; 8 = hiking; 9 = mountain biking; 10 = downhill skiing; 11 = cross-country skiing; 12 = snowmobiling; 13 = snowplay; 14 = hunting; 15 = fishing; 16 = wildlife viewing; 17 = horseback riding; 18 = resort; 19 = rock climbing; 20 = general recreation; 21 = other recreation; 22 = visiting wilderness; 23 = waterskiing; 24 = pleasure driving (can include sightseeing); 25 = visiting arboretums; 26 = going to the beach; 27 = relaxing outdoors; 28 = visiting aquariums; 29 = scuba diving; 30 = windsurfing; 31 = bird watching; 32 = snorkeling; 33 = backpacking; 34 = visiting environmental education centers
V104	ACT TYPE 2	One of the above categories of ACTTYPE except one already chosen
V105	ACT TYPE 3	One of the above categories of ACTTYPE except one already chosen
V106	ACT TYPE 4	One of the above categories of ACTTYPE except one already chosen
V107	NUMACT	Number of activities site offers or typical visitor could participate in at site
V108	AVGINC	Average income of visitors
V109	AVGED	Average education of visitors
V110	AVGAGE	Average age of visitors
V111	AVGSEX	(% female); 1 = female; 0 = male; or percent female for group
V112	RESIDENTS	1,0; 1 = residents only; 0 = both
V113	USEEXP	1,0; 1 = very experienced (level of user experience with site); 0 = otherwise
V114	SUCESRATE	Percentage of success rate in hunting
V115	BAG	Number of animals (in hunting)
V116	HOUR	1,0; 1 if bag reported is per hour, zero otherwise
V117	DAY	1,0; 1 if bag reported is per day
V118	TRIP	1,0; 1 if bag reported is per trip
V118a	YEAR	1,0; 1 if bag reported is per year
V119	HIQUAL	1,0; 1 = author states site is of high quality (e.g., popular, unique, well-known, only in the region, etc.)
V120	DATAYEAR	Year data collected
V121	SAMPSIZE	Total sample size used in analysis
V122	NUMTCZONES	Number of zones or origins in zonal TCM.
V123	MULTSITE	1,0; 1 = yes
V124	NUMSITES	Number of sites modeled in multisite or RUM models
V125	CHOICEOC	Number of choice occasions (frequency)
V126	COMMENTS (COMMENTS2 and COMMENTS3)	Text field where coder can write anything special or unusual about study or details about recreation site or area where study was performed

the spreadsheet data from which to calculate average value based on studies that more closely match the study site.

1. The activities to be valued should be identical, or at least similar; see spreadsheet variables, ACT TYPE1, ACT TYPE 2, and ACT TYPE 3.
2. The general geographic region of the study sites and the policy site should be identical or at least similar; see spreadsheet variables ST NAMES, REGION (USFS Regions 1 through 10) and CTY NAME (when available).
3. The type of public land at the study sites and the policy site should be identical or at least similar; see spreadsheet variables PUBLIC, PRIVATE, NAT FOREST, NATPARK, NRAREA (national recreation area), W/L AREA (state or federal wildlife area), WILDERNESS, STPARKFOR (state park or state forest).
4. For wildlife recreation, similar species should be valued in both cases. For example, for valuation of big game hunting, one should use existing big game hunting studies, not waterfowl or upland game bird hunting studies; see spreadsheet variables W/L SPECIES, W/L SPECIES 2, W/L SPECIES 3.
5. The type of population and magnitude of the human population at the study site and policy site should be similar (i.e., rural to rural, or urban to urban); see spreadsheet variables AVGED, AVGAGE, RESIDENTS.
6. Level of facility development and recreation opportunity spectrum classification should be similar between the study sites and the policy site; see spreadsheet variables DEVELOP, DISPERSED, ROSCLASS.
7. The environmental resource and the natural setting of the resource at the study site and the resource at the policy site should be similar. As mentioned in the example above, it would be desirable to transfer values of a particular recreation activity that occurred in the same environmental setting or ecosystem type. Thus camping in a forest might yield different values than camping at the beach. See spreadsheet variables FOREST, ENV TYPE, LAKE/RESERVOIR, ESTBAY (estuary/bay), OCEAN, RIVER, GREAT LAKES.
8. The markets or determinants of demand (similarity of demographic profiles between the two populations and their cultural aspects) for the study site and the policy site should be similar. That is, similar levels of income, racial composition, degree of ruralness. Unfortunately, most studies did not report demographics, but check spreadsheet variable AVGINC. If there are no observations for this demographic variable, inspection of spreadsheet variables such as ST NAMES and CTY NAME (when available) may be instructive. For example, a camping study in North Dakota might not yield accurate

values for camping at the Angeles National Forest outside of Los Angeles owing to differences in income levels and racial composition of the two populations.

9. 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. It is not accurate to transfer the value per day for rafting down the Colorado River in Grand Canyon National Park to rafting down the Colorado River in the White River National Forest paralleling I-70 in Glenwood Canyon.

Keep in mind that most of the original research studies reported in the database were not designed 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 need to be pragmatic in their applications of the method when considering the many limitations imposed upon them by the limited availability of existing studies. It is this author's opinion that in many cases, even a rough approximation of the average value per day from a conservative benefit transfer is better than simply ignoring the economic value of recreation in forest plans or environmental impact statements.

Validity and Reliability of Benefit Transfers

There are at least two sources of error in benefit transfer that influence the reliability and validity of the resulting benefit estimates. First is the underlying variability in the original study estimates. If the original study reports the standard error of the estimate, then a confidence interval for transferred point estimates can be calculated. This confidence interval provides the statistical range in which we would expect the original estimate to be some large percentage of the time (e.g., a 95-percent confidence interval means the estimate would be within the calculated range 95 percent of the time). However, this confidence interval does not account for the additional error associated with transferring the estimate from the original study site to the policy site.

Several recent studies have tested the convergent validity and reliability of different benefit-transfer methods (Desvousges et al. 1998, Downing and Ozuna 1996, Kirchhoff et al. 1997, Loomis et al. 1995, Rosenberger and Loomis 2000). The methods tested include single-point estimate, average-value, demand-function, and meta-regression-analysis transfers. Although 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 tests of the benefit-transfer methods within the same geographic region, transferred values were very similar to the "true" values and errors were in the range of 4 to 40 percent when using benefit-function transfer (Loomis 1992). In other cases, the disparity between the "true" value and the "tailored" value was quite large. These errors were typically in the range of 50 to 80 percent when using meta-regression benefit transfer as compared with in-sample study values used to estimate the meta-regression (Rosenberger and Loomis 2000) and a comparison to new out-of-sample study values not used to estimate the original meta-regression (Shrestha and Loomis 2003).

Other Potential Limitations of Benefit Transfers

Several other factors can also influence the accuracy of any particular benefit transfer. Factors that affect the accuracy of any specific benefit transfer include:

- The quality of the original study.
- A limited number of studies investigating an activity's economic value, thus restricting the pool of estimates and studies from which to draw information.
- Different research methods across study sites for a specific recreation activity, including differences in 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.
- Different statistical methods used for estimating models, which 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 of the demand function (Adamowicz et al. 1989).
- Unique sites and conditions of existing studies used for valuing recreation activities. See the variables SITE NAME, LAKE NAME, N.P. NAME, W/L AREA NAME, STPKNAME to ensure there is similarity of the study site and 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 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.

Nonetheless it is our belief that national forest decisionmaking involving tradeoffs between types of recreation (motorized vs. nonmotorized), and other multiple-use tradeoffs can often be improved by inclusion of even approximate estimates of nonmarket recreation values.

A Note on Definition of Benefit Measures and Use in Policy Analyses

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 of the average individual values reported 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.[3] 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 some of the simple approaches to benefit transfers such as point-estimate or average-value transfer. If the analyst is evaluating a large-scale ecosystem change, then an original study will often be necessary (and warranted), or a benefit-function transfer approach that incorporates the quality of the resource would be necessary to accurately capture the change in benefits. Such a benefit-function transfer approach would be to apply a demand curve that contains a resource quality variable or apply a contingent valuation method willingness-to-pay equation that contains the relevant resource quality variables for the change being evaluated.

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

Simply stated, the benefit-transfer estimate of a management- or policy-induced change in recreation is the average consumer surplus estimates for the average individual from the literature aggregated for the particular change in use of the natural resource. The change in recreational use of a resource may be induced either through a price change for participating in an activity (e.g., fee change or location of the site) or through a quality change in the recreation site.

Details of Spreadsheet Coding

Often times in performing benefit transfer, it is more appropriate to compute an average value per visitor-day from empirical studies that closely match the policy site, rather than just using an overall average for the region. To facilitate doing this, the spreadsheet contains numerous details about each of the studies.

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 because 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.

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, semilog, 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.

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 (table 5). This was either because information was not reported or was not collected for a study. For example, 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 that further limits the ability to perform critical benefit transfers.

Summary

This report provides updated average values and a spreadsheet that gives information on outdoor recreation use valuation studies, including study source, benefit measures, recreation activity, valuation methodology, and geographic region. This literature review spans 1967 to 2003 and covers more than 20 recreation activities.

Guidance on performing various benefit-transfer methods is also provided in this report. Benefit transfer is the use of past empirical benefit estimates to assess and analyze current management and policy actions. Two benefit-transfer approaches (single-point estimates, average values) were discussed in detail.

A research effort such as this is really never complete, as new studies appear every year. Some of these studies could fill important gaps in the existing literature or increase the small sample of valuation studies for that activity in that region. Augmenting this database with new studies every 5 years is probably a worthwhile undertaking to keep the database current and of greatest use for field personnel.

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References

Adamowicz, W.L.; Fletcher, J.J.; Graham-Tomasi, T. 1989. Functional form and the statistical properties of welfare measures. American Journal of Agricultural Economics. 71(2): 414–421.

Bergstrom, J.C.; Bowker, J.M.; Cordell, H.K.; Bhat, G.; English, D.B.K.; Teasley, R.J.; Villegas, P. 1996. Ecoregional estimates of the net economic values of outdoor recreational activities in the United States: individual model results. Final report submitted to Resource Program and Assessment Staff, U.S. Department of Agriculture, Forest Service, Washington, DC. Athens, GA: Outdoor Recreation and Wilderness Assessment Group SE-4901, U.S. Department of Agriculture, Forest Service, and Department of Agricultural and Applied Economics, University of Georgia. 68 p.

Boyle, K.J.; Bergstrom, J.C. 1992. Benefit transfer studies: myths, pragmatism, and idealism. Water Resources Research. 28(3): 657–663.

Brookshire, D.S.; Neill, H.R. 1992. Benefit transfers: conceptual and empirical issues. Water Resources Research. 28(3): 651–655.

Brown, G.; Hay, M. 1987. Net economic recreation values for deer and waterfowl hunting and trout fishing. Work. Pap. No. 23.Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service, Division of Policy and Directive Management. 15 p.

Carson, R.T.; Wright, J.L.; Carson, N.; Alberini, A.; Flores, N. 1994. A bibliography of contingent valuation studies and papers. La Jolla, CA: Natural Resource Damage Assessment, Inc. 142 p.

Desvousges, W.H.; Johnson, F.R.; Banzhaf, H.S. 1998. Environmental policy analysis with limited information: principles and applications of the transfer method. Northhampton, MA: Edward Elgar. 244 p.

Desvousges, W.H.; Naughton, M.C.; Parsons, G.R. 1992. Benefit transfer: conceptual problems in estimating water quality benefits using existing studies. Water Resources Research. 28(3): 675–683.

Downing, M.; Ozuna, T., Jr. 1996. Testing the reliability of the benefit function transfer approach. Journal of Environmental Economics and Management. 30(3): 316–322.

Englin, J.; Shonkwiler, J.S. 1995. Estimating social welfare using count data models: an application to long-run recreation demand under conditions of endogenous stratification. The Review of Economics and Statistics. 77: 104–112.

Freeman, A.M., III. 1993. The measurement of environmental and resource values: theory and methods. Washington, DC: Resources for the Future. 516 p.

Government Performance and Results Act [GPRA]. 1993. June 23, 1993. P.L. 103-62. Bill S20.

Hilger, J. 1998. A bivariate compound Poisson application: the welfare effects of forest fire on wilderness day hikers. Reno, NV: University of Nevada. 119 p. M.S. thesis.

Kirchhoff, S.; Colby, B.G.; LaFrance, J.T. 1997. Evaluating the performance of benefit transfer: an empirical inquiry. Journal of Environmental Economics and Management. 33(1): 75–93.

Loomis, J. 1992. The evolution of a more rigorous approach to benefit transfer: benefit function transfer. Water Resources Research: 28(3): 701–705.

Loomis, J.; Roach, B.; Ward, F.; Ready, R. 1995. Testing the transferability of recreation demand models across regions: a study of Corps of Engineers reservoirs. Water Resources Research. 31(3): 721–730.

Loomis, J.; Rosenberger, R.; Shrestha, R. 1999. Updated estimates of recreation values for the RPA program by assessment region and use of meta-analysis for recreation benefit transfer. Fort Collins, CO: Colorado State University, Department of Agricultural and Resource Economics. Final report RJVA 28-JV7-962. 36 p.

Loomis, J.B; Walsh, R.G. 1997. Recreation economic decisions: comparing benefits and costs. 2nd ed. State College, PA: Venture Publishing. 440 p.

MacNair, D. 1993. 1993 RPA recreation values database. On file with: U.S. Department of Agriculture, Forest Service, RPA Program. Washington, DC. Contract 43-4568-3-1191.

Markowski, M.; Unsworth, R.; Paterson, R.; Boyle, K. 1997. A database of sport fishing values. Cambridge MA: Industrial Economics, Inc.

Morey, E.R. 1994. What is consumer's surplus *per day of use*, when is it a constant independent of the number of days of use, and what does it tell us about consumer's surplus? Journal of Environmental Economics and Management. 26(3): 257–270.

Rosenberger, R.S.; Loomis, J.B. 2000. Using meta-analysis for benefit transfer: in-sample convergent validity tests of an outdoor recreation database. Water Resources Research. 36(4): 1097–1107.

Rosenberger, R.S.; Loomis, J.B. 2001. Benefit transfer of outdoor recreation use values: a technical report supporting the Forest Service strategic plan (2000 Revision). Gen. Tech. Rep. RMRS-GTR-72. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 59 p.

Rosenthal, D.H.; Brown, T.C. 1985. Comparability of market prices and consumer surplus for resource allocation decisions. Journal of Forestry. 83(1): 105–109.

Rowe, R.; Morey, E.; Ross, A.; Shaw, W.D. 1985. Valuing marine recreational fishing on the Pacific coast. Rep. LJ-85-18C. Washington, DC: U.S. Department of Commerce, National Marine Fisheries Service. 189 p.

Shrestha, R.; Loomis, J. 2003. Meta-analytic benefit transfer of outdoor recreation economic values: testing out-of-sample convergent validity. Environmental and Resource Economics. 25: 79–100.

Sorg, C.F.; Loomis, J.B. 1984. Empirical estimates of amenity forest values: a comparative review. Gen. Tech. Rep. RM-107. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 23 p.

U.S. Water Resources Council. 1979. Procedures for evaluation of national economic development (NED) benefits and costs in water resources planning (Level C). Federal Register. 44(243): 72,892–72,976.

U.S. Water Resources Council. 1983. Economic and environmental principles ad guidelines for water and related land resources implementation studies. Washington, DC: U.S. Government Printing Office. 137 p.

Walsh, R.G.; Johnson, D.M.; McKean, J.R. 1988. Review of outdoor recreation economic demand studies with nonmarket benefit estimates, 1968-1988. Tech. Rep. No. 54. Fort Collins, CO: Colorado State University, Department of Agricultural and Resource Economics. 131 p.

Walsh, R.G.; Johnson, D.M.; McKean, J.R. 1992. Benefit transfer of outdoor recreation demand studies: 1968–1988. Water Resources Research. 28(3): 707–713.

Willig, R.D. 1976. Consumer surplus without apology. American Economic Review. 66(4): 589–597.

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