

Updated Outdoor Recreation Use Values with Emphasis on National Park Recreation

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EXECUTIVE SUMMARY

This report presents updated values per visitor day of outdoor recreation opportunities commonly found at National Park Service sites such as National Parks, Monuments, Seashores, and Historic Sites as well as State Parks and National Forests. Past empirical benefit measures and other information originally obtained through primary data collection can be used for assessing and analyzing current management and policy actions. This use of past valuation information for current policy analysis is called benefit transfer. In this report, the term value is used to mean net willingness to pay or consumer surplus.

We update past USDA Forest Service-sponsored reviews of the literature on outdoor recreation use valuation by including recent analyses and estimates including 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. We have added 479 estimates to the previous database of Rosenberger and Loomis (2001). There are now 1239 estimates obtained from 593 studies, which provide values for 30 separate 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. Average values per visitor day are reported for each activity by Census region when available.

The average value per day for National Park System recreation in the Intermountain West is \$33.90, and \$89.21 per day for the Pacific Coast states. Southwestern National Park units have an average value per day of \$22.61, below the overall National Park System average of \$43.26 per day (based on a sample size of 49).

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INTRODUCTION

Several federal agencies including the National Park Service, U.S. Fish and Wildlife Service, Bureau of Reclamation and the USDA Forest Service requires information on values of recreation. Whether for damage assessment 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, spanning 1967 to 2003, conducted in the United States and Canada, and which 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).

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 twenty 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 to 1988 period (Walsh et al 1988). That 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). A fourth literature review on outdoor recreation use valuation, focusing on studies reported from 1988 to 1998 (Loomis and others 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 and focused on use value estimates for all recreation activity categories identified by USDA Forest Service documents. Fishing benefit studies were not emphasized since this was the focus of a separate review sponsored by the U.S. Fish and Wildlife Service, and available from Industrial Economics Inc. in Cambridge MA (Markowski, et al 1997). We did, however, include those fishing studies coded in the MacNair (1993) database that were from the Walsh et al (1988) review, as generally these were sufficient in number and coverage of fishing studies for statistical purposes.

This report represents the fifth literature review, covering new studies from 1998 through 2003, emphasizing recent studies on National Parks or applicable to National Parks. In this new review, we were able to obtain 479 new observations.

Data Sources and Coding Procedures

We placed a concerted effort to locate studies on activities that were not previously investigated and recreation activities of particular interest to the National Park Service. 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) 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.

For consistency and to allow merging of the new studies with studies compiled by Rosenberger and Loomis (2001) we used the same master coding sheet as they did for a base, additions were made accordingly. The old coding sheet contained 126 fields, while the newest one contains 158. 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 4th 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).

Value Per Day Tables by Activity and Region

New data was combined with old data to create a database of 1239 observations spanning 1967 through 2003. This table (Table 1) presents data separated by the 30 activities reported. Information that can be observed includes the number of studies, number of estimates, mean, standard error, standard deviation, and range of values. In brief, the activities most commonly found include hunting, fishing, wildlife viewing, and camping. Values range from a low of \$.33/per person/per day for hiking to \$464.02/per person/ per day for fishing. The average estimate of consumer surplus is \$39.70/ per person/ per day across all 1239 observations.

Table 1. Summary Statistics on Average Consumer Surplus Values by Activity per person per day from Recreation Benefit Studies 1967-2003 (\$1996 dollars)						
Activity	Number of Studies	Number of Estimates	Mean	Std. Error	Range of Estimates	
Backpacking	1	6	\$43.42	\$7.74	\$22.35	\$66.95
Birdwatching	4	8	\$24.67	\$6.96	\$4.83	\$65.38
Camping	29	48	\$30.99	\$4.81	\$1.69	\$187.11
Cross Country Skiing	8	12	\$26.15	\$2.84	\$11.71	\$40.32
Downhill Skiing	5	5	\$27.91	\$7.07	\$12.54	\$52.59
Fishing	129	177	\$39.30	\$4.01	\$1.73	\$464.02
Floatboating/ Rafting/ Canoeing	20	81	\$84.09	\$7.97	\$2.25	\$329.02
General Recreation	15	39	\$29.25	\$7.24	\$1.18	\$214.59
Going to the Beach	5	33	\$32.86	\$4.22	\$3.15	\$98.18
Hiking	21	68	\$25.70	\$3.61	\$0.33	\$218.37
Horseback Riding	1	1	\$15.10		\$15.10	\$15.10
Hunting	192	277	\$39.10	\$1.83	\$2.17	\$209.08
Motorboating	15	32	\$38.56	\$6.19	\$3.15	\$169.68
Mountain Biking	7	32	\$61.48	\$10.09	\$17.38	\$246.41
Off Road Vehicle Driving	4	10	\$19.10	\$3.29	\$4.37	\$34.05
Other Recreation	15	16	\$40.58	\$9.64	\$4.76	\$172.35
Picnicking	8	13	\$34.55	\$8.91	\$7.45	\$118.95
Pleasure Driving (which may include sightseeing)	4	11	\$49.36	\$15.70	\$2.52	\$139.78
Rockclimbing	4	27	\$46.88	\$5.72	\$22.18	\$113.18
Scuba Diving	2	24	\$26.97	\$9.34	\$2.34	\$208.37
Sightseeing	15	28	\$30.70	\$7.33	\$0.54	\$174.81
Snorkeling	1	9	\$25.26	\$12.80	\$4.36	\$112.74
Snowmobiling	3	8	\$30.24	\$11.03	\$8.99	\$103.70
Swimming	11	26	\$35.57	\$5.12	\$1.83	\$111.95
Visit Environmental Education Center	1	1	\$5.01		\$5.01	\$5.01
Visiting an Arboretum	1	1	\$11.28		\$11.28	\$11.28
Visiting Aquariums	1	1	\$23.59		\$23.59	\$23.59
Waterskiing	1	4	\$40.85	\$10.60	\$12.61	\$58.39
Wildlife Viewing	69	240	\$35.30	\$2.20	\$2.00	\$289.90
Windsurfing	1	1	\$329.56		\$329.56	\$329.56

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, Southeast, and our own construct, Multiple Area. Multiple Area was included as several of the studies spanned more than one region. Here we find 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.

Table 2. Summary Statistics on Average Consumer Surplus Values by Activity and Region per person per day 1967-2003 (1996 dollars)												
	Alaska		Intermountain		Multiple Area Studies		Northeast		Pacific Coast		Southeast	
Activity	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Backpacking									6	\$43.42		
Birdwatching							3	\$29.05			5	\$22.05
Camping			21	\$28.93	2	\$9.85	10	\$27.59	4	\$86.96	11	\$21.49
Cross Country Skiing			7	\$24.90	1	\$12.67	3	\$28.83	1	\$40.32		
Downhill Skiing			3	\$33.02	1	\$19.61			1	\$20.90		
Fishing	4	\$51.66	48	\$41.31	14	\$39.61	69	\$27.17	15	\$36.97	27	\$66.01
Floatboating/ Rafting/ Canoeing	1	\$15.13	22	\$56.42	1	\$28.34	6	\$73.60	4	\$23.20	47	\$106.22
General Recreation	1	\$12.37	12	\$40.38	3	\$3.33	5	\$14.06	9	\$26.96	9	\$35.64
Going to the Beach							22	\$35.50			11	\$27.60
Hiking	1	\$12.93	7	\$32.11	1	\$20.87	3	\$62.65	49	\$19.37	7	\$50.32
Horseback Riding					1	\$15.10						
Hunting	7	\$54.73	109	\$40.46	12	\$51.41	87	\$39.54	18	\$37.91	44	\$29.47
Motorboating			7	\$44.73	1	\$28.63	3	\$24.73	8	\$22.45	13	\$49.10
Mountain Biking			6	\$153.73	1	\$17.61	1	\$34.11	16	\$41.40	8	\$41.35
Off Road Vehicle Driving			7	\$19.01	1	\$19.94			1	\$33.64	1	\$4.37
Other Recreation			10	\$46.96	1	\$17.36			1	\$62.06	4	\$25.06
Picnicking			5	\$23.56	1	\$15.69	2	\$47.04	3	\$53.52	2	\$30.52
Pleasure Driving	3	\$7.01	4	\$58.12	1	\$30.38	1	\$17.79			2	\$120.65
Rockclimbing			3	\$42.04	12	\$22.35	1	\$85.74			11	\$71.42
Scuba Diving							14	\$14.93	10	\$43.83		
Sightseeing	1	\$13.20	11	\$19.65	1	\$14.86	2	\$101.19	4	\$16.89	9	\$38.38
Snorkeling									9	\$25.26		
Snowmobiling			8	\$30.24								
Swimming			1	\$24.62	1	\$19.63	7	\$18.51	4	\$22.74	13	\$50.77
Visit Env. Education Center							1	\$5.01				
Visiting Arboretum											1	\$11.28
Visiting Aquariums											1	\$23.59
Waterskiing			2	\$47.47	1	\$55.83	1	\$12.61				
Wildlife Viewing	8	\$41.11	61	\$31.03	29	\$46.97	65	\$26.08	23	\$60.40	54	\$33.42
Windsurfing											1	\$329.56
Totals	26	\$38.20	354	\$39.58	86	\$36.61	306	\$32.04	186	\$34.96	281	\$52.42

The original study was sponsored by the USDA Forest Service while this update is sponsored by the National Park Service. Therefore, we included a summary of the various agencies (Table 3). This table categorizes the data according to region and recreation area. Recreation area is subdivided into National Forest, National Park, State or City Land, and Various Land Entities. We also include a separate category that presents the observations that were found in Wilderness areas by region. Overall, 186 observations were in National Forests, 49 in National Parks, 990 in other locations, and 14 spanning various entities. Of the 1239 studies, 108 were found to be in Wilderness areas.

Recreation Area	Alaska		Intermountain		Multiple Area Studies		Northeast		Pacific Coast		Southeast		Totals	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Various Entities					12	\$22.35			2	\$29.72			14	\$23.40
National Forest	3	\$11.49	40	\$21.65	9	\$18.69	34	\$25.76	53	\$18.98	47	\$96.40	186	\$40.22
National Park	3	\$7.01	29	\$33.90					11	\$89.21	6	\$22.36	49	\$43.26
State or City Land	20	\$46.89	285	\$42.67	65	\$41.72	272	\$32.83	120	\$37.13	228	\$44.15	990	\$39.66
Wilderness Recreation			32	\$34.73	17	\$23.72	8	\$21.23	46	\$21.85	5	\$98.89	108	\$29.48

We then further subdivide our results by activity and region. These results are presented in Table 4. The region with the least amount of activities was Alaska with nine. This does not mean that only nine activities can be participated in while visiting Alaska, but that we only found consumer surplus studies for nine. None of the regions encompassed all 30 activities, however, the Northeast, Southeast, and Multiple area studies represented 21 of the 30 activities.

Table 4 Detailed Descriptive Statistics on Average Per Day Consumer Surplus Values by Activity and Region - 1967 to 2003 (1996 Dollars)

Region	Activity	N	Mean	Std. Error	Std. Dev	Min	Max
Alaska Region							
	Fishing	4	\$51.66	\$7.68	\$15.36	\$38.00	\$68.28
	Floatboating/ Rafting/ Canoeing	1	\$15.13			\$15.13	\$15.13
	General Recreation	1	\$12.37			\$12.37	\$12.37
	Hiking	1	\$12.93			\$12.93	\$12.93
	Hunting	7	\$54.73	\$4.01	\$10.61	\$39.22	\$71.21
	Pleasure Driving	3	\$7.01	\$3.06	\$5.30	\$2.52	\$12.86
	Sightseeing	1	\$13.20			\$13.20	\$13.20
	Wildlife Viewing	8	\$41.11	\$7.91	\$22.38	\$8.91	\$70.33
Alaska Region Total		26	\$38.20	\$4.48	\$22.83	\$2.52	\$71.21
Intermountain Area Studies							
	Camping	21	\$28.93	\$5.53	\$25.36	\$1.69	\$97.22
	Cross Country Skiing	7	\$24.90	\$3.82	\$10.11	\$11.71	\$38.74
	Downhill Skiing	3	\$33.02	\$11.57	\$20.04	\$12.54	\$52.59
	Fishing	48	\$41.31	\$5.80	\$40.18	\$7.47	\$189.40
	Floatboating/ Rafting/ Canoeing	22	\$56.42	\$11.94	\$55.98	\$2.25	\$263.68
	General Recreation	12	\$40.38	\$17.43	\$60.39	\$6.59	\$214.59
	Hiking	7	\$32.11	\$6.53	\$17.27	\$10.71	\$63.13
	Hunting	109	\$40.46	\$2.79	\$29.17	\$2.17	\$141.09
	Motorboating	7	\$44.73	\$21.61	\$57.17	\$4.41	\$169.68
	Mountain Biking	6	\$153.73	\$34.21	\$83.79	\$54.90	\$246.41
	Off Road Vehicle Driving	7	\$19.01	\$3.59	\$9.51	\$6.63	\$34.05
	Other Recreation	10	\$46.96	\$14.47	\$45.76	\$10.14	\$172.35
	Picnicking	5	\$23.56	\$3.41	\$7.62	\$11.34	\$32.30
	Pleasure Driving	4	\$58.12	\$27.69	\$55.38	\$22.01	\$139.78
	Rockclimbing	3	\$42.04	\$6.32	\$10.95	\$29.82	\$50.95
	Sightseeing	11	\$19.65	\$7.21	\$23.90	\$0.54	\$83.94
	Snowmobiling	8	\$30.24	\$11.03	\$31.21	\$8.99	\$103.70
	Swimming	1	\$24.62			\$24.62	\$24.62
	Waterskiing	2	\$47.47	\$10.91	\$15.43	\$36.56	\$58.39
	Wildlife Viewing	61	\$31.03	\$2.75	\$21.46	\$4.38	\$161.59
Intermountain Area Studies Total		354	\$39.58	\$2.04	\$38.36	\$0.54	\$263.68
Multiple Area Studies							
	Camping	2	\$9.85	\$1.67	\$2.36	\$8.18	\$11.52
	Cross Country Skiing	1	\$12.67			\$12.67	\$12.67
	Downhill Skiing	1	\$19.61			\$19.61	\$19.61
	Fishing	14	\$39.61	\$8.74	\$32.69	\$2.00	\$105.00
	Floatboating/ Rafting/ Canoeing	1	\$28.34			\$28.34	\$28.34
	General Recreation	3	\$3.33	\$1.69	\$2.93	\$1.64	\$6.71
	Hiking	1	\$20.87			\$20.87	\$20.87
	Horseback Riding	1	\$15.10			\$15.10	\$15.10
	Hunting	12	\$51.41	\$19.21	\$66.55	\$5.00	\$193.82
	Motorboating	1	\$28.63			\$28.63	\$28.63
	Mountain Biking	1	\$17.61			\$17.61	\$17.61
	Off Road Vehicle Driving	1	\$19.94			\$19.94	\$19.94
	Other Recreation	1	\$17.36			\$17.36	\$17.36
	Picnicking	1	\$15.69			\$15.69	\$15.69
	Pleasure Driving	1	\$30.38			\$30.38	\$30.38
	Rockclimbing	12	\$22.35	\$0.03	\$0.10	\$22.18	\$22.43
	Sightseeing	1	\$14.86			\$14.86	\$14.86
	Swimming	1	\$19.63			\$19.63	\$19.63
	Waterskiing	1	\$55.83			\$55.83	\$55.83
	Wildlife Viewing	29	\$46.97	\$10.32	\$55.58	\$2.50	\$261.66
Multiple Area Studies Total		86	\$36.61	\$4.77	\$44.26	\$1.64	\$261.66

	Activity	N	Mean	Std. Error	Std. Dev.	Min	Max
Northeast Area							
	Birdwatching	3	\$29.05	\$18.50	\$32.04	\$4.83	\$65.38
	Camping	10	\$27.59	\$5.27	\$16.66	\$5.61	\$55.37
	Cross Country Skiing	3	\$28.83	\$2.35	\$4.08	\$24.75	\$32.91
	Fishing	69	\$27.17	\$4.55	\$37.76	\$1.73	\$210.94
	Floatboating/ Rafting/ Canoeing	6	\$73.60	\$19.11	\$46.81	\$16.73	\$119.58
	General Recreation	5	\$14.06	\$6.73	\$15.05	\$1.64	\$38.91
	Going to the Beach	22	\$35.50	\$5.86	\$27.48	\$3.15	\$98.18
	Hiking	3	\$62.65	\$10.69	\$18.52	\$41.50	\$75.92
	Hunting	87	\$39.54	\$3.36	\$31.37	\$3.47	\$209.08
	Motorboating	3	\$24.73	\$21.01	\$36.39	\$3.15	\$66.75
	Mountain Biking	1	\$34.11			\$34.11	\$34.11
	Picnicking	2	\$47.04	\$39.59	\$55.98	\$7.45	\$86.63
	Pleasure Driving	1	\$17.79			\$17.79	\$17.79
	Rockclimbing	1	\$85.74			\$85.74	\$85.74
	Scuba Diving	14	\$14.93	\$2.86	\$10.70	\$2.34	\$37.50
	Sightseeing	2	\$101.19	\$73.63	\$104.12	\$27.56	\$174.81
	Swimming	7	\$18.51	\$5.12	\$13.54	\$1.83	\$41.75
	Visit Environmental Ed Center	1	\$5.01			\$5.01	\$5.01
	Waterskiing	1	\$12.61			\$12.61	\$12.61
	Wildlife Viewing	65	\$26.08	\$1.82	\$14.64	\$2.00	\$80.25
Northeast Area Studies Total		306	\$32.04	\$1.77	\$30.91	\$1.64	\$210.94
Pacific Coast Area Studies							
	Backpacking	6	\$43.42	\$7.74	\$18.97	\$22.35	\$66.95
	Camping	4	\$86.96	\$37.82	\$75.63	\$6.21	\$187.11
	Cross Country Skiing	1	\$40.32			\$40.32	\$40.32
	Downhill Skiing	1	\$20.90			\$20.90	\$20.90
	Fishing	15	\$36.97	\$7.23	\$28.02	\$3.69	\$86.25
	Floatboating/ Rafting/ Canoeing	4	\$23.20	\$0.84	\$1.68	\$21.01	\$24.65
	General Recreation	9	\$26.96	\$11.98	\$35.93	\$1.18	\$104.64
	Hiking	49	\$19.37	\$2.21	\$15.47	\$0.33	\$108.02
	Hunting	18	\$37.91	\$6.44	\$27.33	\$5.21	\$92.80
	Motorboating	8	\$22.45	\$4.92	\$13.91	\$10.40	\$53.40
	Mountain Biking	16	\$41.40	\$2.28	\$9.11	\$26.42	\$65.62
	Off Road Vehicle Driving	1	\$33.64			\$33.64	\$33.64
	Other Recreation	1	\$62.06			\$62.06	\$62.06
	Picnicking	3	\$53.52	\$33.05	\$57.25	\$12.66	\$118.95
	Scuba Diving	10	\$43.83	\$21.55	\$68.14	\$4.36	\$208.37
	Sightseeing	4	\$16.89	\$11.26	\$22.53	\$4.36	\$50.64
	Snorkeling	9	\$25.26	\$12.80	\$38.39	\$4.36	\$112.74
	Swimming	4	\$22.74	\$9.46	\$18.91	\$5.05	\$49.08
	Wildlife Viewing	23	\$60.40	\$14.08	\$67.53	\$5.91	\$289.90
Pacific Coast Area Studies Total		186	\$34.96	\$2.84	\$38.69	\$0.33	\$289.90
Southeast Area Studies							
	Birdwatching	5	\$22.05	\$5.34	\$11.93	\$7.87	\$36.06
	Camping	11	\$21.49	\$6.74	\$22.34	\$2.75	\$54.18
	Fishing	27	\$66.01	\$19.71	\$102.43	\$3.00	\$464.02
	Floatboating/ Rafting/ Canoeing	47	\$106.22	\$11.21	\$76.87	\$15.04	\$329.02
	General Recreation	9	\$35.64	\$17.09	\$51.28	\$4.18	\$157.88
	Going to the Beach	11	\$27.60	\$4.80	\$15.91	\$5.66	\$44.86
	Hiking	7	\$50.32	\$28.72	\$75.99	\$1.56	\$218.37
	Hunting	44	\$29.47	\$2.38	\$15.78	\$4.74	\$69.00
	Motorboating	13	\$49.10	\$7.99	\$28.81	\$5.76	\$111.95
	Mountain Biking	8	\$41.35	\$4.49	\$12.71	\$17.38	\$56.27
	Off Road Vehicle Driving	1	\$4.37			\$4.37	\$4.37
	Other Recreation	4	\$25.06	\$9.44	\$18.87	\$4.76	\$47.66
	Picnicking	2	\$30.52	\$6.72	\$9.50	\$23.80	\$37.24
	Pleasure Driving	2	\$120.65	\$18.10	\$25.59	\$102.55	\$138.74
	Rockclimbing	11	\$71.42	\$8.15	\$27.04	\$32.73	\$113.18
	Sightseeing	9	\$38.38	\$11.42	\$34.26	\$6.60	\$93.92
	Swimming	13	\$50.77	\$7.50	\$27.05	\$11.37	\$111.95
	Visiting an Arboretum	1	\$11.28			\$11.28	\$11.28
	Visiting Aquariums	1	\$23.59			\$23.59	\$23.59
	Wildlife Viewing	54	\$33.42	\$2.67	\$19.66	\$2.38	\$111.95
	Windsurfing	1	\$329.56			\$329.56	\$329.56
Southeast Area Studies Total		281	\$52.42	\$3.54	\$59.40	\$1.56	\$464.02

DETAILS OF SPREADSHEET DATABASE STUDY CODING.

Often times in performing benefit transfer, it is more appropriate to compute an average value per visitor day just using empirical studies that closely match the policy site, rather than just using an overall average for the region. In order 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 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, 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.

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 (Table 5). 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.

TABLE 5: VARIABLE DEFINITIONS IN SPREADSHEET

GENERAL STUDY CHARACTERISTICS

Code#	Variable	Coding
SORT	SORT	Column to sort on
V000	STUDYID	Study #
V001	ORIGDATA	1,0; 1=Is this the first study to use this data.
V002	AUTHOR(s)	Name(s)
V003	STUDY TITLE	Text
V004	SOURCE/VOL/PAGES	Text
V005	PUBDATE	Year #
V005A	DATEANAL	Just the year without the month for coding
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
II. BENEFIT MEASURES		
V009	BENMEAS	1=WTP 2=WTA
V010	MEAN/MED	1,0; 1= Mean, 0 = Median (mean should be reported where possible)
V010aa	IF 10a is MED	IF the value in 10a is the median put a 1 here, otherwise put nothing
V010a	MEAN/MED VAL	The actual mean or median value
V011	DOLVALUE	Value converted to per person per day.
V011org	ORIVAL	Original value printed in report
V011b	CURDOL	Current dollars 1996, using implicit price deflators
V011c	IMPDFL	Implicit price deflators
V012	YEARVAL	Year of data (i.e., recorded 1994-1997, but values are in 1997 dollars so we put 1994-1997 here)
V012a	YEARVALUSED	Year that the given values are in
V013	ORIGVALUNITS	1=Day 2=Trip 3=Year 4=Season
V013a	AVGTRIP	Average # of days per trip
V013aa	REPESTASK	Reported, estimated or asked author
V013b	ORIGNUM	original number of people per group for original
V014	STD ER	Std 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=multi-state
V018	STATE	1,0, 1=state
V019	ST NAMES	Type in two letter state abbreviation (e.g., CO for Colorado).
V019b	REGION	Forest Service Regions of the US, category 1 thru 10.(and 11 is all regions)
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 description 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)
V19b1	CENSUSREG	Census Regions of the USA, Category 1 thru 5 (and 6 is all regions)
V020	ESTSELEC	1=author recommendation, 0= other
V021	AVGSITIME	Average on-site time per trip, in hours (convert multiple days by using 12 hrs/day)
V022	GROUPSIZE	Average number of people in group
V023	TOTSITEVIS	Total number of visits to the Area/Site per year
V023a	TOTSITDES	Description of the number of visits

V024	SEASLNTH	Season length converted to Days (e.g., hunting period allowed)
V025	ALL/NO-SQ	1,0;1=Yes, Valued for existing condition; 0=No
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=Env /Conservation, 4=Multiple Category of Sponsors, 5=Others,
V030	NUMSVYSRET	Number of surveys returned
V030a	NUMUSE	Number of usable surveys
V031	RESPRATE	Response rate percent
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=code all methods used in the study
V034	INPERSON	1,0; 1=in person
V035	SAMPFRAME	1=On-Site; 2=User List; 3=General Population; 4=Others;
V036	VALMETHOD	1=CVM 0=TCM 2=Both
V037	GEOGAREA	Geographic area of visitor origin (average one-way distance in mile.
III. 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 & revealed preference
V043	PAYCARD	1,0; 1=payment card
V044	MIDPTS	1= Mid -point; 2=Amount circled (refers to payment card) 0=N/A
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 (refers to dichotomous choice)
V048	DCSTAT	1=Logit 2=Probit 3=non param 4=Sem Non para (refers to dichotomous choice)
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 $1/B * (\ln(1 + \exp(B_0)))$); 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/ simple
V054	PROTESTR	1,0; 1=if protest responses removed; 0=if all observations used
IV. DETAILS OF TCM APPLICATION		
V055	TCMTYPE	1=Zonal 2=Individ 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= Correct for Endogenous Stratification
V059	TRAVTIMEVAR	1,0; 1=separate variable given for travel time
V060	OPCOSTIME	% of wage rate
V060a	OPCTIN	1,0; 1= If V060 has value coded, 0 otherwise
V061	COSTMILE	\$ per mile used

V061a	COSTKM	\$ per km used
V062	SUBS	1,0; 1= Price of Substitution given, or Avail of Subst.(if demand equation include a variable for substitute)
V063	SITEQUAL	1,0; 1=if site quality or facility (indicated by author)
V064	HEDTCM	1,0; 1=Hedonic TCM
V065	LHSFUNCFRM	1=Linear 2=Log,Pois,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= if upper limit of integration truncated, e.g., at max observed TC
V069	TCMOUTLIE	1,0; 1= if outliers or multi-destination trips explicitly removed
V. STUDY LOCATION		
V070A	GENDES	General description of area studied
V070	COUNTY	1,0; 1=county
V071	CTY NAME	Type in County name
V072	SITE NAME	Type in 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	1=Atlantic, 2=Pacific 3=Gulf of Mexico
V077	RIVER	1,0; 1=if 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=if recreation use is in Wilderness Area
V090	WILDNAME	Name of Wilderness Area
V091	STPARKFOR	1,0; 1 if 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=T&E; 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	
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, 0 otherwise
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	ROSCCLASS	1= Primitive; 2= SPNM; 3= SPM; 4= RN; 5= Rural; 6= Urban 7=various

V103	ACT TYPE 1	1=CAMPING 2=PICNIC 3=SWIM 4=SISEE 5= OFF RD VEHICLE; 6=MTRBOA; 7=FLTBOAT/RAFT/CANOE; 8=HIKE; 9=MTN BIKE; 10=DHSKI;
		11=X-CSKI; 12=SNMOB; 13=SNPLAY; 14=HUNT; 15=FISH; 16=WLVIEW; 17=HRSEBCK; 18=RESORT; 19=ROCKCLIMB; 20=GENERAL RECREATION; 21=OTHER RECREATION; 22=WILDERNESS 23=WATERSKI 24= PLEASURE DRIVING (can include sightseeing) 25=VISIT ARBORETUM 26=GO TO BEACH 27=RELAX OUTDOORS 28=VISIT AQUARIUMS 29=Scuba diving 30=windsurfing 31=bird watching 32=snorkeling 33=Backpacking 34=visit environmental education center
V104	ACT TYPE 2	One of the above categories of ACTTYPE except the one already chosen.
V105	ACT TYPE 3	One of the above categories of ACTTYPE except the one already chosen.
V106	ACT TYPE 4	One of the above categories of ACTTYPE except the one already chosen.
V107	NUMACT	Number of activities site offers or typical visitor could participate in at site
V108	AVGINC	Average income of visitors
V108a	AVGINC96	Average income 1996 dollars
V109	AVGED	Average education of visitors
V110	AVGAGE	Average age
V111	AVGSEX	M=0, F=1 (% of Female)
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	% (Success rate in hunting)
V115	BAG	# 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 in 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	# Choice occasions (frequency)
	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.

BENEFIT TRANSFER USING TABLES AND DATABASE

What Is a Benefit Transfer?

Benefit transfer is a term referring to the use of existing value information to new sites or areas. Thus, benefit transfer is the adaptation and use of net WTP or value per day 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:

- budget constraints,
- time limitations, or
- 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 strategy is not to 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 in order to perform effective and efficient benefit transfers (Desvousges and others 1992). First, the policy context should be thoroughly defined, including:

- Identifying the extent, magnitude, and quantification of expected site or resource impacts from the proposed action.
- Identifying the extent and magnitude of the population that will be affected by the expected site or resource impacts.
- 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:

- Studies transferred must be based on adequate data, sound economic method, and correct empirical technique (Freeman 1984).
- The study contains information on the statistical relationship between benefits (costs) and socioeconomic characteristics of the affected population.
- The study contains information on the statistical relationship between the benefits (costs) and physical/environmental characteristics of the study site.
- 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.

- 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.

- 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.
- 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 related 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.

- The quality of the original study greatly affects the quality of the benefit transfer process.
- 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.

- Another data limitation is the documentation of data collected and reported. This increases the difficulty of demand estimation and benefit transfer.
- 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.

- 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.
- 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).
- 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 amongst activities.
- 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.

- Some of the existing studies may be based on valuing recreation activities at

unique sites and under unique conditions.

- 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 Park decision-making involving trade-offs between types of recreation (motorized vs non-motorized), and nature preservation. Evaluation of these trade-offs can often be improved by inclusion of even approximate estimates of non-market recreation values. Complete omission of recreation value estimates in economic analytic aids to decision making 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 percent difference). Therefore, the policy context and process will most often dictate the acceptability of transferred data.

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 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 When the change in recreation supply or days is small and localized, consumer surplus is

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 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.

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.

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

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 (1-a) a single (point) benefit estimate from a study site, or (1-b) a measure of central tendency for several benefit estimates from a study site or sites (such as an average value), 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 benefit or demand function from a study site, or (2-b) 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 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.

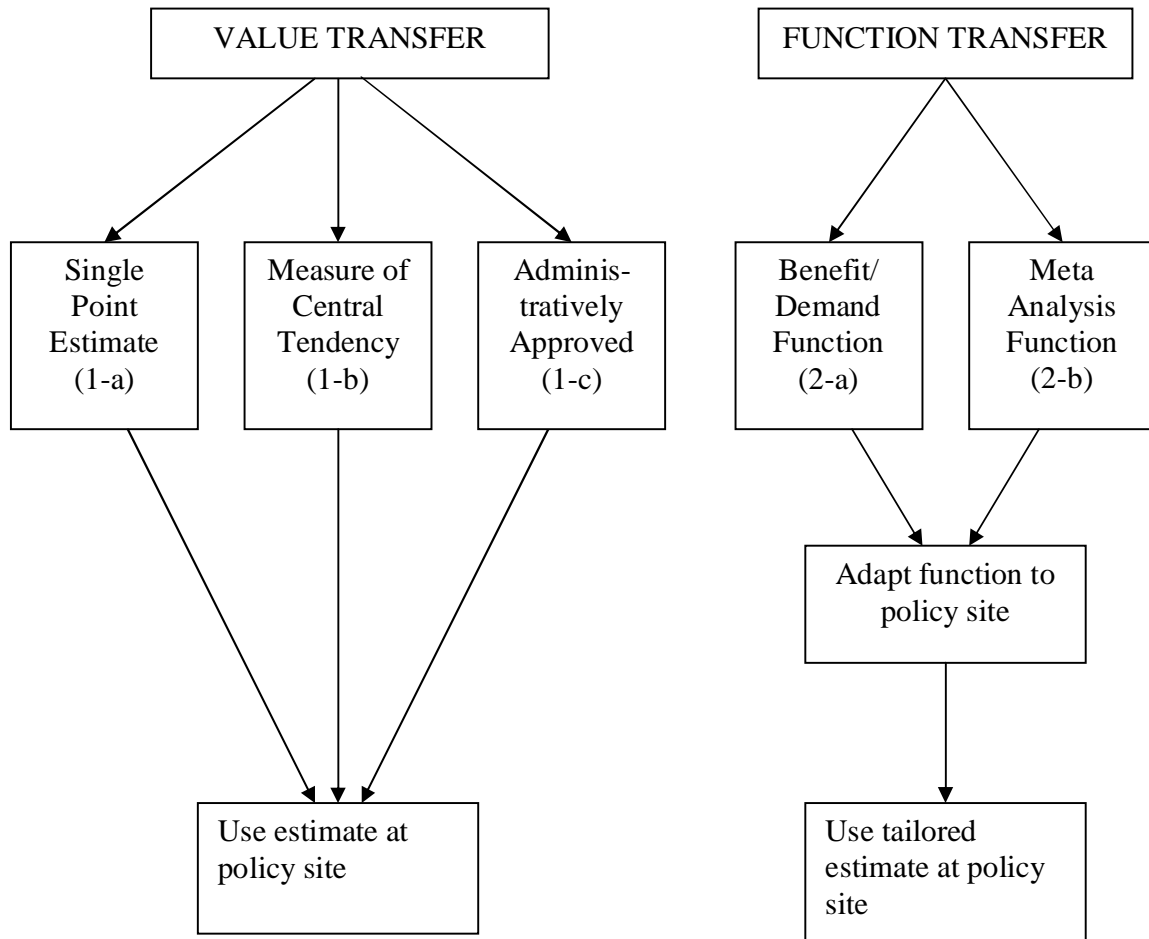


Figure 1. Benefit transfer approaches (From Rosenberger and Loomis, 2001)

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 2) provides a more detailed list of the steps involved in single point estimate transfers.

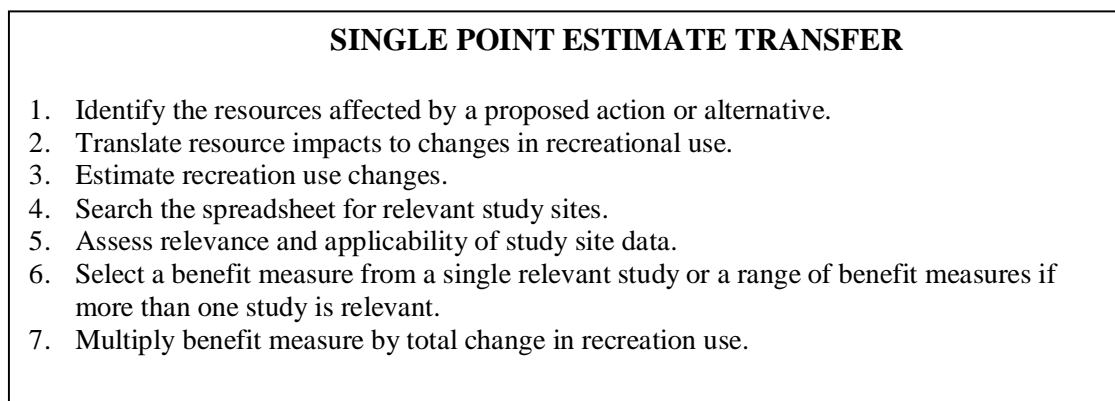


Figure 2. Steps to performing a single point estimate transfer.

We provide information in this report that aids in identifying study site benefit measures from the literature.² The bibliography of this report and 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 a comparable index as changes measured in activity days or convert the activity day measures into the relevant units.

² 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/>.

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.

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).

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.

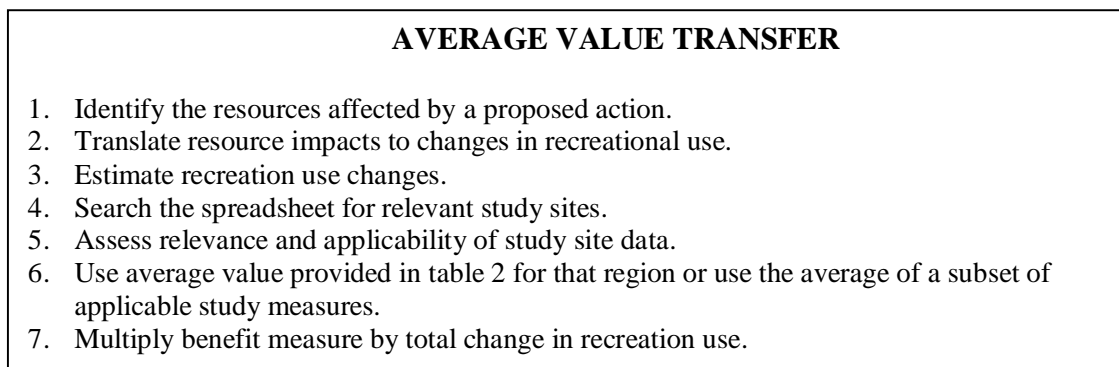


Figure 4. Steps to performing an average value transfer.

SUMMARY

We have updated average values and our values spreadsheet to provide information on and reference to the literature on outdoor recreation use valuation studies, including study source, benefit measures, recreation activity, valuation methodology, and geographic region. We also provided tables that reference the bibliography for each activity, enabling easy location of

studies. Our literature review spans 1967 to 2003 and covers more than 20 recreation activities.

We then provided guidance on performing various benefit transfer methods. 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.

REFERENCES CITED

- Adamowicz, Wiktor L.; Fletcher, Jerald J.; Graham-Tomasi, Theodore. 1989. Functional form and the statistical properties of welfare measures. *American Journal of Agricultural Economics*. 71(2): 414-421.
- Bergstrom, John C.; Cordell, H. Ken. 1991. An analysis of the demand for and value of outdoor recreation in the United States. *Journal of Leisure Research*. 23(1): 67-86.
- Boyle, Kevin J.; Bergstrom, John C. 1992. Benefit transfer studies: Myths, pragmatism, and idealism. *Water Resources Research*. 28(3): 657-663.
- Brookshire, David S.; Neill, Helen R. 1982. Benefit transfers: Conceptual and empirical issues. *Water Resources Research*. 28(3): 651-655.
- Brown, Thomas C; Champ, Patricia A.; Bishop, Richard C.; McCollum, Daniel W. 1996. Which response format reveals the truth about donations to a public good? *Land Economics*. 72(2): 152-166.
- Carson, Richard T.; Flores, Nicholas E.; Martin, Kerry M.; Wright, Jennifer L. 1996. Contingent valuation and revealed preference methodologies: Comparing the estimates for quasi-public goods. *Land Economics*. 72(1): 80-99.
- Carson, Richard T.; Wright, Jennifer L; Carson, Nancy; Alberini, A.; Flores, N. 1994. A bibliography of contingent valuation studies and papers. California: Natural Resource Damage Assessment, Inc.
- Champ, Patricia A; Boyle, Kevin J.; Brown, Thomas C., eds. In preparation. A primer on non-market valuation. Under contract with Kluwer Publishers.
- Creel, Michael D.; Loomis, John B. 1990. Theoretical and empirical advantages of truncated count data estimators for analysis of deer hunting in California. *American Journal of Agricultural Economics*. 72(2): 434-441.
- Desvousges, William H.; Johnson, F. Reed; Banzhaf, H. Spencer. 1998. Environmental policy analysis with limited information: Principles and applications of the transfer method. Massachusetts: Edward Elgar. 244 p.
- Desvousges, William H.; Naughton, Michael C.; Parsons, George R. 1992. Benefit transfer: Conceptual problems in estimating water quality benefits using existing studies. *Water Resources Research*. 28(3): 675-683.
- Downing, Mark; Ozuna Jr., Teofilo. 1996. Testing the reliability of the benefit function transfer approach. *Journal of Environmental Economics and Management*. 30(3): 316-322.
- Freeman, A. Myrick, III. 1984. On the tactics of benefit estimation under Executive Order 12291. In: Smith, V. Kerry, ed. *Environmental policy under Reagan's Executive Order: The role of benefit-cost analysis*. Chapel Hill, NC: The Univ. of North Carolina Press: chapter 6.

- Freeman, A. Myrick, III. 1993. The measurement of environmental and resource values: Theory and methods. Washington, DC: Resources for the Future. 516 p.
- Kirchhoff, Stefanie; Colby, Bonnie G.; LaFrance, Jeffrey T. 1997. Evaluating the performance of benefit transfer: An empirical inquiry. *Journal of Environmental Economics and Management*. 33(1): 75-93.
- Loomis, John B. 1993. *Integrated Public Lands Management*. Columbia University Press. New York, NY. 474 p.
- Loomis, John; Roach, Brian; Ward, Frank; Ready, Richard. 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, John; Rosenberger, Randy; Shrestha, Ram. 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, Dept. of Agricultural and Resource Economics; Final Report RJVA 28-JV7-962. 36 p.
- Loomis, John B; Walsh, Richard G. 1997. *Recreation economic decisions: Comparing benefits and costs*. 2nd ed. State College, PA: Venture Publishing. 440 p.
- MacNair, Doug. 1993. 1993 RPA recreation values database. Washington, DC: USDA Forest Service, RPA Program; Contract 43-4568-3-1191.
- Markowski, M.; Unsworth, R.; Paterson, R.; Boyle, K. 1997. A database of sport fishing values. Washington, DC: Industrial Economics Inc., prepared for US Fish and Wildlife Service, Economics Division.
- Morey, Edward 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, Randall S. and Loomis, John 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, Randall and Loomis, John B. 2001. *Benefit Transfer of Outdoor Recreation Use Values: A Technical Report Supporting the Forest Service Strategic Plan (2000 Revision)*. General Technical Report RMRS-GTR-72. Rocky Mountain Research Station, Fort Collins, CO.
- Rosenberger, Randall S.; Loomis, John B. Submitted. Panel stratification in meta-analysis of in economic studies. *Journal of Agricultural and Applied Economics* 32: 459-470.
- Rosenthal, Donald H.; Brown, Thomas C. 1985. Comparability of market prices and consumer surplus for resource allocation decisions. *Journal of Forestry*. 83(1): 105-109.
- Siderelis, Christos; Moore, Roger. 1995. Outdoor recreation net benefits of rail-trails. *Journal*

of Leisure Research. 27(4): 344-359.

Smith, V. Kerry. 1992. On separating defensible benefit transfers from “smoke and mirrors”. *Water Resources Research* 28(3): 685-694.

Smith, V. Kerry; Houtven, George van; Pattanayak, Subhrendu. 1999. Benefit transfer as preference calibration. Washington, DC: Resources for the Future; Discussion Paper 99-36.

Smith, V. Kerry; Kaoru, Yoshiaki. 1990. Signals or noise?: Explaining the variation in recreation benefit estimates. *American Journal of Agricultural Economics*. 72(2): 419-433.

Sorg, Cindy F.; Loomis, John 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.

SPRA. (2000, January 27). Homepage of Strategic Planning and Resource Assessment, Forest Service, U.S. Department of Agriculture. Available: <http://www.fs.fed.us/plan>.

USDA Forest Service. 1989. Draft 1990 RPA Program. Washington, DC: USDA Forest Service. Paginated by section.

US Water Resources Council. 1973. Principles, standards, and procedures for water and related land resource planning. *Federal Register*. 38(174): part III, 24,778-24,945..

US 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.

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

Walsh, Richard G.; Johnson, Donn M.; McKean, John R. 1988. Review of outdoor recreation economic demand studies with nonmarket benefit estimates, 1968-1988. Fort Collins, CO: Colorado State University, Dept. of Agricultural and Resource Economics, Technical Report No. 54. 131 p.

Walsh, Richard G.; Johnson, Donn M.; McKean, John R. 1992. Benefit transfer of outdoor recreation demand studies: 1968-1988. *Water Resources Research*. 28(3): 707-713.

Willig, Robert D. 1976. Consumer surplus without apology. *American Economic Review*. 66(4): 589-597.

Bibliography for Entire Spreadsheet Database

- Adamowicz, W., S. Jennings, and D. Coyne. 1990. A sequential choice model of recreation behavior. *Western Journal of Agricultural Economics* 15:91-99.
- Adamowicz, W., J. Louviere, and M. Williams. 1994. Combining revealed and stated preference methods for valuing environmental amenities. *Journal of Environmental Economics and Management* 26:271-292.
- Adamowicz, W.L., and W.E. Phillips. 1983. A comparison of extra market benefit evaluation techniques. *Canadian Journal of Agricultural Economics* 31:401-412.
- Adams, R.M., O. Bergland, W.N. Musser, S.L. Johnson, and L.M. Musser. 1989. User fees and equity issues in public hunting expenditures: The case of ring-necked pheasant in Oregon. *Land Economics* 65:376-385.
- Baker, J.C. 1996. A nested Poisson approach to ecosystem valuation: An application to backcountry hiking in California. Reno, NV: University of Nevada, Reno. Pp26.
- Balkan, E., and J.R. Kahn. 1988. The value of changes in deer hunting quality: A travel cost approach. *Applied Economics* 20:533-539.
- 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. Pp 411-422.
- Bayless, Donna S., John C. Bergstrom, Mark L. Messonnier, and H. Ken Cordell. 1994. Assessing the Demand for Designated Wildlife Viewing Sites. *Journal of Hospitality and Leisure Marketing*. 2(3):75-93.
- Bell, Frederick W. and Vernon R. Leeworthy. 1986. An Economic Analysis of the Importance of Saltwater Beaches in Florida. Report #82. Tallahassee, FL: Department of Economics, Florida State University.
- Bergstrom, J.C., J.M. Bowker, H.K. Cordell, G. Bhat, D.B.K. English, R.J. Teasley, and P. Villegas. 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, USDA Forest Service, Washington, DC. Athens, GA: Outdoor Recreation and Wilderness Assessment Group SE-4901, USDA Forest Service, and Department of Agricultural and Applied Economics, Univ. of Georgia. Pp 68.
- 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.
- 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.
- Betz, Carter J., John C. Bergstrom, and J.M. Bowker. 2003. A Contingent Trip Model for Estimating Rail-Trail Demand. *Journal of Environmental Planning and Management*. 46(1):79-96.
- Bhat, Gajanan, John Bergstrom, R. Jeff Teasley, J.M. Bowker, and H. Ken Cordell. 1998. An Ecoregional Approach to the Economic Valuation of Land and Water Based Recreation in the United States. *Environmental Management*. 22(1):69-77.
- 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. Pp 407-435.
- 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.
- 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.
- Bouwes, N., and R. Schneider. 1979. Procedures in estimating benefits of water quality change. *American Journal of Agricultural Economics* 61:535-539.
- Bowes, M., and J. Krutilla. 1989. Multiple-use management: The economics of public forestlands. Washington, DC: Resources for the Future. Pp 177-247.
- 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.
- Bowker, J.M. and Donald B.K. English. 2002. Mountain Biking at Tsali: An Assessment of Users, Preferences, Conflicts, and Management Alternatives. Preliminary USDA Forest Service Report: www.srs.fs.fed.us/trends/tsali.html
- Bowker, J.M., Donald B.K. English, and Jason A. Donovan. 1996. Toward a Value for Guided Rafting on Southern Rivers. *Journal of Agricultural and Applied Economics*. 28(2):423-432.
- Bowker, J.M. and V.R. Leeworthy. 1998. Accounting for Ethnicity in Recreation Demand: A Flexible Count Data Approach. *Journal of Leisure Research*. 30(1):64-78.
- Bowker, J.M., Morgan P. Miles, and E. James Randall. 1997. A Demand Analysis of Off-Road Motorized Recreation. Paper presented at the Association of Marketing Theory and Practice Annual Meeting entitled "Expanding Marketing Horizons into the 21st Century" at Jekyll Island, SC.
- 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. Pp .
- Boyle, K.J., S.D. Reiling, and M.L. Phillips. 1990. Species substitution and question sequencing in contingent valuation surveys evaluating the hunting of several types of wildlife. *Leisure Science* 12:103-118.
- 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.
- Boyle, Kevin J., Brian Roach, and David G. Waddington. 1998. 1996 Net Economic Values for Bass, Trout and Walleye Fishing, Deer, Elk and Moose Hunting, and Wildlife Watching: Addendum to the 1996 National Survey of Fishing, Hunting and Wildlife Associated Recreation. Report 96-2. U.S. Fish and Wildlife Service.
- 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. Pp 111-130.
- Brooks, R. 1988. The net economic value of deer hunting in Montana. Helena, MT: Montana Department of Fish, Wildlife, and Parks.

- 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. Pp 171-204.
- Brown, G., and M. Hay. 1987. Net economic recreation values for deer and waterfowl hunting and trout fishing. Washington, DC: USDI Fish and Wildlife Service, Division of Policy and Directive Management. Working paper No. 23.
- 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.
- 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.
- 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.
- Cameron, T., and M. James. 1987. Efficient estimation methods for close-ended contingent valuation surveys. *Review of Economics and Statistics* 69:269-276.
- 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.
- 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.
- Cavlovic, Therese. 2000. Valuing the Loss in Access: An Institutional and Welfare Analysis of Rock Climbing on U.S. Public Lands. Ph.D. Dissertation, University of New Mexico: Albuquerque, NM.
- Cesar, Herman, Pieter van Beukering, Sam Pintz, and Jan Dierking. 2002. Economic Valuation of the Coral Reefs of Hawaii. Hawaii Coral Reef Initiative Research Program. University of Hawaii.
- Chakraborty, Kaylan and John E. Keith. 2000. Estimating the Recreation Demand and Economic Value of Mountain Biking in Moab, Utah: An Application of Count Data Models. *Journal of Environmental Planning and Management*. 43(4):461-469.
- 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.
- 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.
- 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.
- 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. Pp 447-463.
- 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.
- 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.
- 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.

- Coupal, Roger H., Chris Bastian, Juliet May, and David T. Taylor. 2001. The Economic Benefits of Snowmobiling to Wyoming Residents: A Travel Cost Approach with Market Segmentation. *Journal of Leisure Research*. 33(4):492-510.
- Crandall, K.B. 1991. Measuring the economic benefits of riparian areas. Master's Thesis, University of Arizona.
- 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.
- Daniels, S. 1987. Marginal cost pricing and efficient provision of public recreation. *Journal of Leisure Research* 19:22-34.
- 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.
- 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.
- 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.
- Douglas, Aaron J. and Jonathan G. Taylor. 1998. Riverine based eco-tourism: Trinity River non market benefits estimates. *International Journal of Sustainable Development and World Ecology*. 5:136-148.
- Downing, Mark and Roland K. Roberts. 1991. Estimating Visitor Use-Value of Arboreta: The Case of the University of Tennessee Arboretum. *Journal of Environmental Horticulture*. 9(4):207-210.
- Duffield, J. 1984. Travel cost and contingent valuation: A comparative analysis. In V.K. Smith and A.D. Witte (eds.), *Advances in Applied Micro-Economics*, Vol. 3. Greenwich, CT: JAI Press. Pp 67-87.
- Duffield, J. 1988. The net economic value of elk hunting in Montana. Helena, MT: Report for Montana Department of Fish, Wildlife, and Parks.
- Duffield, J., J. Loomis, R. Brooks, and J. Holliman. 1987. The net economic value of fishing in Montana. Helena, MT: Report for Montana Department of Fish, Wildlife, and Parks.
- Duffield, J., and C. Neher. 1990. A contingent valuation assessment of Montana deer hunting: Attitudes and economic benefits. Helena, MT: Report for Montana Department of Fish, Wildlife, and Parks.
- Duffield, J., and C. Neher. 1991. Montana waterfowl hunting: A contingent valuation assessment of economic benefits and hunter attitudes. Helena, MT: Report for Montana Department of Fish, Wildlife, and Parks.
- Duffield, J., C. Neher, and T. Brown. 1992. Recreation benefits of instream flow: Application to Montana's Big Hole and Bitterroot Rivers. *Water Resources Research* 28:2169-2181.
- Dwyer, J., G. Peterson, and A. Darragh. 1983. Estimating value of urban forests using the travel cost method. *Journal of Arboriculture* 9:182-185.
- Ekstrand, E.R. 1994. Economic benefits of resources used for rock climbing at Eldorado Canyon State Park, Colorado. Ph.D. Dissertation, Colorado State University.
- Englin, J., and R. Mendelsohn. 1991. A hedonic travel cost analysis for valuation of multiple components of site quality: The recreation value of forest management. *Journal of*

- Environmental Economics and Management* 21:275-290.
- Englin, J., and J.S. Shonkwiler. 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.
- English, Donald B. K. and J. M. Bowker. 1996. Sensitivity of Whitewater Rafting Consumers Surplus to Pecuniary Travel Cost. *Journal of Environmental Management*. 47:79-91.
- Eubanks, Ted Lee Jr., Robert B. Ditton, and John R. Stoll. 1998. Platte River Nature Recreation Study: The Economic Impact of Wildlife Watching on the Platte River in Nebraska. Prepared for the U.S. Environmental Protection Agency Region VII.
- Eubanks, Ted and John R. Stoll. 1999. Avitourism in Texas: Two Studies of Birders in Texas and their Potential Support for the Proposed World Birding Center. www.fermatainc.com/basic/eco_avitourism.html
- Fadali, E., and W.D. Shaw. 1998. Can recreation values for a lake constitute a market for banked agricultural water? *Contemporary Economic Policy* 16:433-441.
- Farber, Stephen. 1988. The Value of Coastal Wetlands for Recreation: An Application of Travel cost and Contingent Valuation Methodologies. *Journal of Environmental Management*. 26:299-312.
- Farber, S., and A. Rambaldi. 1993. Willingness to pay for air quality: The case of outdoor exercise. *Contemporary Policy Issues* 11:19-30.
- Feltus, D.G., and E.E. Langenau. 1984. Optimization of firearm deer hunting and timber values in northern lower Michigan. *Wildlife Society Bulletin* 12:612.
- Fermata, Inc. 2000. Wildlife Associated Recreation on the New Jersey Delaware Bayshore. Delaware Horseshoe Crab and Shorebird Survey.
- Findeis, J.L., and E.L. Michalson. 1984. The demand for and value of outdoor recreation in the Targhee National Forest, Idaho. Moscow, ID: University of Idaho, Agricultural Experiment Station, Bulletin No. 627.
- Fisher, W. 1982. Travel cost and contingent value estimates explored. Paper presented at the Eastern Economic Association Meeting.
- Fix, P., and J. Loomis. 1998. Comparing the economic value of mountain biking estimated using revealed and stated preference. *Journal of Environmental Planning and Management* 41:227-236.
- Gericke, K.L. 1993. Multiple destination trips and the economic valuation of outdoor recreation sites. Ph.D. Thesis, Virginia Polytechnic Institute and State University.
- Garrett, J., G. Pon, and D. Arosteguy. 1970. Economics of big game resource use in Nevada. Reno, NV: University of Nevada, Reno, Agricultural Experiment Station.
- Gibbs, K. 1974. Evaluation of outdoor recreational resources: A note. *Land Economics* 50:309-311.
- Gibbs, K., L. Queirolo, and C. Lomnicki. 1979. The valuation of outdoor recreation in a multiple-use forest. Corvallis, OR: Forest Research Laboratory, Oregon State University.
- Gilbert, A.H., D.W. McCollum, and G.L. Peterson. 1988. A comparison of valuation models using cross-country skiing data from Colorado and Vermont. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station Draft Paper.
- Glass, R., and T. More. 1992. Equity preferences in the allocation of goose hunting opportunities. *Journal of Environmental Management* 35:271-279.
- Goodwin, B.K., L.A. Offenbach, T.T. Cable, and P.S. Cook. 1993. Discrete/continuous contingent valuation of private hunting access in Kansas. *Journal of Environmental*

- Management* 39:1-12.
- Grijalva, Therese C., Robert P. Berrens, Alok K. Bohara, Paul M. Jakus, and W. Douglass Shaw. 2002. Valuing the Loss of Rock Climbing Access in Wilderness Areas: A National-Level, Random-Utility Model. *Land Economics*. 78(1):103-120.
- Grubb, H., and J. Goodwin. 1968. Economic evaluation of water oriented recreation in the preliminary Texas water plan. Dallas, TX: Texas Water Development Board.
- Halstead, J., B.E. Lindsay, and C.M. Brown. 1991. Use of tobit model in contingent valuation: Experimental evidence from Pemigewasset wilderness area. *Journal of Environmental Management* 33:79-89.
- Hammer, Miriam Z. 2001. Applying the TCM with Secondary Data to White Water Boating in Grand Canyon National Park. Masters Thesis: Colorado State University, Fort Collins, CO.
- Hansen, C. 1977. A report on the value of wildlife. Ogden, UT: USDA Forest Service, Intermountain Region, Miscellaneous Publication No. 1365.
- Hansen, W., A. Mills, J. Stoll, R. Freeman, and C. Hankamer. 1990. A case study application of the contingent valuation method for estimating urban recreation and benefits. U.S. Army Corp of Engineers, IWR Report 90-R-11.
- Hanson, LeRoy, Peter Feather, and David Shank. 1999. Valuation of Agriculture's Multi-Site Environmental Impacts: An Application to Pheasant Hunting. *Agricultural and Resource Economics Review*. 199-207.
- Harpman, D., E. Sparling, and T. Waddle. 1993. A methodology for quantifying and valuing the impacts of flow changes on a fishery. *Water Resources Research* 29:575-582.
- Haspel, A., F.R. Johnson. 1982. Multiple destination trip bias in recreation benefit estimation. *Land Economics* 58:364-372.
- Hausman, J.A., G.K. Leonard, and D. McFadden. 1995. A utility-consistent, combined discrete choice and count data model assessing recreational use losses due to natural resource damage. *Journal of Public Economics* 56:1-30.
- Hay, J.M. 1988. Net economic values of non-consumptive wildlife-related recreation. Washington, DC: USDI, Fish and Wildlife Service. Report 85-2.
- Hellerstein, D.M. 1991. Using count data models in travel cost analysis with aggregate data. *American Journal of Agricultural Economics* 73:861-867.
- Henderson, Michelle M., Keith R. Criddle, and S. Todd Lee. 1999. The Economic Value of Alaska's Copper River Personal Use and Subsistence Fisheries. *Alaska Fishery Research Bulletin*. 6(2).
- Hilger, James. 1998. A Bivariate Compound Poisson Application: The Welfare Effects of Forest Fire on Wilderness Day Hikers. Masters Thesis: University of Nevada, Reno, NV.
- Hushak, Leroy J., David O. Kelch, and Sophia J. Glenn. 1999. The Economic value of the Lorain County, Ohio, Artificial Reef. *American Fisheries Society Symposium*. 22:348-362.
- Hushak, L., J. Winslow, and N. Dutta. 1984. Economic value Lake Erie sport fishing to private-boat anglers. Ohio State University.
- Hushak, L., J. Winslow, and N. Dutta. 1988. Economic value of Great Lakes sportfishing: The case of private-boat fishing in Ohio's Lake Erie. *Transactions of the American Fisheries Society* 117:363-373.
- Johnson, D.M., and R.G. Walsh. 1987. Economic benefits and costs of the fish stocking

- program at Blue Mesa Reservoir, Colorado. Fort Collins, CO: Colorado Water Resources Research Institute, Colorado State University, Technical Report No. 49.
- Kalter, R., and L. Gosse. 1969. Outdoor recreation in New York states: Projections of demand, economic value, and pricing effects for the period 1970-1985. Ithaca, NY: Cornell University, Special Cornell Series No. 5.
- Kealy, M.J., and R. Bishop. 1986. Theoretical and empirical specifications issues in travel cost demand studies. *American Journal of Agricultural Economics* 68:660-667.
- Keith, J.E. 1980. Snowmobiling and cross-country skiing conflicts in Utah: Some initial research results. Proceedings of the North American Symposium on Dispersed Winter Recreation. St. Paul, MN: University of Minnesota. Pp 57-63.
- Keith, J., P. Halverson, and L. Fumworth. 1982. Valuation of a free flowing river: The Salt River, Arizona. Tucson, AZ: Utah State University of Arizona.
- King, D., and J. Hof. 1985. Experimental commodity definition in recreation travel cost models. *Forest Science* 31:519-529.
- King, D.A., T.C. Brown, T. Daniel, M.T. Richards, and W.P. Stewart. 1988. Personal Communication between D.A. King and R.G. Walsh. University of Arizona, Tucson.
- Klemperer, D.W., P.S. Verbyla, and L.D. Jouner. 1984. Valuing white-water river recreation by the travel cost method. National River Recreation Symposium, Baton Rouge, LA. Pp 709-719.
- Kline, Jeffrey D. and Stephen K. Swallow. 1998. The Demand for Local Access to Coastal Recreation in Southern New England. *Coastal Management*. 26:177-190.
- Knetsch, J., R. Brown, and W. Hansen. 1976. Estimating expected use and value of recreation sites. In C. Gearing, W. Swart, and T. Var (eds.), *Planning for Tourism Development: Quantitative Approaches*. New York, NY: Proeger.
- Leeworthy, Vernon R. and Peter C. Wiley. 1991. Recreational Use Value for Island Beach State Park. Strategic Environmental Assessments Division of the Office of Ocean Resource Conservation and Assessment: Rockville, MD.
- Leggett, Christopher G., Naomi S. Kleckner, Kevin J. Boyle, John W. Duffield, and Robert Cameron Mitchell. 2003. Social Desirability Bias in Contingent Valuation Surveys Administered Through In-Person Interviews. Forthcoming, November 2003 in *Land Economics*.
- Leuschner, W.A., P.S. Cook, J.W. Roggenbuck, and R.G. Oderwald. 1987. A comparative analysis for wilderness user fee policy. *Journal of Leisure Research* 19:101-114.
- Leuschner, W., and R. Young. 1978. Estimating the southern pine beetle's impact on reservoir campsites. *Forest Science* 24:527-537.
- Loomis, J. 1979. Estimation of recreational benefits from Grand Gulch primitive area. Moad, UT: USDI, Bureau of Land Management.
- Loomis, J. 1982. Use of travel cost models for evaluation lottery rationed recreation: Application to big game hunting. *Journal of Leisure Research* 14:117-124.
- Loomis, John and Lynne Caughlan. 2003. Economic Analysis of Alternative Bison and Elk Management Practices on the National Elk Refuge and Grand Teton National Park: A Comparison of Visitor and Household Responses. Draft Report. Full Report forthcoming from U.S.G.S. Biological Resources Division, Fort Collins, CO
- Loomis, J., and J. Cooper. 1988. The economic value of antelope hunting in Montana. Montana Department of Fish, Wildlife, and Parks.
- Loomis, J., J. Cooper, and S. Allen. 1988. The Montana elk hunting experience: A contingent

- valuation assessment of economic benefits to hunter. Helena, MT: Montana Department of Fish, Wildlife, and Parks.
- Loomis, J., M. Creel, and J. Cooper. 1989. Economic benefits of deer in California: Hunting and viewing values. Davis, CA: College of Agricultural and Environmental Sciences, University of California.
- Loomis, J., D. Donnelly, C. Sorg, and L. Oldenburg. 1985. Net economic value of hunting unique species in Idaho: Bighorn sheep, mountain goat, moose, and antelope. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-10.
- Loomis, J., and M. Feldman. 1995. An economic approach to giving "equal consideration" to environmental values in FERC hydropower relicensing. *Rivers* 5:96-108.
- Loomis, J., D. Updike, and W. Unkel. 1989. Consumption and nonconsumption values of a game animal: The case of California deer. *Transactions of the North American Wildlife and Natural Resource Conference* 54:640-650.
- Loomis, John, Shizuka Yorizane, and Douglas Larson. 2000. Testing Significance of Multi-Destination and Multi-Purpose Trip Effects in a Travel Cost Method Demand Model for Whale Watching Trips. *Agricultural and Resource Economics Review*. 29(2):183-191.
- Lutz, Janet, Jeffrey Englin, and J. Scott Shonkwiler. 2000. On the Aggregate Value of Recreational Activities. *Environmental and Resource Economics*. 15:217-226.
- Markstrom, D., and D. Rosenthal. 1987. Demand and value of firewood permits as determined by the travel cost method. *Western Journal of Applied Forestry* 2:48-50.
- Martin, W., F. Bollman, and R. Gum. 1982. Economic value of Lake Mead fishing. *Fisheries* 7:20-24.
- Martin, W., R. Gum, and A. Smith. 1974. The demand for and value of hunting, fishing, and general rural outdoor recreation in Arizona. Tucson, AZ: Agricultural Experiment Station, University of Arizona.
- May, J.A. 1997. Measuring consumer surplus of Wyoming snowmobilers using the travel cost method. Master's thesis. University of Wyoming.
- McCollum, D.W., R.C. Bishop, and M.P. Welsh. 1988. A probabilistic travel cost model. Madison, WI: Department of Agricultural Economics, University of Wisconsin.
- McCollum, D., A. Gilbert, and G. Peterson. 1990. The net economic value of day use cross country skiing in Vermont: A dichotomous choice contingent valuation approach. *Journal of Leisure Research* 22:341-352.
- McCollum, Daniel W., Michelle A. Haefele, and SuzAnne M. Miller. 1998. Attributes and the Value of a Recreation Experience: A Preliminary Analysis of Wildlife Viewing in Denali National Park. In: Jakus, Paul M. Comp. Benefits and costs of resource policies affecting public and private land: eleventh interim report. Western Regional Research Publication W-133. Knoxville, TN: University of Tennessee, Department of Agricultural Economics and Rural Sociology: 179-200.
- McCollum, D.W., and S.M. Miller. 1994. Alaska voter, Alaska hunters and Alaska non-resident hunters: Their wildlife related trip characteristics and economics. Anchorage, AK: Alaska Department of Fish and Game.
- 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. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Research Paper RM-89.

- McConnell, K. 1979. Values of marine recreational fishing: Measurement and impact of management. *American Journal of Agricultural Economics* 61:921-925.
- McKean, John R. and R.G. Taylor. 2000. Outdoor Recreation Use and Value: Snake River Basin of Central Idaho. Idaho Experiment Station Bulletin: Moscow, ID.
- Mendelsohn, R. 1987. Measuring the value of recreation in the White Mountains. *Appalachia* 46:73-84.
- Menz, F., and D. Wilton. 1983a. Alternative ways to measure recreation values by the travel cost method. *American Journal of Agricultural Economics* 65:332-336.
- Menz, F., and D. Wilton. 1983b. An economic study of the muskellunge fishery in New York. *New York Fish and Game Journal* 30:??.
- Michaelson, E. 1977. An attempt to quantify the esthetics of wild and scenic rivers in Idaho. St. Paul, MN: USDA Forest Service, North Central Forest Experiment Station, General Technical Report NC-28. pp 320-328.
- Michaelson, E., and C. Gilmour. 1978. Estimating the demand for outdoor recreation in the Sawtooth Valley, Idaho. Moscow, ID: Agricultural Experiment Station, University of Idaho, Research Bulletin No. 107.
- Miller, J., and M. Hay. 1984. Estimating substate values for fishing and hunting. *Transactions of the North American Wildlife and Natural Resources Conference* 49:345-355.
- Moncur, J.E. 1975. Estimating the value of alternative outdoor recreation facilities within a small area. *Journal of Leisure Research* 7:301-311.
- Morey, E. 1985. Characteristics, consumer surplus, and new activities. *Journal of Public Economics* 26:221-236.
- Morey, Edward, Terry Buchanan, and Donald M. Waldman. 1999. Estimating the Benefits and Costs to Mountain Bikers of Changes in Trail Characteristics, Access Fees, and Site Closures: Choice Experiments and Benefits Transfer. University of Colorado: Boulder, CO.
- 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.
- Mullen, J., and F. Menz. 1985. The effect of acidification damages on the economic value of the Adirondack fishing to New York anglers. *American Journal of Agricultural Economics* 67:112-119.
- 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.
- 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.
- Parsons, George and Kevin Boyle. 2003. Padre Island National Seashore Visitor Day Values. Foster Wheeler Environmental Corporation Report. Lakewood, CO.
- Peterson, G.L., and J.R. Arnold. 1987. The economic benefits of mountain running the Pike's Peak marathon. *Journal of Leisure Research* 19:84-100.
- 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.
- Prince, R. 1988. Estimating recreation benefits under congestion, uncertainty, and disequilibrium. Harrisonburg, VA: Department of Economics, James Madison

University.

- Ribaudo, M., and D. Epp. 1984. The importance of sample discrimination in using the travel cost method to estimate the benefits of improved water quality. *Land Economics* 60:397-403.
- Richards, M., and T. Brown. 1992. Economic value of campground visits in Arizona. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Research Paper RM-305.
- Richards, M., D.B. Wood, and D. Coyler. 1985. Sport fishing at Lees Ferry, Arizona: User differences and economic values. Flagstaff, AZ: Northern Arizona University.
- Richardson, Robert B. 2002. Estimating the economic effects of climate change on nature based tourism: a comparison of revealed and stated preference methods. Ph.D. Dissertation. Colorado State University, Natural Resource Economics Department, Fort Collins, CO.
- Richer, Jerrell Ross and Neal A. Christensen. 1999. Appropriate Fees for Wilderness Day Use: Pricing Decisions for Recreation on Public Land. *Journal of Leisure Research*. 31(3):269-280.
- Roach, Brian, Kevin Boyle, John Bergstrom, and Stephen Reiling. 1999. The Effect of Instream Flows on Whitewater Visitation and Consumer Surplus: A Contingent Valuation Application to the Dead River, Maine. *Rivers*. 7(1):11-20.
- Roberts, K., M. Thompson, and P. Pawlyk. 1985. Contingent valuation of recreational diving at petroleum rigs, Gulf of Mexico. *Transactions of the American Fisheries Society* 114:214-219.
- Rosenthal, D. 1987. The necessity for substitute prices in recreation demand analysis. *American Journal of Agricultural Economics* 69:828-837.
- Rosenthal, D.H., and H.K. Cordell. 1984. Pricing river recreation: Some issues and concerns. National River and Recreation Symposium, Baton Rouge, LA: School of Landscape Architecture, Louisiana State University. Pp 272-284.
- Rosenthal, D., and R. Walsh. 1986. Hiking values and the recreation opportunity spectrum. *Forest Science* 32:405-415.
- Rowe, R., E. Morey, A. Ross, and W.D. Shaw. 1985. Valuing marine recreational fishing on the Pacific coast. Washington, DC: USDC National Marine Fisheries Service, Report LJ-85-18C.
- Samples, K., and R. Bishop. 1985. Estimating the value of variations in anglers' success rates: An application of the multiple-site travel cost method. *Marine Resource Economics* 21:55-74.
- Sanders, L., R. Walsh, and J. McKean. 1991. Comparable estimates of the recreational value of rivers. *Water Resources Research* 27:1387-1394.
- Shafer, Elwood L., Robert Carlline, Richard W. Guldin, and H. Ken Cordell. 1993. Economic Amenity Values of Wildlife: Six Case Studies in Pennsylvania. *Environmental Management*. 17(5):669-682.
- Shafer, E., and M. Wang. 1989. Economic amenity values of fish and wildlife resources. State College, PA: Penn State University.
- Shaw, W. D., and P. Jakus. 1996. Travel cost models of the demand for rock climbing. Paper presented at the Western Regional Research Publication W-133, Benefits and Costs in Natural Resources Planning.
- Siderelis, Christos. 2001. Incidental Trips and Aquarium Benefits. *Leisure Sciences*. 2(3):193-199.

- Siderelis, C., G. Brothers, and P. Rea. 1995. A boating choice model for the valuation of lake access. *Journal of Leisure Research* 27:264-282.
- Siderelis, C., and R. Moore. 1995. Outdoor recreation net benefits of rail-trails. *Journal of Leisure Research* 27:344-359.
- Silberman, J., and M. Klock. 1989. The behavior of respondents in contingent valuation: Evidence on starting bids. *Journal of Behavioral Economics* 18:51-60.
- Smith, V.K., and R. Kopp. 1980. A regional recreation demand and benefits model. *Land Economics* 56:64-72.
- SMS Research. 1983. Experimental valuation of recreational fishing in Hawaii. Washington, DC: USDC National Marine Fisheries Service, Report H-83-11C.
- Sohnngen, Brent, Frank Lichtkoppler, and Mary Bielen. 1999. The Value of Day Trips to Lake Erie Beaches. Publication OHSU-TB-039. Ohio Sea Grant College Program.
- Sorg, C., J. Loomis, D. Donnelly, G. Peterson, and L. Nelson. 1985. Net economic value of cold and warm water fishing in Idaho. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Resource Bulletin RM-11.
- Sorg, C., and L. Nelson. 1986. Net economic value of elk hunting in Idaho. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Resource Bulletin RM-12.
- Stoll, J., and L.A. Johnson. 1984. Concepts of value, nonmarket valuation and the case of the whooping crane. *Transactions of the North American Wildlife and Natural Resources Conference* 49:382-393.
- Strong, E. 1983. A note on the functional form of travel cost models with zones of unequal populations. *Land Economics* 59:342-349.
- Sublette, W., and W. Martin. 1975. Outdoor recreation in the Salt-Verde Basin of central Arizona: Demand and value. Tucson, AZ: Agricultural Experiment Station, University of Arizona.
- Sutherland, R. 1982. The sensitivity of travel cost estimates of recreation demand to the functional form and definition of origin zones. *Western Journal of Agricultural Economics* 7:87-98.
- Teasley, R.J., and J.C. Bergstrom. 1992. Estimating revenue-capture potential with public area recreation. Athens, GA: University of Georgia.
- Upneja, Arun, Elwood L. Shafer, WonSeok Seo, and Jihwan Yoon. 2001. Economic Benefits of Sport Fishing and Angler Wildlife Watching in Pennsylvania. *Journal of Travel Research*. 40: 68-78.
- Vaughan, W., and C. Russell. 1982. Valuing a fishing day: An application of a systematic varying parameter model. *Land Economics* 58:450-463.
- Waddington, D.G., K.J. Boyle, and J. Cooper. 1991. 1991 Net economic values for bass and trout fishing, deer hunting, and wildlife watching. Washington, DC: USFWS Division of Federal Aid.
- Wade, W., G.M. McCollister, R.J. McCann, and G.M. Jones. 1988. Estimating recreation benefits for instream and diverted users of waterfowls of the Sacramento-San Joaquin rivers watershed. Paper presented at the Western Regional Research Publication W-133, Benefits and Costs in Natural Resources Planning, Monterey, CA.
- Walsh, R.G., R. Aukeman, and R. Milton. 1980. Measuring benefits and the economic value of water in recreation on high country reservoirs. Fort Collins, CO: Colorado Water Resources Research Institute, Colorado State University.
- Walsh, R.G., and G.J. Davitt. 1983. A demand function for length of stay on ski trips to Aspen.

- Journal of Travel Research* 22:23-29.
- Walsh, R.G., R. Ericson, D. Arosteguy, and M. Hansen. 1980. An empirical application of a model for estimating the recreation value of instream flow. Fort Collins, CO: Colorado Water Resources Research Institute, Colorado State University.
- Walsh, R.G., and L. Gilliam. 1982. Benefits of wilderness expansion with excess demand for Indian Peaks. *Western Journal of Agricultural Economics* 7:1-12.
- 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.
- Walsh, R.G., J.B. Loomis, and R.S. Gillman. 1984. Valuing option, existence, and bequest demand for wilderness. *Land Economics* 60:14-29.
- Walsh, R.G., N. Miller, and L. Gilliam. 1983. Congestion and willingness to pay for expansion of skiing capacity. *Land Economics* 59:195-210.
- Walsh, R.G., and J.P. Olienyk. 1981. Recreation demand effects of mountain pine beetle damage to the quality of forest recreation resources in the Colorado Front Range. Fort Collins, CO: Department of Economics, Colorado State University.
- Walsh, R.G., O. Radulaski, and L. Lee. 1984. Value of hiking and cross-country skiing in roaded and nonroaded areas of a national forest. In F. Kaiser, D. Schweitzer, and P. Brown (eds.), *Economic Value Analysis of Multiple-Use Forestry*. Pp 176-187.
- Walsh, R.G., L.D. Sanders, and J.B. Loomis. 1985. Wild and scenic river economics: Recreation use and preservation values. Fort Collins, CO: Department of Agricultural and Resource Economics, Colorado State University.
- Walsh, R.G., L.D. Sanders, and J.R. McKean. 1987. The value of travel time as a negative function of distance. Fort Collins, CO: Department of Agricultural and Resource Economics, Colorado State University.
- Walsh, R.G., F.A. Ward, and J.P. Olienyk. 1989. Recreation demand for trees in National Forests. *Journal of Environmental Management* 28:255-268.
- Ward, F. 1982. The demand for and value of recreational use of water in southeastern New Mexico, 1978-79. Los Cruces, NM: Agricultural Experiment Station, New Mexico State University, Research Report No. 465.
- Weithman, S., and M. Haas. 1982. Socioeconomic value of the trout fishery in Lake Tanneycomo, Missouri. *Transactions of the American Fisheries Society* 111:223-230.
- Wellman, Katharine F. and Benjamin Noble. 1997. Selected Recreational Values of the Corpus Christi Bay National Estuary Program Study Area. Publication CCBNEP-18. Corpus Christi, TX.
- Whitehead, John C. and Jo Sharratt. 2002. The Recreation Benefits of the Pamlico Sound: A Comparison of Models. personal.ecu.edu/whiteheadj/data/pam/pamrec.htm
- Wilman, E. 1984. Benefits to deer hunters from forest management practices which provide deer habitat. *Transactions of the North American Wildlife and Natural Resources Conference* 49:334-344.
- Young, J., D. Donnelly, C. Sorg, J. Loomis, and L. Nelson. 1987. Net economic value of upland game hunting in Idaho. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Resource Bulletin RM-15.
- Zawacki, William T., Allan Marsinko, and J.M. Bowker. 2000. A Travel Cost Analysis of Nonconsumptive Wildlife-Associated Recreation in the United States. *Forest Science*. 46(4):496-506.

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