4.0 RESULTS

4.1 RESPONSE TO MAILINGS

Table 4.1-1 shows the sampling plan and the responses obtained for each version of the mail questionnaire. The overall unadjusted mail survey response rate, net of the returned bad addresses, was 58.2 percent. After adjusting for estimated remaining bad addresses identified though the telephone follow-up (discussed in Section 4.3) the overall mail response rate was computed to be 73 percent. Including the telephone follow-up, responses were obtained from approximately 76 percent of the valid sample. The response rates for the California and New York residents were somewhat lower than for the residents of the other three states.[1]

One issue of concern is whether respondents may be more or less likely to respond to different survey versions, which may indirectly reflect differences in their ability or interest in completing the instrument and, therefore, indirectly introduce a bias into the responses. For example, respondents from the same state as a national park of interest, who may have higher values, may also have higher response rates.

Table 4.1-2 shows comparisons of the response rates for the questionnaires concerning different national park regions (Versions 1, 2, and 3). The first section of the table shows a small, but statistically significant higher response rate for the questionnaire concerning the Southeastern national parks than for the other two park regions. This difference is seen in the five-state averages and for Missouri alone, but not for New York alone. The other three states were not compared separately in this section due to potential confounding effects of larger sample sizes in the home state of the park. The second section of the table shows that there is no statistically significant difference in response rates when the WTP questions focus upon national parks in the respondent's own state versus focusing upon national parks in other regions.

Table 4.1-3 shows comparisons of response rates for different versions of the Southwestern national parks questionnaire (Versions 5 and 6 versus Version 3), and for the multiple region questionnaire (Version 4). Some statistically significant differences are shown, but the directions of the differences are not consistent.

[1] Elsewhere (Sanghvi et al. 1989, Peterson et al. 1987), we have experienced somewhat lower response rates in California and we do not attribute the small differences in response rates across the states experienced in the current effort as reflecting anything unique about the visibility survey, but rather we believe that they reflect different rates of mobility resulting in different rates of undetected bad addresses, other socio-economic differences across the states and different attitudes about completing such surveys.

TABLE 4.1-1
SAMPLING PLAN AND SURVEY RESPONSE RATES

VERSION NAME:	CALIFORNIA PARKS (V1)			
	TOTAL	BAD ADD	REC'D	UNADJUSTED NET % RECD
TOTAL MAILED/BAD ADDS	785	128	375	57.1%
ARIZONA	125	22	61	59.2%
VIRGINIA	125	17	67	62.0%
CALIFORNIA	285	50	128	54.5%
NEW YORK	125	23	55	53.9%
MISSOURI	125	16	64	58.7%
PERCENTS	100.0%	16.3%	47.8%	57.1%

	SOUTHEAST PARKS (V2)			
	TOTAL	BAD ADD	REC'D	UNADJUSTED NET % RECD
TOTAL MAILED/BAD ADDS	785	120	406	61.1%
ARIZONA	125	12	74	65.5%
VIRGINIA	285	60	140	62.2%
CALIFORNIA	125	13	63	56.3%
NEW YORK	125	23	55	53.9%
MISSOURI	125	12	74	65.5%
PERCENTS	100.0%	15.3%	51.7%	61.1%

	SOUTHWEST PARKS (V3)			
	TOTAL	BAD ADD	REC'D	UNADJUSTED NET % RECD
TOTAL MAILED/BAD ADDS	785	124	378	57.2%
ARIZONA	285	49	145	61.4%
VIRGINIA	125	29	56	58.3%
CALIFORNIA	125	13	57	50.9%
NEW YORK	125	19	60	56.6%
MISSOURI	125	14	60	54.1%
PERCENTS	100.0%	15.8%	48.2%	57.2%

VERSION NAME:	MULTIPLE REGIONS (V4)			
	TOTAL	BAD ADD	REC'D	UNADJUSTED NET % RECD
TOTAL MAILED/BAD ADDS	330	47	156	55.1%
ARIZONA	110	19	65	71.4%
VIRGINIA	0	0	0	
CALIFORNIA	110	13	41	42.3%
NEW YORK	110	15	50	52.6%
MISSOURI	0	0	0	
PERCENTS	100.0%	14.2%	47.3%	55.1%

	LIMITED INFORMATION (V5)			
	TOTAL	BAD ADD	REC'D	UNADJUSTED NET % RECD
TOTAL MAILED/BAD ADDS	330	49	166	59.1%
ARIZONA	110	18	60	65.2%
VIRGINIA	110	15	58	61.1%
CALIFORNIA	0	0	0	
NEW YORK	110	16	48	51.1%
MISSOURI	0	0	0	
PERCENTS	100.0%	14.8%	50.3%	59.1%

	SINGLE REGION FOCUS (V6)			
	TOTAL	BAD ADD	REC'D	UNADJUSTED NET % RECD
TOTAL MAILED/BAD ADDS	330	47	166	58.7%
ARIZONA	110	19	58	63.7%
VIRGINIA	0	0	0	
CALIFORNIA	110	14	59	61.5%
NEW YORK	110	14	49	51.0%
MISSOURI	0	0	0	
PERCENTS	100.0%	14.2%	50.3%	58.7%

	TOTAL OF ALL VERSIONS			
	TOTAL	BAD ADD	REC'D	UNADJUSTED NET % RECD
TOTAL MAILED/BAD ADDS	3,345	515	1,647	58.2%
ARIZONA	865	139	463	63.8%
VIRGINIA	645	121	321	61.3%
CALIFORNIA	755	103	348	53.4%
NEW YORK	705	110	317	53.3%
MISSOURI	375	42	198	59.5%
PERCENTS	100.0%	15.4%	49.2%	58.2%

TELEPHONE SURVEY ADJUSTED % RECEIVED

LOWER % RECEIVED*	CENTRAL % RECEIVED**
62.20%	72.60%
67.50%	77.00%
65.10%	75.00%
57.50%	68.50%
57.40%	68.50%
63.50%	73.60%

* ASSUMES 15.3% 0F REMAINING NON-REPSONSES WERE BAD ADDRESSES BASED ON TELEPHONE FOLLOW-UP.

** ASSUMES 47.5% OF REMAINING NON-REPSONSES WERE BAD ADDRESSES BASED ON TELEPHONE FOLLOW-UP.

Table 4.1-2
Comparisons of Response Rates for Different Park Regions

State of Residence	Version	Number of Valid Addresses	Mean Percent Returned	Standard Error of Mean	Statistically Significant Differences (Direction)
I. Different Regions					
5-State Total	1	657	57.1%	0.95	
	2	665	61.1%	0.92	$p < .01$ (positive)
	3	661	57.2%	0.95	
New York	1	102	53.9%	2.46	
	2	102	53.9%	2.46	
	3	106	56.6%	2.39	
Missouri	1	109	58.7%	2.32	
	2	113	65.5%	2.13	$p < .05$ (positive)
	3	111	54.1%	2.35	
II. Home State Park					
California	1	235	54.5%	1.61	
	2 + 3	224	53.6%	1.66	
Arizona	3	236	61.4%	1.94	
	1 + 2	216	62.5%	2.02	
Virginia	2	225	62.2%	1.57	
	1 + 3	204	60.3%	1.68	

Table 4.1-3
Comparisons of Response Rates for Different Questionnaire Versions

State of Residence	Version (s)	Number of Valid Addresses	Mean Percent Returned	Standard Error of Mean	Statistically Significant Differences (Direction)
I. Multiple Region WTP (Version 4)					
Arizona	4	91	71.4%	2.14	p < .01
	3	236	61.4%	1.90	(positive)
	1 + 2	216	62.5%	2.02	
California	4	97	42.3%	2.48	p < .01
	1	235	54.5%	1.61	(negative)
	2 + 3	224	53.6%	1.66	
New York	4	95	52.6%	2.56	
	1 + 2 + 3	310	54.3%	1.40	
II. Limited Information (Version 5)					
Arizona	5	92	65.2	2.36	p < .10
	3	236	61.4	1.94	(positive)
Virginia	5	95	61.1	2.45	
	3	96	58.3	2.48	
New York	5	96	51.1	2.55	p < .05
	3	106	56.6	2.38	(negative)
3-State Total	5	283	59.1	1.44	
	3	438	59.6	1.15	
III. Single Region Focus (Version 6)					
Arizona	6	91	63.7	2.42	
	3	236	61.4	1.94	
California	6	96	61.5	2.42	p < .01
	3	97	50.9	2.53	(positive)
New York	6	96	51.0	2.55	p < .05
	3	106	56.6	2.39	(negative)

Overall, there appears to be very little variation in response rates for the different versions of the questionnaire. Rather, response rates appear to vary across states due to other socio-economic factors. We therefore conclude that variations in the survey versions do not appear to introduce potential bias to the results as a result of varying response rates.

4.2 CHARACTERISTICS OF RESPONDENTS

Table 4.2-1 shows selected characteristics of the mail and telephone respondents and values of comparable characteristics for the United States population. Focusing upon the mail survey respondents, a greater percentage are male and the median age is somewhat higher than for the national population. Household size is comparable. Education and income are both higher for the respondents than for the national population. Because low incomes are expected to be correlated with less education, it is not surprising that this population group is under represented in the respondent group. It is not clear, however, how much these differences are due to differences in characteristics in the sampled states versus the entire U.S., or due to differences in the sample frame versus the characteristics of the underlying populations, but this issue is addressed in part through the follow-up telephone survey. The associations between these characteristics and the responses to the willingness to pay questions are also examined in subsequent sections of this chapter and allow one to interpret the impact of these differences upon the sample mean WTP estimates.

4.3 TELEPHONE FOLLOW-UP INTERVIEW OF NON-RESPONDENTS

While the mail survey response rates are high, bias may still enter into the data through the self selection of respondents to the mail survey. The telephone follow-up survey was undertaken to examine for the existence, direction and general magnitude of any potential bias affecting the WTP estimates.[2]

A sample of non-respondents to the mail questionnaire was selected and telephoned to obtain some information about the characteristics of non-respondents and to identify potential additional bad addresses. Telephone respondents were asked a few questions about their visitation at national parks and about the importance to them of visibility protection for national parks in the specific region of interest. The telephone sample was taken from the Version 2 (national parks in the Southeast) and the Version 3 (national parks in the Southwest) samples. The questions asked in the telephone interview are presented in the Appendix.

[2] The results of the telephone survey should be interpreted cautiously. This is in part due to the much smaller sample size (so the estimates are less reliable), unlisted numbers causing sampling problems, failure to contact all targeted names, refusals to participate, and necessary differences in the survey instrument.

Table 4.2-1
Comparison of Respondents and
National Population Characteristics

Variable	Mail Respondents	Telephone Respondents	National
Completed Responses	1632	72	---
Sex:			
Male	59%	53%	49%
Female	41%	47%	51%
Median Age (18 +)	44 years	50 years	40 years
Mean Household Size	2.77	2.87	2.78
Education:			
Mean Years	14.0		12.6
1987 Mean Household Income	$41,441	$34,483	$32,144
Income Distribution:			
Under $10,000	7.0%		11.7%
$10,000 - 49,999	63.0%		65.5%
$50,000 +	30.0%		22.9%

Table 4.3-1 shows the telephone sample and response rates. A total of 304 numbers were selected from the non-respondents to Versions 2 and 3. An approximately equal number was selected for each version. Of these, no contact was made with 56, and 12 said that they had mailed back the questionnaire, leaving a net telephone sample of 236. Bad addresses made up 47.5 percent of the net telephone sample. The bad address classification included numbers not in service, business numbers, wrong numbers ("no one by that name lives here"), and the respondent is dead. The net number of remaining good numbers was 124, and of these, completed interviews were obtained with 72 (58.1 percent). When the response rate to the mailed questionnaire is adjusted for this additional rate of bad addresses (47.5 percent of the non-responses) the overall response rate to the mailed questionnaire becomes 72.6 percent. The original and adjusted response rates for the mailed questionnaire are shown in Table 4.1-1.

Included in the bad addresses identified in the telephone follow-up was a relatively large number of "wrong numbers" and "that person is dead" responses. These are appropriately interpreted as bad addresses, but to account for the possibility that some people may give these responses just to get rid of the interviewer, we also calculated a lower bound overall response rate to the mailed questionnaire treating all of these as refusals. Under this assumption, 15.3 percent of the net telephone sample is bad addresses (rather than 47.5 percent) implying an overall response rate to the mailed questionnaire of 62.2 percent. These lower response rates are also shown in Table 4.1-1. The true response is probably closer to the 73 percent estimate as these responses were usually given prior to the interviewer stating who they were or the purpose of the telephone contact. The computed response rates would be higher if the telephone respondents with a language barrier were also considered as bad addresses (because there is some likelihood of difficulty reading the survey instrument).

As reported in Table 4.2-1, the telephone sample is older than the mail sample and national average and has a household income comparable to the national average, but 17 percent less than the mail respondents.

Table 4.3-2 shows the national park visitation characteristics of the telephone respondents. Their average past and probable future visitation to the national parks is somewhat lower than the average for the mail questionnaire respondents to Versions 2 and 3. The results reported in Table 4.3-3, however, suggest that this lower visitation does not also reflect less perceived importance of visibility protection for national parks. The responses concerning the importance of preventing visibility from getting worse and the importance of improving visibility in national parks were very similar to those given by the mail respondents to Versions 2 and 3.[3]

[3] The percentages shown in Table 4.3-3 for the mail responses were converted from the five point importance scale used in the mail questionnaire to the three point scale used in the telephone questions by splitting the groups at 2 and 4 on the scale in half and allocating half to each of the adjacent points on the scale (see Table 4.4-11).

Table 4.3-1
Telephone Follow-up Response Rates

	Version 2 Southeast	Version 3 Southwest	Total	Percent
Numbers Selected	**149**	**155**	**304**	
No Contact	**26**	**30**	**56**	
No Answer	21	25	46	
Phone Busy	--	2	2	
Respondent Deaf	2	--	2	
Language Problem	3	3	6	
Mailed Back Questionnaire	**6**	**6**	**12**	
Net Phone Sample	**117**	**119**	**236**	
Bad Numbers	**51**	**61**	**112**	**47.5%**
Not in Service	13	17	30	
Business Number	1	5	6	
Respondent Died	2	3	5	
Wrong Number	35	36	71	
Net Good Numbers	**66**	**58**	**124**	
Non-Response	**31**	**21**	**52**	
Refusals	19	15	34	
Terminated	1	1	2	
Call-Back	11	5	16	
Completed Interviews	**35**	**37**	**72**	**58.1%**

Table 4.3-2
Summary of National Park Visitation
Characteristics of Telephone Respondents

	Percent of Phone Respondents	Percent of Mail Respondents
Have visited any national park	64.7%	78.9%
Have visited specific national park (Grand Canyon or Shenandoah)	18.1%	35.8%
Will visit a national park in the region (Southwest or Southeast) in the next five years	14.7%	25.3%
May visit a national park in the region (Southwest or Southeast) in the next five years	44.1%	48.5%
Will not visit a national park in the region (Southwest or Southeast) in the next five years	41.2%	26.2%

Note: Telephone respondents were asked about either the Southwest parks or the Southeast parks, not both. Fifty-one percent of completed interviews were for the Southwest.

Table 4.3-3
Summary of Importance to Telephone Respondents of Visibility Protection for National Parks in the Selected Region

	Phone Responses		Mail Responses
	Number	Percent	Percent
Importance of preventing visibility from getting worse:			
Not at all important	2	2.9%	3.6%
Somewhat important	16	23.5%	27.6%
Extremely important	50	73.5%	68.9%
Importance of improving visibility:			
Not at all important	2	3.0%	5.0%
Somewhat important	25	37.3%	43.8%
Extremely important	40	59.7%	5 1.4%

Note: The rate of refusal to answer these questions was 5.5% to 7.0% for telephone respondents and 3.5% to 4.5% for mail respondents.

Table 4.3-4 shows the responses to the questions about whether the telephone respondent would be willing to pay something for visibility protection for national parks. The responses show that most respondents were willing to pay for visibility protection. The positive response rate appears to be slightly lower than that obtained for the most comparable question in the mail questionnaire for Versions 2 and 3.[4]

Analysis of the mail questionnaire responses indicates that the dollar amount the respondent gave in response to the WTP question was correlated positively with:

- the household income;
- the probable future visitation to national parks in the selected region;
- the willingness to pay (on the five point scale) for visibility protection at national parks; and
- the importance rating for improving or preventing degradation in visibility at national parks.

The responses to the telephone follow-up indicate that the telephone respondents were similar for the fourth characteristic, but were somewhat less likely to visit national parks in the selected regions and had lower household income than did the mail respondents. This suggests that the dollar WTP for the telephone respondents might be somewhat, but probably not dramatically, lower than for the mail respondents and the impact of non-response bias upon the sample wide WTP estimate would be relatively small.[5]

To further examine for the potential magnitude of any such response bias, the mail responses were categorized into five groups, each with about 200 observations, according to the date of receipt, as shown in Table 4.3-5. The mean adjusted WTP response (discussed in Section 4.5 below) is highest for the early respondents. then fairly constant and dropping only slightly for the last 176 responses received (10 percent of all respondents, and 13.4 percent of the mail respondents), although such a drop was also experienced in the middle of the sample and is not statistically significant. If the responses of this last group are reflective of the entire 27 percent non-respondents, the sample-wide WTP mean would drop by only six percent. If one assumed a more extreme assumption that the average WTP for all non-respondents was as little as 50 percent of the value reported by mail survey respondents, the sample-wide WTP estimates would drop by about 14 percent.

[4] Exact comparison is difficult as the telephone survey used only a yes/no format while the mail survey used a five point scale of willingness to pay for visibility protection (See Table 4.4-10).

[5] Based upon Table 4.3-2, and the results reported in Section 4.5, the predicted effect of the reduced likelihood of future visits and reduced income for telephone respondents would be on the order of a 30 to 40 percent reduction in WTP. Assuming the telephone respondents are representative of all non-respondents, the corresponding impact upon the computed sample-wide mean WTP would then be 10 percent or less.

Table 4.3-4
Willingness of Telephone Respondents to Pay Something for Visibility Protection for National Parks

		Phone Respondents	
	Response	Number	Percent
Willing to pay to prevent degradation	YES	43	70.5%
	NO	18	29.5%
Willing to pay to obtain improvement	YES	39	63.9%
	NO	22	36.1%
Refused to answer this question		11	15%

Table 4.3-5
Mean Adjusted WTP by Response Group

Date Received		Adjusted WTP1*
Before 9-19	mean	62.88
	SE	9.42
	N	191
9-19	mean	36.11
	SE	3.74
	N	226
9-20	mean	41.08
	SE	4.81
	N	249
9-21 to 9-27	mean	44.68
	SE	5.68
	N	266
9-28 to 10-11	mean	44.43
	SE	7.54
	N	205
After 10-11	mean	34.06
	SE	4.38
	N	176

* See Section 4.5 for definitions.

4.4 RESPONSES TO GENERAL QUESTIONS

The first ten questions of each survey version concerned national park visitation and general attitudes about protection of resources at national parks. The purpose of these questions was twofold. One purpose was to obtain information that might be useful in analyzing WTP responses from different individuals. Another purpose was to get the respondents thinking about national parks and about the many different resource protection issues facing the parks, of which visibility is only one (see Section 3.1).

National Park Visitation Patterns of Respondents

Table 4.4-1 summarizes the national park visitation history reported by the respondents. More than three quarters of the respondents reported having visited a national park at some time in their lives. Between one-quarter and one-half of the respondents had visited each of the national parks used in the photographs set. Overall, visitation rates were highest for the Grand Canyon and lowest for Shenandoah, but Virginia residents had visitation experience at Shenandoah comparable to that of Arizona residents at the Grand Canyon. Out-of-state residents were less likely to have visited Shenandoah than the other two parks.

Visitation in the last two years showed a similar pattern. About one-half of the Arizona residents said they had visited the Grand Canyon in the past two years. Almost 60 percent of the Virginia residents had visited Shenandoah in the past two years. About 30 percent of the California residents had visited Yosemite in the past two years.

Item non-response to the visitation questions, especially about specific parks, was fairly high. The responses shown in Table 4.4-1 reflect responses made to previous questions when appropriate. For example, if a respondent indicated he had never visited a national park in California and did not answer the Yosemite question, he was coded as never having visited Yosemite. Still, the higher non-response rate for out-of-state residents suggests that they are more likely to be non-visitors than visitors. The high item non-response rate overall may reflect some recall difficulty with these questions.

Table 4.4-2 summarizes responses concerning the probability of visiting any national park in each of the three selected regions during the next five years. The mean response for each of the regions is about three ("might visit"), a little higher for the Southwest and a little lower for the Southeast. As with previous visitation, home-state residents give a higher probability of visiting parks in their own regions in the near future, with a mean response close to four (“probably will visit”) in each case. The mean responses for out-of-state residents fall between “probably will not visit” and “might visit.”

The responses to the past and probable future national park visitation questions suggest that questions about resource protection for national parks in these three regions are likely to be meaningful for the vast majority of respondents in terms of their own personal

Table 4.4-1
National Park Visitation History

	Yes	No	No Response
Ever Visited any National Park?			
All Respondents (n=1632)	80.5%	15.5%	4.0%
Ever Visited any NP in California?			
California Residents (n=343)	77.6%	15.5%	7.0%
Residents of Other States (n=1289)	37.5%	43.7%	19.0%
All Respondents (n=1632)	50.0%	37.6%	16.5%
Ever Visited Yosemite NP?			
California Residents (n=343)	61.2%	30.6%	8.2%
Residents of Other States (n=1289)	25.3%	60.3%	14.4%
All Respondents (n=1632)	32.8%	54.0%	13.1%
Visited Yosemite in Last 2 Years?			
California Residents (n= 343)	30.6%	53.9%	15.5%
Residents of Other States (n=1289)	9.4%	71.6%	19.0%
Ever Visited any NP in the Southwest?			
Arizona Residents (n=455)	88.1%	9.2%	2.6%
Residents of Other States (n=1177)	39.5%	42.1%	18.4%
All Respondents (n=632)	53.1%	33.0%	14.0%
Ever Visited Grand Canyon NP?			
Arizona Residents (n=455)	78.2%	18.2%	3.5%
Residents of Other States (n=1177)	33.1%	55.0%	12.0%
All Respondents (n=1632)	45.6%	44.7%	9.6%
Visited Grand Canyon in Last 2 Years?			
Arizona Residents (n=455)	52.1%	35.6%	12.3%
Residents of Other States (n=1177)	12.7%	69.9%	17.3%
Ever Visited Parks in the Southeast?			
Virginia Residents (n=317)	76.0%	19.9%	4.1%
Residents of Other States (n=1315)	27.5%	53.1%	19.5%
All Respondents (n=1632)	36.9%	61.2%	12.7%
Ever Visited Shenandoah NP?			
Virginia Residents (n=317)	76.7%	18.3%	5.0%
Residents of Other States (n=1315)	13.8%	71.6%	14.6%
All Respondents (n=1632)	26.0%	61.2%	12.7%
Visited Shenandoah in Last 2 Years?			
Virginia Residents (n=317)	59.6%	31.2%	9.1%
Residents of Other States (n=1315)	4.5%	77.7%	17.5%

Table 4.4-2
Probability of Future National Park Visitation in Next Five Years

	Frequency of Responses					
	Definitely Will Not Visit (1)	Probably Will Not Visit (2)	Might Visit (3)	Probably Will Visit (4)	Definitely Will Visit (5)	Mean
Any NP in California						
California Residents (n=272)	2.6%	9.2%	18.4%	28.3%	41.5%	4.0
Residents of Other States (n=1028)	13.3%	253%	295%	22.0%	9.9%	2.9
All Respondents	11.1%	21.9%	27.2%	23.3%	16.5%	3.1
Any NP in the Southwest*						
Arizona Residents (n=439)	2.7%	7.3%	18.0%	33.5%	38.5%	4.0
Residents of Other States (n=1027)	13.8%	225%	31.2%	20.5%	12.1%	2.9
All Respondents	10.5%	17.9%	27.2%	24.4%	20.0%	3.3
Any NP in the Southeast						
Virginia Residents (n=291)	4.5%	8.3%	25.1%	25.8%	36.4%	3.8
Residents of Other States (n=982)	19.3%	37.3%	26.0%	11.7%	5.8%	2.5
All Respondents	15.9%	30.6%	25.8%	14.9%	12.8%	2.8

* Version 6 respondents (n=165) were asked about probable future visitation to Southwest parks only.

experience. For example, only 7 percent of the respondents said they had never visited any national park in the Southwest and that they definitely would not visit parks in this region in the next five years. Comparable percentages for California national parks and Southeast national parks were 8 percent and 13 percent, respectively. Past and/or potential future visitation to national parks in the region of interest should aid the respondents in understanding the visibility protection good and how changes in the good may affect them.

Reasons and Priorities for Protecting National Park Resources

Table 4.4-3 shows the responses to the Question 5 concerning the importance to the respondent of various possible reasons for visiting national parks. The majority of the respondents ranked all of the listed reasons as at least somewhat important. The two highest ranked reasons were related to enjoying nature and unique natural places, reasons most closely linked to the preservation of the natural environment. Next came doing something enjoyable with other people and having a change from usual surroundings. The most frequently given "other" reason was also related to the preservation of the environment as it involved witnessing or enjoying beauty. The most frequent other reasons that were cited are listed in Table 4.4-4.

These ratings of reasons for visiting national parks are consistent with findings of recent on-site research conducted at several national parks. Ross et al. (1985) conducted interviews with visitors at Grand Canyon, Mesa Verde, Mount Rainier, Great Smoky Mountains, and Everglades National Parks in which respondents were given a list of park features and asked how important each feature was to their recreational experience. At all five parks, features related to the natural environment were rated as having the highest importance to visitors.

In Question 6 respondents were asked if they would want any of their taxes spent to preserve and manage national parks even if they personally could never visit. Over 96 percent of the respondents said maybe yes or definitely yes. This supports the notion that there is a widespread perception that protecting and preserving the national parks is important for society, beyond the individual's interest in his or her own opportunity to visit these areas.

Question 7 then asked about the importance of various potential reasons for preserving and managing national parks independent of the respondent's own visitation. The responses to these questions are summarized in Table 4.4-5 and 4.4-6. Again, the vast majority of the respondents rated all of the listed reasons as at least somewhat important. The highest ranked reasons were all related to preservation motives not necessarily related to use. These were:

- So there will be areas preserved in their natural condition, even if no one ever goes there.
- To preserve our national heritage.
- So there is not development everywhere.

Table 4.4-3
Reasons for Visiting National Parks

	Not at all Important (1)	Slightly Important (2)	Somewhat Important (3)	Very Important (4)	Extremely Important (5)	Mean
To experience unique natural places Responses (n=1554)	2.4%	4.4%	19.6%	42.2%	31.5%	4.0
To experience unique historic places Responses (n=1549)	3.0%	9.5%	28.6%	39.6%	19.3%	3.6
To do something enjoyable with other people (for example, family and friends) Responses (n=1555)	3.7%	7.4%	21.2%	39.9%	27.9%	3.8
To enjoy the vastness of nature Responses (n=1559)	2.1%	4.4%	14.6	35.5%	43.4%	4.1
To take part in outdoor recreation, such as hiking, fishing, or camping Responses (n=1540)	12.1%	12.4%	23.2%	28.6%	23.8%	3.4
To have a change from my usual surroundings Responses (n=1546)	5.3%	8.0%	24.1%	35.4%	27.2%	3.7

Please list any other reasons you like to, or would like to, visit national parks: See Table 4.4-4.

Table 4.4-4
Most Frequent "Other" Reasons for Visiting National Parks

Frequency	Reason
56	To witness beauty
52	To relax, experience quiet
51	To see a particular park, or the country in general
34	To experience fresh air or a different climate
37	To see wildlife
29	To undertake a special activity such as photography
25	To get away from the city
25	To observe nature
18	For spiritual restoration
16	For education

Table 4.4-5
Reasons for Preserving National Parks, Regardless of Own Visitation

Q-6 Federal taxes are used to preserve and manage national parks. If you personally could never visit a national park, would you want any of your taxes spent to preserve and manage national parks? (Circle number)

	Definitely No (1)	Maybe No (2)	Maybe Yes (3)	Definitely Yes (4)	Mean Score
Responses (n=1577)					
% responding	2.2%	1.3%	16.7%	79.9%	3.74

Q-7 If you personally could never visit a national park in the future, how important to you would each of the following reasons be to spend taxes to preserve and manage national parks? (Circle number of best response for each reason)

	Not at All Important (1)	Slightly Important (2)	Somewhat Important (3)	Very Important (4)	Extremely Important (5)	Mean
So other members of my family will have the opportunity to visit these areas now and in the future						
Responses (n=1543)	1.6%	3.3%	14.2%	41.2%	39.7%	4.1
So people outside my family will have the opportunity to visit these areas now and in the future						
Responses (n=1532)	1.6%	5.1%	20.8%	42.1%	30.5%	3.9
So there will be areas preserved in their natural condition, even if no one ever goes there						
Responses (n=1540)	3.1%	4.5%	13.6%	29.0%	49.9%	4.2
To allow scientific research on nature or history						
Responses (n=1520)	3.2%	8.8%	24.9%	35.8%	27.4%	3.8
To preserve our national heritage						
Responses (n=1529)	1.8%	3.3%	14.8%	33.4%	46.8%	4.2
So there is not development everywhere						
Responses (n=1510)	3.8%	4.9%	11.7%	27.0%	52.7%	4.2

Do you have any other reasons? (Please list) See Table 4.4-6.

Table 4.4-6
Most Frequent "Other" Reasons for Preserving National Parks, Regardless of Own Visitation

Frequency	Reason
84	To preserve wildlife/animal habitat
40	To preserve for the future
27	To preserve nature in general
12	To preserve clean areas

Close behind these were opportunities for others to visit, with visitation of other family members being ranked somewhat higher than visitation of others outside the respondent's own family. The most frequently given "other" reason was also tied to preservation of the natural environment and involved the preservation of wildlife habitat.

Question 8 concerned priorities the respondents place on various potential adverse effects on national park resources from human activities outside the parks. Degraded visibility due to manmade air pollution is one of these effects. The responses also give us an idea how visibility degradation ranks relative to other similar potential problems at parks and helps set-up visibility protection as separate from other protection issues (to help minimize part-whole bias) and as only one of many potential concerns (to help minimize importance bias).

The responses to Question 8 are summarized in Table 4.4-7. The majority of the respondents rated protection of national parks against all of the listed effects at medium or high priority. Notably lower on the list was preventing seeing or hearing mining or industrial activities located outside park boundaries, with almost 25 percent giving this low priority. Protecting visibility was about in the middle, with preventing water pollution injury to aquatic life and preventing air pollution damage to vegetation rated somewhat higher. Somewhat below visibility was air pollution damage to historic structures and aesthetic damage from water pollution. Protecting parks from human pollution was the most frequently given "other" priority (see Table 4.4-8).

General Attitudes About Visibility Protection for Parks

Question 9 asked about the effect of visibility improvements on visit enjoyment. Respondents were asked to consider the potential effect of having conditions as shown in the B photographs rather than the average conditions as shown in the C photographs during a visit to a national park in each of the three regions. This question served to introduce the photographs on the insert and the "substantive definitional" issue of whether varying

Table 4.4-7
Priorities for Protecting National Park Resources from Human Activity Outside the Parks

Q-8 Below are some types of effects that are happening or could happen in national parks due to people's activities outside park boundaries. What priority do you give to prevention of the following effects in national parks due to human activities outside park boundaries? (Circle number of best response for each effect)

	Low Priority (1)	Medium Priority (2)	High Priority (3)	Mean
Air pollution decreasing the ability to see scenic vistas				
Responses (n=1569)	2.9%	25.2%	71.9%	2.7
Air pollution injury to vegetation				
Responses (n=1570)	1.5%	11.2%	87.3%	2.9
Air pollution damage to historic structures				
Responses (n=1570)	5.0%	29.4%	65.7%	2.6
Water pollution in streams or lakes that harms fish or other aquatic life				
Responses (n=1581)	0.7%	3.5%	95.8%	3.0
Water pollution that muddies streams or lakes, but does not harm fish or aquatic life				
Responses (n=1562)	8.5%	41.7%	49.9%	2.4
Park visitors being able to see or hear mining or industrial activities located outside park boundaries				
Responses (n=1548)	22.6%	36.9%	40.5%	2.2

Are there other types of effects of special concern to you? (Please list) See Table 4.4-8.

Table 4.4-8
Most Frequent "Other" Responses for Priorities in Protecting National Park Resources

Frequency	Concern
44	Human Pollution
36	Threats to wildlife/animal habitat
23	Forest fires/fire management
21	Litter and defacement
20	Too much development
15	Noise pollution
15	Acid Rain

visibility would affect on-site enjoyment, and provided some information to help interpret willingness to pay responses. The responses to Question 9 are summarized in Table 4.4-9. Only about five percent of the respondents said that this would have no effect on their enjoyment. About two-thirds of the respondents said that this would very much increase their enjoyment. The responses for each region were very similar. I.e., the effect on on-site enjoyment for the hypothesized changes is perceived to be roughly comparable across the sites.

Question 10 asked about willingness of the respondent to pay something for visibility protection at national parks as an introduction to and confirmation of the specific willingness to pay questions that followed. The responses are summarized in Table 4.4-10. As with the enjoyment question, responses for the different regions were very similar. In-state residents indicated a greater willingness to pay for visibility protection than out-of-state residents, but the differences were not as great as might have been expected based on the visitation differences. The mean responses for in-state and out-of-state residents exceeded "somewhat willing" for all three regions. Six to eight percent of in-state residents were "not at all willing" to pay for visibility protection and nine to eleven percent of out-of-state residents were "not at all willing."

Table 4.4-9
Effect of Visibility Improvement on Park Visit Enjoyment

Q-9 If you were to visit a national park in each of these regions, you would probably have average visibility like Photograph C. How do you think having somewhat less than average haze due to air pollution, like Photograph B rather than Photograph C, would affect your enjoyment of the visit? (Circle number of best response for each region)

Region	Have no effect on enjoyment (1)	Somewhat increase enjoyment (2)	Very much increase enjoyment (3)	Mean
California Response (n=1392)	4.1%	27.2%	68.8%	2.6
The Southwest* Response (n=1559)	5.1%	32.4%	62.5 %	2.6
The Southeast Response (n=1389)	5.1%	32.3%	62.6%	2.6

* The 165 respondents to Version 6 were asked about the Southwest only.

Table 4.4-10
Willingness to Pay Something for Visibility Protection

Region	Frequency of Responses					Mean
	Not at all Willing (1)	(2)	Somewhat Willing (3)	(4)	Extremely Willing (5)	
California Parks						
California Residents (n=274)	5.8%	10.6%	27.7%	23.7%	32.1%	3.7
Other State Residents (n=1104)	10.6%	11.2%	36.0%	25.4%	16.9%	3.3
Southwest Parks*						
Arizona Residents (n=446)	7.0%	8.7%	30.9%	28.7%	24.7%	3.6
Other State Residents (n=1097)	8.8%	10.7%	35.3%	26.1%	19.2%	3.4
Southeast Parks						
Virginia Residents (n=303)	7.9%	7.3%	27.7%	31.7%	25.4%	3.6
Other State Residents (n=1068)	10.3%	12.1%	35.4%	24.5%	17.7%	3.3

* Version 6 respondents (n=165) were asked about willingness to pay for visibility protection at southwest parks only.

Question 11 shifted the focus to one specific region and further helped to introduce the WTP questions, and provided information for evaluating the WTP responses. Subjects were asked to rate the importance of obtaining improvements, and of preventing degradations, in visibility at national parks in the selected region. In most versions of the questionnaire subjects were asked about only one region in this question. In Version 4 the question referred to all three regions.

The responses to Question 11 are summarized in Table 4.4-11. As with the previous questions, the responses for different regions are very similar. The difference between in-state and out-of-state respondents is less pronounced than for Question 10 suggesting a perceived difference between asking about "importance" versus "will you pay." Preventing a degradation in visibility is consistently rated more important than obtaining an improvement, although the average ratings for both are between "somewhat" and "extremely" important. More than half of both in-state and out-of-state respondents said that preventing degradation is "extremely important" for all three regions.

Non-Response Rates for Specific Questions

Table 4.4-12 shows non-response rates for selected specific questions for all versions of the questionnaire. There are usually some respondents who do not answer any particular questions, so some non-response is always expected. Of interest is whether a question has a notably higher non-response rate than other questions, suggesting that respondents may have had particular problems or concerns with that question. In some cases, the respondent wrote on the questionnaire that he or she did not know the answer or did not accept a premise, but in most cases the response was left blank without any explanation given.

The non-response rates for questions Q-5 through Q-11 were all between 4 and 6 percent. Therefore, approximately 5 percent can be considered as the baseline expected non-response rate for questions in this questionnaire. The non-response rates to the national park visitation history questions were shown in Table 4.4-1, and were mostly higher than 5 percent, suggesting some possible problems with recall for these questions. The question concerning the probability of future national park visitation (Q-4) had a non-response rate of about 10 percent, perhaps reflecting uncertainty about future visits.

The non-response rates to the willingness to pay questions (Q-12 through Q-13) were 8 to 9 percent. Because we expect that some respondents will find these questions difficult, and others will use non-response as a form of protest response, it is not surprising that the non-response rate is higher than the 5 percent baseline level. It is reassuring that the WTP non-response rate is actually lower than for many of the park visitation questions and for the household income question (which typically draws a relatively higher non-response rate).

Table 4.4-11
Importance of Visibility Protection at National Parks

	Frequency of Responses					
	Not at all Important (1)	(2)	Somewhat Important (3)	(4)	Extremely Important (5)	Mean
California Parks Focus Version						
California Residents						
Obtaining Improvement (n=123)	0.8%	1.6%	21.1%	31.7%	44.7%	4.2
Preventing Degradation (n=123)	0%	0.8%	12.2%	22.8%	64.2%	4.5
Other State Residents						
Obtaining Improvement (n=238)	1.7%	2.1%	29.4%	28.2%	38.7%	4.0
Preventing Degradation (n=237)	2.1%	0.8%	14.8%	25.3%	57.0%	4.3
Southwest Parks Focus Version						
Arizona Residents						
Obtaining Improvement (n= 299)	1.0%	3.7%	21.4%	34.8%	39.1%	4.1
Preventing Degradation (n=302)	1.0%	1.3%	13.6%	22.2%	61.9%	4.4
Other State Residents						
Obtaining Improvement (n=367)	2.7%	4.4%	27.5%	30.2%	35.1%	3.9
Preventing Degradation (n=367)	2.2%	3.3%	14.2%	24.3%	55.9%	4.3
Southeast Parks Focus Version						
Virginia Residents						
Obtaining Improvement (n=129)	3.1%	5.4%	27.1%	33.3%	31.0%	3.8
Preventing Degradation (n=132)	1.5%	3.8%	10.6%	26.5%	57.6%	4.4
Other State Residents						
Obtaining Improvement (n=245)	2.4%	4.1%	28.2%	29.8%	35.5%	3.9
Preventing Degradation (n=244)	2.0%	2.9%	16.4%	25.4%	53.3%	4.3
All Three Regions (Version 4)						
Obtaining improvement (n=149)	0.7%	4.0%	27.5%	36.2%	31.3%	3.9
Preventing Degradation (n=150)	0.7%	2.7%	16.0%	22.7%	58.0%	3.4

Table 4.4-12
Non-Response Rates for Selected Questions

	Don't Know (%)	Left Blank (%)	Total Non-Response (%)
A. For All Respondents Who Answered the Questionnaire (n=1632)			
Q-4 Future Park Visitation			
California	0.2%	10.0%	10.2%
Southwest	0.3%	9.9%	10.2%
Southeast	0.3%	11.6%	11.9%
Q-12 WTP1	1.8%	6.8%	8.6%
Q-13 WTP2	1.6%	6.4%	8.0%
Q-14 WTP3	1.4%	7.7%	9.1%
Q-27 Education	0.6%	3.1%	3.7%
Q-28 Income	0.1%	13.7%	13.8%
B. For All Respondents who Answered Non-zero to at Least One WTP (n=1403)			
Q-16 Accuracy	0.2%	1.7%	1.9%
Q-17 % for Visibility	0.4%	4.8%	5.2%
Q-18 % for One Park	0.9%	6.1%	7.0%
Q-19 % for Option Price	0.3%	7.7%	8.0%
% for Request	0.2%	7.8%	8.0%
% for Existence	0.2%	7.7%	7.9%

Questions Q-16 through Q-19 were relevant for only those respondents who gave a non-zero dollar response to at least one of the WTP questions. Non-response rates for this subsample for these questions are shown in the second part of Table 4.4-12.

4.5 WILLINGNESS TO PAY RESPONSES FOR CHANGES IN VISIBILITY

4.5.1 Evaluation of WTP Responses

CVM responses are considered problematic when they reflect a rejection of the scenario, rather than revealing the consumer's surplus value of the change in visibility being valued. For example, some respondents may list zero, while stating the problem is very important to them, because they reject the payment scenario. These types of problems are common in CVM surveys, and they need not invalidate the use of a large number of valid responses.

To address problems of potentially invalid observations, and to address the overall validity of the CVM data, we use a procedure of "consistency checks" proposed by Rowe and Chestnut (1985), which extends the zero bid evaluation procedures used in early CVM studies (Cummings et al. 1986). Consistency checks identify CVM responses that are inconsistent with other responses given by that respondent, including written comments. Comments and responses to other questions may suggest that the CVM responses do not reveal the value estimate sought by the researcher. Consistency checks can also be used to help evaluate the apparent validity of the overall CVM responses. One would question the validity of the CVM responses if a substantial share of respondents failed rudimentary tests of internal consistency (Fischhoff and Furby, 1988, page 161-162).

Distribution of WTP Responses Across the Checklist

The responses to all of the WTP questions for each version of the questionnaire covered the whole range of values listed in the checklist. The pattern of responses in terms of the frequency with which each value was selected is similar for each of the WTP questions. Table 4.5-1 gives an example of this pattern based on the responses to Question 12 for Version 1, focusing on national parks in California. The first part of Table 4.5-1 shows the percentage of respondents who selected values in each of the columns of the checklist (there were four values in each column). Column 4 showed the greatest frequency of responses at about 25 percent, with columns 3 and 5 both at about 20 percent. Values in the first two columns (the lowest value) were selected somewhat more frequently than those in the last two columns (the highest value).

The second part of Table 4.5-1 sheds more light on this observed pattern of responses. For this question, approximately 53 percent of the respondents selected one of five values out of the checklist of 28 values. These "key" values appear to be round numbers and are located at various portions in the checklist (i.e., sometimes at the top of

Table 4.5-1
Example of Distribution of WTP Responses Across the Checklist

A. Distribution of Q-12 Responses for Version 1 Across the Checklist Columns

Checklist Column	1	2	3	4	5	6	7
Dollar Range	$0 to $1.50	$2 to $5	$8 to $20	$25 to $50	$60 to $125	$150 to $300	$400 to more than $750
Percent of Respondents*	11.1%	12.2%	18.1%	25.1%	21.1%	8.5%	3.8%

B. Most Frequent Values Selected for Q-12, Version 1

Value	Percent of Respondents
$0	7.3%
$10	8.8%
$25	13.2%
$50	9.9%
$100	13.7%
Total	52.9%

* Percentage based on the total number of respondents who gave any answer to this question (n=342).

columns, sometimes in the middle, etc.). Two of these key values are located in the fourth column, which may account for the higher response rate for that column. The tendency to select round numbers, such as $25 or $100 rather than $8 or $125, is suggestive of the level of precision of the WTP responses.

For all three park regions, the percentage of respondents who selected one of the five "key" values for the second and third WTP questions dropped to under 50 percent. This suggests that many respondents may have selected a key value for the first response and then adjusted their responses for the second and third WTP questions.

Evaluation of Zero WTP

In most contingent valuation studies an effort is made to evaluate zero WTP responses to determine whether the respondent really means he does not value the hypothetical change being considered, or whether the response reflects some objection to the question and should not be interpreted as a true zero value for the change in the good in question. Irwin et al. (1989) suggest that zero bids may also reflect that respondents do not know their value, or do not want to expend the effort required in the exercise and therefore opt not to engage in the transaction.

A common zero bid evaluation approach has been to list several alternative explanations for a zero WTP response and ask the respondent to select the one that best explains his response. Examples might be "I don't care about visibility" and "Polluters should pay for pollution control." Our experience with this procedure suggests that some true zeros may be incorrectly interpreted as protest responses as respondents may further justify true zero value responses by also checking a protest comment (Rowe and Chestnut 1985, 1986).

The consistency check approach used to evaluate zero responses was to look for confirmation in the comments or in responses to other questions that the respondent really cares very little about the hypothesized changes in visibility at national parks in the selected region. The evaluation was designed to err on the side of keeping invalid zeros rather than eliminating valid zeros. Responses to Question 9 and Question 11, and written comments, were used in this evaluation. Zero responses were retained as valid if any one of the following conditions was met.

- Response to Question 9 indicated that an improvement in visibility from C to B in the selected region (in the WTP question) would not affect the respondent's enjoyment of a park visit in that region.

- Response to Question 11 indicated that improving or preventing deterioration in (comparable to the direction of change hypothesized in the WTP question) visibility conditions at parks in the selected region is not at all important.

- Respondent offered a comment that he could not afford to pay anything.

- Respondent offered a comment that he does not care about visibility conditions either at the selected location or at all.

Both of the following conditions had to be met for the zero response to be interpreted as a rejection of the question rather than a valid zero:

1. Respondent said that enjoyment would be enhanced at the better visibility level (Q9), or that improving visibility (or preventing degradation) is at least somewhat important (Q11).

2. A rejection comment was given, indicating some objection to the premises of the WTP questions. Rejection comments include:

> Polluters should pay. Taxes shouldn't be raised. The government should use current tax revenues more efficiently. I don't believe the problem you describe really exists (e.g., it's humidity, not air pollution). Park users should pay. Visibility is an urban problem, not a park problem (i.e., your assumptions are wrong).

Most of the zero WTP responses fell unambiguously into either the accept or reject group, but for a few respondents neither the acceptance nor rejection conditions were met (primarily due to non-response to Questions 9 and 11 and no comments being offered). These zero WTP responses were presumed to be valid. The number of zero responses given to each of the three WTP questions is shown in Table 4.5-2. Zero responses were about eight percent of all responses to the questionnaire. After this evaluation process, just under 70 percent of the zero responses were kept as valid zero value responses. The rejected zero responses were recoded to missing values. The accepted zeros shown in Table 4.5-2 (the table rows labeled "adjusted") also reflect the addition of some valid zeros as a result of the adjustments based on Question 17. The rejection/missing response rate is similar to or lower than for many previous CVM exercises (Mitchell and Carson 1989, Cummings et al. 1986). Table 4.5-4 also shows that protest and non-response bidders were less likely to visit the parks and placed somewhat lower importance on visibility protection, factors associated with lower WTP responses. If one made the extreme assumption that all the protests and non-responses actually reflect true zero value, the sample-wide WTP means would decrease approximately ten percent.

Adjustments Based on Question 17: WTP Specifically for Visibility

One of the concerns with previous contingent valuation studies for estimating preservation values for visibility at national parks has been that respondents may be giving WTP responses that reflect their general desire to support the preservation and protection of the parks and may therefore overstate their WTP for the specific incremental changes in visibility conditions hypothesized in the question. The questionnaire was designed to examine the magnitude of this potential part-whole bias by identifying as a separate issue and requesting that respondents focus specifically on visibility values prior to the WTP questions. After the WTP questions, recognizing the potential cognitive difficulty for respondents in performing the separation ex ante, Question 17 asked respondents to consider whether their WTP responses were specifically for visibility in and around national parks or whether they also reflected some value placed on national park protection in general. If they indicated that the entire value may not be for visibility, they were asked to estimate the percentage of their WTP responses that was specifically for visibility.

Table 4.5-2
Frequency of Refusals and Zeros in WTP Responses

	Refusals and Non-Response	Zeros
WTP1 (Question 12)		
Raw	140 (8.6%)	125 (7.7%)
Adjusted*	185 (11.3%)	107 (6.6%)
WTP2 (Question 13)		
Raw	131 (8.0%)	132 (8.1%)
Adjusted*	176 (10.8%)	111 (6.8%)
WTP3 (Question 14)		
Raw	149 (9.1%)	129 (7.9%)
Adjusted*	195 (11.9%)	110 (6.7%)

Note: Percentages are of all 1,632 respondents.

* Adjusted removing protest zeros, questionable high WTP and corrected for Question 17 responses.

Table 4.5-3
Visibility Focus Verification: Question 17

Question: Would you say the dollar amounts you gave in answer to Question 12, 13, and 14 are:

Response	Percentage of Responses*	Mean Percentage of WTP Specifically for Visibility**
1. Basically for the stated changes in visibility at the national parks	32% (n=449)	87% (n=449)
2. Somewhat for the stated changes in visibility and somewhat to help with other needs at the national parks	45% (n=624)	51% (n=607)
3. Basically to help the national parks and are not related to the stated changes in visibility	7% (n=103)	40% (n=97)
4. Other	6% (n=81)	42% (n=74)
No response to first part of question	10% (n=145)	50% (n=102)
Overall mean % for visibility		62% (n=1329)

* Percent of all respondents who gave a non-zero response to at least one WTP question.

** Respondents who answered 2, 3, or 4 were directed to a box asking "About what percent of your dollar answers is for visibility at national parks?" Some respondents who answered 1 to the first part of the question also marked something other than 100% in response to the second part of the question (115 out of 449).

Table 4.5-4
High WTP and Non-Response WTP Evaluation

	All Identified High WTP[1] n=47	Absolute High WTP Respondents[2] n=14	Protests and Non-Respondents n=166	Other WTP Respondents[3] n=1419
Importance of Improving Visibility at National Parks in the Region	4.60* (SE=0.08)	4.86* (SE=0.10)	3.88 (SE=0.10)	3.98 (SE=0.03)
Importance of Preventing Visibility Degradation at National Parks in the Region	4.89* (SE=0.08)	5.00* (SE=0)	4.17** (SE=0.09)	4.35 (SE=0.02)
Effect of Visibility Improvement on Visit Enjoyment	2.83* (SE=0.06)	2.79 (SE=0.11)	2.53 (SE=0.05)	2.58 (SE=0.02)
Willingness to Pay to Protect Visibility at National Parks in the Region	4.47* (SE=0.10)	4.64* (SE=0.17)	2.88** (SE=0.12)	3.44 (SE=0.03)
Ever Visited a National Park in the Region	0.85* (SE=0.06)	0.91* (SE=0.09)	0.54 (SE=0.05)	0.59 (SE=0.01)
Probability of Future Visit to a National Park in the Region	3.72* (SE=0.19)	3.86 (SE=0.31)	2.80** (SE=0.11)	3.28 (SE=0.03)

[1] Includes all respondents who gave identified absolute and relative to income high WTP responses accepted as valid.

[2] Includes all respondents who gave accepted as valid WTP of "more than $750" for all three WTP questions. These are also included in the first column.

[3] Includes all respondents who gave accepted WTP responses, including zeros and excluding protests and non-responses.

* Statistically significantly higher than for other respondents at 95% confidence.

** Statistically significantly lower than for other respondents at 95% confidence.

Table 4.5-3 summarizes the responses to Question 17. The average percentage of the WTP response specifically for visibility was 62 percent across everyone who answered this question.[6] The second column in Table 4.5-3 shows that the mean percentage for visibility decreased, as expected, with responses indicating less and less connection between the previous WTP answers and the specific changes in visibility described. Respondents who selected the first response to the first part of Question 17 and did not answer the second part were assumed to be indicating that 100 percent of their WTP for the specific changes in visibility.

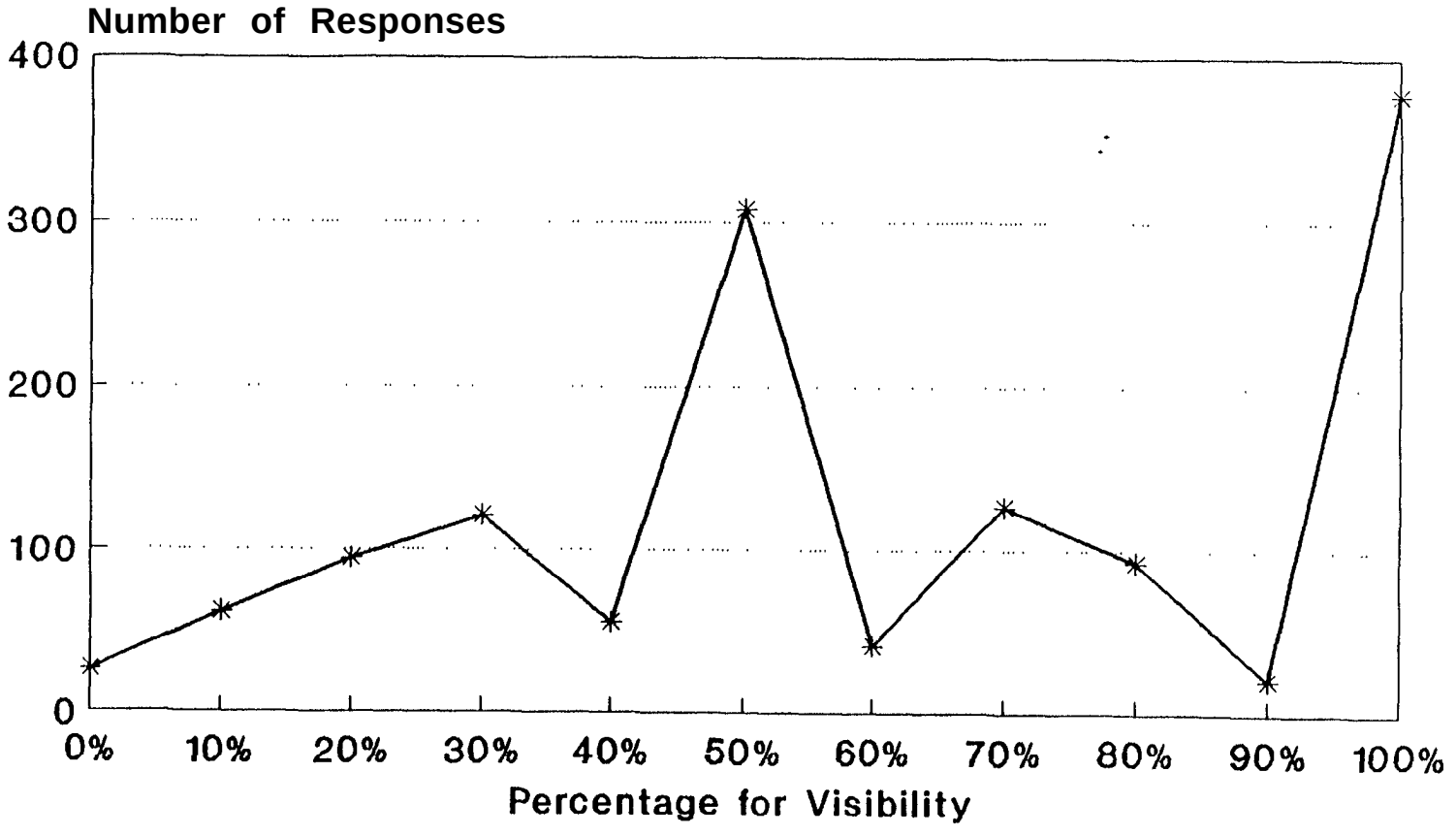
Figure 4.5-1 shows the frequency of the Question 17 responses regarding the percentage of the WTP response that the respondent said was specifically for visibility in and around national parks. About one-fourth of the respondents indicated 100 percent, and about one-fourth indicated 50 percent. Twenty-six respondents indicated that none of their WTP value was really for changes in visibility. This was about two percent of those who gave non-zero responses to the WTP question.

The responses to Question 17 were used to adjust the WTP responses to more accurately reflect WTP specifically for the hypothesized changes in visibility conditions. Mean percentages for all respondents were used for subjects who answered the WTP questions but did not answer Question 17. If they answered the first part of Question 17, then the mean percentage given by others who selected the same first part response was used (unless they selected the first response for which 100 percent was presumed unless otherwise indicated by the respondent). If they did not answer any part of Question 17, then 62 percent was used.

To examine the factors that may be related to the percentages given specifically for visibility, and to help in understanding the significance of the responses to this question, correlations between the percentages for visibility and responses to other questions were examined. This analysis found that the percentages for visibility were not related to the WTP responses, but there was a statistically significant negative correlation between responses to Question 17 and responses to Question 16 on perceived accuracy of the WTP responses. This is consistent with expectations: those who believed their responses were very accurate said that a higher percentage of their WTP response was specifically for visibility and those who felt their responses were less accurate were more likely to reveal a tendency toward part-whole bias. Other statistically significant ($p < .01$) positive correlations emerged between the percentage for visibility and:

[6] Many of the 449 respondents who responded "basically for the stated changes ..." completed the box indicating what share of their bid was for visibility, even though they were not explicitly directed to the box About one fourth of the 449 individuals in this group indicated values less than 100 percent.

Figure 4.5-1
Frequency of Question 17 Responses: Percentage for Visibility



Note: Includes respondents to all versions who gave at least one non-zero WTP response

- national park visitation and home-state residence

- percentages of WTP for own household use and use of others now and in the future (Question 19), which may reflect more concern about how visibility would substantively affect on-site enjoyment by themselves or others leading to more attention to the specific visibility concern.

- the importance rating for obtaining improved visibility at national parks in the selected region and for preventing degradation of visibility (Question 11)

- the priority rating for protection of scenic vistas from air pollution (Question 8 showing an increased concern for visibility vis-a-vis other issues)

- household income (perhaps reflecting education)

These correlations suggest that the WTP responses are likely to be more closely aligned with the specific visibility changes being hypothesized when, as Fischhoff and Furby suggest, the substantive definition is relevant to the individual. Such relevance may be greater when the respondent is more likely to actually visit the park, is more concerned about actual visitation by his own household and by others, and places a higher importance on protection of visibility at national parks. The responses to this question also indicate that the overstatement of WTP for changes in visibility in previous studies may have been substantial, and that even when visibility is partitioned by the researcher in the WTP set-up and valuation questions, some respondents have difficulty with the chore. However, the follow-up question appeared to work well in allowing respondents a chance to reconsider (in a non-threatening way) the intent of their WTP response and to adjust the response, thereby minimizing the impact of any potential part-whole bias on the final WTP results.

Evaluation of High WTP Responses

Another way that respondents can object to the WTP question, or misrepresent values. is by giving very high responses that misstate their true values. Most contingent valuation studies have found that some respondents give apparently unrealistically large estimates of WTP. This may occur for strategic reasons (although little evidence of such strategic response has been found), due to inaccuracy in response combined with lack of consideration to budget constraints, or due to other reasons. Responses were selected for detailed review if either of the following conditions was met:

- The adjusted (based on Question 17) WTP estimate was greater than one percent of income for any one of the three WTP responses.

- All three WTP responses were the maximum listed on the checklist (greater than $750, which was coded as $1000).

A total of 51 respondents were identified as meeting at least one of these two criterion. Forty-two met the first criterion, and fifteen met the second (six met both). Figure 4.5-2 shows the distribution of the adjusted WTP responses to the first WTP question as a percentage of reported income (truncating observations between 1 percent and 2.7 percent for presentation purposes). Approximately 95 percent of the WTP responses were less than or equal to 0.5 percent of annual income, two-thirds were less than .25 percent of annual income, and all the responses were under 3 percent. Responses to the second and third WTP questions showed similar distributions.

The evaluation of the identified high responses relied primarily on a review of the comments offered by the respondent. Several types of comments were classified as protest comments, reflecting an objection to the premises of the WTP questions, or as support comments, indicating that the respondent thinks that protecting visibility at national parks is important. Protest comments included:

> The questions are too narrow or vague. Anti-developer comments. Anti-industry or anti-polluter comments. The government needs to do better.

Support comments included:

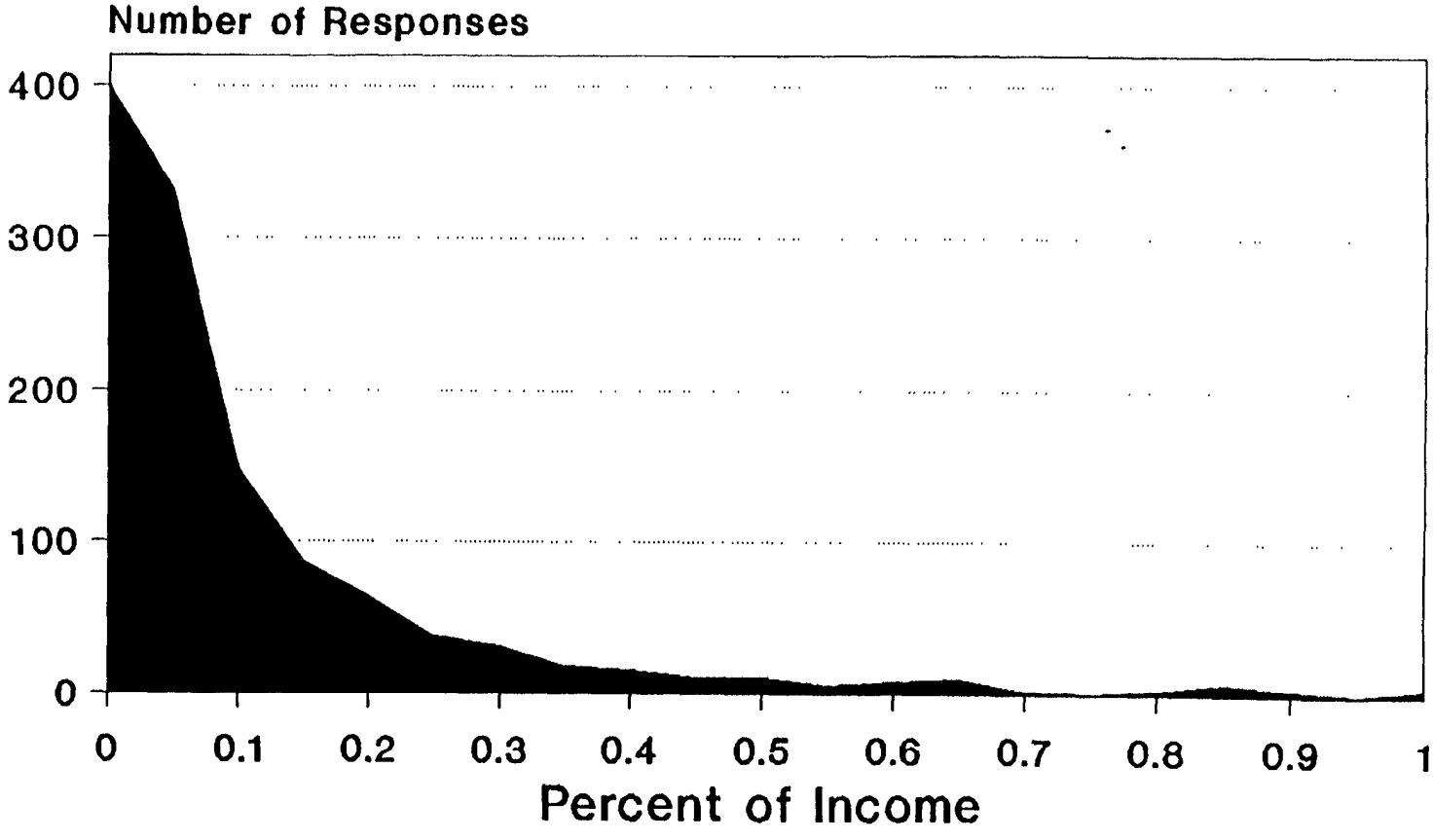
> Visibility at national parks is important. Protecting national parks is important. Everyone should help and that would pay for it. Environmental protection is important. I am willing to spend even more to improve air quality everywhere. If we don't clean up now, we will suffer later. Concern about pollution in general. Can't afford more (combined with a high response).

Four of the identified high responses were associated with a protest comment and no support comment. We interpreted these four responses as rejections of the WTP questions and recoded them to missing values. The remaining high responses each met at least two of the following conditions and were retained as valid WTP responses. These conditions were:

- One or more support comments were written by the respondent
- Respondent had visited national parks in the selected region
- The mean of the three adjusted WTP estimates was less than or equal to one percent of the reported income
- No protest comments were given

Additional analysis, reported in Table 4.5-4, illustrates that, overall, the high WTP responses apparently reflect attitudes, behavior and respondent characteristics consistent with a priori expectations. In Table 4.5-4, four data columns are listed. The first presents statistics for

Figure 4.5-2
Adjusted WTP1 as a Percent of Household Income



Note: Figure includes non-zero WTP1 responses, adjusted for Question 17 responses, for which income was given.

15 additional respondents (1%) gave values between 1% and 2.7% of income.

the 47 high responders identified by the two criteria above after deleting four apparent protests. The second column presents statistics for only the 14 respondents who answered " > $750" for each of the three WTP questions. The fourth column gives statistics for all other respondents. The analysis indicates high responders assign statistically significantly higher importance to visibility protection, to willingness to pay for that protection, and to its effect on enjoyment; are more likely to have visited or to plan to visit; and, for the absolute high responders (column 2), have substantially larger incomes.

Some analysts have suggested one approach to remove protest zero, and high bids, and to reduce the effect of inaccuracy on the analysis is to arbitrarily trim a fixed percent off each end of the bid distribution (alpha trimming, see Mitchell and Carson, 1989). Our analysis finds this procedure would apparently incorrectly remove valid small and large value statements.

The distributions of the adjusted WTP responses are shown in Table 4.5-5 for the results from survey Versions 1, 2 and 3. The adjusted responses reflect the evaluations of zero and high responses and the responses to Question 17. The net effect of these three adjustments is an overall decrease in the WTP estimates, with the median values being decreased an average of 33 percent, as compared to the raw data. The primary source of change is due to the Q17 adjustment. These adjusted WTP estimates are used throughout the remainder of the analysis, unless otherwise noted.

Self Evaluated Accuracy of WTP Responses

After answering the WTP questions, respondents were asked in Question 16 to give some qualitative judgments about how accurate they felt their WTP answers were. The responses to this question are shown in Table 4.5-6.[7] About 80 percent of the respondents felt their answers were “very accurate” or “within the ballpark”. Just under 20 percent said that their responses were somewhat or very inaccurate. We find these responses reassuring in that the vast majority of respondents appear to indicate their responses give a meaningful value signal.

The responses to this accuracy self evaluation were used to evaluate two concerns that have been raised about contingent valuation results: (1) that difficulty, or uncertainty, in answering the questions is related to overstatement of WTP, and (2) that unfamiliarity with the good contributes to inaccuracy and upward bias. Although this question allows only a crude evaluation of these concerns, the results do not support either of these contentions.

The second column in Table 4.5-6 shows the mean (unadjusted) WTP responses associated with each accuracy response. Contrary to the first concern, WTP declines in statistically significant increments as self-perceived accuracy declines. A similar pattern holds with the adjusted WTP responses, shown in the third column. This pattern of decreasing mean

[7] Responses to Version 4 of the questionnaire are not included in this table because the structure of the WTP questions was different. The results for Version 4 with respect to the accuracy question were similar.

Table 4.5-5
Frequency Distribution of Adjusted* WTP Responses For Versions 1, 2, and 3

	Version 1 (California Parks)			Version 2 (Southeast Parks)			Version 3 (Southwest Parks)		
	WTP1	WTP2	WTP3	WTP1	WTP2	WTP3	WPT1	WPT2	WPT3
10th Percentile	$0.50	$0.60	$0.50	$0.50	$0.80	$0.60	$0.40	$0.30	$0.60
20th Percentile	$2.50	$2.50	$2.40	$2.00	$2.00	$2.00	$2.00	$2.50	$2.50
30th Percentile	$5.00	$6.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00
40th Percentile	$10.00	$12.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00
50th Percentile	$17.50	$22.50	$20.00	$12.50	$17.50	$15.00	$14.00	$20.00	$15.00
60th Percentile	$25.00	$30.00	$25.00	$25.00	$25.00	$25.00	$25.00	$30.00	$25.00
70th Percentile	$40.00	$50.00	$50.00	$37.50	$50.00	$40.00	$30.00	$50.00	$40.00
80th Percentile	$70.00	$90.00	$75.00	$50.00	$75.00	$62.50	$50.00	$75.00	$50.00
90th Percentile	$100.00	$135.00	$125.00	$100.00	$126.00	$100.00	$100.00	$125.00	$120.00
95th Percentile	$200.00	$200.00	$200.00	$150.00	$225.00	$200.00	$175.00	$250.00	$250.00
99th Percentile**	$400.00	$525.00	$400.00	$360.00	$1,000.00	$600.00	$500.00	$500.00	$500.00
Total Number of Responses	331	334	330	346	350	344	337	338	332

* Adjusted removing protest zeros and questionable high WTP responses, and corrected for the percentage of WTP solely for visibility from Question 17.

** The maximum response was "MORE THAN $750." For analysis, this was coded as $1000.

Table 4.5-6
Perceived Accuracy of WTP Responses

Accuracy	Responses*	Mean Raw WTP1 Response (SE of Mean)	Mean Adjusted WTP1 Response (SE of Mean)	Responses for those who gave accepted zeros to WTP1	Responses for those who have ever visited a national park shown on the map	Responses for those who have ever visited the park shown in the photographs**
Very Accurate	14.7% (n=192)	$90.29 (15.61) (n=190)	$60.97 (11.46) (n=190)	63% (n=63)	13.4% (n=141)	14.5% (n=78)
Within the Ballpark	66.3% (n=864)	$67.43 (3.72) (n=858)	$43.27 (2.40) (n=858)	23% (n=23)	69.2% (n= 729)	68.3% (n=367)
Somewhat Inaccurate	14.1% (n=184)	$53.01 (7.34) (n=179)	$32.33 (4.14) (n=179)	7% (n=7)	13.0% (n=137)	12.1% (n=65)
Probably Very Inaccurate	4.8% (n=63)	$40.15 (6.96) (n=62)	$26.62 (6.23) (n=62)	7% (n=7)	4.5% (n=47)	5.0% (n= 27)
Total # Respondents	1303	1289	1289	100	1054	537

* These are the accuracy responses for respondents to all versions, except version 4, who gave a dollar response (including accepted zeros) to any of the WTP questions.

** This is the number of respondents who said they had ever visited the specific park that was the focus of the WTP questions they were asked. This is a subset of those who have ever visited <u>any</u> national park.

WTP with decreasing self-perceived accuracy is accentuated when zero WTP values are removed, because a significant share of respondents who gave zero WTP said that their responses were "very accurate." The accuracy responses for individuals who gave accepted zero responses to the first WTP question are shown in the fourth column in Table 4.5-6.

The fifth and sixth columns show the accuracy responses for respondents with some visitation experience at the national parks. The distribution of accuracy responses is essentially the same for these visitor segments of the sample. This suggests that previous visitation is not related to the perceived accuracy of the WTP responses, contrary to expectations.

An examination of potential relationships between self-perceived accuracy responses and responses to other questions revealed two statistically significant relationships, independent of the relationship with WTP already discussed. Self-reported accuracy increased as the respondent's education level increased, and a higher percentage of WTP specifically for visibility (Q-17) was associated with a higher self-reported accuracy for the WTP responses.

Combined with results of Question 17, the Question 16 results indicate that individuals with low self-perceived accuracy tended to give lower values for the visibility change and were more likely to give responses that reflected part-whole bias. This has important implications:

- The less well understood the resource change is for the respondent, the more uncertain and inaccurate responses are likely to be and values will decrease.

- Lowered values with lowered accuracy may reflect a tendency to provide a value lower than the maximum WTP to reflect uncertainty about the valuation (i.e., a hedging strategy that downward biases WTP response and similarly may upward bias WTA responses -- see Schulze et al. 1990 forthcoming). This implies that visibility studies with poor stimuli may result in reduced WTP values.

- Forcing respondents to provide answers to questions about which they are uncertain, which Fishhoff and Furby (1988, page 169) argue against doing, may lead to downward bias in the sample-wide mean WTP estimates.

To be conservative, responses with low self-reported accuracy are retained in subsequent analyses, although this may introduce downward biases into the estimates. To examine this potential impact on the overall results, selected sample means were calculated weighting the observation by the inverse of the self-perceived evaluation score. These weighted means were only slightly larger, on the order of five percent, than the unweighted means presented in the report. Due to the small amount of difference, these weighted means are not presented.

WTP Responses All Equal

In general, one might expect that WTP responses would be different for the different changes in visibility conditions. WTP2 for an improvement in average conditions from the

current 50th percentile to the current 90th percentile would be expected to equal or exceed WTP1 for an improvement from the 50th to the 75th percentile. Based upon the responses to Question 11 (Table 4.4-11) and prospect theory (Kahneman and Tversky 1979 and 1982) one might also expect WTP3 to prevent a degradation to the 10th percent conditions to exceed the WTP1 but not to be as large as WTP2. This is because the percent change in visual range in the WTP3 scenarios is generally equal to or larger than in the WTP1 scenarios, but less than in the WTP2 scenarios (Table 3.3-2), and because preventing degradations is ranked as slightly more important than obtaining improvements.[8]

The overall mean WTP responses are consistent with these expectations. But, looking at the data on an individual observation basis, it is found that a significant portion of the respondents gave the same non-zero bid for all three WTP scenarios.

Table 4.5-7 shows the number and percentage of respondents in each of three categories of WTP responses: (1) accepted zero WTP for all three, (2) the same non-zero dollar amount for all three, and (3) a different dollar amount to one or more of the three. The numbers in Table 4.5-7 are based on the adjusted WTP responses (but for any individual the same adjustment percentage was used for all three WTP responses). Results for each national park region are reported. Version 4 is treated separately because the three WTP questions in this version are for the same percentile change in three separate regions, not for three different levels of visibility in the same region. The three WTP responses for Version 4 being all the same raises different issues than for the other versions of the questionnaire.

Table 4.5-7 shows that the percentage of respondents who gave the same non-zero dollar response to all three WTP questions is almost identical for the three regions, ranging from 40 to 42 percent. The percentage of all-equal non-zero WTP responses for Version 4, which may occur for different' reasons than in the other survey versions, is only slightly higher at 45 percent.

The high percentage of all-equal non-zero WTP responses raises some questions about how closely the responses are tied to the specific changes in visibility presented for each scenario. It may be the case that the changes in visibility are perceived as being quite similar. I.e, the WTP1 and WTP2 visibility measures (Table 3.2-1) are nearly identical for the Grand Canyon, and the change in these measures is also nearly equal for the WTP1 and WTP3 scenarios. In other cases, very flat indifference curves for visibility improvements beyond some level would also result in WTP1 approximately equal WTP2. In cases such as these, respondents may simply state the same value, rather than make small adjustments in the value. While these arguments may hold in some cases, the differences in visibility conditions in some scenarios for some locations, combined with the high (and similar) percent of all equal response for each survey version, are sufficient to suggest this alone does not adequately explain the "all-equal WTP" responses. Sanghvi et al. (1989) also reported an unexpectedly high percentage of equal WTP responses for different changes in

[8] If responses reflect the weighted average atmospheric transmission measure, similar implications would result. If respondents are focusing upon the change in the percentile, then one would expect WTP3 = WTP2 > WTP1. This is because the WTP1 and WTP3 scenarios both have a change of 40 percentile points, while WTP1 has a change of 25 percentile points.

Table 4.5-7
All Equal Versus Different WTP Responses

	California Parks (Version 1)		Southwest Parks (Version 3, 5, 6)		Southeast Parks (Version 2)		Multiple Regions (Version 4)	
	number	percent	number	percent	number	percent	number	percent
All Zero (Accepted)	17	5%	47	7%	23	7%	7	5%
Non-Zero All Equal	138	41%	259	40%	149	42%	61	45%
Different	181	54%	337	52%	180	51%	67	50%
TOTAL*	336		643		352		135	

* Net of missing and identified protests.

the frequency of power outages, and we suspect that this is a common occurrence in CVM studies that has only recently begun to be reported. Explanations for this phenomenon will remain speculative until further research is conducted to specifically examine this issue.

We have two hypotheses regarding these all-equal responses and have examined the information available from this study to see if either of these hypotheses is supported. These hypotheses are:

1. Respondents may be anchoring on the first scenario and failing to expend the effort necessary to adjust the response to changes in the subsequent scenarios.

2. Respondents may be expressing a value for the good or service in question that is only loosely tied to the exact change described in the scenario.

The evidence available in this study regarding these hypotheses is mixed and inconclusive. Both hypotheses are supported to some extent, and they are not necessarily mutually exclusive.

Table 4.5-8 shows the mean WTP responses for the all-equal and the different WTP groups, combined across Versions 1, 2, 3, 5, and 6. The raw and adjusted responses to the first WTP question are not statistically significantly different for the two groups, while for the second and third WTP questions the mean responses of the all-equal group are statistically significantly lower. This suggests that there is an anchoring of the first WTP bid on the first visibility control scenario rather than just being a contribution unrelated to visibility changes. The anchoring hypothesis is also consistent with the tendency of responses to select relatively round numbers such as $25 or $100 (as discussed earlier in this section). having decided upon such a number for the first WTP question, some respondents may not be inclined to put the effort into fine tuning their responses for what they may see as relatively small changes in the scenario, or if there is a sense that the accuracy of the response is less than the magnitude of the refinement.

Table 4.5-8 shows that the all-equal WTP group gave an average percentage specifically for visibility in Question 17 that is statistically significantly lower for the different WTP group. This suggests that the raw responses for this group are less closely tied to the specific visibility changes presented, which is consistent with the second hypothesis. The adjusted responses account for this difference to the extent that respondents are able to estimate what percentage really is for the specific changes in visibility.

The results of a logit analysis further examining the differences between the all-equal WTP group and the different WTP group are shown in Table 4.5-9. Age and education are statistically significantly related to the likelihood of giving all-equal WTP responses, while the gender of the respondent is not. The signs of the age and education coefficients are consistent with the anchoring and less effort hypothesis. Older respondents are more likely to give all-equal responses and those with more education are less likely to give all-equal responses.

Table 4.5-8
WTP Means for All Equal
Versus Different Responses

	Mean Raw WTP Responses		Mean Adjusted WTP Responses	
	Non-Zero All Equal	Different	Non-Zero All Equal	Different
All Versions Except 4				
WTP1	$73 (6.82) n=556	$69 (3.92) n=691	$45 (4.59) n=546	$48 (3.04) n=680
WTP2	$73 (6.82) n=556	$106** (6.10) n=700	$45 (4.59) n=546	$74** (4.83) n=689
WTP3	$73 (6.82) n=556	$88* (5.46) n=687	$45 (4.59) n=546	$62** (4.28) n=676
Percent for Visibility	58% (l.4) n=532	65%* (1.1) n=666		

* Statistically signicantly different versus non-zero all equal means at 90% confidence.

** Statistically different versus non-zero all equal means at 95% confidence.

Table 4.5-9
Logit Analysis on Whether Respondent Gave the Same WTP

Independent Variable	Model 1	Model 2
One	1.27**	0.60
	(3.03)	(1.25)
Male	-0.041	-0.060
	(-0.31)	(-0.45)
Age	0.013**	0.013**
	(2.90)	(2.89)
Education	-0.14**	-0.15**
	(-3.9 1)	(-4.40)
Allpay Comment	0.62**	0.58**
	(3.03)	(2.87)
Future Visit (Q-4)	-0.10*	-0.13**
	(-1.86)	(-2.44)
Percent for Visibility (Q-17)	-0.005**	-0.005**
	(-2.33)	(-2.37)
Support WTP (Q-10)	-0.15**	
	(-2.32)	
Importance (Q-11)		
		0.094
		(1.24)
N	1059	1056
% Correctly Predicted	60.9	60.7

* $p < .10$
** $p < .05$

NOTE: Dependent variable = 1 if respondent gave same dollar response to all three WTP question, 0 otherwise. Sample excludes Version 4 and excludes respondents who gave zero or no response to all three WTP questions. t-ratios in parentheses.

Model 2 results show that responses to Question 11 asking respondents to rate the importance of obtaining improvements in visibility at national parks in the specific region of focus in their questionnaire are not related to the likelihood of giving all-equal WTP responses. However, Model 1 shows that respondents who say they are less willing to pay (qualitatively) for protection of visibility at national parks are more likely to give all-equal WTP responses. Combined with Model 2 results, this suggests that respondents giving all-equal WTP responses do not necessarily care less about visibility at national parks, but may have more trouble with the idea of being asked to pay for such protection. This is also consistent with the anchoring hypothesis in that these respondents appear to be having more trouble with the WTP questions.

The results of the logit analysis also indicate that respondents who say they are less likely to visit national parks in the specific region of the focus in the subsequent WTP questions are more likely to give all-equal WTP responses. This is consistent with the possibility that these respondents are less concerned about the exact visibility changes and therefore tend to see the different scenarios as roughly equivalent.

Some respondents volunteered a comment along the lines of "if everyone paid some amount then we could take care of this problem." This type of comment suggests a contribution type of attitude toward the WTP questions, which might be expected to be associated with less concern about the specific scenarios. The logit analysis results are consistent with this possibility, showing that respondents giving this type of comment (ALLPAY=1) are more likely to have given the same WTP response to all three questions.

It is important to note that the effect of the all-equal WTP responses in this study is to lower the estimated coefficient for changes in visibility, because the first scenario generally presents the smallest change in visibility and the respondents giving all-equal responses appear to be anchoring on the first WTP question. The analysis presented here suggests that the available evidence points to several possible explanations for this phenomenon, but this needs to be further examined in future research designed to specifically address this issue.

4.5.2 Means, Medians, and Simple Correlation of Willingness to Pay Responses

This section presents the WTP means and medians by state and by park region. Simple correlations between the WTP responses and responses to other questions are also discussed.

Means of Willingness to Pay Responses

Mean willingness to pay responses by questionnaire version for respondents in the sample from each state are given in Table 4.5-10. These are means of the adjusted responses, as discussed in the previous section. All of the willingness to pay figures are annual values for the household.

For all questionnaire versions except Version 4, WTP1 is willingness to pay for an improvement in average conditions from the 50th to the 75th percentile. WTP2 is for an improvement in average conditions from the 50th to the 90th percentile. WTP3 is to prevent a degradation in average conditions from the 50th to the 10th percentile. For Version 4: WTP1 is for an improvement in average conditions from the 50th to the 75th percentile at national parks in California; WTP2 is for an improvement in average conditions from the 50th to the 75th percentile at national parks in the Southwest; and WTP3 is for an improvement in average conditions from the 50th to the 75th percentile at national parks in the Southeast.

Several patterns emerge from the results in Table 4.5-10. For all questionnaire versions except Version 4, WTP2 is greater than WTP1. For the most part, WTP3 falls between WTP1 and WTP2. In one case, WTP3 exceeds WTP2. Responses for residents of the state located in the region of interest are always the highest or second highest state means for the states sampled for each questionnaire version.

The home-state effect is present in the Version 4 results, but appears to be smaller than for the other versions. The order of the means by state of residence is the same for all three park regions: Arizona residents give the lowest WTP and New York residents give the highest WTP. However, Arizona residents have a higher mean WTP for southwestern parks than for the other two regions and California residents have a higher mean WTP for California parks than for the other two regions, although these differences are not statistically significant.

Comparisons of the mean WTP responses for the different states may be confounded by differences in the average characteristics of the residents of each of the sampled states. Table 4.5-11 shows selected characteristics of the sample by state. The most notable difference between the states is in average household income. The lower average income combined with the distance from the selected park regions may explain why the mean WTP responses for Missouri residents were among the lowest for all three regions. In Table 4.5-10, whenever the home state WTP mean is exceeded by the mean for another state, the other state also has a higher average income. For example, the mean WTP1 for Arizona is exceeded by the mean WTP1 for Virginia. The Virginia respondents have an average household income of $45,000, while the Arizona respondents have an average household income of $36,000. It is interesting that there do not appear to be significant differences across the states in terms of general perceived importance of preserving natural resources at national parks. The relationships between various characteristics of the respondents and the WTP responses are further explored in subsequent sections of this chapter.

Responses for different questionnaire versions, including those for different regions of interest, do not appear to be statistically significantly different. In particular, Versions 3, 5, and 6 obtained very similar WTP responses for visibility at parks in the southwestern U.S. Table 4.5-12 shows the WTP means by state for the southwest region, combined across all three of these questionnaire versions. The question of the effect of different versions of the questionnaire is explored further in section 4.5.4 below.

Table 4.5-10
Means of Adjusted Willingness to Pay
Responses by Version and by State

Version 1: California Parks

State of Residence	WTP1	WTP2	WTP3
Arizona	$27.54 (5.05) n=55	$34.29 (5.70) n=56	$3[illegible] (5.[illegible] n=57
Virginia	$41.94 (9.62) n=59	$46.37 (11.48) n=60	$49.73 (12.76) n=57
California	$60.19 (10.88) n=113	$71.92 (12.25) n=113	$64.13 (11.12) n=113
New York	$57.20 (14.90) n=47	$77.86 (23.36) n=47	$73.01 (23.31) n=47
Missouri	$32.74 (6.68) n=57	$40.09 (7.56) n=58	$35.77 (7.21) n=56
All States	$46.36 (4.85) n=331	$56.33 (5.95) n=334	$52.79 (5.75) n=330

Standard error of mean in parentheses.

Table 4.5-10 (continued)
Means of Adjusted Willingness to Pay
Responses by Version and by State

Version 2: Southeast Parks

State of Residence	WTP1	WTP2	WTP3
Arizona	$24.70 (5.69) n=61	$56.21 (22.80) n=61	$53.56 (22.88) n=61
Virginia	$59.77 (11.78) n=120	$74.89 (13.48) n=124	$67.60 (11.72) n=124
California	$38.24 (9.93) n=55	$54.65 (13.62) n=55	$47.68 (11.43) n=55
New York	$39.55 (8.20) n=46	$53.96 (10.19) n=46	$45.69 (9.90) n=45
Missouri	$25.62 (4.04) n=64	$30.52 (4.84) n=64	$26.40 (4.08) n=62
All States	$41.16 (4.73) n=346	$57.59 (6.78) n=350	$5 1.77 (6.28) n=347

Standard error of mean in parentheses.

Table 4.5-10 (continued)
Means of Adjusted Willingness to Pay
Responses by Version and by State

Version 3: Southwest Parks

State of Residence	WTP1	WTP2	WTP3
Arizona	$45.35 (7.55) n= 130	$65.91 (10.29) n= 130	$54.87 (9.05) n=130
Virginia	$66.51 (20.24) n=48	$69.94 (17.47) n=49	$72.96 (18.05) n=48
California	$34.80 (8.56) n=49	$53.86 (14.71) n=49	$36.80 (10.35) n=47
New York	$44.15 (11.76) n=55	$57.41 (15.23) n=55	$50.72 (13.15) n=53
Missouri	$17.86 (2.80) n=55	$21.32 (3.29) n=55	$19.63 (3.18) n=54
All States	$42.14 (4.75) n=337	$56.11 (5.79) n=338	$48.53 (5.17) n=332

Standard error of mean in parentheses.

Table 4.5-10 (continued)
Means of Adjusted Willingness to Pay
Responses by Version and by State

Version 4: Three Region

State of Residence	WTP1 (California)	WTP2 (Southwest)	WTP3 (Southeast)
Arizona	$28.96 (6.81) n=58	$35.36 (8.08) n=58	$26.55 (6.90) n=54
California	$40.50 (8.47) n=34	$37.93 (7.59) n=33	$33.70 (7.92) n=31
New York	$58.59 (24.23) n=42	$56.38 (23.53) n=43	$60.88 (24.36) n=43
All States	$41.17 (8.43) n= 134	$42.74 (8.50) n= 134	$39.81 (8.93) n= 128

Standard error of mean in parentheses.

Table 4.5-10 (continued)
Means of Adjusted Willingness to Pay
Responses by Version and by State

Version 5: Limited Information (SW)

State of Residence	WTP1	WTP2	WTP3
Arizona	$63.22 (18.24) n=56	$73.28 (18.88) n=56	$65.50 (18.35) n=57
Virginia	$39.12 (16.57) n=47	$42.47 (16.37) n=48	$37.79 (16.02) n=49
New York	$26.55 (5.79) n=46	$39.10 (9.90) n=46	$30.79 (6.89) n=46
All States	$44.30 (8.84) n=149	$52.94 (9.34) n=150	$46.06 (8.89) n=152

Standard error of mean in parentheses.

Table 4.5-10 (continued)
Means of Adjusted Willingness to Pay
Responses by Version and by State

Version 6: One Region (SW)

State of Residence	WTP1	WTP2	WTP3
Arizona	$51.14 (13.94) n=55	$66.94 (16.19) n=54	$52.72 (15.93) n=54
California	$55.07 (13.54) n=51	$85.01 (24.78) n=52	$70.22 (19.91) n=51
New York	$31.32 (7.84) n=44	$37.20 (8.53) n=44	$29.67 (7.62) n=43
All States	$46.66 (7.25) n=150	$64.48 (10.72) n=150	$52.05 (9.30) n=148

Standard error of mean in parentheses.

Table 4.5-11
Average Sample Characteristics by State

Characteristic	Arizona (n=446)	Virginia (n=305)	California (n=333)	New York (n=306)	Missouri (n=188)
1987 Household Income	$36,000	$45,000	$44,000	$47,000	$36,000
% Male Respondent	59%	66%	61%	57%	63%
Age of Respondent	48	46	46	47	46
% Have Visited a National Park	94%	86%	88%	67%	75%
Number of Children in Household	.7	.7	.6	.7	.7
Importance of Natural Conditions at National Parks (Q-5a)	4.0	3.9	4.0	3.9	3.9
Importance of Preservation for Its Own Sake (Q-7c)	4.1	4.2	4.2	4.3	4.2

Table 4.5-12
Combined Means of Adjusted Willingness to Pay
for the Southwest Parks by State
(Versions 3, 5, and 6)

State of Residence	WTP1	WTP2	WTP3
Arizona	$50.83 (6.67) n=241	$67.86 (7.95) n=240	$56.90 (7.42) n=241
Virginia	$52.96 (13.12) n=95	$56.35 (12.00) n=97	$55.19 (12.12) n=97
California	$45.14 (8.11) n=100	$69.89 (14.63) n=101	$54.19 (11.56) n=98
New York	$34.67 (5.38) n=145	$45.47 (7.06) n=145	$37.89 (5.89) n=142
Missouri	$17.86 (2.80) n=55	$21.32 (3.29) n=55	$19.63 (3.18) n=54
All States	$43.72 (3.67) n=636	$57.33 (4.53) n=638	$48.76 (4.08) n=632

Standard error of mean in parentheses.

Table 4.5-13 shows mean WTP responses for WTP1 for each of the three regions, split according future visitation expectations. Visitation and residence location were related, as was shown in Section 4.4, and visitation may be the underlying cause of the home-state effect seen in the responses. Those who responded to Question 4 saying that they probably or definitely would visit a national park in the region of interest in the next five years gave WTP responses about twice those given by respondents who indicated less likelihood of visiting. For all three regions, these means are statistically significantly different. A similar pattern is seen when the sample is split according to previous visitation, although the difference in the means is greatest when the sample is split according the future visitation expectations.

Medians of Willingness to Pay Responses

Table 4.5-14 shows the medians of the adjusted WTP responses for each park region by state. Fifty percent of the sample gave responses this high or higher, and fifty percent gave responses this low or lower. The Version 4 medians are reported separately. The responses for the southwest region are combined from Versions 3, 5, and 6. The home-state effect is reflected in the medians as it was in the means. In general, the medians are about one-third to one-half the magnitude of the means, due to the effect of the skewed distribution of responses. This pattern is typical of all WTP estimates because they are necessarily truncated at zero and there are typically a few relatively high responses.

Simple Correlations with Willingness to Pay Responses

One of the questions that this study was designed to address is whether WTP responses for protection of visibility at national parks can be substantiated by responses to non-quantitative questions about the general importance of the visibility and natural resource protection for national parks. Even though questions will remain about the accuracy of the dollar responses to the WTP questions, it increases our confidence that the response are meaningful if they are at least correlated with responses to other questions concerning the importance of protecting the visibility at national parks.

Simple correlations were estimated between the responses to Questions 5 through 11 and the response to the first WTP question (Question 12) for all versions of the questionnaire. Table 4.5-15 lists the questions the responses to which were significantly positively correlated with the WTP response. The group showing the strongest correlations ($p < .001$) had correlation coefficients typically in the range of .10 to .30. The second group ($.001 < p < .01$) had correlation coefficients typically in the range of .05 to .15.

These correlations are consistent with expectations. For Question 5 concerning reasons for visiting national parks, the items most closely related to WTP for visibility are those concerning enjoyment of the natural environment. The importance ratings for all of the items listed for Question 7, reasons for protecting national parks even if you yourself never visit, are related to the WTP response. The Question 8 response concerning the priority rating for visibility was significantly related to the WTP given for visibility.

Table 4.5-13
WTP1 Means by Likelihood of Future Visit

	Probably or Definitely Will Visit (Q-4 = 4 or 5)	Less Likely to Visit (Q-4 = 1, 2, or 3)
California Parks (version 1)	$66.4 (9.1) n=191	$27.9 (2.9) n=240
Southwest Parks (version 3, 5, 6)	$58.3 (6.1) n=357	$31.2 (3.6) n=360
Southeast Parks (version 2)	$67.1 (12.5) n=126	$32.6 (3.9) n=298

Standard error of mean in parentheses.

Table 4.5-14
Medians of Adjusted Willingness to Pay
by Region of Focus and by State of Residence

California Parks (Version 1)

State of Residence	WTP1	WTP2	WTP3
Arizona	$12.50	$20.00	$15.00
Virginia	$10.00	$12.50	$12.50
California	$25.00	$35.00	$30.00
New York	$15.00	$20.00	$17.50
Missouri	$10.00	$15.00	$15.00
All States	$17.50	$22.50	$20.00

Southwest Parks (Versions 3, 5, and 6)

State of Residence	WTP1	WTP2	WTP3
Arizona	$24.00	$30.00	$25.00
Virginia	$10.00	$10.00	$10.00
California	$14.00	$20.00	$15.00
New York	$10.00	$15.00	$10.00
Missouri	$10.00	$12.00	$10.00
All States	$15.00	$20.00	$15.00

Table 4.5-14 (continued)
Medians of Adjusted Willingness to Pay
by Region of Focus and by State of Residence

Southeast Parks (Version 2)

State of Residence	WTP1	WTP2	WTP3
Arizona	$10.00	$10.50	$7.50
Virginia	$20.00	$25.00	$20.00
California	$10.00	$15.00	$15.00
New York	$15.00	$30.00	$25.00
Missouri	$10.00	$10.00	$12.00
All States	$12.50	$17.50	$15.00

Version 4

State of Residence	WTP1 California Parks	WTP2 Southwest Parks	WTP3 Southeast Parks
Arizona	$5.00	$10.00	$4.80
California	$25.00	$25.00	$20.00
New York	$20.00	$20.00	$20.00

Table 4.5-15
Significant Positive Correlations with
Willingness to Pay for Visibility Protection

$p < .001$

Question 5: Importance of following reasons to visit national parks:

- To experience unique natural places
- To enjoy the vastness of nature

Question 7: Importance of following reasons for protecting national parks even if you never visit:

- So other members of my family can visit
- So other people outside of my family can visit
- So there will be areas in natural condition even if no one visits
- Scientific research opportunities
- Preserve national heritage
- So there is not development every where

Question 8: Priority of preventing following potential effects on national parks:

- Air pollution decreasing ability to see scenic vistas

Question 10: Willingness to pay higher prices and taxes to support visibility protection in selected region

Question 11: Importance of improving or preventing degradation in visibility at parks in selected region

Table 4.5-15 (continued)
Significant Positive Correlations with
Willingness to Pay for Visibility Protection

.001 < p < .01

Question 5: Importance of following reasons to visit national parks:

- Outdoor recreation opportunities
- Change from usual surroundings

Question 8: Priority of preventing the following potential effects on national parks:

- Air pollution injury to vegetation
- Water pollution - aesthetic effects only
- Hearing or seeing mining/industrial activities outside boundaries

Question 9: Effect of an improvement in visibility on enjoyment of a visit to selected park

Questions 10 and 11 were even more closely tied to the WTP questions and concerned willingness to pay for visibility protection at parks in the selected regions in general (rather than a specific dollar amount for a specific level of protection) and the importance of improving or preventing degradation in visibility at parks in the selected region. The response to Question 9 concerning the perceived effect of an improvement in visibility on a potential visit to the selected park was also significantly correlated with the WTP response.

These types of analyses provide an overall consistency check on the data quality and reflect that, on the whole, the WTP responses are meaningfully related to underlying attitudes and behaviors.

4.5.3 Variations in WTP for Different Regions

The means of the adjusted WTP responses for the different regions were reported in Tables 4.5-10 and 4.5-12. Comparing overall means for the basic questionnaire Versions 1, 2, and 3 suggests that the WTP responses for the different regions are nearly identical. Regression analysis was used to further examine this question.

Exploratory regression results for the adjusted WTP responses from Versions 1, 2, and 3 are shown in Tables 4.5-16 and 4.5-17. The purpose of these regressions is to determine if there is a statistically significant difference in the WTP responses for the different regions after controlling for other factors that might influence the responses, such as income or park visitation. The levels of visual range and the features of the parks, as illustrated in the selected photographs, were different for each region, and it was expected that this might cause differences in the WTP responses. The WTP1 equations are for obtaining improvements in average conditions from the current 50th percentile to the current 75th percentile. The WTP2 equation is for obtaining an improvement in average conditions from the current 50th percentile to the current 90th percentile. The WTP3 equation is for preventing degradation in average conditions from the current 50th percentile to the current 10th percentile. Dummy variables (0,1) were included if the focus of the WTP questions was the Southeast parks or the California parks.

The results shown in Table 4.5-16 confirm what was seen in the WTP means, that there is no statistically significant difference in responses for the different park regions. The coefficients for the Southeast and California variables are small and not statistically significant in any of the equations. Explanatory variables that are statistically significant and fairly stable across the different WTP questions are household income and the respondent residing in the state in which the illustrated park is located. The probability of a future visit to a park in the region is also statistically significant as shown in Equation 1 for the first WTP question. Residence in the park state and probability of future visitation are highly correlated and were not therefore included in the same equation.

Table 4.5-16
Regression Results for Adjusted WTP,
Versions 1, 2, and 3

Variable	WTP1 Equation 1 Coefficient (t-statistic)	WTP1 Equation 2 Coefficient (t-statistic)	WTP2 Equation Coefficient (t-statistic)	WTP3 Equation Coefficient (t-statistic)
Intercept	1.85 (0.12)	15.54 (1.19)	26.89 (1.58)	26.93 * (1.69)
Income	0.73 ** (5.81)	0.77 ** (6.19)	1.01 ** (6.28)	0.82 ** (5.42)
Age	-0.07 (-0.33)	-0.14 (-0.69)	-0.31 (-1.16)	-0.32 (-1.24)
Male	-6.95 (-1.06)	-6.24 (-0.95)	-7.71 (-0.90)	-5.27 (-0.65)
F-Visit	5.67 ** (2.17)			
P-State		16.98 ** (2.65)	20.40 ** (2.44)	15.08 * (1.92)
Southeast	-0.85 (-0.11)	-2.36 (-0.31)	1.84 (0.18)	3.64 (0.39)
California	3.06 (0.40)	2.95 (0.39)	-1.00 (-0.10)	5.07 (0.54)
R^2	.05	.06	.06	.04
n	831	831	836	828
F	7.69 **	8.10 **	8.39 **	6.14 **

* $p < .10$
** $p < .05$

Table 4.5-16 (continued)
Regression Results for Adjusted WTP1,
Versions 1, 2, and 3

Dependent variable definitions:

WTP1 - Annual household WTP to obtain an improvement in average conditions from the current 50th percentile to the current 75th percentile.

WTP2 - Annual household WTP to obtain an improvement in average conditions from the current 50th percentile to the current 90th percentile.

WTP3 - Annual household WTP to prevent a degradation in average conditions from the current 50th percentile to the current 10th percentile.

Independent variable definitions:

Income - Annual 1987 household income before taxes in thousands (mid-point of the range).

Age - In years.

Male - Equals 1 if respondent is male.

F-Visit - Probability of a future visit to a park in the region of focus in the next five years. A five-point scale: 1 = definitely will not visit and 5 = definitely will visit.

P-State - Park illustrated is in the state in which respondent resides.

Southeast - Equals 1 if the region of focus is the Southeast.

California - Equals 1 if the region of focus is California.

Table 4.5-17
Regression Coefficients for Different Regions for WTP1

	California		Southwest		Southeast	
	Equation 1	Equation 2	Equation 1	Equation 2	Equation 1	Equation 2
Income	0.82 **	0.64 **	1.04 **	0.88 **	0.72 **	0.65 **
	(4.56)	(3.12)	(6.99)	(5.40)	(3.60)	(3.07)
Age	0.14	-0.06	-0.11	-0.23	0.11	-0.03
	(0.69)	(-0.27)	(-0.63)	(-1.21)	(0.47)	(-0.13)
Male	-8.00	-9.09	-2.06	-5.48	-6.42	-8.82
	(-0.71)	(-0.80)	(-0.24)	(-0.63)	(-0.57)	(-0.78)
F-Visit		8.95 **		6.87 **		6.64 *
		(2.48)		(2.56)		(1.81)
P-State	25.40 **		19.65 **		22.77 **	
	(2.30)		(2.41)		(2.01)	
R^2	.27	.27	.24	.24	.21	.21
F	24.82 *	25.10 *	41.51 *	41.74 *	18.20 *	17.96 *
n	274	274	534	534	275	275

* $p < .10$
** $p < .05$

Other explanatory variables that were included in earlier estimations were education and whether there were children in the household. Education was found to be highly correlated with income and therefore dropped from subsequent estimations, as income showed a stronger explanatory power. Having children in the household was not related to the WTP responses.

Table 4.5-17 shows the estimated regression coefficients for each region for WTP1 (the change from 50th to 75th percentile). The purpose of these regressions is to assess the stability of the coefficients for the socio-economic variables for the different regions. The results in Table 4.5-17 show that the statistically significant coefficients are reasonably stable across the regions. These are income. residence in the region (P-STATE), and the probability of visiting a park in the region in the next five years (F-VISIT).

4.5.4 Effects of Questionnaire Design Variations

Three different versions of the questionnaire were developed to test for effects of certain variations in the instrument design. All three of these versions focused on the Southwest and provide comparison to the baseline Version 3 for the Southwest, and to one another. Version 5 presented a different amount of information in the introduction to the WTP questions. Version 6 excluded photographs and information about the other two regions. Version 4 asked a WTP question for each of the regions.

Mean and median WTP responses can be compared using the information in Tables 4.5-10, 4.5-12 and 4.5-14. However, pairwise (across two survey versions) mean tests are relatively weak due to changing sample characteristics across the small samples for survey Versions 4, 5 and 6. Therefore, to be able to control for visitation, income and other important respondent characteristics across the versions and to use the information in all four versions (Versions 3 through 6), regression analysis was undertaken with dummy variables for survey Versions 4, 5 and 6. Results are reported in Table 4.5-18. For Version 4, only responses to the Southwest WTP question are included in the results reported in Table 4.5-18.

Effect of Information

Version 5 was the same as Version 3 except that the introduction to Question 12 (the first WTP question) was shortened from two paragraphs to one paragraph. Information was deleted stressing that the WTP questions refer to visibility only and specifying additional assumptions about when payments begin and who would make payments. This change was expected to cause WTP responses to increase or to change only minimally (see discussion in Section 3.1.3).

While the mean WTP responses for Arizona residents who received Version 5 are higher than for Arizona residents who received Version 3, the opposite is true for residents of Virginia and New York, and only a few of the differences in means are statistically different at very low confidence levels. The regression analysis confirms that the change in information had no apparent consistent effect on the results.

Table 4.5-18
Regression Results Highlighting Effects of Different Versions for Southwest Parks

Variable	WTP1 Equation 1 Coefficient (t-statistic)	WTP1 Equation 2 Coefficient (t-statistic)	WTP1 Equation 3 Coefficient (t-statistic)
Intercept	-19.68 (-1.00)	11.83 (0.76)	13.90 (0.91)
Income	0.90 ** (5.82)	1.00 ** (6.35)	1.00 ** (6.31)
Age	-0.09 (-0.36)	-0.25 (-1.02)	-0.26 (-1.05)
Male	-8.27 (- 1.03)	-6.02 (-0.75)	-6.16 (-0.77)
F-Visit	10.33 ** (3.12)		
P-State		14.66 ** (1.86)	16.28 ** (1.95)
Vers4 * P-State			-9.05 (-0.57)
Version 4	2.97 (0.27)	3.50 (0.32)	
Version 5	6.84 (0.65)	6.76 (0.64)	4.70 (0.45)
Version 6	0.04 (0.003)	2.65 (0.26)	0.63 (0.06)
Vers6 * CARes			
R^2	.07	.06	.06
F	7.22	6.27	6.31
n	645	645	645

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Table 4.5-18 (cont.)
Regression Results Highlighting Effects of Different Versions for Southwest Parks

Variable	WTP1 Equation 1 Coefficient (t-statistic)	WTP2 Equation 2 Coefficient (t-statistic)	WTP3 Equation 3 Coefficient (t-statistic)
Intercept	11.30 (0.72)	24.96 (1.31)	25.65 (1.46)
Income	0.99 ** (6.32)	1.21 ** (6.76)	0.93 ** (5.16)
Age	-0.25 (- 1.02)	-0.[illegible]3 * (-1.35)	-0.43 (-1.50)
Male	-6.35 (-0.79)	-0.75 (-0.08)	-3.95 (-0.43)
F-Visit			
P-State	16.69 ** (2.06)	22.83 ** (2.35)	19.42 ** (2.16)
Vers4 * P-State			
Version 4	3.43 (0.32)		
Version 5	6.81 (0.64)	-0.39 (-0.03)	-0.31 (-0.03)
Version 6	-3.75 (-0.31)	8.94 (0.76)	5.27 (0.49)
Vers 6 * CARes	18.66 (1.02)		
R^2	.07	.08	.06
F	5.62	8.56	5.75
n	645	573	568

WTP values arc for Southwestern parks. Questionnaire Versions 3, 4 (WTP2), 5, and 6 arc included in the WTP1 equations. The WTP2 and WTP3 equations include Versions 3, 5. and 6. See variable definitions in Table 4.5-13.
* p < .10, ** p < .05

Responses to Question 16, concerning perceived accuracy of the WTP responses, and responses to Question 17, concerning allocation of the WTP to visibility only, were very similar for Versions 3 (baseline) and 5. Response rates for the two versions were also very similar (Table 4.1-1). In general, it is expected that the shorter the questionnaire, the higher the response rate. However, this one paragraph in this 12-page questionnaire apparently made little difference.

These results suggest that the additional information included in Version 3 had minimal, if any, effect on the WTP responses. Fischhoff and Furby (1988) have addressed the issue of balancing the need for a very complete scenario development versus information overload. These results suggest that omitting some features, which in this case are more formal than substantive using the Fishhoff and Furby nomenclature, may have minimal impact, or as a group may have offsetting impact. This does not mean that WTP questions do not need to be carefully introduced, but it suggests that the introduction included in Version 5 was sufficient (or at least that the additional explanation included in Version 3 did not alter things in any appreciable way).

Effect of Limited Regional Focus

Version 6 presented information on the southwestern region only. The same national map was included in the insert, but the only photographs included were those for the Grand Canyon. In addition, Questions 3, 4, 9, and 10 referred to parks in the southwestern region only. The WTP questions themselves were exactly the same, but it was expected that the responses might be higher for Version 6 as there was less emphasis placed on visibility in regions other than the Southwest in the earlier questions.

The differences in the means for Versions 3 and 6 are generally statistically insignificant, although for California residents the Version 6 results are substantially larger. However, the means decrease for New York residents and are virtually unchanged for Arizona residents. The California residents may have been affected differently than the New York residents because California was one of the three regions included in the set of photographs and some of the preliminary questions in Version 3 of the questionnaire. Seeing some information about their own region may have had more of a downward influence on their WTP responses for another region than for the New York residents who lived in none of the three focus regions. It is also possible that since California is a neighboring state to the region of focus in Version 6, the California respondents may have responded more similarly to Arizona residents than they did when information about California parks was also included. For these reasons, a dummy variable for both Version 6 and California residents (Ver6*CARes) was included in the analysis reported in Table 4.5-18.

The regression results shown in Table 4.5-18 confirm that the WTP responses to Version 6 are not statistically significantly different. The coefficient for the Version 6 dummy variable is not statistically significant in any of the regressions for the three WTP responses. Equation 4 for WTP1 finds that the coefficient for the dummy variable for both Version 6 and California residence is positive and similar in magnitude to the home-state coefficient. The coefficient is not, however, statistically significant.

It appears that showing photographs from only one region does not necessarily cause a significant upward bias in the WTP responses; or at least such a bias is not changed by including photographs and preliminary questions for other regions. The exception may be if photographs from the respondent's own region are included before asking questions about another region. The results for the California respondents are statistically inconclusive on this question, but suggest that it should be further explored in future research. The results could have important implications for CVM design and expense. They suggest that it may not be necessary to spend substantial effort (including researcher resources and survey pages) to address at length many weakly related resource changes.

Effect of Multiple Region Bidding

Version 4 respondents were asked what they would be willing to pay to improve avera visibility individually in each of the three regions from the 50th percentile level to the 75th percentile level. The WTP introduction indicated "... would be worth to your household if you had to pay for the improvements in all three regions each year." It was expected that the per region WTP responses would be lower than for the versions that asked for WTP for one region only (See Section 3.1.3). Of particular interest is whether residents from the same state as the park in a WTP question respond differently from other respondents. To examine this, an additional dummy variable (Vers4 * P-state) is equal to one when the respondent is answering Version 4 and lives in the same state as the park pictured for the focus region in question.

Regression results shown in Table 4.5-18 illustrate the lack of a statistically significant effect of Version 4 on the WTP responses for the southwestern region. The Version 4 dummy variable appears only in the WTP1 regressions because only the change from the 50th percentile to the 75 percentile was considered in Version 4. The Version 4 coefficient was not statistically significant in either of the first two WTP1 regressions. The estimated coefficient for the V4*P-state variable suggests that the responses to Version 4 showed a negative impact on the “home state” effect, but the difference is not statistically significant. Similar results (not shown) were obtained with the WTP responses for the California parks.

This suggests that it may not be incorrect to add together WTP responses given for one region at a time, if more than one region were to be affected by a particular pollution control option being considered. However, these results are inconsistent with the findings of some previous contingent valuation studies (discussed in Chapter 2). It is possible that these results are an artifact of having broken the WTP question into three parts, asking about each of the regions separately. It may be the case that had one WTP been asked to protect all three regions at once, that the value would be less than the sum of the three individual WTPs, even though the introduction indicated all three regions were to be paid each year. For example, in recent research, Irwin et al. (1989) and Boyce et al. (1990) found that the sum of WTP values for individual components of a resource change, when asked separately, exceeded a single WTP for the total change, which the authors refer to as a problem of additivity. The conclusion Irwin et al. draw is that it may be more appropriate to value the entire policy package in one WTP and then disaggregate to component values rather than value individual resource components and aggregate.

4.5.5 Estimated WTP Functions for Changes in Visibility

If WTP estimates are to be used to analyze policy alternatives that might cause changes in visibility other than the exact changes presented in the WTP questions, it is necessary to know how WTP can be expected to change as a function of the change in visibility. This section presents the results of regression analysis on the WTP responses using several different measures of the changes in visibility reflected in the WTP questions. It is not certain what measure best reflects respondents' perceptions of the visibility conditions presented in the photographs. The four quantitative measures used are:

Change in Percentile (DPTILE): The difference between the percentile score of current visibility conditions for each photo. For example, C to A = 90 - 50 = 40, C to B = 75 - 50 = 25, etc. The change in percentile is the same for each of the regions for WTP1, then again for WTP2 and for WTP3 (except in Version 4). These measures are examined because they were the only quantitative information presented in the survey instrument and photo handout.

Change in Average Visual Range (DVR): The difference between the current average visual range associated with each of the percentile conditions illustrated in the photographs. These visual range estimates are not derived directly from the photographs, but are based on the historic record of visibility conditions at the sites at which the photos were taken.

Log of the Ratio of Visual Range (LNVR): The natural logarithm of the ratio of the hypothetical new average visual range to the current average visual range. Using this measure in the WTP function implies that WTP is constant for a given percentage change in visual range.

Change in Average Atmospheric Transmission (DATRAN): These estimates are based on measurements taken directly from the photographs in the insert and reflect an average measure of contrast across the whole scene. The atmospheric transmission is higher when the visibility is better. Previous perceptions studies have found a correlation between observer ratings of perceived visual air quality and atmospheric transmission (See Section 3.2).

The values of these four measures for each of the scenes shown in the questionnaire insert were given in Table 3.2-1. The simple correlation coefficients among these measures are quite high (from .60 to .94), suggesting that all four measures are reflecting similar information about the differences shown in the photographs. However, as can be seen in Table 3.2-1, there are some noticeable differences between the regions in how these measures change across the set of four photographs. The percentiles are the same for all

three regions. The changes in visual range (and the levels of visual range) are greatest for the Southwest and smallest for the Southeast. The spread in the atmospheric transmission estimates is greatest for the Southeast photographs and smallest for the Southwest photographs.

These four different measures of the change in visibility conditions shown in the photographs are used to estimate WTP functions in this section of the analysis. The WTP function attempts to explain variations in the WTP responses by considering the change in visibility conditions presented in the WTP questions, various characteristics of the scenario, and various socio-economic characteristics of the respondent. The WTP function has a direct relationship with a utility function, therefore the form of the WTP function implies a related form of the utility function. The WTP function is derived from the utility function in that it is a representation of the change in income that would keep utility constant in the event of the change in visibility conditions. A general form of the utility function with respect to visibility might be:

$$U = a * f(V) + b * g(X) * f(V) + d * Y \qquad (4\text{-}1)$$

Where:

U	=	utility
f(V)	=	some function of visibility conditions V
g(X)	=	some function of the individual's socio-economic characteristics X that influence the effect of V on the individual's utility
Y	=	income
a,b,d	=	coefficients

The WTP function for a change in visibility conditions from V_1 to V_2 derived from this utility function is:

$$WTP = a_1 * [f(V_2) - f(V_1)] + b_1 * g(X) * [f(V_2) - f(V_2)] \qquad (4\text{-}2)$$

Where a_1 and b_1 are new coefficients.

Tables 4.5-19 through 4.5-22 show estimation results for several different specifications of a WTP function using the four measures of the change in visibility conditions defined above. For three of these measures (DPTILE, DVR, and DATRAN), f(V) is a simple linear function. For LNVR, f(V) is the natural log of visual range. All of the adjusted WTP responses for each region and each different change in visibility are included in these four tables. For the most part, this means three WTP estimates per respondent. The means and standard deviations for all of the regression variables in these tables are given in Table 4.5-23.

Table 4.5-19
WTP Regression Results with Change in Percentile

	Equation (1) Full Sample	Equation (2) Full Sample	Equation (3) Excludes WTP All Equal > $0	Equation (4) Full Sample	Equation (5) Full Sample	Equation (6) Full Sample
DPTILE	1.42 ** (31.24)	1.25 ** (22.09)	1.73 ** (27.50)	0.07 (0.27)	1.41 ** (21.29)	0.0016 (0.006)
DP * CA					0.05 (0.45)	0.04 (0.35)
DP * SE					0.02 (0.15)	0.10 (0.78)
DP * AGE				-0.007 ** (-2.01)		-0.007 * (-1.93)
DP * MALE				-0.24 ** (-2.21)		-0.24 ** (-2.21)
DP * INC				.024 ** (11.50)		0.024 ** (11.42)
DP * FVIS				0.27 ** (6.16)		0.27 ** (6.20)
DP * PSTATE		0.48 ** (5.09)				
R^2	.18	.19	.24	.23	.18	.23
F	975.90	503.68	755.97	215.45	325.23	153.92
n	4340	4340	2441	3573	4340	3573

t-statistics in parentheses.
* $p < .10$
** $p < .05$

Table 4.5-20
WTP Regression Results with
Change in Visual Range (km)

	Equation (1) Full Sample	Equation (2) Full Sample	Equation (3) Excludes WTP All Equal > $0	Equation (4) Full Sample	Equation (5) Full Sample	Equation (6) Full Sample
DVR	0.88 ** (28.87)	0.79 ** (20.54)	1.08 ** (25.45)	-0.02 (-0.10)	0.75 ** (20.45)	-0.30 * (-1.74)
DVR * CA					0.34 ** (4.38)	0.35 ** (4.08)
DVR * SE					0.66 ** (6.55)	0.79 ** (6.70)
DVR * AGE				-0.004* (-1.94)		-0.003 (-1.45)
DVR * MALE				-0.15 ** (-2.06)		-0.15 ** (-1.99)
DVR * INC				0.016 ** (11.36)		0.015 ** (11.03)
DVR * FVIS				0.17 ** (5.68)		0.20 ** (6.68)
DVR * PSTATE		0.26 ** (4.15)				
R^2	.16	.16	.21	.21	.17	.22
F	833.31	426.81	647.80	186.78	299.03	142.99
n	4340	4340	2441	3573	4340	3573

t-statistics in parentheses.
* $p < .10$
** $p < .05$

Table 4.5-21
WTP Regression Results with
Log of Ratio of Visual Range (km)

	Equation (1) Full Sample	Equation (2) Full Sample	Equation (3) Excludes WTP All Equal > $0	Equation (4) Full Sample	Equation (5) Full Sample	Equation (6) Full Sample
LNVR	77.73 ** (28.16)	66.69 ** (19.69)	95.57 ** (24.97)	4.09 (0.28)	139.73 ** (21.16)	88.45 ** (5.28)
LNV * CA					-43.28 ** (-4.82)	-47.45 ** (-4.62)
LNV * SE					-84.49 ** (-11.36)	-87.92 ** (-10.19)
LNV * AGE				-0.35 (-1.61)		-0.55 ** (-2.57)
LNV * MALE				-14.20 ** (-2.13)		-14.17 ** (-2.16)
LNV * INC				1.21 ** (9.49)		1.28 ** (10.18)
LNV * FVIS				16.29 ** (6.26)		11.79 ** (4.54)
LNV * PSTATE		32.44 ** (5.59)				
R^2	.15	.16	.20	.19	.18	.22
F	792.81	414.77	623.68	172.13	319.68	142.48
n	4340	4340	2441	3573	4340	3573

t-statistics in parentheses.

* $p < .10$
** $p < .05$

Table 4.5-22
WTP Regression Results with Change in Average Atmospheric Transmission

	Equation (1) Full Sample	Equation (2) Full Sample	Equation (3) Excludes WTP All Equal > $0	Equation (4) Full Sample	Equation (5) Full Sample	Equation (6) Full Sample
DATRAN	220.49 ** (23.67)	190.12 ** (16.53)	272.27 ** (20.84)	17.25 (0.34)	894.84 ** (20.94)	782.55 ** (11.18)
DAT * CA					-660.38 ** (-14.63)	-708.25 ** (-13.69)
DAT * SE					-736.64 ** (-16.60)	-780.58 ** (- 15.28)
DAT * AGE				-0.78 (-1.06)		-1.30 * (-1.81)
DAT * MALE				-40.44 * (-1.78)		-40.11 * (-1.83)
DAT * INC				3.32 ** (7.72)		3.53 ** (8.50)
DAT * FVIS				42.32 ** (4.75)		31.06 ** (3.57)
DAT * PSTATE		87.58 ** (4.48)				
R^2	.11	.12	.15	.14	.17	.19
F	560.12	29135	434.45	117.91	290.92	123.07
n	4340	4340	2441	3573	4340	3573

t-statistics in parentheses.

* $p < .10$
** $p < .05$

Table 4.5-23
Means and Standard Deviations of Regression Variables

Variable	N	Mean	Standard Deviation	Minimum	Maximum
WTP	4340	19.14	114.27	-1000.00	1000.00
LNVR	4896	0.18	0.56	-0.92	1.10
DVR	4896	26.38	45.26	-45.00	95.00
DATRAN	4896	0.06	0.17	-0.20	0.44
DPTILE	4896	9.90	33.41	-40.00	40.00
AGE	4698	47.00	15.83	18.00	94.00
MALE	4896	0.59	0.49	0.00	1.00
INC	4224	41.44	25.52	5.00	105.00
FVIS	4417	3.22	1.25	1.00	5.00
PSTATE	4896	0.34	0.48	0.00	1.00

The first equation in each of the four tables shows the results of the WTP responses regressed on the visibility measure alone. In each case the estimated coefficient is statistically significant at greater than the 99 percent confidence level. The R-squared statistics indicate that these measures alone explain between 11 and 18 percent of the variation in the WTP responses. The highest R-squared was obtained with the change in percentile measure, and the lowest was obtained with the weighted average atmospheric transmission measure.

The second equation in each of the four tables shows the results when a dummy variable (PSTATE) is added that equals one when the respondent is a resident of the state in which the illustrated park is located, multiplied by the visibility measure. In each case this "home-state" variable is statistically significant at greater than the 95 percent confidence level. When the home-state variable is added, the coefficients for the visibility measures alone (now representing the WTP of the out-of-state residents) are reduced, but remain statistically significant. The results of these second equations suggest WTP is 33 percent to 50 percent higher for home state residents.

The third equation in each of the four tables shows the results of regressing the WTP response on the visibility measure when respondents who gave the same non-zero WTP response for different changes in visibility are excluded. It was expected that this might increase the statistical significance and the magnitude of the estimated coefficient as compared to the estimated coefficients in the first equations. The question is to what degree the coefficients might be affected due to the inclusion of the all equal responses. In all cases, the statistical significance increased, as expected, and the coefficients increased by about 23 percent. It is not entirely clear whether deleting the all-equal non-zero responses might be more appropriate for evaluating a policy alternative involving a change in visibility. This depends on the reasons for the all-equal responses, which remain somewhat speculative without further research (See Section 4.5.1 above). To remain conservative, the all-equal responses have been retained throughout the remaining analysis.

The fourth equation in the four tables includes four socio-economic variables: (1) age of respondent (AGE), (2) sex of respondent (MALE), (3) 1987 annual household income in thousands (INC), and (4) probability of a visit to a park in the region in the next five years (FVIS). Following the form of the WTP function shown above, the socio-economic variables are multiplied by the visibility measure.[9] The results show a statistically significant positive relationship between WTP and both income and future park visit expectations. This is consistent with findings reported in previous sections of the analysis. The future park visitation probability and the home-state variable are significantly correlated (correlation coefficient is .44, $p < .001$) and show fairly similar explanatory power in

[9] Strictly speaking, income would not enter interactively with visibility under specification 4-1, although it might enter in this way under alternative specifications. It is modeled this way in the regression analysis for consistency with other socio-economic variables. Alternatively, it could be considered a proxy for other socio-economic variables, such as education, that would enter the specification in this manner.

separate regressions. The coefficient for MALE is negative and significant at least at the 90 percent confidence level in ail four tables. The coefficient for AGE is negative and significant in some cases. In all of these fourth equations, the coefficient for the visibility measure alone is no longer statistically significant. The effect of the visibility measure is now reflected in the coefficients for the other independent variables.

Dummy variables for the different focus regions have been added in the fifth equations in the four tables. This was done to see if there were significant differences in the WTP responses for the same change in each visibility measure in the different regions. This could occur for many different reasons. One may be that the differences in the scenery provoke different responses. Another may be that there are non-linearities in the values for changes in visibility that are not fully reflected in the visibility measures used in these estimations. The results show significant differences across the regions for some of the visibility measures. If the coefficients in the fifth equations are labeled in order as A, B, and C, they can be interpreted as follows:

WTP for Southwest parks = A * change in visibility

WTP for California parks = (A + B) * change in visibility

WTP for Southeast parks = (A + C) * change in visibility

The results shown in Table 4.5-19 indicate that the coefficient for DPTILE is essentially the same in the three regions. The DVR coefficient, shown in Table 4.5-20, is statistically significantly different for the each of the regions, being lowest for the Southwest and highest for the Southeast. The coefficients for LNVR and DATRAN, shown in Tables 4.5-21 and 4.5-22, are also statistically significantly different for all three regions. For both of these measures the coefficients are smallest for the Southeast and largest for the Southwest. The results for Equations 4 through 6 in Tables 4.5-19 through 4.5-22 show that the coefficients for the regional visibility shift variables (i.e., DP*CA) are robust to the inclusion or exclusion of the socio-economic variables, and vise versa.

The choice of visibility measure in Tables 4.5-19 through 4.5-22 has little impact on the overall explanatory power of the variance in the WTP responses, as based upon the F and R^2 statistics, although the percentile and ln(V2/V1) measures are slightly preferred in the selected functional form. Other results concerning the relative merit of the alternative visibility measures might be found using alternative functional forms.

The consistent sign and statistical significance of the percentile visibility measure for each of the three study regions is of some interest as this measure has not previously been used in visibility value or visual air quality rating studies. One reason for this finding may be that the percentile of current visibility conditions was the only visibility measure tied to the photographs explicitly presented to the respondents. Respondents may have anchored upon this information as a basis for their WTP response. Similar WTP responses across regions

might occur if respondents generally feel that visibility protection is equally important for national parks in each region, and use the percentile figures to determine the range of possible improvements to be obtained, or degradations to be prevented. In essence, respondents may be anchoring upon the status quo conditions at each site (Samuelson and Zeckhauser 1986) and bidding for modest and large changes relative to the maximum obtainable changes. The results are also consistent with the hypothesis that the visibility changes at parks in each region are of comparable value because the differences in visibility condition changes across the regions are offset by differences in the scenic quality impacts due to the visibility impairment.

4.5.6 Allocations of WTP to Specific Parks and Motives

Two questions that followed the WTP questions asked respondents to estimate the percentage of their WTP responses that they would want to allocate in various ways. Question 18 asked them what percentage they would want to go to the specific park shown in the photograph. Question 19 asked them what percentage of their WTP responses they would attribute to various specified motives.

Values for Specific Parks

Table 4.5-24 shows the average percentages given for each of the specific parks. The results are given by home-state residents and residents of states outside the region. Overall, the average percentage given for the illustrated park ranged from 41 percent to 45 percent. Figure 4.5-3 shows the frequency of the responses to Question 18 for all respondents who gave at least one non-zero WTP response. All the regions are combined in this figure, but Version 4 is excluded because this question was not asked. The pattern was very similar for each of the regions. For each region, the share to the park included in the photographs exceeds 1/n where n is the number of parks shown on the map for each region. This may be because the pictured parks are more prominent than some of the other parks in the same region.

One factor that appears to affect the responses to Question 18 is whether the respondent lives in the state in which the specific park is located. These home-state residents have a significantly higher average percentage for that specific park (roughly 50 percent versus about 40 percent for residents of other states). Home-state residence is correlated with previous and future visitation to the parks in the region, including the specific park of interest. As each of the illustrated parks is among the most frequently visited in each of the states, it is likely that the home-state effect is related to familiarity with the park due to previous visitation and to higher expectations regarding future visits to that park.

Question 18 allows some comparison to the results of the Southwest Parklands study (Schulze et al. 1981), in which respondents were asked to give WTP for the Grand Canyon and then to give WTP for the same change in visibility throughout the remainder of the

Table 4.5-24
Average Percentage of Regional WTP
for the Individual Park

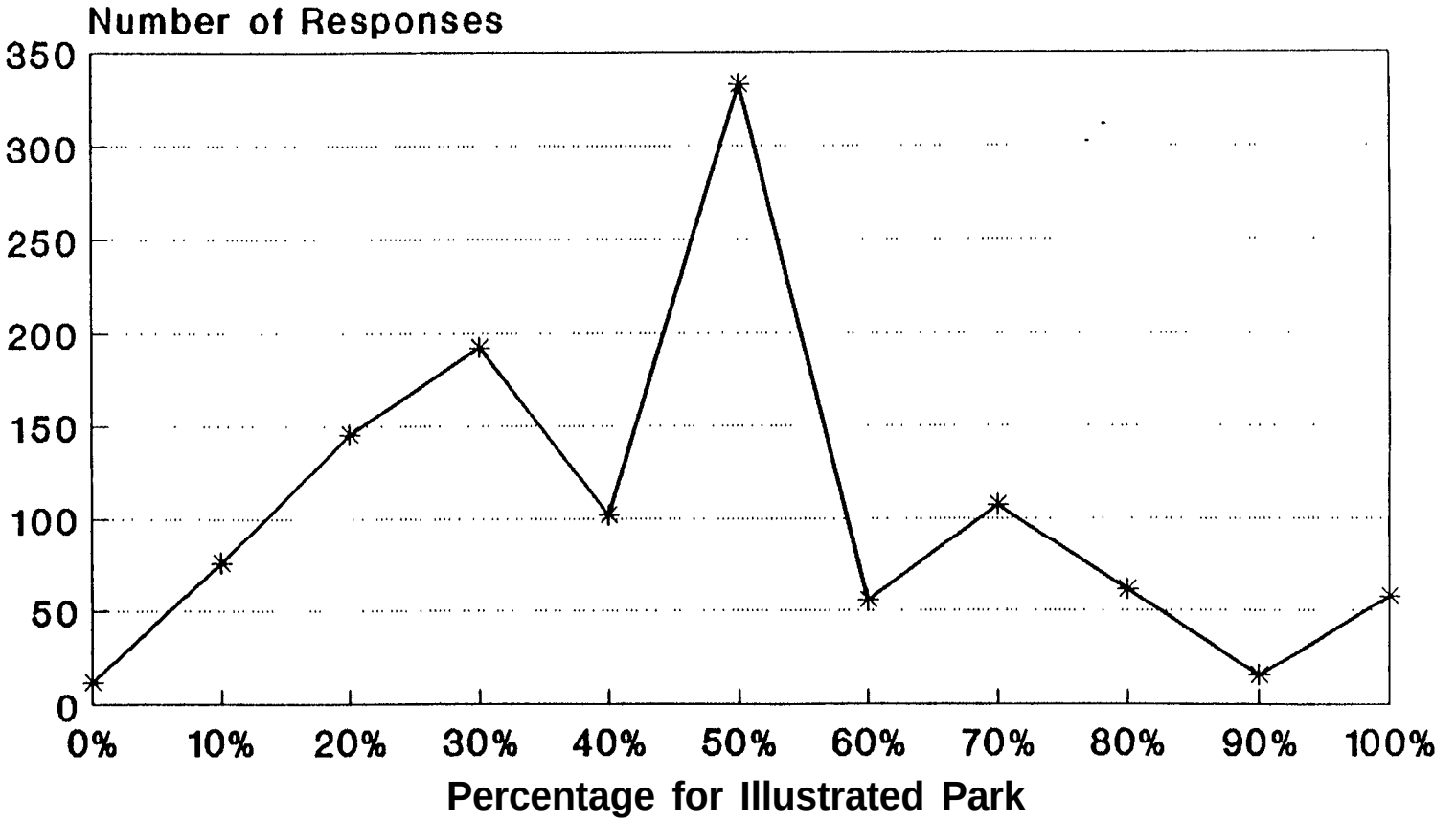
	Yosemite (Version 1)	Grand Canyon (Versions 3, 5, 6)	Shenandoah (Version 2)
Home-State Residents	46%	52%	54%
Residents of Other States	38%	41%	38%
All Respondents	41%	45%	44%

region. It was expected that the percentage of total WTP for the region allocated to the Grand Canyon might be higher in the Southwest Parklands study because of the order in which the questions were asked. The results are consistent with this expectation, although the difference is not large. The percentage of total WTP attributed to the Grand Canyon was about 54 percent in the Southwest Parklands study versus about 45 percent in the current study.

Table 4.5-25 shows the average WTP estimates for each of the potential changes in visibility for each of the specific parks. These were calculated by multiplying the percentage given by each respondent for the specific park by the WTP responses given for the region. If the respondent gave WTP responses, but did not answer Question 18, then the average percentage response for that park given by other residents of the same state was used. The results in Table 4.5-25 show an even greater spread in WTP means between home-state residents and residents of other states than was the case with the regional WTP estimates. This is the result of the combined effect of the higher regional WTP and higher percentages for the specific park. As with the percentages, the overall average WTP estimates for each park are similar.

Table 4.5-26 shows the regression coefficients for WTP1 (for the change from the 50th to the 75th percentile) for the different parks. The dependent variable is the product of the WTP1 response and the percentage given for the illustrated park. The income coefficients are reasonably stable, as they were for the regions (Table 4.5-17), but the visitation and home-state coefficients are somewhat less stable than for the regions. The magnitude of the visitation coefficient (F-VISIT) is fairly consistent, but the statistical significance is not. The reduced stability relative to that observed for the regions presumably reflects the fact that the original WI'P responses were tied to visibility conditions at all parks (on the map) in the region. Therefore, it is appropriate that regional park visitation is more highly correlated to the regional WTP responses.

Figure 4.5-3
Frequency of Question 18 Responses: Percentage for Illustrated Park



Note: Includes respondents to all versions, except version 4, who gave at least one non-zero WTP response.

Table 4.5-25
WTP Means for Individual Parks

Park	Home State Residents	Residents of Other States	All Respondents
Yosemite			
WTP1	$29.1 (5.2) n=113	$20.5 (3.0) n=218	$23.4 (2.7) n=331
WTP2	$35.1 (5.9) n=113	$24.4 (3.6) n=221	$28.0 (3.1) n=334
WTP3	$30.7 (5.3) n=113	$23.9 (3.6) n=217	$26.2 (3.0) n=330
Grand Canyon			
WTP1	$31.0 (5.2) n=241	$19.5 (2.6) n=395	$23.8 (2.6) n=636
WTP2	$40.8 (6.0) n=240	$23.8 (2.7) n=398	$30.2 (2.8) n=638
WTP3	$35.4 (5.8) n=241	$21.5 (2.6) n=391	$26.8 (2.7) n=632
Shenandoah			
WTP1	$39.6 (9.8) n=120	$14.6 (1.8) n=226	$23.3 (3.7) n=346
WTP2	$48.8 (11.1) n=124	$22.3 (3.4) n=226	$31.7 (4.5) n=350
WTP3	$42.4 (8.5) n=124	$19.3 (3.1) n=223	$27.6 (3.7) n=347

Note: Missing values for the percentages for specific parks were replaced by means for the corresponding questionnaire versions and states.

Standard error of mean in parentheses.

Table 4.5-26
Regression Coefficients for Different Parks for WTP1

	Yosemite		Grand Canyon		Shenandoah	
	Equation (1)	Equation (2)	Equation (1)	Equation (2)	Equation (1)	Equation (2)
Income	0.37 ** (3.69)	0.26 ** (2.31)	0.55 ** (5.18)	0.47 ** (4.05)	0.42 ** (2.71)	0.41 ** (2.49)
Age	0.13 (1.10)	0.002 (0.01)	-0.05 (0.45)	-0.07 (-0.51)	0.06 (0.33)	0.02 (0.11)
Male	-4.34 (-0.69)	-5.27 (-0.84)	-1.99 (-0.32)	-3.53 (-0.56)	-8.60 (-0.99)	-9.79 (-1.11)
F-Visit		4.85 ** (2.44)		3.33 * (1.73)		3.44 (1.21)
P-State	10.63 * (1.74)		15.38 ** (2.64)		20.27 ** (2.32)	
R^2	.22	.23	.16	.16	.14	.13
F	18.73	19.66	25.63	24.45	10.84	9.73
n	274	274	534	534	275	275

t-statistics in parentheses
* $p < .10$
** $p < .05$

Tables 4.5-27 and 4.5-28 show regression results for WTP for Yosemite National Park. Table 4.5-27 shows the results when the change in percentile (DPTILE) is used as the visibility measure. Table 4.5-28 shows the results when the log of the ratio of visual range (LNVR) is used. Tables 4.5-29 and 4.5-30 show the same regressions for Grand Canyon National Park, and Tables 4.5-31 and 4.5-32 show the same regressions for Shenandoah National Park.

As with the region-wide WTP responses reported in Table 4.5-19, the coefficients for the change in the visibility percentile (Equation 1 in Tables 4.5-27, 4.5-29, and 4.5-31) are very similar for the different parks. Equation 2 in Tables 4.5-27, 4.5-29, and 4.5-31 suggests that the home-state effect is more variable than the responses for out-of-state respondents. The home-state coefficient for Shenandoah is almost three times the home-state coefficient for Yosemite. The home-state coefficient for Grand Canyon lies between these two. This reflects more variability in the home-state coefficient than was seen for the regions. Adding the age, sex, and income variables in Equations 3 and 4 increases the explanatory power of the regressions somewhat, primarily due to the statistical significance of the income coefficient. The sign and magnitude of the coefficients for socio-economic variables are generally consistent in the regressions for each of the three regions. Age and sex were not significant except for Shenandoah, where male respondent gave significantly lower WTP. This is apparently related to the percentage for Shenandoah rather than to the WTP for the region because this difference was not seen in Table 4.5-17.

The coefficients for the log of the ratio of the second to the first level of visual range are different for the three parks, as they were for the regions. The highest is for Grand Canyon and the lowest is for Shenandoah. The explanatory power of this measure of visibility is very similar to that obtained with the change in percentile. The results for the other variables are also very similar.

Values for Specific Motives

In Question 19, all the respondents were asked to estimate what percentage of their WTP responses they would attribute to three specific motives. Respondents were given the opportunity to give another motive if the three listed were not sufficient to account for 100 percent of their WTP response. The three motives were intended to reflect (1) option price, (2) bequest value, and (3) existence value (See Section 3.1.4).

“Other” responses were given by 173 respondents (about 13 percent of those who answered the question). Review of the other motives listed found they all fell into two categories: (1) they were for things other than visibility at national parks, or (2) they could be interpreted as one of the three motives already listed. Therefore, no other motives were added to the original list of three for further analysis. Even when we accounted for the “other” responses, we found that 109 respondents (8 percent) gave percentages that did not sum to 99 or 100 percent. About two-thirds of these summed to less than 99 and about one-third summed to more than 100. In order to exclude the “other” responses and adjust for the summation problems, the responses given for the three motives were adjusted to sum to 100 percent. Each response was adjusted proportionately. This affected the mean percentage responses for each motive in the following way:

Table 4.5-27
WTP Regressions for Yosemite with Change in Visibility Percentile

	Equation (1)	Equation (2)	Equation (3)	Equation (4)
DPTILE	0.72 **	0.64 **	0.39 *	-0.17
	(15.23)	(10.99)	(1.88)	(-0.66)
DP * AGE			-0.001	0.001
			(-0.40)	(0.37)
DP * MALE			-0.08	-0.09
			(-0.70)	(-0.80)
DP * INC			0.009 **	0.008 **
			(4.32)	(3.60)
DP * FVIS				0.18 **
				(3.95)
DP * PSTATE		0.24 **	0.24 **	
		(2.41)	(2.17)	
R^2	.19	.19	.22	.23
F	231.88	119.41	46.08	48.85
n	995	995	821	821

t-statistics in parentheses
* $p < .10$
** $p < .05$

Table 4.5-28
WTP Regressions for Yosemite with
Log of Ratio of Visual Range (km)

	Equation (1)	Equation (2)	Equation (3)	Equation (4)
LNVR	47.33 **	42.11 **	26.35 *	-10.06
	(14.83)	(10.74)	(1.90)	(-0.58)
LNV * AGE			-0.10	0.08
			(-0.43)	(0.31)
LNV * MALE			-5.01	-5.74
			(-0.66)	(-0.76)
LNV * INC			0.58 **	0.49 **
			(4.17)	(3.47)
LNV * FVIS				11.75 **
				(3.80)
LNV * PSTATE		15.31 **	15.03 **	
		(2.28)	(2.00)	
R^2	.18	.19	.21	.22
F	219.99	113.05	43.60	46.23
n	995	995	821	821

t-statistics in parentheses
* $p < .10$
** $p < .05$

Table 4.5-29
WTP Regressions for Grand Canyon with Change in Visibility Percentile

	Equation (1)	Equation (2)	Equation (3)	Equation (4)
DPTILE	0.75 **	0.60 **	0.09	-0.36
	(17.17)	(10.88)	(0.46)	(-1.40)
DP * AGE			-0.003	-0.0004
			(-0.99)	(-0.11)
DP * MALE			-0.06	-0.11
			(-0.53)	(-1.02)
DP * INC			0.017 **	0.014 **
			(8.08)	(6.98)
DP * FVIS				0.19 **
				(4.26)
DP * PSTATE		0.40 **	0.52 **	
		(4.42)	(5.01)	
R^2	.13	.14	.18	.17
F	294.87	158.66	70.17	68.50
n	1906	1906	1598	1598

t-statistics in parentheses
* $p < .10$
** $p < .05$

Table 4.5-30
WTP Regressions for Grand Canyon with Log of Ratio of Visual Range (km)

	Equation (1)	Equation (2)	Equation (3)	Equation (4)
LNVR	74.45 ** (17.00)	59.43 ** (10.76)	8.34 (0.42)	-36.50 (-1.43)
LNV * AGE			-0.32 (-0.97)	-0.03 (-0.10)
LNV * MALE			-5.35 (-0.50)	-10.50 (-0.98)
LNV * INC			1.65 ** (8.04)	1.42 ** (6.94)
LNV * FVIS				18.77 ** (4.26)
LNV * PSTATE		39.77 ** (4.43)	51.25 ** (4.98)	
R^2	.13	.14	.18	.17
F	289.05	155.72	68.90	67.31
n	1906	1906	1598	1598

t-statistics in parentheses
* $p < .10$
** $p < .05$

Table 4.5-31
WTP Regressions for Shenandoah with Change in Visibility Percentile

	Equation (1)	Equation (2)	Equation (3)	Equation (4)
DPTILE	0.77 ** (12.00)	0.53 ** (6.72)	0.57 ** (1.98)	0.65 ** (1.90)
DP * AGE			-0.006 (-1.24)	-0.006 (-1.22)
DP * MALE			-0.33 ** (-2.12)	-0.35 ** (-2.22)
DP * INC			0.012 ** (4.18)	0.013 ** (4.35)
DP * FVIS				0.028 (0.46)
DP * PSTATE		0.68 ** (5.12)	0.50 ** (3.19)	
R^2	.12	.14	.15	.14
F	144.07	86.86	31.15	28.81
n	1043	1043	832	832

t-statistics in parentheses
* $p < .10$
** $p < .05$

Table 4.5-32
WTP Regressions for Shenandoah with Log of Ratio of Visual Range (km)

	Equation (1)	Equation (2)	Equation (3)	Equation (4)
LNVR	30.16 ** (12.06)	20.72 ** (6.74)	22.30 ** (2.00)	25.43 ** (1.92)
LNV * AGE			-0.25 (-1.25)	-0.25 (-1.23)
LNV * MALE			-13.32 ** (-2.19)	-13.94 ** (-2.28)
LNV * INC			0.49 ** (4.21)	0.51 ** (4.38)
LNV * FVIS				1.12 (0.48)
LNV * PSTATE		26.69 ** (5.17)	19.51 ** (3.23)	
R^2	.12	.14	.16	.15
F	145.50	87.90	31.61	29.20
n	1043	1043	832	832

t-statistics in parentheses
* $p < .10$
** $p < .05$

Motive	Unadjusted	Adjusted
Option Price	29%	31%
Bequest Value	34%	37%
Existence Value	30%	32%
Other	5%	0%

The relative magnitudes of the mean percentages did not change with this adjustment. They were all increased by a similar amount.

Table 4.5-33 shows the mean adjusted percentages for each region, for home state and other residents. The responses for the different regions appear very similar. Home-state residents gave higher percentages for option price, as might be expected, and lower percentages for bequest and existence values. The overall mean percentages for each motive are each close to one-third, although they are a bit higher for bequest than for the other two motives. Figure 4.5-4 illustrates, however, that the responses varied across the sample, with as many respondents giving a very low percentage for one of the motives as those who gave 33 percent for each of the three.

Table 4.5-34 shows how the WTP motives are correlated with prior ratings of reasons for visiting and protecting national parks (Questions 5 and 7 discussed in Section 4.4). This table indicates whether a statistically significant correlation exists between the respondent's rating of a particular reason and the percentage allocated to each motive. These correlations are essentially consistent with a priori expectations and, on the whole, support the credibility of the responses to Question 19. The existence value percentage is correlated with the importance placed on the natural environment and on the concept of preservation in general. The option price percentage is correlated with the importance the respondent placed on things related more to use, such as outdoor recreation activities, doing things with others, and having a change from usual surroundings. The percentage for option price is also significantly correlated with the following factors:

- the number of children in the household
- previous visitation to national parks in the region
- probable future visitation to national parks in the region

Table 4.5-35 shows the adjusted mean WTP values for option price, bequest value, and existence value for the first visibility change scenario (WTP1). These motive values are computed for each individual as their WTP * percent for visibility * percent to each motive, then averaged across all respondents. For the total WTP and for each of the motives, and each of the regions, the means for the home-state residents are higher than the means for residents of other states. In general, bequest value and existence value for each park region show less variability across state of residence than does option price.

Table 4.5-33
Average Percentage Allocation of WTP by Motive

	Option Price Percentage	Bequest Value Percentage	Existence Value Percentage
California Parks (version 1)			
California Residents (n=110)	36% (2.2)	33% (1.9)	31% (2.5)
Residents of Other States (n=195)	27% (1.5)	39% (1.9)	34% (2.1)
All Respondents (n=305)	30% (1.3)	37% (1.4)	33% (1.6)
Southwest Parks (versions 3, 5, 6)			
Arizona Residents (n=224)	34% (1.4)	39% (1.6)	27% (1.7)
Residents of Other States (n=353)	29% (1.3)	38% (1.5)	33% (1.6)
All Respondents (n=577)	31% (1.0)	38% (1.1)	31% (1.2)
Southeast Parks (version 2)			
Virginia Residents (n=109)	35% (2.1)	34% (2.1)	31% (2.7)
Residents of Other States (n=202)	28% (1.7)	38% (1.9)	34% (2.2)
All Respondents (n=311)	30% (1.3)	36% (1.4)	33% (1.7)
All Three Regions (version 4)			
All Respondents (n=153)	32% (1.7)	37% (1.9)	31% (2.0)

Standard error of mean in parentheses.

Figure 4.5-4
Frequency of Responses for Option Price Bequest Value, and Existence Value

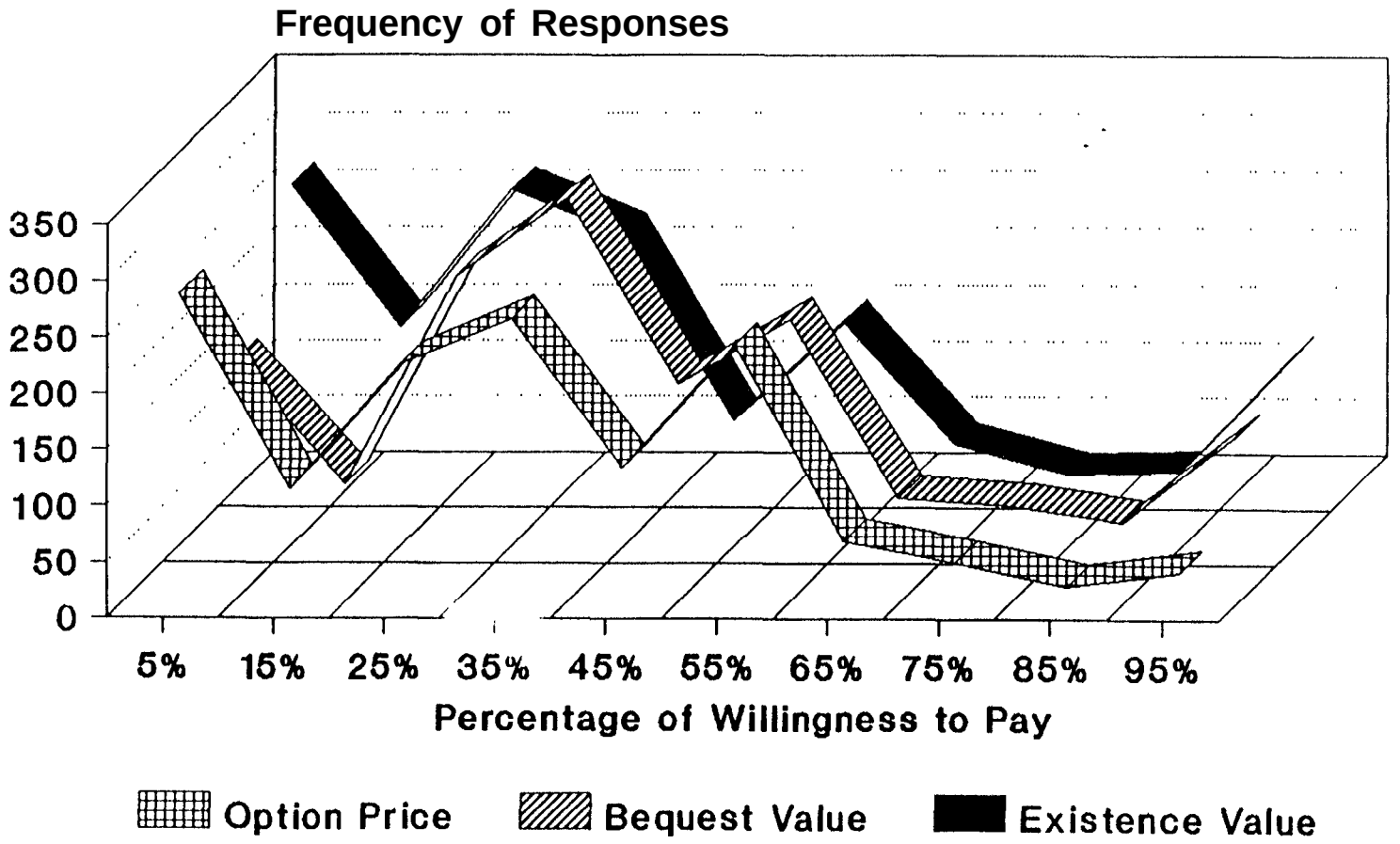


Table 4.5-34
Correlations Between Responses to Question 19 and Reasons for Visiting and Protecting National Parks

	Significant Positive Correlation Found ($p < .05$)		
	Percent for Use by Self and Household	Percent for Use by Others Now and Future	Percent for Existence Regardless of Use
Reasons for Visiting (Q-5)			
1. Experience unique natural places			x
2. Experience unique historic places	x		
3. Do something enjoyable with others	x		
4. Enjoy vastness of nature			x
5. Outdoor recreation activity	x		
6. Change from usual surroundings	x		
Reasons for Protecting (Q-7)			
1. Others in family can visit	x		
2. Others outside family can visit		x	
3. Natural preservation, even if no one visits			x
4. Scientific research			x
5. National heritage			x
6. Not development everywhere			x

Table 4.5-35
Average Option Price, Bequest and Existence Values for WTP1

	Option Price	Bequest Value	Existence Value
California Parks (version 1)			
California Residents (n=113)	$18.08 (2.65)	$17.89 (2.74)	$24.22 (9.13)
Residents of Other States (n=218)	$10.81 (1.91)	$15.53 (2.48)	$12.85 (2.27)
All Respondents (n=331)	$13.29 (1.56)	$16.34 (1.88)	$16.73 (3.46)
Southwest Parks (version 3,5,6)			
Arizona Residents (n=241)	$15.52 (2.42)	$17.42 (2.13)	$17.89 (3.38)
Residents of Other States (n=395)	$10.87 (1.31)	$14.14 (1.70)	$14.37 (2.63)
All Respondents (n=636)	$12.63 (1.23)	$15.38 (1.330)	$15.70 (2.08)
Southeast Parks (version 2)			
Virginia Residents (n=120)	$23.43 (4.99)	$19.15 (4.14)	$17.18 (3.93)
Residents of Other States (n=226)	$7.64 (1.09)	$13.48 (2.17)	$10.15 (1.20)
All Respondents (n = 346)	$13.12 (1.91)	$15.45 (2.02)	$12.59 (1.58)
All Three Regions			
Range of values for ratio of (other state/ home state)	33-70%	70-87%	53-80%

Note: Missing values for the percentages by motives were replaced by the means for the corresponding questionnaire versions and states. Adjusted WTP values are used.

Standard error of mean in parentheses.

4.5.7 Additional Sensitivity Tests

Tables 4.5-19 through 4.5-22 and 4.5-27 through 4.5-32 pool observations to examine the effect of changes in visibility upon the WTP bids. However, in these regressions it is often the case that when socioeconomic variables are entered into the equation, interactively with visibility, that the individual visibility variable (not interacted with other variables) losses statistical significance. One issue, then, is whether the inclusion of the visibility variable is in fact explaining a significant share of the variation in the data, or whether socio-economic variables alone would be sufficient. Table 4.5-36 verifies that visibility is an important variable in the analysis using the Grand Canyon WTP data as an example. The first equation in the table replicates Equation (3) results earlier reported in Table 4.5-30. The second equation eliminates the visibility variable. It is quickly apparent that the inclusion of the visibility variable is statistically significant.

Because the WTP distribution is truncated at zero, a tobit model (Tobin 1958) is a more correct analytic procedure than ordinary least squares (OLS). Tobit models were run for several of the specifications estimated earlier with OLS. The magnitude of the coefficients for each of the previously significant variables changed by no more than ten percent, and usually by much less. Previously significant variables remained statistically significant. The minimal change in results may be due to the relatively small share (7%) of zero values in the data.

Two additional modified regression analyses were undertaken to further examine the sensitivity of the data to specific data characteristics. Recognizing the nature of the data as pooled data with multiple observations (up to three) per respondent, fixed effects models and random effects models (also referred to as error components models) were run (see Judge et al. 1982, pages 497-498; or Pindyck and Rubinfeld 1981, pages 252-261, for additional discussion). Selected specifications from Tables 4.5-19, 4.5-21, 4-5.29 and 4.5-30 were rerun using these statistical techniques. In nearly all cases, neither the fixed effects models nor random effects models significantly altered the analysis. While some individual coefficients changed, very few changes were statistically significant, and the predicted WTP values never changed by more than 10 percent (usually increased) for any of the visibility scenarios considered, and were never statistically significantly different from what would be predicted with the ordinary least squares models already presented. The second analysis used a weighted regression approach that weighted observations by the inverse of the self-reported accuracy score. Again, the results were not statistically significantly different from the ordinarily least squares models.

4.6 SUMMARY OF WRITTEN COMMENTS

Respondents were asked, following the WTP questions, to provide any additional information that might help explain their responses to these and other questions. They were also asked to provide any other comments they might have at the end of the questionnaire. Sixty-two percent of the respondents gave one or more comments in response to these questions.

Table 4.5-36
Selected Regression Sensitivity Analyses
for the Grand Canyon WTP

	Equation (1)	Equation (2)
Method	OLS	OLS
LNVR	8.34 (0.42)	
LNVR * AGE	-0.32 (-0.97)	
AGE		-0.04 (-0.53)
LNVR * MALE	-5.35 (-0.50)	
MALE		-0.00 (-0.00)
LNVR * INC	1.65 ** (8.04)	
INC		.000216 (3.25) **
LNVR * PSTATE	51.25 ** (4.98)	
PSTATE		5.99* (1.655)
R^2	.18	.02
F	68.90	9.486
N	1598	1716

t-statistics in parentheses.
* $p < .10$
** $p < .05$

Table 4.6-1 provides a summary of the written comments offered by respondents. Comments have been grouped into fourteen categories. These categories cover the most frequent types of comments received. The percentages in Table 4.6-1 sum to more than 100 because some respondents gave more than one comment. The most frequently given comment indicated that visibility protection and/or protection of national parks in general is seen by the respondent as an important issue. A comment along these lines was given by about 20 percent of those who gave any comment. This contrasts with the 5 percent who wrote that the issue is not very important and the 1.8 percent who wrote that they saw little value in visibility protection for national parks.

About 17 percent of those who gave written comments wrote that they thought everyone should pay to clean up air pollution, while about 9 percent said that polluters and park users should pay to protect the park resources. About 13 percent said that they could not afford to pay more than they had given in response to the WTP questions. Many of these comments included suggestions that the respondent would have liked to have given a higher dollar amount, but felt he or she could not. This comment was given with the whole range of dollar responses, including several of the zeros.

About 10 percent indicated that they had other concerns related to national parks that they would also like to see addressed, such as water pollution, littering, congestion, fire management, acid rain and wildlife protection. About 14 percent also complained about taxes being too high or about government inefficiency of some sort. Other comments are summarized in the table.

4.7 COMPARISONS OF RESULTS TO PRIOR NATIONAL PARK VISIBILITY PRESERVATION VALUE STUDIES

Table 4.7-1 summarizes the WTP responses, adjusted to 1988 dollars, for the most comparable scenario for visibility protection at the Grand Canyon National Park for this study, the Southwest Parklands study (Schulze et al. 1981), and Tolley et al. (1986). (See Section 2.3 for a review of the latter two studies). Each of these scenarios presents the WTP to prevent degradation in average conditions, and the WTP and visual range levels in the study scenarios used for comparison are listed in the first three columns. Because the WTP values are for different changes in visibility, the last two columns normalize the results in terms of WTP per percent change in visual range, and WTP per km change in visual range. Using these normalizations, mean WTP for visibility protection at the Grand Canyon National Park in this study is about 25 to 32 percent of the WTP mean obtained for the Southwest Parklands study and is about 13 to 45 percent larger than the mean obtained by Tolley et al.

The Southwest Parklands study is most comparable to the current effort. Among the reasons results of the current study are so much lower than those obtained in the Southwest Parklands study, we believe, are:

Table 4.6-1
Summary of Written Comments

	Number	Percent of all Respondents
Respondents giving one or more comments	1012	62.8%

Comment Categories	Number	Percent of Respondents Giving Comments
Visibility/national parks important	207	20.5%
General concerns about pollution	175	17.3%
Everyone should help pay	169	16.7%
Complaints about government or taxes	144	14.2%
Can't afford to pay more (or anything)	133	13.1%
Other issues also important	103	10.2%
Others (polluters, users) should pay	93	9.2%
Problems answering questions	70	6.9%
Complaints about industry/developers	61	6.0%
Issue isn't very important	51	5.0%
Complaints about study/questions	34	3.4%
Low value for visibility protection	18	1.8%
Concerned about parks only in own region	16	1.6%
Complaints about National Park Service	4	0.4%

Table 4.7-1
Comparing Point Estimates of Visibility Value Studies

Study	Mean Annual Household WTP ($1988)	V1 (km)	V2 (km)	WTP per Percent Change in Visual Range	WTP per km Change in Visual Range
Southwest Parklands	$95	200	155	$4.22	$2.11
Tolley et al.	$21	200	155	$0.93	$0.47
NP Visibility Values*	$27	155	115	$1.05	$0.68

* Using the WTP to prevent a decrease in visibility scenario

1. The adjustment for visibility alone correcting for part-whole bias. This adjustment alone reduces the Grand Canyon values in the current study by about 35 percent.

2. Asking for the percentage of WTP for the Grand Canyon after asking WTP for the region, rather than asking for WTP for the Grand Canyon first, to minimize aggregation impacts. I.e., starting with the larger policy package then disaggregating to individual components. As a result, the portion of total region-wide WTP assigned to the Grand Canyon is about 45 percent versus about 55 percent in the earlier effort, or an 18 percent decrease in the reported Grand Canyon value.

3. Using annual versus monthly WTP questions, to minimize aggregation impacts, and other CVM design refinements. The magnitude of these effects is unknown, but they are expected to have further decreased the estimated values in the current effort.

4. Lead questions about other resource protection issues, and information and photos about visibility in other regions to place the issue in perspective. These again are expected to decrease the values in the current effort.

5. Different procedures for identifying potential protest zero and large bid responses. Unfortunately, the number of accepted and rejected zero and high bids, and missing responses, were not reported in the Southwest Parklands study making it impossible to determine the significance of the different approaches used.

6. Differences in sample socioeconomic characteristics and sampling procedures and response rates. The Southwest Parklands study used on-site interviewers, versus the current mail survey approach. The refusal to participate rates were not reported for the on-site interview solicitations, and the effect of any potential interview bias, or importance bias created by on-site interviewers, is unknown.

In total, items 1 and 2 account for a 50 percent reduction in the current study values as compared to the Southwest Parklands study (.62 * .82 = .50). Items 3 through 6 may account for much of the remaining differences in the values received.

The Tolley et al. WTP values are much different. They are incremental values for visibility protection at the Grand Canyon NP as part of a policy package that also protects visibility in Chicago and throughout the eastern U.S. This is a significantly different (larger) policy package than considered in the current study. In other regards the study is similar to the Southwest Parklands study. Due to the differences in the policy package alone, it is not surprising that the WTP estimates for visibility protection at the Grand Canyon are lower than those obtained in the Southwest Parklands study and in the current study. Moreover,

in Tolley et al, the Grand Canyon presentation and value elicitation occurred after the Chicago and eastern U.S. bids were elicited. The Grand Canyon values might have been larger had information been initially presented that this was to be included in the package. The limited documentation on survey implementation and data handling procedures provided by Tolley et al. make more detailed comparisons difficult.