PRESERVATION VALUES FOR VISIBILITY PROTECTION AT THE NATIONAL PARKS

Draft Final Report

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DISCLAIMER

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List of Tables

List of Tables, Page 2

List of Tables, Page Three

List of Tables, Page Four

List of Tables, Page Five

List of Figures

1.0 INTRODUCTION

This document presents the design and results of a study conducted for the U.S. Environmental Protection Agency, the National Park Service, and the University of Colorado concerning the estimation of preservation values held by the general public for the protection of visibility at national parks from air pollution impacts.

1.1 BACKGROUND

Under the Organic Act of 1916, the National Park Service (NPS) is charged with protecting the resources of areas under its jurisdiction to assure their continued availability for the enjoyment of the public. The fact that these areas have been set aside reveals a Congressional intent to preserve the resources, purposes, and values of these unique national treasures in perpetuity. These actions reveal a value for preserving the resources that goes well beyond the use of the resource in the current period and perhaps beyond future use as well.

Because of the increasing use of cost-benefit analysis in various decision-making processes, there is a need to develop methodologies that can be used to quantify the economic benefits associated with preserving park resources to assure that credible and useful information concerning how the public values these resources can be provided to decision-makers. The costs and benefits of alternative industrial development scenarios or regulatory approaches are routinely weighed by federal, state, and local agencies during certain decision-making processes. For example, the Clean Air Act allows regulatory and permitting agencies to consider costs and benefits before deciding whether to require installation of retrofit controls on existing stationary sources that are contributing to visibility impairment in Class I areas. Costs and benefits may also be weighed by permitting authorities in permitting decisions for new sources that may adversely affect a scenic vista, but not cause any adverse impact within park boundaries. Finally, the Environmental Protection Agency has recently suggested that the Clean Air Act might allow the Agency to consider costs and benefits when establishing secondary national ambient air quality standards. Secondary standards are designed to prevent “welfare” effects (e.g., adverse effects on visibility, soils, water, vegetation, etc.) and are, therefore, critical to assure protection of park resources.

In addition to the likelihood that costs and benefits of alternative actions will be considered in decisions made by others, regulatory actions initiated by the EPA and NPS are subject to the requirements of Executive Order 12291. The order requires that costs and benefits to society be weighed before new regulations are issued, that a regulation not be issued unless the potential benefits to society outweigh the costs, and that of the alternative

approaches to a given regulatory objective, an agency must select the alternative involving the least net cost to society. Even in cases where a statute explicitly excludes economic considerations from entering into a decision, a regulatory impact analysis must be performed for new major regulations. The regulatory impact analysis must include a discussion of the costs and benefits of alternative regulatory approaches.

Current estimation methods and empirical estimates of social benefits associated with preservation of natural area park resources, and visual air quality at these sites, other than for current period use, are quite limited. Analyses conducted for the Integral Vista Regulatory Impact Analysis (Chestnut and Rowe 1983) exemplified the limited information currently available for use in quantifying benefits of NPS resource protection, especially with regard to preservation benefits that extend beyond direct benefits to current park visitors. One study has extensively considered preservation values for visibility protection at national parks of the Southwest (Schulze et al. 1981); a few other studies have, in a limited way, addressed issues in this study (Daniley et al. 1986, Rahamatian 1986); and another only casually addressed the issue for one national park in the eastern U.S. (Rae 1984). These studies provide only limited evidence for visibility-related preservation values at a handful of national parks. Moreover, the accuracy of the results has been questioned as practitioners learn more about the design and application of the contingent valuation method used to obtain these results. The limited nature of the work done to date makes general application of findings vulnerable to criticism based on questionable transferability of results from one setting or issue to another. Because of the general lack of agreement on, or acceptance of, any preservation value estimate, federal, state, and local agencies may be forced to give less weight to potential social benefits in regulatory analysis.

For all of the above reasons, this study has been designed with the intention of advancing the state-of-the-art in estimation of preservation values and to produce additional empirical results that can be used to provide information to decision-makers who are authorized, if not required, to consider costs and benefits when making regulatory or permitting decisions affecting visual air quality in and around national parks. Therefore, the objective of the study is to attempt to establish a set of defensible benefit estimates for visibility protection for a variety of national parks with sufficient accuracy, reliability, and variety to be useful in answering broad national policy questions and in addressing specific issues on a case-by-case basis.

1.2 ORGANIZATION OF THE REPORT

Chapter 2 provides background information on the concepts of visibility values and issues concerning the use of the contingent valuation method to obtain preservation values for visibility protection at national parks. Chapter 2 also reviews key literature covering previous empirical studies of preservation values for visibility protection at national parks, and other related preservation value studies.

Chapter 3 describes the design and implementation of a new contingent valuation method (CVM) mail survey used to obtain preservation value estimates for visibility protection in and around national parks of the Southwest, California, and the Southeast. Included in this chapter are discussions of how the various features are designed to minimize, test for, and correct selected potential biases in the CVM instrument.

Chapter 4 presents a detailed summary of results and their implications. Because the analysis is quite detailed and extensive, Chapter 5 presents a simple bulleted summary of the key findings, and discussions of the interpretation and use of the results. Chapter 5 also discusses potential future directions for the use of the CVM method in estimating preservation values for national park resources.

Sample mail and telephone survey instruments are found in the Appendices.

2.0 ESTIMATING VALUES FOR PROTECTING VISIBILITY AT NATIONAL PARKS

This chapter introduces the concepts and measures of value for changes in non-market natural resources that have been developed in the economics literature, and briefly discusses key issues in the contingent valuation method (CVM), which is used in this study. The second section of this chapter summarizes the results of previous studies that have estimated values for changes in visibility at national parks, and discusses selected related literature concerning estimation of preservation values for natural resources.

2.1 CONCEPTS OF VALUE

Before talking about the "value of visibility" at national parks, it is important to define what is meant by this in the economics literature. The accepted economic measure of the dollar value to an individual for a change in the quantity or quality of any good or service is the change in income that would cause the same (or offsetting) change in the individual's well-being (utility) as a specified change in the good or service. This measure is commonly referred to as "consumer's surplus."[1] Thus, the information desired for this benefit analysis is the change in income, for all affected parties, that would cause the same (or offsetting) change in utility as the change in visibility that is being considered.

For environmental public goods that are not exchanged in a market, there are two ways traditionally used to define this change in income:

- Willingness to pay (WTP) is the maximum dollar amount the individual is willing to pay to obtain an increase, or prevent a decrease, in the quantity or quality of the good.

- Willingness to accent compensation (WTA) is the minimum dollar amount the individual is willing to accept to voluntarily forgo an increase, or to accept a decrease, in the quantity or quality of the good.

One important distinction that has been drawn in the literature is that some value is related to one's own use of the resource, while some value may not be related to one's own use. Use values for visibility at national parks are the values associated with the park's visual air quality during an individual's own on-site visits to a park and through off-site enjoyment of park features with films, photographs, paintings, etc. Non-use values for visibility at national parks are values the individual may have for protecting visibility unrelated to his or her own use, which may be held even if he or she never visits the parks.

[1] See Freeman (1979), Just et al. (1982), Morey (1984), Vartia (1983), and Randall and Stoll (1980) for more rigorous definitions and discussion of welfare value measures for environmental goods based on standard economic utility theory, and see Rowe and Chestnut (1982) for a discussion of this theory specifically related to visibility.

The concept of non-use value for natural resources was first elucidated by Krutilla (1967) who observed that "there are many persons who obtain satisfaction from mere knowledge that part of wilderness North America remains even though they would be appalled by the prospect of being exposed to it." The concepts of use and non-use values for natural resources have received considerable attention in the economics literature and more rigorous definitions of use and non-use values have been developed since Krutilla first introduced the concept in the resource economics literature. Important contributions to this literature have been made by Krutilla and Fisher (1975), Randall and Stoll (1983), McConnell (1983) Freeman (1988), Cicchetti and Freeman (1971), Krutilla et al. (1972), Freeman (1984) and others. Several different categories of, and nomenclature for, use and non-use values have been developed in this literature, including (but not limited to) the following. These terms are used in this report as defined here, but may be used somewhat differently by other authors.

- Option price. Option price is a measure of use value that reflects uncertainty regarding future use of a resource. It equals the expected value of impacts upon current and future use plus a risk premium, which may be positive, negative, or zero. The risk premium is related to uncertainty regarding desired future use and the impact of the resource change upon future use, and its sign (positive or negative) depends on whether the individual prefers to err toward preserving a resource that may not be wanted for use in the future, or toward losing a resource that may be wanted for use in the future.

- Bequest value. This is the component of non-use value that is related to the use of the resource by others now and in the future. This value is typically thought of as altruistic in nature.

- Existence value. This is the component of non-use value that is related to preservation of the resource, even if there is no human use of the resource in the traditional sense. In practice, bequest and existence values are difficult to distinguish and are often together referred to as existence value.

- Preservation value. This term refers to the total value of a resource and includes all use and non-use values.

While much of this literature has focused on whether or not a particular natural resource, such as an endangered species, is to be preserved, the same value categories apply to changes in the quality of a resource (Freeman 1988). With visual air quality at national parks, the issue is typically at what level it is to be maintained, not whether or not it will exist at all.

Option price differs from on-site use value because it is an ex ante measure based on expected use rather than an ex post measure of value based on actual use, and includes a risk aversion premium. As the ex ante measure, option price is the appropriate measure for analysis of proposed regulatory decisions that may affect the quality or availability of the future use of a resource (Chavas et al. 1986).

2.2 THE CONTINGENT VALUATION ESTIMATION METHOD

2.2.1 Why the Method is Selected

For private market goods, WTP and WTA measures of value can be derived from market information on prices and quantities of the goods sold. For non-market goods such as environmental quality, this direct market information is not available and other methods must be used to estimate these measures of value.

Contingent valuation methods and travel cost/time allocation methods are potentially useful for estimating on-site use values related to visibility at national parks, although only the contingent valuation methods have been applied to date to obtain dollar estimates of these types of visibility-related on-site use values. The contingent valuation methods are the only methods available at this time for estimating non-use values, because these values are not expected to be revealed in observable market behavior, which is used as the basis for most other value estimation methods to value changes in non-market goods.

The contingent valuation method (CVM) involves the use of survey instruments to obtain information on the values respondents believe they would place on potential changes described to them in the survey. Variations of the CVM method include direct WTP or WTA questions, referendum questions, and contingent ranking questions. In this report we highlight key issues in applying CVM for estimating preservation values for visibility at national parks. Thorough reviews of CVM as applied to non-market resource and visibility valuation are available elsewhere (See Mitchell and Carson 1989; Rowe and Chestnut 1982; Cummings et al. 1986; Freeman 1988; Fischhoff and Furby 1988).

2.2.2 Accuracy and Reliability of CVM Responses

CVM is a developing empirical method and the credibility and reliability of the results have been the subject of some controversy in the economics profession. The skepticism results primarily from the hypothetical nature of the method. It is based on what people say, not necessarily on what they would actually do. Several potential sources of inaccuracy in implementing CVM include:

1. Failed Correspondence Between Theory and Method. While the underlying theory may correctly define the value measures of interest, the method chosen to implement the theory may not be designed to obtain the correct measure.

2. Failed Correspondence Between Method and Questionnaire. The method may be appropriate, but the questionnaire itself may fail to correctly implement the method. The researcher may simply ask the wrong questions.

3. Questionnaire Design Problems. Even if the correct questions are asked from the perspective of the researcher, they may not correspond with how the respondent views the issue, or some survey information may mislead the respondent. The researcher may be asking the right kind of questions, but in the wrong way. For example, the respondent could reject the property rights implied in the questionnaire, be influenced by the design of the questions, value a slightly different good or service due to a different understanding of the problem, or the respondent may be overtaxed by the difficulty of the questions. The result is the respondent may give valid responses, but for a different set of circumstances than the researcher believes he is addressing, or the results may be biased by the instrument.

4. Response Problems. Even if the questions are designed properly, correspond to the respondent's view of the issue and are well understood, the respondent may have difficulty accurately quantifying the responses required. This may be due to a lack of familiarity with the scenario of the good being valued, questions that are too difficult or inconsistent with the cognitive processes used in decision-making or due to a lack of effort in responding to the questions.

5. Implementation and Statistical Problems. Even with valid and accurate responses for individual respondents, incorrect sampling and small sample sizes may still lead to invalid results. Miscoding and statistical misinterpretation of data can add further error or bias.

Most research addressing the validity and accuracy of CVM applications has focused upon categories 2-4, although significant errors can result from all categories. Cummings at al. (1986) have identified several conditions they suggest must be met to have a high level of accuracy in CVM responses which include:

1. Subjects must understand and be familiar with the commodity to be valued.

2. Subjects must have had (or be allowed to obtain) prior valuation and choice experience with respect to consumption levels of the commodity.

3. There must be little uncertainty.

4. WTP, not WTA, measures should be elicited.

Cummings et al. suggest that when these conditions are not met, the CVM responses may still be valid, but the accuracy decreases. These conditions are useful to consider in evaluating a CVM, but they are not comprehensive (they fail to consider many other potential sources of inaccuracy), nor are they uniformly applicable to all CVM applications.

Mitchell and Carson (1989) have provided a useful and structured presentation of many of the potential sources of inaccuracy and bias in the application of a CVM valuation exercise. These are found in Table 2.2-1. Other problems not identified above may also contribute to inaccuracy in CVM.

To address the accuracy and reliability of CVM results, Cummings et al. review 15 comparisons of CVM results with results using other valuation techniques, such as hedonic pricing models and travel cost models. In all of the comparisons, the calculated value estimates were within 60 percent of one another and many are much closer. This does not prove the accuracy of any one CVM is within 60 percent of the "true" value, but suggests that each of these methods may often converge to the same range of values and that the CVM method may be more desired in some instances due to its relative strengths as to when and how it can be applied. Mitchell and Carson (1989) provide similar evidence for a selected set of CVM studies.

Conclusions on the Accuracy and Reliability of CVM

Reviewing the list of potential sources of error in CVM studies, one might conclude the results may often be invalid and inaccurate. However, careful design, pretesting, implementation, and interpretation of results can minimize biases and inaccuracies and yield valid and accurate value information. Next, the hypothetical nature of the questions need not result in invalid or inaccurate answers. Respondents often face WTP decision in markets, through political decisions and elsewhere that require real behavior similar to the hypothetical behavior in a CVM. According to Mitchell and Carson, "But can CV surveys actually measure values that are sufficiently reliable and valid for use in benefit estimation? Our conclusion is basically affirmative." (1989, p. 295).

CVM is now widely used and is among the methods recommended by the United States Department of Interior for evaluation of natural resource injuries. Use of the method for these purposes was challenged recently in the United States Court of Appeals (Ohio vs. U.S. DOI, No. 86-1529). The court ruling denied the challenge stating, "We find DOI's promulgation of CV methodology reasonable and consistent with Congressional intent, and therefore worthy of deference" (p. 94), and "We find no cause to overturn DOI's considered judgment that CV methodology, when properly applied, can be structured so as to eliminate undue upward biases" (p. 96).

2.2.3 Specific Application Issues for Measuring Visibility Preservation Values

While most all general CVM design and application issues are of concern in the valuation of visibility preservation values for national parks, a few issues are of specific concern, and are discussed below.

Table 2.2-1
Typology of Potential Response Effect Biases in CV Studies*

1. *Incentives to Misrepresent Responses*
Biases in this class occur when a respondent misrepresents his or her true willingness to pay (WTP).

   A. *Strategic Bias:* where a respondent gives a WTP amount that differs from his or her true WTP amount (condition on the perceived information) in an attempt to influence the provision of the good and/or the respondents's level of payment for the good.
   B. *Compliance Bias*
      1. *Sponsor Bias:* where a respondent gives a WTP amount that differs from his or her true WTP amount in an attempt to comply with the presumed expectations of the sponsor (or assumed sponsor).
      2. *Interviewer Bias:* where a respondent gives a WTP amount that differs from his or her true WTP amount in an attempt to either please or gain status in the eyes of a particular interviewer,

2. *Implied Value Cues*
These biases occur when elements of the contingent market are treated by respondents as providing information about the "correct" value for the good.

   A. *Starting Point Bias:* where the elicitation method or payment vehicle directly or indirectly introduced a potential WTP amount that influences the WTP amount given by a respondent. This bias may be accentuated by a tendency to yea-saying.
   B. *Range Bias:* where the elicitation met hod presents a range of potential WTP amounts that influences a respondent's WTP amount.
   C. *Relational Bias:* where the description of the good presents information about its relationship to other public or private commodities [hat influences a respondent's WTP amount.
   D. *Importance Bias:* where the act of being interviewed or some feature of the instrument suggests to the respondent that one or more levels of the amenity has value.
   E. *Position Bias:* where the position or order in which valuation questions for different levels of a good (or different goods) suggest to respondents how those levels should be valued.

3. *Scenario Misspecification*
Biases in this category occur when a respondent does not respond to the correct contingent scenario. Except in A, in the outline that follows it is presumed that the intended scenario is correct and that the errors occur because the respondent does not understand the scenario as the researcher intends it to be understood.

   A. *Theoretical Misspecification Bias:* where the scenario specified by the researcher is incorrect in terms of economic theory or the major policy elements.
   B. *Amenity Misspecification Bias:* where the perceived good being valued differs from the intended good.
      1. *Symbolic:* where a respondent values a symbolic entity instead of the researcher's intended good.
      2. *Part-Whole:* where a respondent values a larger or a smaller entity than the researcher's intended good.

Table 2.2-1
Typology of Potential Response Effect Biases in CV Studies* (cont.)

a. *Geographical Part-Whole:* where a respondent values a good whose spatial attributes are larger or smaller than the spatial attributes of the researcher's intended good.
b. *Benefit Part-Whole:* where a respondent includes a broader or a narrower range of benefits in valuing a good than intended by the researcher.
c. *Policy-package Part-Whole:* where a respondent values a broader or a narrower policy package than the one intended by the researcher.

3. *Metric:* where a respondent values the amenity on a different (and usually less precise) metric or scale than the one intended by the researcher.
4. *Probability of Provision:* where a respondent values a good whose probability of provision differs from that intended by the researcher.

C. *Context Misspecification Bias:* where the perceived context of the market differs from the intended context.

1. *Payment Vehicle:* where the payment vehicle is either misperceived or is itself valued in a way not intended by the researcher.
2. *Property Right:* where the property right perceived for the good differs from that intended by the researcher.
3. *Method of Provision:* where the intended method of provision is either misperceived or is itself valued in a way not intended by the researcher.
4. *Budget Constraint:* where the perceived budget constraint differs from the budget constraint the researcher intended to invoke.
5. *Elicitation Question:* where the perceived elicitation question fails to convey a request for a firm commitment to pay the highest amount the respondent will realistically pay before preferring to do without the amenity. (In the discrete-choice framework, the commitment is to pay the specified amount.)
6. *Instrument Context:* where the intended context or reference frame conveyed by the preliminary nonscenario material differs from that perceived by the respondent.
7. *Question Order:* where a sequence of questions, which should not have an effect, does have an effect on a respondent's WTP amount.

* From Mitchell and Carson (1989). [Permission may be needed for inclusion in final draft]

Familiarity With the Resource Change

Estimating non-use values may pose some additional difficulties for CVM. The primary concern that has been raised is that the lack of familiarity with the good, or with thinking about dollar values for the good, may make respondents particularly susceptible to unintended influences in the survey instrument. Lack of familiarity is a concern with non-use values because the respondents will necessarily include individuals who have not used, and may never use, the resource. This may be particularly important when considering subtle ecological changes or obscure endangered species. However, in the present case, most people know what national parks are and have experience with various levels of visual air quality in their daily lives, even if they have never experienced varying visibility levels at a specific park. Therefore, they may be better able to comprehend and value visibility changes at national parks than for some other types of resource changes. The design of the questionnaire will allow this issue to be further addressed.

Context and Information

Recent work by Fischhoff and Furby (1988) has extended the discussion of the context of simulated market transactions for visibility valuation. They assert, "In general, the more novel a transaction, the more of its details will need to be explained and the more difficult it will be to ensure that those details are understood." (page 152) They suggest that paying for visibility improvements may be a reasonably novel transaction and that seemingly irrelevant factors may affect responses. One might then infer that paying for preservation of visibility at national parks, especially by those who are non-users, may be even more novel. In part, these views are consistent with Shuman and Presser (1981), who have argued that the more crystallized the values and attitudes are, the less important minor context impacts are likely to be in survey design.

Fischhoff and Furby continue by identifying an array of potential characteristics of a visibility valuation transaction that may be of concern. These characteristics are broken down as defining main features of (1) the good, (2) the payment and (3) the social context of the transaction. For each of these three features, characteristics can be considered as helping to convey to the respondent "substantive" and "formal" definitions of the transaction. Substantive definitions refer to characteristics that help identify how the transaction affects the respondents directly, such as how their activities would be affected and how they would pay for the transaction. Formal definitions refer to technical specifications of the characteristics, such as duration and certainty of impacts. Many of these issues overlap the scenario development concerns identified by other CVM researchers, and summarized by Mitchell and Carson (1989).

Fischhoff and Furby suggest that to obtain accurate values for unfamiliar transactions, as visibility valuation may be, the transaction may need to be extensively defined. When characteristics of the transaction are left unspecified, respondents must rely upon their default assumptions, which may differ from one another and from what the researcher intended. They note, however:

> ... simply telling people everything provides no guarantee that they have understood everything. Such a strategy might even impede understanding if attention to critical features of the contingent market is diverted by a deluge of details about features that could have gone without saying because they have little practical effect on decisions. (page 152)

The researcher must, therefore, balance the need for information against the interests of the respondents to absorb information. Relatively minor context features will have to be unstated for a CVM instrument to be manageable. The challenge for the researcher is to determine which information is critical in terms of the impact upon WTP measures of interest. In the current research, reported in Chapters 3 through 5 below, the baseline instruments are designed to incorporate many of the characteristics identified by Fischhoff and Furby. The guiding principle used in designing the context for the value elicitation is to keep it realistic and credible, but as simple and straightforward as possible. Several survey variations then alter the context and information presented to begin to specifically address some of the issues raised by these authors.

Part-Whole, Sequencing and Aggregation/Disaggregation

Part-whole bias, sequencing and the appropriate level of aggregation in the valuation, are three interrelated issues of particular concern to the valuation of visibility protection at national parks. Each is discussed and practical solutions identified below.

Part-Whole Bias. Mitchell and Carson (1989) define part-whole bias as occurring when a respondent values a larger or smaller entity than the researcher intended. Potential part-whole bias has been a significant concern in reviews of past urban visibility value studies where, for example, Fischhoff and Furby (1988) indicate:

> ... respondents might be told to disregard how a change in air pollution affected their health risk. However, such selective forgetting may not always be possible. If it is natural to think of an intervention's impacts as a whole, there may be no way to segregate mentally its individual effects. (page 155)

Concerns for the separation of health from visibility impacts of urban air pollution control are the focus of two ongoing CVM studies (Carson et al. 1989 and Irwin 1989), and preliminary results confirm, to some degree, the difficulty respondents have in separating these two characteristics of air pollution control in urban environments.

In the valuation of visibility protection for national parks, part-whole bias could enter in at least three ways:

1. Respondents fail to isolate visibility effects from other effects of air pollution, such as damage to vegetation and risks to human health.

2. Respondents fail to isolate visibility effects from other concerns about national parks, such as preservation of natural geologic features and prevention of water pollution. "Symbolic bias," as suggested by Mitchell and Carson, is also potentially related in that a respondent may more broadly value protection at national parks rather than be concerned with the specific resource impairment of concern to the researcher.

3. Respondents fail to isolate visibility effects at the identified park(s) from similar effects at other park(s) or in other geographic areas.

Therefore, it is of significant importance to minimize the potential of these types of part-whole bias in the survey design, and to test and correct for any remaining part-whole bias in the CVM responses.

Sequencing. Sequencing bias occurs when the respondent provides different bids for the same resource protection depending upon the number and order of environmental protection issues to be valued. For example, Tolley et al. (1986) found the average stated WTP value for the visibility protection at the Grand Canyon was lower when respondents were first asked to give WTP values for visibility protection at other areas and then asked an incremental WTP for the Grand Canyon, versus when they were asked a WTP for visibility protection at only the Grand Canyon. These results are discussed further in Section 2.3.

In part, this sequencing effect may be due to individuals having a "mental account" for a category of environmental protection items based upon a limited ability to adjust their budget at any one time. As a result, as more and more resource protection items are to be simultaneously funded, the available financial resources per item decrease, and the average amount that can be paid for each item decreases. If this is only revealed to the respondent in an incremental manner (i.e., respondents are not told they will also have to purchase additional visibility protection at other [illegible], as was done by Tolley et al. 1986), the stated WTP for the later items considered may diminish as compared to if these items were first in the list, if the items are grouped under the same mental account.

These budget constraint and sequencing issues are not a unique problem for resource economics. A household's WTP for a bundle of consumer goods may change if it is also, or first, required to buy a second bundle of goods and services. This may logically be the case because components of the two different bundles may be perceived as substitutes for meeting some of the goals (or motives) for which the bundles would be purchased; and because diminishing marginal utility for bundles of goods and services, and budget constraints, reduce the WTP for like incremental goods and services.

Several approaches may be taken to address sequencing effects. The simplest is to alter the sequence for which items are valued and retest the results, but this simply recreates the problem. The second, which is tied to the aggregation issue discussed next, is to define the entire policy package to be valued before the valuation commences.

Aggregation/Disaggregation. Aggregation refers to the appropriate level of resource impacts to consider; i.e., what is the total policy package of interest? Disaggregation refers to how value estimates should be obtained for individual components of the policy package.[2]

As discussed for sequencing, as more and more items are added to a policy package to be obtained at any one time, the WTP for any individual item may fall. In a similar vein, Irwin et al. (1989) and Boyce et al. (1990) found that while WTP estimates given for individual components of a good, such as visibility effects and health effects of air pollution control, are less than the WTP amount for the good as a whole, the sum of the values for individual components, when estimated separately, exceeded the WTP bid for the entire good. This may be reflecting part-whole bias, budget constraints and/or other economic and psychological response behavior. Therefore, it might occur that the sum of WTP values obtained from separate CVM studies for individual parks in a region (or regions in the country) may equal or exceed the WTP for simultaneous visibility protection throughout the region (or throughout the country).

Similar problems are observed when WTP questions are asked in terms of monthly payments versus annual payments: the monthly WTP estimates are less than the annual WTP estimates, but they sum to more than the single annual estimate. This may be reflecting failure to accurately consider budget constraints, or to fully comprehend the long term nature of the payment stream when providing monthly payments.

The solution to these problems is not entirely clear. Available research does suggest that the conservative direction to take in CVM exercises is to define and value the entire policy package of interest, then disaggregate to component values through follow-up questions or through statistical procedures. These component values may be for different parks, for different value motives or for other components of interest.

This solution does not mean that, for example, all potential natural resource protection issues must be simultaneously considered and valued in order to obtain a value for any one resource protection issue. For practicality, the researcher must take a common-sense approach concerning what the typical respondent will be able to isolate and what must be treated as a total package. Finally, natural resource policy often occurs sequentially and using values from independent studies covering independent issues in relative isolation may be appropriate as, through time, economic agents have time to readjust their budgets and may have the flexibility to fund additional (subsequent) resource protection.

The Motives Behind the Value Statements

Understanding motives behind preservation values is important to the valuation exercise. This understanding allows more appropriate interpretation of what these motives are and why they exist, which may be used to refine the CVM design to measure values for motives

[2] Irwin et al. (1989) discuss aspects of this issue using the term “additivity,” rather than aggregation.

as individuals see them, rather just as economists define them. This may also help in better understanding what types of resource quality and quantity changes will be of most value to society. Examining motives is also important as a means to evaluate the credibility of CVM responses, and to determine the appropriate application of the results for policy analysis.

Madariaga and McConnell (1987) have raised the question of motives behind bequest values from another perspective and suggest that certain kinds of motives can confound CVM responses and their interpretation for use in policy analysis. They argue that there are two types of altruism that could underlie bequest motives. The first is an "individualistic altruism" that is based on the utility of others and assumes the bequestor would not want to leave a bequest that costs the receivers more than it benefits them. The second type is defined as "paternalistic altruism" that is based on another's consumption of a specific good because it will be good for them.

Based upon the above definitions, Madariaga and McConnell develop a model that suggests that the usual efficiency criteria (that the sum of individual benefits exceeds costs, where those benefits do not include any interdependence of utility) still gives the optimal allocation of resources even in the presence of utility interdependence. This applies to the "individualistic altruism" bequest motive -- benefits to future users must exceed costs to future users or the altruist gains no utility. They conclude that knowing who bears future benefits and costs, and how much they are, is desirable information to be included in contingent valuation questions. What is not stated, however, is how to present future costs and benefits when they are uncertain. They apply this conclusion with some small sample empirical tests and find that willingness to pay is indeed smaller when subjects are told that future users will incur costs as well as benefits.

We suspect that the paternalistic altruism, which is given limited attention by Madariaga and McConnell, may be important with regard to parks. To the extent that a person believes that others should have the perspective and ethical value associated with contact with the natural environment, he may derive satisfaction from knowing the parks are available for those he cares about regardless of, and almost certainly not knowing, whether they would have been better off (in terms of maximum attainable utility) under a different allocation of resources. Many of the choices that have been made to establish and protect national parks were made without knowledge of future expenses, and may well reflect a societal "paternalistic altruism."

An additional aspect of this paternalistic altruism may be the perception that there is a broad social externality from the availability of the resource that goes beyond the well-being of any one individual who actually uses the resource. In this case, it is not that the bequestor's utility is directly enhanced because of use of the resource by specific individuals, but rather because society as a whole may be better off in a way that exceeds the sum of each individual's direct benefits. For example, consider programs taking juvenile delinquents on wilderness experiences, which are intended to help with self confidence and perspective, and hopefully reduce future crime.

Another potential motive behind bequest value responses may be the perceived irreversibility of failure to protect many natural resources. Even though in this case visibility degradation is a reversible impact (the air clears up when emissions are reduced), there may be a perceived irreversibility in terms of policy precedence. It may be that some people perceive that if we allow the degradation now, we give up the right to prevent it in the future, and open the door to other environmental degradation.

To a considerable extent, these discussions of motives behind bequest values are speculation without empirical research to determine which motives dominate. A detailed analysis of bequest values motives is beyond this study's focus and resources. This study does attempt to obtain attitudinal information to understand and verify bequest values, and attempts to circumvent the problem of interdependence of utility in the survey design.

2.3 PREVIOUS CVM STUDIES CONCERNING PRESERVATION VALUES

The section provides a brief review of selected CVM studies that have been conducted concerning visibility protection at national parks and concerning other similar natural resource protection issues.

2.3.1 Preservation Value Studies for Visibility Protection at National Parks

One previous CVM study, called the Southwest Parklands study, has estimated preservation values for changes in visibility at the Grand Canyon National Park and at all national parks in the Southwestern United States (Schulze et al. 1981). The Southwest Parklands study is the only previous CVM study that is directly comparable to the study being presented in this report. Two small follow-up studies of the Southwest Parklands study have been conducted to examine specific questions raised about the Southwest Parklands study (Tolley et al. 1986; and Rahmatian 1986). Rae (1984) also examined a few questions concerning preservation values for visibility protection at Great Smoky Mountains National Park.

Southwest Parklands Study

The Southwest Parklands study represents the first attempt to estimate preservation values for visibility protection at national parks with respondents not physically on-site at the parks in question. The results reflect estimates of preservation values for non-users as well as for users. Respondents were interviewed in-person in four major metropolitan areas: Los Angeles, Albuquerque, Denver, and Chicago. Four hundred and fifty completed (non-protest) responses were obtained for the preservation value questionnaire. Three basic questions were addressed: What is the value of controlling haze at the Grand Canyon National Park? What is the value of controlling haze throughout the remainder of the Southwest region? and, What is the value of controlling plumes visible from the Grand Canyon National Park?

In the introduction to the preservation value questionnaire, respondents were told that air pollution from human sources sometimes impairs visibility at the Grand Canyon, and were shown a set of photographs of the Grand Canyon. The photos showed three different scenes, each under five different visibility conditions (fifteen photographs in total). The respondents were told that the five photographs in each set showed conditions ranging from good visibility to poor visibility, with the middle photographs reflecting current average visibility conditions. Respondents were not given any quantitative information such as frequency percentiles or visual range for the conditions shown in the photographs.

The first set of questions concerned previous and expected future visitation to the Grand Canyon and other national parks in the Southwest. Respondents were then told that additional industrial emissions controls might be required to prevent visibility at the Grand Canyon from deteriorating and that such controls would likely make electricity more expensive. They were asked to estimate what they would be willing to pay in increases in their monthly utility bills to prevent an increase in air pollution that would cause average conditions to deteriorate from the middle photos to the next worse photos. This represented a change from approximately the current (1979) 50th percentile of visibility conditions to approximately the then current 25th percentile. The photographs represented approximate visual range levels of 200 km and 155 km. The respondents were then shown a similar set of photographs showing scenes from three national parks in the Southwest (Grand Canyon, Mesa Verde, and Zion) and were asked what additional amount they would be willing to pay to prevent the same deterioration in visibility throughout the region.

Respondents who gave zero WTP were asked if they thought the change in visibility was not important, or if they thought someone else should pay. The second response was interpreted as a protest response and these zeros were dropped from the results. The authors do not report the total number of zero responses obtained or the number interpreted as protest zeros for the preservation value responses.

The average monthly WTP responses per household were (after exclusion of protest responses):

Mean for Grand Canyon NP	$5.50
SE of Mean	0.41
N	450
Mean for remainder of region	$4.66
SE of Mean	0.36
N	450

Adjustingg to 1988 dollars and multiplying by twelve to obtain an estimate of annual WTP, these results imply an average annual 1988 WTP per household of $95 to prevent a degradation in visibility from the 50th to the 25th percentile at the Grand Canyon due to haze, and an additional $80 for preventing this amount of degradation at all other parks in the region.

The analysis of the WTP responses reported by the authors suggests no relationship between the WTP amount stated and the distance of residence from the Grand Canyon, and very little relationship between the WTP amount stated and previous or expected future Grand Canyon visitation. Older respondents gave significantly lower WTPs and respondents with higher incomes were associated with higher WTPs. The income elasticity was approximately 0.3, implying that a 10 percent higher income was associated with a 3 percent higher WTP response.

Questions have been raised about the effect in this study of focusing on such a perceived "national treasure" as the Grand Canyon and whether the responses would be the same if other areas were also considered at the same time. The concern is that respondents may have overstated their true WTP for the Grand Canyon and included some value for changes in visibility in other areas as well. A related question raised is whether stated WTP for visibility protection at the Grand Canyon would change if respondents were also requested to simultaneously spend more to protect visibility in other areas.

Southwest Parklands Follow-up Studies

Two follow-up studies have attempted to address some of the questions concerning the Southwest Parkland Study. While the followup studies do not entirely resolve issues in the original study, they do suggest that some problems may exist.

Tolley et al. (1986) addressed the question of whether responses would be different if respondents were asked to give WTP for changes in visibility where they live as well as for protection of visibility at the Grand Canyon. A sample of residents in Chicago was asked a set of three WTP questions: (1) WTP to prevent a degradation in visibility in Chicago, (2) additional WTP to prevent a similar degradation throughout the remainder of the U.S. east of the Mississippi, and (3) additional WTP to simultaneously protect against a specified degradation in visibility at the Grand Canyon. The Grand Canyon photographs and hypothesized change were the same as those used in the Southwest Parklands study. All the questions were for monthly increases in utility bills to cover costs of pollution controls. The results are summarized in Table 2.3-1 (adjusted to annual WTP in 1988 dollars).

Even though the sample sizes are small, the WTP estimates for the Grand Canyon are substantially smaller when asked as the third in a series of WTP questions. The authors conclude that the WTP responses are influenced by the order of the questions. In the Southwest Parklands study, the change in visibility being considered was for the Grand Canyon only, while in the follow-up study the visibility change is for Chicago, the East and the Grand Canyon all at once. This appears to be a change in the good being valued as well as the order of the questions. The results therefore are best interpreted as demonstrating that when considering a change in one area such as the Grand Canyon, it is important to consider whether changes in visibility would also occur in other areas as part of the same policy package. It is a substantially different question for the respondent to give WTP for changes in, for example, the entire U.S. versus WTP for changes in just

Table 2.3-1
Comparison of Schulze et al. and Tolley et al.
Grand Canyon Visibility Value Results

	Annual WTP for Chicago	Annual Additional WTP for Remainder of East	Annual Additional WTP for Grand Canyon
Tolley et al. (N = 59)	$296	$36	$21 (SE = 12)
Schulze et al. (Chicago sample, N = 130)			$132 (SE = 20)

one location, such as the Grand Canyon. With income constraints, and assuming visibility is a normal good, one would expect that incremental WTP to prevent degradation at an additional site would be smaller than WTP for the same site if it were the only site needing protection. This is the aggregation issue discussed above.

This problem may have been further exacerbated by the procedure used in the Tolley et al. study. Respondents were not informed at the beginning of the WTP questions that they would be asked to give estimates of WTP for visibility protection in more than one location, which reinforces sequencing problems, as discussed above. As a result, respondents may have allocated a larger share of this "visibility budget" to the first site considered as if it were the only item in a policy package, than they would have if they had considered all three sites simultaneously as part of one policy package.

A second follow-up study was conducted in Denver in 1982 (Rahmatian 1986), also with the aim of examining the effect of considering changes in visibility at the Grand Canyon alone versus changes in a larger area as well as the Grand Canyon. Some subjects were asked to give willingness to pay estimates for the Grand Canyon alone. Others were shown photographs of the Grand Canyon and other parks in the Southwest and then asked to give willingness to pay estimates (1) for the Grand Canyon and then (2) for the parks in the remainder of the southwest region. This second protocol is similar to the questions asked in the Southwest Parklands study except that the photos for the region as well as for the Grand Canyon were shown before the willingness to pay questions were asked. There is no statistically significant difference in the mean WTP estimates given for the Grand Canyon in these two procedures, and in both cases the mean responses are not statistically significantly different than the results obtained in the Southwest Parklands study. However, the Grand Canyon question was asked first in both cases; therefore, the results do not adequately address the question of whether responses are different if the order of the questions is changed.

Other concerns with the Southwest Parklands study include the separability of visibility from other resource protection issues. For example, a major concern regarding measuring visibility values is whether other effects of air pollution, such as health effects or vegetation damage, are being separated fully from visibility protection values. There is also concern that park resource protection motives unrelated to visibility may be reflected in the responses. This is the potential part-whole bias discussed above.

The focus of the Southwest Parklands study was also geographically limited and only one level of change in visibility conditions related to haze was valued. The uncertainties involved with transferring these results to other locations and other visibility change scenarios limits the applicability of the results for current policy issues without further verification with new research. Finally, some questions have been raised about specific design elements of the CVM application in this study, such as the order of the questions and the use of the monthly utility bill payment vehicle.

Rae (1984)

Rae (1984) conducted a CVM study in Cincinnati, Ohio, which primarily focused on benefits of reducing urban air pollution, but a few questions were also asked later in the questionnaire about visibility at the Great Smoky Mountains National Park. Interviews were conducted with 316 adults. Visibility at Great Smoky Mountains was illustrated with two photographs of a scene at the park showing 20 km visual range and 100 km visual range. Subjects were asked the maximum their household would be willing to pay annually to have visibility conditions at the park like those shown in the 100 km photograph most of the time rather than the 20 km conditions. No payment vehicle was specified. A list of values (in intervals) ranging from $0 to $500 was shown to the subjects. Subjects were asked about past and expected future visits to the park. After excluding one $1000 response, the average response to the first visibility question regarding Great Smokies was about $60. A significant portion of the subjects had visited the park and/or planned to visit it in the future, so this willingness to pay can be expected to reflect perceived benefits associated with actual visits as well as potential non-use values.

Subjects were also asked a second set of questions about their willingness to pay for ten "good causes," including protecting visual air quality at Great Smokies, to see how their responses might change when more than one good cause was considered. The average willingness to pay for visibility protection at the park was about one-third of the previous average response. This suggests the possibility that subjects may not be considering the full range of alternative uses of their money when they are asked to estimate their willingness to pay for a single good cause, and that when competing "good causes" are also included, the willingness to pay for one of the causes may be smaller. However, in this question the magnitude of the change in visual air quality and in the other good causes was not specified. This uncertainty may also play an important role in the change in visibility bids. Cummings et al. (1986), Mitchell and Carson (1989), and Fischhoff and Furby (1988) all suggest uncertainty leads to inaccurate, and often reduced, bids.

2.3.2 On-Site Use Value Studies for Visibility at National Parks

A number of contingent valuation studies have been conducted that have estimated dollar values for visibility impacts to on-site visitation at national parks. More extensive reviews of these studies can be found in Chestnut and Rowe (1983). These studies are briefly discussed here because they are CVM studies concerning visibility protection at national parks, but their focus was much different than that of the current study.

Results of on-site use value studies concerning visibility at national parks are summarized in Table 2.3-2. Two of these studies have obtained estimates of use values for changes in visibility at the Grand Canyon, one of the parks selected for the focus of this study. In both of these studies survey respondents were asked what they would be willing to pay in additional daily entrance fees to have one level of visibility rather than another while visiting the Grand Canyon National Park.

MacFarland et al. (1983) interviewed about 1000 visitors at the Grand Canyon and at Mesa Verde in the summer of 1980 for the willingness-to-pay portion of their study. Visitors interviewed at the Grand Canyon were shown two sets of slides, each showing five different levels of visibility at a particular viewpoint. The authors report approximate levels of visual range for the five different conditions, as shown in Table 2.3-2. Respondents were asked to estimate the most they would be willing to pay in additional daily entrance fees, over the then current two dollars, to have visibility at level B, C, D, and E rather than level A while visiting the park. Possible response options were provided to respondents using a checklist format. The mean responses are shown in Table 2.3-2.

Schulze et al. (1981) interviewed 166 subjects for the use value portion of the Southwest Parklands study. Subjects were interviewed at their homes in Albuquerque, Denver, Los Angeles, and Chicago. Respondents were excluded from the use value questions if they said that they had not visited the Grand Canyon in the last 10 years and if they did not plan to visit the Grand Canyon in the next 10 years. The willingness to pay questions were very similar to those asked by MacFarland et al. The primary difference was that the respondents were interviewed at their homes rather than at the park and some of them (roughly 40%) had not been to the park in the last 10 years. Schulze et al. do not report visual range estimates for their photographs, but they report $\mu g/m^3$ pollutant loadings and visibility frequency percentiles the photos represent based on point contrast measurements taken throughout the summer of 1979. We have calculated approximate visual ranges for these pollutant loadings and percentiles from historic data on visual range levels at the Grand Canyon (reported by NPS 1988 and by MacFarland et al. 1983). These estimated levels of visual range and the mean WTP responses obtained by Schulze et al. are shown in Table 2.3-2.

Other use value studies for changes in visibility at parks or recreation areas have typically asked visitors what they would be willing to pay in additional park entrance fees to ensure one level of visibility during their visit to the park versus another level. In general, the

Table 2.3-2
On-Site Use Values for
Visibility Protection at Recreation Sites: Selected Studies

Study	Site[a]	Observations	Initial Visibility (miles)	New Visibility (miles)	$1988 WTP Per Visitor Party Day	Method Used[b]
Rowe, et al. (1980)	Navajo	26	75	50	$6.98	IB
	Navajo	26	75	25	$11.14	IB
	Navajo	26	50	25	$5.19	IB
Schulze, et al. (1981)	GCNP	166	75	95	$2.47	CL
	GCNP	166	75	125	$4.06	CL
	GCNP	166	75	175	$5.73	CL
	GCNP	166	75	240	$7.57	CL
McFarland, et al. (1983)	GCNP	1000	70	100	$1.40	CL
	GCNP	1000	70	130	$2.34	CL
	GCNP	1000	70	165	$3.07	CL
	GCNP	1000	70	215	$4.03	CL
	MVNP	800	70	100	$1.24	CL
	MVNP	800	70	130	$1.68	CL
	MVNP	800	70	165	$2.56	CL
	MVNP	800	70	215	$3.73	CL
Rae (1983)	MVNP	196	74-95[c]	160	$4.42	CR
	MVNP	193	95	160	$11.88	CL
	GSMNP	202	6-12[c]	60	$5.67	CR
	GSMNP	202	12	60	$3.76	CR
	GSMNP	201	12	60	$2.94	CL

a GCNP = Grand Canyon National Park, MVNP = Mesa Verde National Park, GSMNP = Great Smoky Mountains Park, Navajo = Navajo Reservoir, NM.

b All studies used entrance fee vehicles
IB = iterative bidding
CL = Check list of value ranges to select from
CR = Contingent ranking

c Two scenarios, each with a different baseline, provided indistinguishable results and were merged together.

mean WTP estimates obtained in these studies range from $2 to $8 per day per household. These studies are summarized by Chestnut and Rowe (1983), Freeburn (1987) and Gilbert (1989). The results obtained for national parks other than the Grand Canyon are not dramatically different, suggesting that there is not a noticeable premium for the Grand Canyon at least when it comes to on-site use values.

One thing that is striking about the on-site use value results is how small they are compared to expenditures, stated response behavior to visibility changes, and other consumer's surplus estimates, given that viewing is often cited as the single most important activity at national parks. No one has estimated the total consumer's surplus associated with a visit to the GCNP, but Haspel and Johnson (1982) and Johnson and Haspel (1983) estimated total WTP for a visit to Bryce Canyon National Park (BCNP), with average visits lengths of 1 day, at between $93 and $130 ($1988). We have no reason to expect the consumer's surplus for visits to the GCNP would be substantially less than for BCNP. Finally, the results found by MacFarland et al. (1983) suggest that 50 percent changes in visual range at the GCNP would result in a majority of visitors changing their time spent at the park by 13 to .5 hours, a figure that seems potentially inconsistent with WTP estimates of a few dollars per day per visitor party.
There are several possible reasons why the available estimates of the on-site use value component of visibility related consumer's surplus estimates for the GCNP are relatively small.

1. The values may be accurate. Values may be small because while viewing is important, it is not the only aspect of the experience. Moreover, recreators have the ability to substitute to other sites, or in some cases to other activities. Finally, it may be the case that with high trip costs, there is little consumer's surplus left.

2. The reported values may be biased due to survey design elements. Most of these surveys represent relatively early CVM exercises. The responses to these early WTP questions may be biased downward as a result of psychological response behavior that has been identified in the literature, but cannot be statistically adjusted for with the current data. Psychological research suggests that "anchoring and adjustment" problems frequently occur in choice making (Slovic 1969). Individuals may anchor on a well understood situation or value, such as current entrance fees, and adjust this value to respond to the CVM scenario. This adjustment process often falls short of being complete. Respondents may be further anchoring upon what is felt to be a "reasonable" payment, rather than the maximum payment they would make before they would choose the alternative.

Of importance for the studies summarized in Table 2.3-2 is that they used entrance fee vehicles that may have anchored respondents upon the then typical $2 entrance fee. Respondents may have been psychologically prone to consider that if they pay $2 for an entrance fee (covering the whole experience), then something on this order may be "reasonable" to protect the viewing component of the experience. Moreover, respondents

may have objected to the suggestion that national park entrance fees be used to generate funds to control nearby industrial emissions. Little was done or reported in past studies to test or adjust for these types of problems.

Some recent research may support the above argument for downward bias in the on-site use values. Gilbert (1989) estimated changes in consumer's surplus for haze impacts to recreation in Vermont. This study first had respondents allocate trip costs to viewing scenery (called scenery costs), and to other purposes, then asked for an incremental WTP to obtain improved visibility, or to prevent visibility degradation. In contrast to earlier studies, the scenery cost variable serves as the anchor rather than entrance fees and estimated values per day are much higher. Another study by Rowe et al. (1989) examined CVM and travel cost consumer's surplus measures for Atlantic salmon fishing in Maine. The CVM estimates, using a fishing license vehicle, roughly equaled the current license fee, while the travel cost estimates were nearly 10 times larger. The most apparent explanation for this difference was the potential influence of the current license fee as an anchor as to "reasonable payments," which was reinforced by written comments from respondents.

2.3.3 Other Similar CVM Preservation Value Studies

Several other studies address similar preservation valuation issues and have study designs and findings that are instructive for the present study. Two studies (Bishop and Boyle 1985, and Walsh et al. 1982) have estimated total preservation values for protecting sites similar to parklands. The purpose in these studies was different than for the present study because the value being elicited was for preservation of the site (or sites) as a nature preserve or wilderness, rather than for changes in the quality of the resources at these sites. Another study of interest (Sutherland and Walsh 1985) examined the relationship between preservation values for protection of water quality at a recreation site and the distance of the subject's residence from the site.

A fourth study reviewed here (Carson and Mitchell 1988) has estimated total values for protection of the quality of freshwater lakes, rivers and streams (exclusive of drinking water) throughout the country. Although the subject matter is different, there are some similarities to this study in that the subject is the quality of an environmental resource that occurs in all parts of the country and varies from place to place. It is also similar in that the general population was sampled whether or not they were involved in any water related recreation activities.

Bishop and Boyle (1985)

Bishop and Boyle used a mail questionnaire to obtain values to Illinois residents for preserving the Illinois Beach State Nature Preserve, which is located at the southern end of the Illinois Beach State Park on Lake Michigan. The Nature Preserve is currently

threatened by erosion of the sand dunes which if allowed to continue will result in the flooding of the Nature Preserve. A stratified random sample of 600 Illinois residents was selected and the overall response rates were 63%.

Information about the Nature Preserve was included in the form of maps and questions and answers. The willingness to pay question was the close-ended referendum style. Respondents were asked whether they would pay a given amount for a membership to a private foundation that would provide the funds necessary to build an off-shore breakwater and manage the Nature Preserve day to day. Follow-up questions were asked to find out what respondents thought about their answers to the membership question. Additional sections of the questionnaire probed respondents about their familiarity with the Nature Preserve and about their attitudes toward environmental protection and this questionnaire.

Respondents' familiarity with the Nature Preserve was not high even for respondents from nearby counties, but 77% of the sample said that it was somewhat or very important to them personally that the Nature Preserve be preserved. This percentage was about the same for the residents of nearby counties, and for those who live further away and were much less familiar with the Nature Preserve. This suggests that visitation to, or even name recognition of the specific site, may not be as important as might be expected.
The weighted average annual willingness to pay to preserve the Nature Preserve in its current state was $28 per household. The authors took a conservative approach in calculating total values for the State by presuming that non-respondents placed no value on preservation of the Nature Preserve, because those who do not return the questionnaire are more likely to care less (but not necessarily zero) about the resource in question.

Responses to the follow-up questions and the environmental protection attitudes provide some insight about how the respondents were thinking about the issue in general and how they reacted to the presentation of the issue in this particular questionnaire. These types of follow-up and attitude questions are very helpful in interpreting the results of the valuation questions, especially with a mail questionnaire where there is no chance to gage the respondents reaction in any other way.

More than half of the respondents who said yes to the membership question, also checked the follow-up response that said “I don’t know what I would pay for a membership, but I thought the State Nature Preserve should be preserved.” About 85% of the respondents said that it was definitely or probably true that they thought their response was important because they could participate in the decision of whether to preserve the Nature Preserve. These responses suggest that a significant percentage of the respondents were uncertain about what they would have paid for a membership, but that they said yes to the amount asked because they wanted to “vote for” preservation. However, when presented with the statement, "I felt that preserving the State Nature Preserve would not really cost me anything because the membership question was hypothetical," about 62% of the respondents said this was probably or definitely false. It appears that the respondents were uncertain about the actual payment they were willing to make, but that they took the questionnaire seriously and believed that their responses would have an effect on the policy decisions that were made and ultimately on costs that they would bear.

Responses to questions about general environmental protection attitudes also give an idea how respondents think about these issues. The majority of respondents indicated their sentiments that the plants and animals have a right to exist and that human interests should not take precedence. The respondents seemed to be expressing a kind of environmental ethic that was discussed above in the context of existence value. This may be related to why such a large portion of the respondents said that it was somewhat or very important to them personally that the Nature Preserve be protected even though only a small percentage of them had ever visited it. The findings on response attitudes, accuracy and motives suggest these are important issues deserving more attention.

Walsh et al. (1982)

This study obtained estimates of willingness to pay to preserve wilderness areas in Colorado. A mail questionnaire was sent to 600 Colorado residents during summer 1980, with a response rate of 40%. Four maps of the State illustrated alternative levels of wilderness protection, ranging from the then-current area (1.2 million acres) to up to 10 million acres. Respondents were also asked their willingness to pay to preserve alternative amounts of wilderness throughout the remainder of the country.

Respondents were asked to assume that the only way to preserve wilderness in Colorado would be by paying into a special fund to be used exclusively for that purpose. They were then asked the maximum they would be willing to pay each year for each of the four levels of protection. Following this question they were asked to estimate what portion of their payment they would allocate for the following reasons, which the authors interpreted as use value, option value, existence value, and bequest value respectively:

- Payment to visit existing or potential Wilderness Areas this year.
- Payment for the option to visit existing or potential Wilderness Areas in the future, should you choose.
- The value to you from knowing there exists a natural habitat for plants, fish, wildlife, etc.
- The value to you from knowing that future generations will have Wilderness Areas.

Approximately 84% of the respondents were willing to pay some positive amount for the preservation of at least the amount of designated wilderness that existed in Colorado in 1980 and 77% were willing to pay some positive amount for wilderness preservation throughout the country in addition to the payment for Colorado wilderness. Average annual willingness to pay per household for 1980 level wilderness in Colorado was $26, with approximately 45% of this amount being allocated to use value. Average annual additional willingness to pay per Colorado household to preserve current (1980) wilderness

throughout the remainder of the country was $14, with about 20% being allocated to use value. Willingness to pay was higher than this for larger amounts of wilderness in Colorado and throughout the country, although the proportion allocated to use value was somewhat higher for the higher acreage amounts. The percentages of the payment allocated for option, existence, and bequest values were roughly similar, although the percentage given for option value tended to be somewhat smaller than for the other two.

Total values, including both use and preservation values, were significantly related to the distance from the respondent's residence to the nearest wilderness area and to the amount of wilderness visitation made. More frequent visitors and those living nearer gave higher values for both use and non-use motives.

Responses to questions concerning the importance of various reasons for preserving wilderness indicated that preservation related motives were considered somewhat more important than user motives. Protection of water quality, air quality, and wildlife habitat, and knowing that future generations will have wilderness, ranked slightly above recreation use values and option of future use values.

Sutherland and Walsh (1985)

Sutherland and Walsh conducted a CVM study concerning the protection of water quality from degradation due to coal mining in the Flathead River and Flathead Lake area in Montana. This is a recreation area currently used primarily by local residents. Seventy-five percent of the visitors are from Montana and most of the remaining visitors are from neighboring states. The authors were particularly interested in examining the relationship between the WTP responses and the distance the respondent lives from the site.

A mail survey instrument was sent in the summer of 1981 to a sample of residents from four Montana cities located various distances from the site. These distances were 10, 115, 227, and 420 miles. Usable responses from 171 residents were obtained. The response rate was 61 percent. Respondents were asked the total annual amount their household would be willing to pay into a special fund to protect water quality in the Flathead River and Lake area. They were then asked to allocate this payment across four reasons they may want to protect water quality in this area:

1. For their own visits to the area in the current year.

2. For their future visits to the area.

3. To know that good water quality exists in the area.

4. To know that future generations will have good water quality in the area.

The mean total preservation value response was $64, with $7, $11, $20, and $26 being the average amounts (based on percentage of the total) for each of the above reasons, respectively. The results of the analysis of the WTP responses indicates a significant relationship between the WTP response and the distance of residence from the site, and between the WTP and the frequency of visitation to the site, which was also correlated with distance from the site. The authors report that the observed relationship suggests that the value falls to near zero at about 640 miles, although this is based on an extrapolation outside the range of residence distances included in the sample. The authors stress that unlike well-known national parks that might be considered national environmental resources due to wide dissemination of information about them, the Flathead River and Lake area is more of a regional resource with which most non-visitors are not very familiar.

Carson and Mitchell (1988)

Carson and Mitchell conducted a nationwide survey in 1984 concerning the value of protecting the quality of freshwater lakes, rivers and streams throughout the country. In-person interviews were conducted with 813 individual, with 79% of the eligible respondents completing interviews.

The potential range of water quality levels was described with the help of a ladder on which four water quality levels were shown: swimmable, fishable, boatable, and too polluted for any human, plant, or animal contact. It was explained that with current pollution control efforts, 99% of the nation's freshwater lakes, rivers, and streams are at least boatable with most being fishable and perhaps 70-80% being as clean as swimmable. Subjects were told that they are currently paying for pollution control efforts through higher prices and taxes, and that if these control efforts were stopped that the water quality in areas that can now be used only for boating would in many cases fall to less than boatable.

Subjects were asked to give the maximum they would be willing to pay for their household in taxes and higher prices (including the amount they are currently paying) to ensure that the boatable level is maintained in virtually all (99%) water bodies; the maximum additional amount they would pay to have a minimum level of fishable; and the maximum additional amount to have a minimum of swimmable. In follow-up questions subjects were shown estimates of typical amounts paid through higher prices and taxes for water quality protection by households in a similar income category, and were asked if they wanted to revise their responses. A subset of subjects were also told the typical amount a household in their income bracket is paying for air pollution control as well as water pollution control. The idea was to test for the possibility that people forget that water pollution control is only one aspect of environmental quality and would therefore revise their responses downward given the information about air pollution control expenditures. Subjects were also asked if they would still be willing to pay the amount they gave for the fishable level if 5% of the nation's water bodies remained at the boatable level, and if 50% remained at boatable. Subjects were also asked to divide their willingness to pay between the state where they live and the remainder of the country.

Usable willingness to pay responses were obtained from 70% of those who were interviewed. The breakdown of those who did not give usable responses was as follows: (1) 72 said they didn't know; (2) 133 gave protest zeros with explanations falling into one of two groups, attitudes of anti-governmental taxes and expenditures or strong environmentalist attitudes with feelings that putting dollars on such things is immoral; (3) 16 gave responses of more than 5% of their incomes and were judged to be too high; and (4) 10 gave very low estimates (e.g. $1) that were judged to be protest responses that were not caught because a value other than zero was given.

The mean response per household to obtain the swimmable level for all freshwater lakes, rivers, and streams from the baseline of what would occur without current controls (i.e., non-boatable in some areas) was $280 (1984 dollars) per year. The authors used a statistical procedure to account for potential non-response bias when they aggregated to a U.S. total. Responses were weighted to make the sample more representative of the Census population. This adjustment resulted in a 12 percent reduction in the mean WTP value for obtaining the swimmable level.

The authors use an indirect approach to separate values for different motives by comparing the values given by users versus non-users. When non-users were defined as those who reported no in-stream (or in-lake) recreation by household members in the past year, non-use values were at least 30% of total values. When non-users were defined as those who reported no direct or indirect use (e.g. picnicking by a lake or stream), non-use values were at least 19% of total value. These are lower bounds in that no non-use value is attributed to users, although expectations about potential future use by those who were non-users last year are unknown.

Responses indicated that subjects considered the 95% option to be essentially equivalent to the full attainment of the fishable level in all water bodies, and the reduction that was made in responses if only 50% would obtain the fishable level was significantly less than half the original amount given. There is the possibility that subjects were influenced by the wording of the question. Since it asked whether they would still pay the amount they originally gave, there may have been some reluctance to change their answers. A more neutral approach would have been to ask what they would pay for the alternatives involving less than complete attainment of the fishable level.

Subjects reported that about two-thirds of their willingness to pay was for water quality in their own state and one-third for the remainder of the country. The changes in the estimates after subjects were shown estimates of the amount they currently pay for water quality protection, were small. Those whose first response was below their current payment estimates tended to increase their responses somewhat, and those whose first response was above their current payment estimates tended to stay the same. Overall, the subjects' willingness to pay responses were surprisingly close to estimates of their current payment.

Responses concerning willingness to pay for water quality protection did not change significantly when estimates of current payment for air quality protection were also shown to the subjects. This is different than the findings in some previous surveys that found significant changes in responses when more issues were introduced. Since the way these tests were made differ, it is difficult to draw satisfactory conclusions from these findings. This finding may have been the result of introductory information concerning a variety of public issues that may have served to help respondents think about water quality protection issues without forgetting about other competing demands on their budgets. An alternative explanation is that respondents may become defensive when new information is presented that suggests they should reconsider their bids, and therefore refuse to revise their responses.

Finally, income was found to be significantly related to the responses, showing an income elasticity of about 1. This is a larger income effect than has been found in many willingness to pay surveys and may have been influenced by the income adjusted anchors used on the payment cards.

2.3.4 Lessons from the Related Research

Several key lessons from related research highlight issues and directions to be addressed in the current effort.

- The preservation value studies have addressed issues from local sites to nation-wide concerns. The WTP values also vary considerably, from tens of dollars to hundreds of dollars each year, and reflect that respondents do not simply give the same response for any preservation value WTP question. Overall, evaluations of these surveys indicate respondents generally take the survey seriously and attempt to give valid responses to the CVM questions. Respondents acknowledge uncertainty in the accuracy of their responses.

- The researcher must carefully present the policy package of interest, and perhaps present information on related policy actions.

- WTP response tend to generally reflect expressed attitudes and behavior conveyed in other parts of the survey. The use of this type of information is critical for evaluating the survey responses.

- Values in previous studies are found to be related to expected use and often to distance from a site, although this impact may be lessened for more prominent sites, such as national parks. Therefore, these data should be collected.

- Follow-up questions that ask respondents to comment on and evaluate their WTP bids were well received and may be of particular importance in evaluating a CVM application. Respondents acknowledge uncertainty in the accuracy of their responses to total preservation value questions, and addressing the level and impact of this uncertainty upon the analysis is of particular importance for preservation value studies. On the other hand, follow-up questions that ask for new bids based upon new information may not be well received.

- Larger changes in resource provision, beyond the initial proposed change, may result in relatively flat WTP response surfaces, although little investigation has been given to this issue.

- Separating, or disaggregating, values to individual value motives may be a difficult exercise for respondents, just as it is for other characteristics of air pollution control. (See Section 2.2.3). However, using indirect methods, such as in Carson and Mitchell 1988 may add even more error to the exercise. The estimates of value for individual components obtained in these studies are consistent with other survey evidence, although the average option price estimated in Walsh (1982) is quite large relative to theoretical expectations (Freeman 1988). It may be inappropriate and overtaxing to ask respondents to consider separately current use, option value and future use in favor of just asking for values related to current and potential future use.

3.0 STUDY DESIGN

This chapter describes the design of the survey instrument and the implementation procedures.

3.1 DEVELOPMENT OF THE SURVEY INSTRUMENT

This study was designed to address some of the questions that have been raised concerning the estimation of preservation values for visibility protection at national parks and to extend the information available. from previous studies. Basic objectives include:

- Examining how visibility protection values vary across different regions and parks. To do so, the analysis considers visibility impacts at national parks throughout the Southwest, California, and the Southeast; and values are estimated for one selected park in each region.

- Analyzing how different resource protection attitudes and behaviors are tied to WTP, and to the motive definitions economists traditionally use (option price, bequest value, existence value). This examines the validity of the separation of values into these motive categories, which is also done in the study.

- Examining the impact of respondent uncertainty in the CVM exercise upon the reported values, and examining which respondent characteristics are tied to valuation uncertainty. This is accomplished through a follow-up question on the respondents' self-perceived accuracy of their WTP responses.

- Testing for the ability to control part-whole bias related to other air pollution impacts and other national park natural resource protection issues, and correcting for any such bias. This is done through a survey design attempting to mitigate such impacts before the WTP question, paired with a follow-up question addressing the existence and significance of the problem.

- Developing direct and realistic CVM scenario context information, and testing the impact of specific changes in context information.

- Addressing the issue of what level of information must be presented about visibility protection at other potentially competing national park sites, while bidding on only one park region, by including this information in some survey versions, but not in others.

- Addressing how visibility values change with changes in the number of park regions to be protected by including a survey version that addresses values for protection in three regions at once.

- Refining select CVM design features and analysis procedures to address issues raised in the literature.

Six versions of the questionnaire were developed to address these questions. All versions included a photograph insert showing alternative visibility conditions at one or more national parks. These versions are summarized in Table 3.1-1 and discussed below.

3.1.1 Pilot Tests, Peer Reviews, and Pretests

After two rounds of pilot testing, with approximately ten individuals per round, a revised instrument was prepared and sent out for peer review. The reviewers included sociologists familiar with national park visitor issues and survey design issues, economists familiar with CVM design, and an atmospheric scientist familiar with visibility issues. Based upon these reviews, the instrument. was revised to a pretest draft.

Twenty in-person pretests were conducted by two professional interviewers from Colorado Market Research, a Denver survey firm. The interviewers obtained responses from twenty Denver residents in several different neighborhoods selected to represent a range of socioeconomic characteristics. The interviewers carried a display showing the same photographs and map as were used in the final questionnaire insert. Respondents were shown the display and asked to answer the questionnaire on their own. The interviewer then asked some specifically prepared follow-up questions and made note of any other comments offered by the respondents.

Overall, the pretest respondents indicated interest in the topic and in the photographs and seemed to understand the questions, including the WTP questions. The pretest results indicated that the average time to complete the questionnaire (33 minutes) was still longer than desired. A few more questions were therefore either simplified or eliminated to get the expected average completion time closer to 25 minutes. Other minor changes in the presentation were also made to further streamline and reduce the print on each page, as well as to further refine some specific wordings.

One of the pretest follow-up questions was whether the respondent felt his WTP responses were for the specific changes in visibility only, or the responses also included some value for the protection of national parks in general. The responses to this question suggested that some of the respondents were including general values. This question was, therefore, included in the final questionnaire.

3.1.2 Outline of the Final Baseline Questionnaire

The baseline version (labeled Version 3 below) of the questionnaire consists of six sections, with WTP questions focusing on the national parks in the Southwest. A copy of this baseline questionnaire is included in Appendix A and includes the sections discussed below.

Table 3.1-1
Summary of Questionnaire Versions

	Title	Photo Insert Illustrates	Focus Region for WTP	Focus Park
1.	California Parks	3 regions	California	Yosemite
2.	Southeast Parks	3 regions	Southeast	Shenandoah
3.	Southwest Parks (Baseline version)	3 regions	Southwest	Grand Canyon
4.	Multiple Regions (1 WTP for each of three region)	3 regions	California, Southeast, and Southwest	Yosemite, Shenandoah, and Grand Canyon
5.	Limited Information (reduced WTP scenario details)	3 regions	Southwest	Grand Canyon
6.	Single Region Focus (presentation for only 1 region)	1 region only	Southwest	Grand Canyon

Cover

The cover provides the title "MANAGING VISIBILITY AT NATIONAL PARKS: WHAT IS YOUR OPINION?"; a pictograph with trees, mountains, a dollar sign, fish and a family to indicate a variety of competing issues facing the family and the natural environment. The cover also states, “Research conducted for the Center for Economic Analysis at the University of Colorado.” The back cover states that the survey should be returned to RCG/Hagler, Bailly. These affiliations, rather than a federal agency, are listed to reduce any perceived incentives related to potential sponsor bias (Mitchell and Carson 1989). The back cover also allows space for comments, which are used in consistency checking of individual responses, and to better understand the overall responses.

Section 1: About Your Visits to National Parks

The first four questions in this section concern the respondent's past and expected future visitation to national parks. These questions are fairly straightforward making it relatively easy for the respondent to get started (Dillman 1978). They also get the respondent thinking about national parks in general and their own past and intended future visitation and experiences as a means to help the respondent begin to establish the substantive importance to themselves, if any, of the hypothesized visibility changes.

National park visitation is expected to be an important factor related to responses concerning the value of protecting visibility at national parks for two reasons. The first is that visiting national parks probably reflects a greater interest and concern for the protection of this sort of resource, and will therefore be one measure of differences in tastes and preferences across the sample. The second is that national park visitors will have some actual experience to draw upon in answering the questions, which may result in some differences in their responses to hypothetical questions. These hypotheses are tested in Chapter 4.

These questions also lead the respondent to view the map included in the insert, which shows most of the national parks in the country at which visibility is considered an important resource[1] (See below for discussion of the insert). This distinction allowed the focus to be on just those units of concern, versus all NPS units, without using the term “class I areas.” This map is intended to help define the regions (Southwest, Southeast and California) used in the questions, identify the national parks in the region where visibility is an important resource, and to provide the subsequent perspective that the WTP questions are about only a portion of all the national parks that might be of interest to the respondent.

[1] Section 169a of the Clean Air Act gives certain measures of visibility protection to federal class I areas where visibility is an important resource. Subsequently, regulations were promulgated (40 CFR Part 81.400; November 30, 1979) identifying these sites following NPS recommendations.

The last three questions in this section let the respondent consider the importance, if any, of reasons (or motives) people may want to visit and protect national parks. Question 5 asks respondents to rate the importance of potential reasons for visiting national parks. The list is based, in part, on results of national park visitor surveys (Ross et al. 1985) and is intended to allow some distinction between reasons related specifically to enjoying the natural environment versus other reasons people visit national parks, such as to spend time with family or to simply have a change of surroundings. Questions 6 and 7 are about the respondents' interest in protecting national parks even if they personally could never visit a national park. The purpose of these two questions is to identify the relative importance of bequest value and existence value types of motives for the preservation and management of national park resources, and to get respondents thinking about the reasons they may want national parks preserved, and protected.

The information on attitudes about national park use and protection are also useful as consistency checks on WTP responses. I.e., one would expect that those with strong use and non-use protection attitudes would be more likely to provide positive WTP. One would also expect those with higher scores for preservation, even if they could not visit the park, would assign a larger share of their WTP to bequest value and existence value motives in subsequent questions.

Section 2: About Pollution Issues Facing National Parks

Question 8 asks respondents to consider several different types of potential pollution impacts to national park resources from human activities outside the parks, and whether they consider the prevention of each a low, medium, or high priority. One of the impacts listed is visibility degradation. This question is aimed at:

- Getting respondents to think about the range of potential threats to park resources before considering one threat in more detail as a means of attempting to separate visibility protection from other national resource protection issues. This again is directed to minimize part-whole bias as well as to acknowledge competing resource protection issues.

- Obtaining information about the perceived relative importance of protecting visibility versus other types of pollution impacts from human activities outside the parks.

- Introducing the impacts as being due to man-made activity, and originating from outside the parks.

Section 3: About Visibility In and Around National Parks

This section serves to introduce, through the photograph insert and text discussions and questions, the range of effects of air pollution on visibility conditions in the three study regions. The photograph insert is discussed in detail below in Section 3.2. The photographs are presented as representing events that occur with different frequencies "on days without rain or fog" (underline added). Frequencies are presented to communicate that the average condition does not occur on all days, but rather there is a distribution of different conditions. The underlined text above is also stated on the photograph insert. The pretest results indicate respondents seem to understand this caveat.

Question 9 asks what effect having visibility as in Photo B rather than as in Photo C would have on the respondent's enjoyment of a national park visit in each of the three regions. Photo B shows a somewhat less than average amount of haze for each of the park regions, while Photo C shows the average for each region. This is the visibility change considered in the first WTP scenario. This question is intended to have respondents consider the potential significance, if any, that such a change in visibility would have for them personally (and presumably for others as well) during a park visit. This is expected to be related to option price and bequest value motives and serves to get respondents thinking about how they would be affected by such a change before asking them the more difficult WTP questions. This question also provides non-dollar information about how important a change in visibility might be for the respondent in terms of his or her own park visitation, which is useful in evaluating and interpreting the WTP responses, and provides some information from each respondent about potential attitudes toward visibility protection for all three park regions as opposed to just the one region considered in the WTP section of most survey versions.

Question 10 begins to define the pollution control mechanisms, the payment vehicle, and social context of the visibility transaction to be used in the CVM questions terms of who will pay and how. After introducing this context, it asks how willing the respondent might be to pay higher prices or taxes to support visibility protection for national park in each of the three regions. It also highlights that each region is only one of many that might be considered for additional visibility protection to again recognize the potential for competing resource protection and to reduce potential part-whole bias. This question also provides information from each respondent about attitudes toward paying for visibility protection for all three regions, unlike the specific WTP questions that focus on just one region.

Section 4: About Visibility at National Parks in the Southwest

Question 11 asks that the subject consider the photographs (for Version 3) for the Grand Canyon NP, as representative of conditions at national parks throughout the Southwest, and assess the importance of (1) improving visibility and (2) preventing visibility from getting worse at national parks in the Southwest. This question brings the respondent's focus to the single region of interest for the subsequent WTP questions and provides some non-

dollar information about the respondent's attitude toward visibility protection for parks in that region. It also introduces the idea that additional expenditures might be required to prevent visibility from deteriorating as well as to obtain improvements over current conditions. Indirectly, one can also assess the applicability to visibility protection of a prospect theory (Kahneman and Tversky 1979 and 1982) tenet that preventing losses is seen as more important than obtaining gains.

Section 5: What is the Value of Protecting Visibility at National Parks in the Southwest

This section establishes the context for the WTP valuation, includes the specific WTP questions, and includes follow-up questions to help in interpreting the WTP responses. Key elements in the scenario development include:

- "New air pollution laws being considered for the protection of visibility at national parks in the Southwest could mean higher prices and higher taxes throughout the country." This reinforces the vehicle and social context of the payment introduced in the prior section.

- "These questions concern only visibility at national parks in the Southwest and assume there will be no change in visibility at national parks in other regions. Other households are being asked about visibility, human health and vegetation protection in urban areas and at national parks in other regions." These comments are designed to reduce the tendency to include values for other air pollution impacts and at other locations into the visibility value responses.

- "... assume you could be sure that any change would occur next year and continue forever, ..." This is included to reduce concerns about the certainty of provision, which has been identified as a concern by Mitchell and Carson (1989), Fischhoff and Furby (1988) and others.

- "... all households now and in the future would also pay the most it is worth to them to protect visibility." This again establishes the social context of the transaction in terms of who will pay. Moreover, it is intended to partially address concerns raised by Madariaga and McConnell (1987) about bequest values (See Section 2.2). These authors indicate that, to correctly formulate WTP values related to bequest values, respondents must know the benefits and costs to future generations. However, future benefits and costs cannot be known. This comment, therefore, addresses this problem by stating that future generations will pay the most it is worth to them, implying that net benefits to others can be assumed to be unchanged.

- "... average conditions will change in and around all national parks in the Southwest..." Again, to minimize potential aggregation biases (since many policies could affect many national parks rather than just one), regional aggregate bids are obtained, then disaggregated to values for the individual parks shown in the photographs.

Three WTP questions follow this introduction. Each question asks "What is the most your household would be willing to pay every year in increased prices and taxes" for the specified change in average visibility conditions "at all national parks in the Southwest." While monthly payments may better proxy financial decision-making for many households, annual payments are perceived by the research team to better clarify the annual financial impacts in relation to budget constraints (in order to minimize potential budget constraint bias identified by Mitchell and Carson, 1989), and are expected to have a downward effect on the valuation (see the discussion of aggregation in Section 2.2.3).

The WTP approach is selected, as opposed to a willingness to accept payment (WTA) to forgo improvements, or to incur degradation, due to the operational practicalities. WTA measures have some appeal in theory, and may be appropriate if the affected individuals have a property right to be compensated by the lluters. Where WTA measures are appropriate, they can be expected to exceed WTP measures. However, the theoretical difference is uncertain and may range from very small under specific assumptions (Randall and Stoll 1980) to very large if preferences begin to reflect a lexicographic ordering phenomenon. Operationally, WTA responses are often plagued by those who do not respond, or respond with infinity, potentially reflecting emotional or ethical rejection of the WTA premise. As a result, CVM practitioners often advise against the use of WTA measures (Mitchell and Carson 1989). Finally, any policy the reduces widespread haze impacts at national parks will likely call for control measures that are ultimately paid for by a large number of individuals, or even by all of society. Therefore, a WTP measure has an appropriate foundation in policy analysis as well.

WTP is obtained for the three hypothesized changes in average visibility conditions.

1. Obtaining improvement in average conditions from Photo C to Photo B. This is a compensating surplus value measure and is subsequently referred to as WTP1.

2. Obtaining improvement in average visibility conditions from Photo C to Photo A, which exceeds (or equals) the improvement from Photo C to Photo B. This is a compensating surplus value measure and is subsequently referred to as WTP2.

3. Preventing degradation in average visibility conditions from Photo C to Photo D. This is an equivalent surplus measure and is referred to as WTP3.

Prospect theory, and neo-classical utility theory, would suggest that for a comparable visibility change, WTP to prevent a degradation would exceed WTP to obtain an improvement, but the expected magnitude of such a difference is uncertain.

The WTP elicitation procedure in the questionnaire employs a payment card approach with no benchmarks, where respondents have the option to review a variety of potential alternative payments and choose the best response. This approach was selected to obtain greater estimation efficiency for the selected sample size, as opposed to referendum approaches (Cameron and Huppert 1988). In addition, we have found that payment cards typically obtain lower item non-response rates in mail surveys than do open ended WTP questions (see, for example, Rowe et al. 1986, Rowe et al. 1985, and Rowe and Schulze, 1987). The dollar checklist is the same for each WTP question and ranges from $0.00 to "more than $750." To minimize the potential for researcher induced range bias discussed by Mitchell and Carson (1989), and Fischhoff and Furby (1988), the range of values included in the checklist was based on the pretest results.

Question 1.5 asks respondents to give any information that might help explain their answers to the WTP questions. This approach was selected over a checklist of possible explanations for zero responses because we have found that comments offered in the respondents' own words are very helpful for interpreting the refusals, zeros, high bids, and other non-zero WTP responses, and it allows the researcher the benefit of the respondent's own clarification on the issue and their WTP response. Respondents are also invited to give any additional comments on the back page of the questionnaire.

Question 16 recognizes the difficulty in such-WTP exercises and asks for a self assessment of the accuracy of the WTP responses. It allows respondents to indicate the overall strength of the value signal provided. Fischhoff and Furby (1988) express concern about "forcing" more out of respondents than they have to give. They suggest it may be more appropriate to screen respondents for whether they have answers to give, than for them to be forced to trust and express nascent feelings (page 169). To address the impact of any forcing induced by survey design, this question was intended to allow examination of the differences in responses between those who believe their responses are fairly accurate versus those who believe their responses are very inaccurate.

Following in the same vein, Question 17 asks respondents to consider their WTP responses and to say whether they were basically for the stated changes in visibility at national parks or whether the responses also reflected values for other needs. Based upon the pretest, there was particular concern that the WTP values may reflect a contribution to support other needs at national parks as well as visibility protection. The second part of the question asks respondents who say that other concerns are also reflected in their WTP to then estimate what percentage of their WTP responses is really for visibility. Because the early sections in the questionnaire separated visibility from other issues, and clearly indicated that the WTP responses were to be only for the stated visibility changes at national parks, this question provides information to address whether extensive scenario development can, on its own, overcome potential part-whole bias for related resource protection issues, and provides data to correct for any such bias in the value calculations.

Question 18 asks respondents to estimate what percentage of their WTP for the region they would want to allocate to the specific national park illustrated in the photographs. This reverses the order of these questions as compared to the Southwest Parklands study (Schulze et al. 1981) in which subjects were first asked a WTP for the Grand Canyon and then a WTP for the remainder of the region. The decision was made to start with WTP for the region because:

- The long range transport nature of the emissions related to many of the current visibility effects at national parks suggests that many pollution control strategies targeting visibility at national parks are likely to have regional, rather than single park, effects, and

- It is presumed that the appropriate aggregation/disaggregation approach is to start with large units all simultaneously affected by a policy package and then disaggregate to small units to obtain individual park values.

Question 19 asks respondents to give the percentage of their WTP responses that they would attribute to the following motives:

- So my household and I could enjoy conditions as natural as possible on visits to national parks in the Southwest

- So others, now and in the future, could enjoy conditions as natural as possible on visits to national parks in the Southwest

- To have conditions as natural as possible at national parks in the Southwest, even if no one were to ever visit

- Other (please specify)

These potential motives are defined to reflect option price, bequest value, and existence value as defined in Section 2.1. Some previous CVM studies (Greenley et al., 1981) have asked for separate WTP estimates for the different motives, assuming that these could be summed to obtain a total preservation value. The approach taken here presumes there is less potential for upward bias in the total value estimate, which is of most importance, and in the individual component value estimates, if the total is first obtained and then disaggregated to value components (see Section 2.2.3).

Section 6: About You and Your Household

The last page of questions concerns socioeconomic characteristics of the respondent and the household that might be related to attitudes about visibility protection at national parks. These include age, sex, education level, and employment status of the respondent; and the number and age of all household members and household income.

3.1.3 Description of the Six Versions

As summarized in Table 3.1-1, questionnaire Versions 1, 2, and 3 are identical except that they focus on different regions in Sections 4 and 5 (Questions 11-19) of the questionnaire. Version 1 focuses on national parks in California, as illustrated in the photo insert by Yosemite National Park. Version 2 focuses on national parks in the Southeast, as illustrated in the photo insert by Shenandoah National Park. Version 3 focuses on national parks in the Southwest, as illustrated in the photo insert by Grand Canyon National Park. The photo insert, discussed below, is identical for Versions 1 through 5. As summarized in Table 3.1-1, Versions 4, 5, and 6 reflect alternative variation of the instrument to allow for tests of the effects of specific changes in the design.

Version 4: Multiple Region Focus

There is concern in CVM exercises that values for resource protection for one site (or issue) will be different if resource protection must simultaneously be purchased at multiple sites (or for multiple issues). As a result, it may be invalid to add together values for individual policy package components, if they were estimated independently and individually, to obtain a total value for the entire policy package. I.e., one may not be able to add together values derived separately for the Southwest and California to value a policy package that obtains both. This is the aggregation problem discussed in Chapter 2.

For visibility protection at national parks, it may be the case that some policies may impact multiple regions simultaneously. To examine the potential magnitude of the aggregation problem for more than one region, Version 4 includes WTP question about visibility protection for national parks in all three regions simultaneously.

All the introductory questions and information are the same as in the baseline survey version, except that Question 11 and the WTP introduction refer to all three regions rather than just one. The introduction to the WTP questions in Version 4 reads as follows:

> New air pollution controls being considered for the protection of visibility at national parks in California, the Southwest, and the Southeast could mean higher prices and higher taxes throughout the country. The next questions concern how much obtaining improvements and preventing worsening in visibility at national parks in each of these regions would be worth to your household if you had to pay for the improvements in all three regions each year.
>
> These questions concern only visibility at national parks in California, the Southwest, and the Southeast, and assume there will be no change in visibility at national parks in other regions.... (the remainder of the introduction is unchanged).

There are three separate WTP questions, one for each region for obtaining an improvement in average visibility conditions from the current 50th to the current 75th percentile at national parks in that region. The WTP follow-up questions are the same except that the percentage for a single park is not asked, and the remaining questions refer to all three regions.

The responses to these three WTP questions can be analyzed in concert with the responses to the first WTP question in Versions 1 through 3: Question 12 in Version 4 asks for a WTP for the same change in visibility as that asked in Question 12 in Version 1; Question 13 in Version 4 asks for a WTP for the same change in visibility as that asked in Question 12 in Version 3; and Question 14 in Version 4 asks for a WTP for the same change in visibility as that asked in Question 12 in Version 2.

Version 5: Limited Information

The continuing investigation into the design of CVM scenarios has tended to lead to identifying more and more transactions characteristics that may impact the valuation. For example, Mitchell and Carson (1989) have defined many potential sources of bias due to the selection or inclusion of scenario information. Similarly, Fischhoff and Furby (1988) have identified a long list of definitional attributes that may be important. These issues were discussed in Chapter 2. In fact, nearly every CVM author has added information issues of concern to the scenario design. The problem, however, arises that to meet every identified potential need may result in a deluge of detail that distracts attention from the critical features of the CVM scenario. Some attempts must be made to begin to look away from what information may have some impact, and to look to what information has the most significant impacts upon the magnitude of the estimates.

Version 5 presents one look at this issue by simply deleting most of the second paragraph in the baseline WTP scenario development, which includes several potential information needs recently identified in the literature. Specifically, Version 5 deletes the following information used in Version 3 (with identifiers (l), (2) and (3) added for reference in the subsequent discussion):

> (1) Other households are being asked about visibility, human health and vegetation protection in urban areas and at national parks in other regions. (2) For these questions, assume you could be sure that any change would occur next year and continue forever, and (3) all households now and in the future would also pay the most it is worth to them to protect visibility.

Comment (1) was originally included to reduce incentives to inflate WTP to cover values for other air pollution control effects as a means of reducing part-whole bias. The effect of its deletion, if any, is expected to result in higher WTP values. Comment (2) reduced uncertainty about the provision of the good. Mitchell and Carson (1989) and Fischhoff and Furby (1988) suggest that if this is unspecified, the subject may have concerns about the

actual provision of the good. The effect of its deletion, if any, is expected to result in lower WTP values. However, we suspect the effect may be minimal as our experience is that most individuals accept the assumption of the stated change for responding to the valuation, and those who are uncertain, or do not accept the assumption, frequently state $0 and add written comments clarifying the rejection nature of their response, which leads to their WTP response being treated as a rejection bid rather than a valid value statement for visibility changes. Comment (3) was included to better establish the social context of the transaction, and to address the bequest value formation and interpretation concerns raised by Madariaga and McConnell (1987). Omitting this information reintroduces the "individualistic altruism motive" these authors identify, and the effect, if any, is expected to increase bids.

Several of the follow-up questions can also be examined to see if the difference in the introduction has any effect. Overall, the deletion of this information could have minimal effect if the individual effects are all minimal, or if the effects are offsetting. Because we expect minimal impact of deleting the comment on certainty, but cannot be sure of these expectations, we expect the deleting of this paragraph will have a zero or positive impact upon the bids.

Version 6: Single Region Focus

As identified in Chapter 2, there is concern that CVM experiments need to identify, or even include, other similar environmental impacts that may compete for funding. The primary issue that motivates this concern is potential part-whole bias, where the respondent may inadvertently include values for related goods. Therefore, it is sometimes argued that stated values for the resource protection issue in question may be overstated, due to failure to at least consider the existence of other competing resource protection issues in the survey instrument. If many competing resource protection issues must all be identified, explained, and even bid upon in CVM experiments, it adds significant complexity and cost to the exercise, may distract the respondents from focusing upon the one resource protection issue of most concern, and may result in lower response rates. For visibility protection at national parks, an important aspect of this question is the extent to which respondents are able to isolate national parks in a single region, or a single national park, from other national parks around the country.

To begin to address this issue, Version 6 focuses on the national parks of the Southwest and does not include many of the questions, or parts of questions, in the baseline version that refer to visitation to and visibility protection at national parks in other regions. Also the photograph insert included with the Version 6 questionnaire shows only the photographs of the Grand Canyon National Park. Sections 3 and 4 are combined and all of the questions in this section refer only to national parks in the Southwest. The WTP questions and the remainder of Sections 5 and 6 are identical to Version 3.

3.2 PRESENTATION OF VISIBILITY CONDITIONS

3.2.1 Visual Air Quality Measures and Human Perception

Because the survey relies on photographs to convey important information about visual air quality at the national parks, it is important to consider what is known about how human subjects perceive visual air quality depicted in this way. Several studies have been conducted that have examined the factors influencing human judgements of visual air quality. Malm et al. (1980, 1981), for example, asked subjects to rate the visual air quality in a series of scenes on a 1 to 10 scale. This rating is called the Perceived Visual Air Quality (PVAQ).

The relationship between PVAQ and the importance (and hence WTP) a subject might place on obtaining better or preventing worse visual air quality has not been examined. There is no reason to assume that because a subject can perceive a difference in visual air quality that they value such a change, but it is probably safe to assume that there is no value for changes that cannot be perceived. It is probably ‘also safe to assume that for any one individual, a larger change in PVAQ would be valued the same or greater than a smaller change in PVAQ. Thus, factors that are correlated with PVAQ are likely to be correlated with WTP. We can, therefore, use the results of the PVAQ studies to help minimize the introduction of extraneous factors in the presentation of alternative levels of visibility that are known to influence PVAQ judgements. We can also use the results of the PVAQ studies to identify physical parameters that may be appropriate for relating WTP based on specific photographs to objective measures of air quality that can be tied to pollution emissions.

Four findings from the PVAQ studies are particularly important for consideration in designing and analyzing WTP studies concerning visibility conditions.

1. PVAQ ratings of actual scenes are correlated with PVAQ ratings of slides taken at the same time.

This means that using photographic representations to illustrate different levels of visual air quality is not likely to introduce distortions in subjects’ responses relative to how they would respond to the actual scene in person. There are, however, many remaining questions concerning the use of photographs in WTP studies for changes in visibility. Several important factors that are not known include how differences in the features of the scene used to illustrate different levels of air quality might be expected to affect WTP responses, and how color differences between on-site viewing and photographic representations might affect WTP responses.

2. PVAQ ratings are affected by the presence of clouds, snow cover, and sun angle, as well as by air quality.

These findings underscore the importance of holding factors other than air quality constant when illustrating different levels of visual air quality for evaluation by subjects.

3. When there is a dominant distant feature in the scene, and factors such as cloud cover and sun angle are held constant, PVAQ ratings are linearly related to the atmospheric transmittance between the feature and the observer. Therefore, PVAQ is, to a first approximation, proportional to the apparent contrast of the feature against the horizon sky.

Because contrast is an objective measure of visibility conditions, it is reassuring that it has been found to be so highly correlated with PVAQ judgements. This means that subjects are responding to measurable changes in air quality in some predictable fashion. Malm et al. (1981) suggest that in the presence of multiple vista elements, PVAQ will be a function of the contrast (transmittance) of each element weighted by the fractional area subtended by that element. They qualify this suggestion with the observation that subjects seem to key in on the most sensitive features of the scene when judging changes in visual air quality. For example, a foreground feature with unchanged contrast does not seem to affect PVAQ judgements when more distant features are changing.

4. PVAQ ratings are inversely, and non-linearly, related to measures of light extinction between the observer and a distant target, such that the PVAQ ratings are more sensitive to increases in pollution (i.e., decreases in light extinction) in cleaner atmospheres.

Light extinction is inversely related to visual range, which is the distance at which a large black object on the horizon is just perceptible. This means that PVAQ ratings can be expected to be positively related to visual range levels.

3.2.2 Selection of Photographs

Visibility conditions at national parks in each of the regions are illustrated with a set of photographs from a park in each region selected from the National Park Service air quality monitoring network. This network includes automatic cameras at several national parks around the country that take daily photographs of the same view at set times of day. This network is managed for the National Park Service by Air Resource Specialists, Inc., in Fort Collins, Colorado.

The parks selected to represent each of the regions are those with visibility conditions typical of most parks in the region and for which photographs were available. The selected parks are well-known parks and among the most frequently visited in each region. Yosemite National Park was selected for California, Grand Canyon National Park for the Southwest, and Shenandoah National Park for the Southeast.

The decision was made to use actual photographs rather than computer generated photographs for two reasons. The first was that the availability of the extensive NPS photograph network made it possible to obtain an acceptable set of photographs for each park (showing a range of air quality conditions with minimal variation in other factors) at relatively low cost. The second reason was that using actual photographs enhances the credibility of the presentation because it is possible to say that these various conditions actually occur, as opposed to explaining that the photos presented are artificially generated representations of conditions that do occur. Using actual photographs, however, makes it impossible to maintain exact uniformity in all factors other than air quality.

The photographs used in this study were selected to show a range of visibility conditions associated with different levels of air quality, with differences such as sun angle, clouds, snow, and color avoided as much as possible. All of the selected photographs were taken at 3 o'clock in the afternoon. Slight differences in sun angle therefore occur because the photographs were all not taken on the same day of the year. Slight differences in color due to slides being processed in different batches were also difficult to avoid.

The WTP questions in this study are framed in terms of changes in average visibility conditions, but a range of visibility conditions is shown to communicate that there is a distribution of conditions, that all days are not "average," and that a change in the average really means a shift in the distribution. Due to differences in the pattern of meteorological conditions across the seasons, presentation of an annual distribution of visibility conditions due to fluctuations in air quality can be confounded by the differences in the meteorology. We therefore decided to show the typical range of conditions during the summer, when the majority of national park visitation currently occurs. Because the purpose of the presentation is to communicate the general day-to-day variability of conditions for a lay audience, rather than give a precise depiction of a year-round distribution, and because it is necessary to keep the information presentation brief, no information about visibility conditions during other times of the year is presented. In fact, median visibility conditions are typically somewhat better in the winter than in the summer, but show a similar variability between best and worst conditions at most national parks.

Slides were selected by Air Resource Specialists, Inc., to approximately represent typical 10th, 50th, 75th, and 90th percentiles of summertime visibility conditions at each park. These slides were then reproduced as printed photographs on the glossy inserts. These photographs are not exact representations of each of these percentiles, but can be expected to adequately represent the range of these percentiles in most years. This is because the film processing and photograph reproduction process always introduces some slight changes and because actual visibility conditions vary from year to year.

Table 3.2-1 gives information about each of the photographs including the view, the NPS inventory number, and values for different visibility measures.[2]

[2] For additional technical discussion see Malm et al. (1980, 1981), EPA (1985) and Trijonis et al. (1990).

Table 3.2-1
Photographs Used to Illustrate Visibility Conditions

Park	View	NPS Photo Inventory Number	Representative Percentile	Average Visual Range for the Percentile (km)	Single-Target Contrast	Single-Target Atmospheric Transmission	Weighted Average Atmospheric Transmission
Yosemite	Half Dome	A 65	90	150	-0.81	0.00	0.973
		B 657	75	125	-0.66	0.73	0.924
		C 114	50	90	-0.23	0.26	0.723
		D 105	10	45	-0.05	0.06	0.524
Grand Canyon	Mt. Trumbull	A 738	90	250	-0.71	0.89	0.941
		B 887	75	200	-0.72	0.90	0.945
		C 1087	50	155	-0.64	0.80	0.892
		D 1182	10	115	-0.55	0.69	0.830
Shenandoah	Rocky Mt.	A 552	90	75	-0.84	0.93	0.861
		B 1869	75	50	-0.39	0.43	0.445
		C 2297	50	25	-0.35	0.39	0.418
		D 379	10	10	-0.15	0.17	0.256

- Representative percentile is the approximate percent of time visibility is less than or equal to the represented level during the summer season.

- Visual range is the distance at which a large black object just disappears from view, or can no longer be distinguished from the background.

- Single-target atmospheric transmission is a measure of the light transmitted from a single point in the scene.

- Single-target contrast is derived from the single-target atmospheric transmission and is a measure of the difference in brightness between the target and the background.

- Weighted average atmospheric transmission is the atmospheric transmission between each scenic feature and the observer, weighted by the fractional area of the scene subtended by each feature.

None of these measures fully accounts for the different content of the scenes across the three national parks considered, and they therefore have limitations for use in comparisons across the different parks.

The approximate visual ranges typical of each percentile are given in the table. NPS (1988) reports 10th, 50th, and 90th percentile visual ranges for each of the national parks in the network based on teleradiometer, photographic densitometry, or extinction measurements. We took the averages of the 10th, 50th, and 90th percentile estimates reported for monitored summers (available data varies by park, but typically cover several years during the 1980s) at each of the three parks and interpolated to get an approximate visual range for the 75th percentile at each park.

The last three measures given in Table 3.2-1 are taken directly from the photograph insert used in the survey. NPS staff calcula:. these measurements using information recorded with a digitizing camera, which converts light reflected from the image into digital density values. As expected, these measures are somewhat, but not dramatically, different than the same measures for the original slides.

The single-target measures used Half Dome in the Yosemite photos, the U-shaped ridge to the right of Mount Trumbull in the Grand Canyon photos, and the near ridge to the right of the center of the image in the Shenandoah photos. Due to the target specific nature of these single-target contrast measurements, it is not appropriate to compare these across the scenes for the different parks, or to necessarily infer that the contrast at the point is representative of the entire photograph.

The weighted average atmospheric transmission measurements may be somewhat more comparable across the scenes for the different parks because they take into account each different-distance feature in the overall atmospheric transmission.

One potential problem in the photoset is that both of the atmospheric transmission measurements for the 75th and 90th percentile photographs for the Grand Canyon are virtually identical. The visual air quality in both of these photographs is quite high, but visual inspection shows that the detail of the canyon walls is more clearly delineated in the 90th percentile photograph than in the 75th percentile photograph. Atmospheric transmission is just one technical measure that can be used to characterize visual air quality, but it does not necessarily reflect all the information that the human observer sees and responds to when viewing a scene.

3.2.3 Layout of the Photograph Insert

Two inserts were developed to accompany the survey instrument: the baseline insert, used with Versions 1 through 5; and the Versions 6 insert, which focused upon the Southwest and the Grand Canyon National Park. The baseline insert is a single sheet of glossy stock that measures about 16 by 17 inches and is folded three times. The Version 6 insert measures about 11 by 13.5 inches. The title pages, shown in actual size in Figures 3.2-1 and 3.2-2, state that the visibility impacts are due to air pollution on days without rain or natural fog to reinforce that the survey concerns man-made pollution impacts upon visibility. The map, which is about 17 by 8.5 inches in the baseline insert and 12 by 5.5 in the Version 6 insert, is shown reduced in Figure 3.2-3. The map shows the continental United States divided into six regions and identifies all of the national parks that are defined as Class I areas under the Clean Air Act and that NPS has identified as parks where visibility is considered an important resource (40 CFR Part 81.400).

Inside the baseline insert, four 3 by 5 inch photographs for each of three parks are positioned in vertical columns as illustrated in Figure 3.2-4. The name of the park is given at the top of each of the three columns: Yosemite, Grand Canyon, and Shenandoah. The A photos are in the top row, and these are the 90th percentile photos for each park showing the best visibility conditions. The visibility descends to the bottom row showing the 10th percentile for each park. The Version 6 insert includes just the Grand Canyon photographs as arranged in Figure 3.2-5. The captions are the same for the four photos for each park and read as follows:

A. Visibility on about 15% of days

B. Visibility on about 20% of days

C. Visibility on about 40% of days

D. Visibility on about 25% of days

Figure 3.2-1
Insert Title Page
Version 1 through 5

VISIBILITY IN THE NATIONAL PARKS

Visibility Impacts Due to Air Pollution on Summer Days Without Rain or Natural Fog

Photographs and Map Inside

Figure 3.2-2
Insert Title Page
Version 6

VISIBILITY

IN

GRAND CANYON

NATIONAL PARK

Visibility Impacts
Due to Air Pollution
on Summer Days
Without Rain or Natural Fog

Photographs and Map Inside

Figure 3.2-3
Insert Map

NATIONAL PARKS WHERE VISIBILITY IS

CONSIDERED AN IMPORTANT RESOURCE

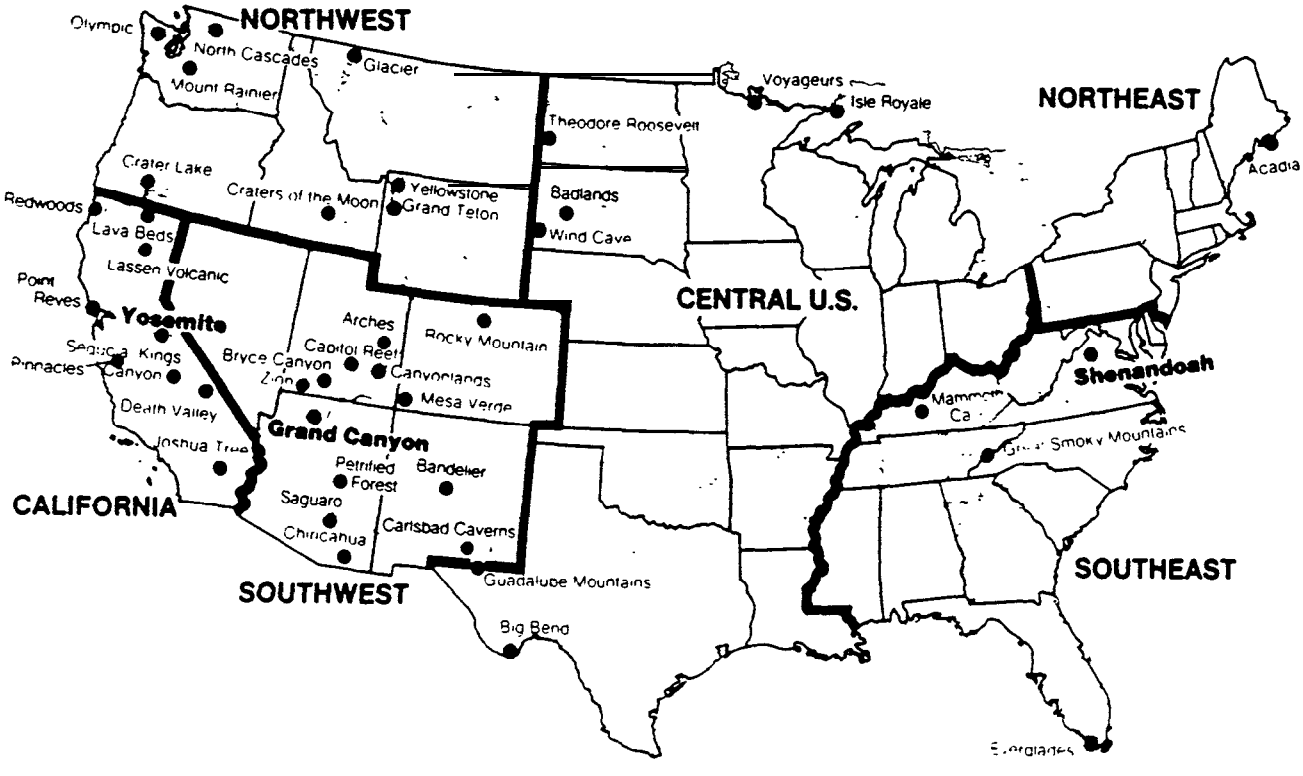


Figure 3.2-4
Insert Photograph Layout
Versions 1 through 5

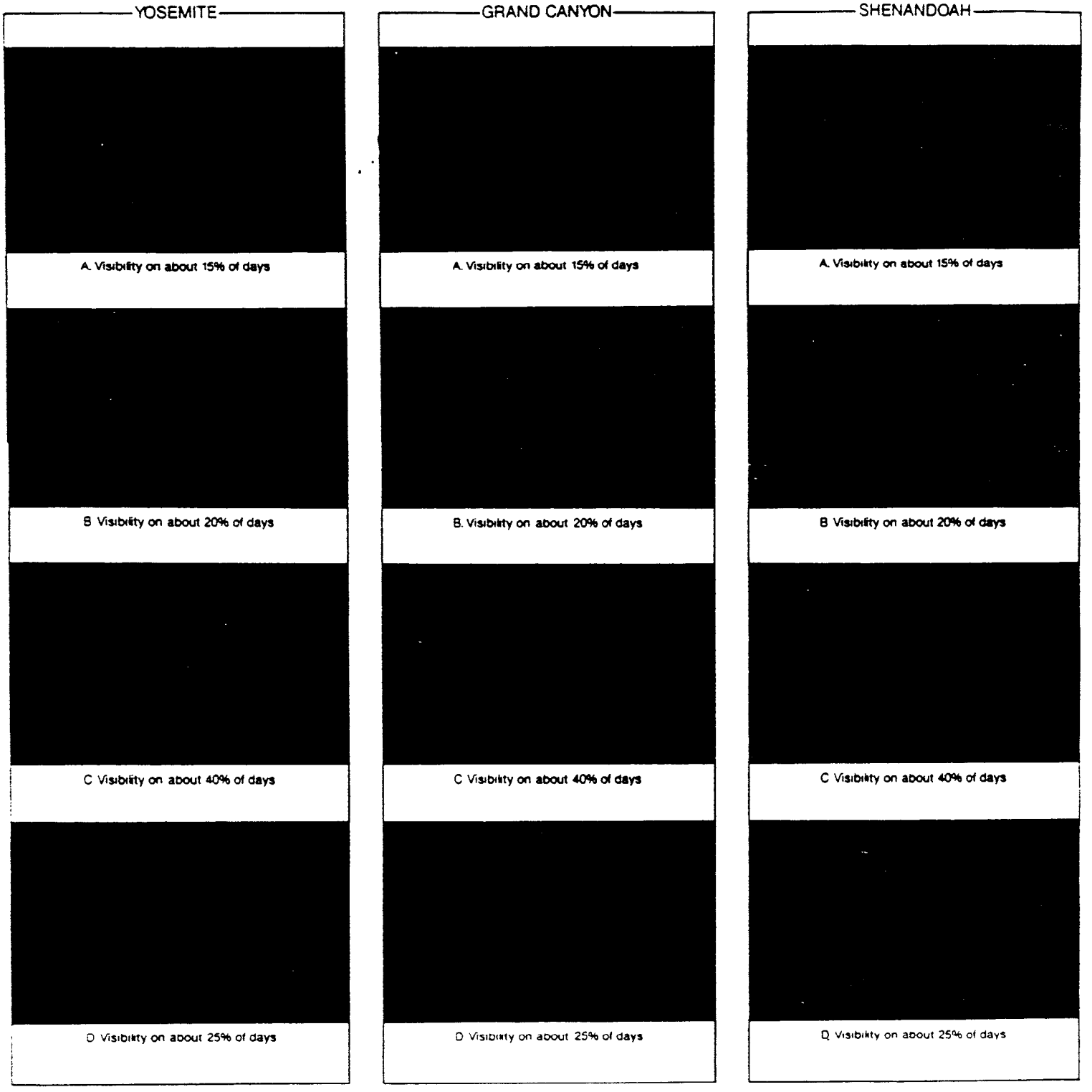
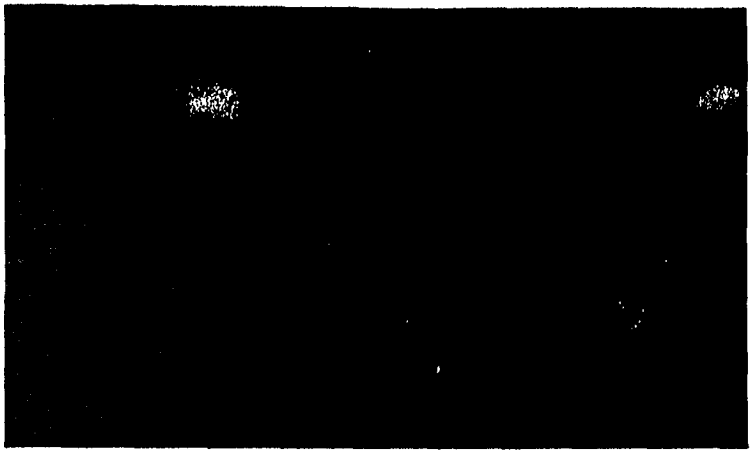
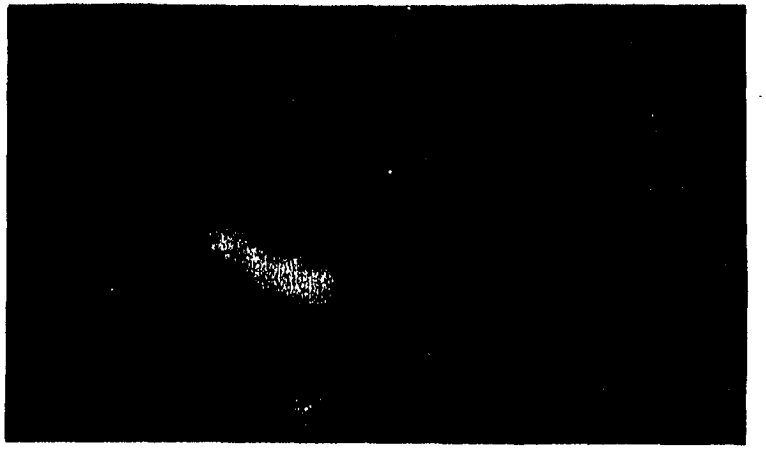


Figure 3.2-5
Insert Photograph Layout
Version 6

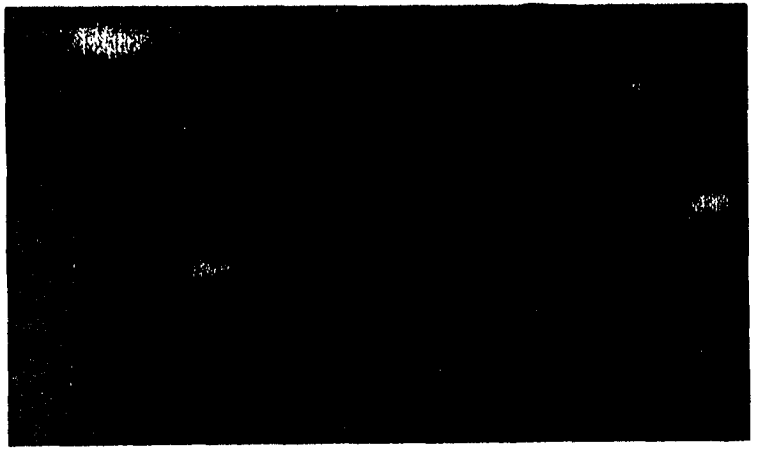


A. Visibility on about 15% of days

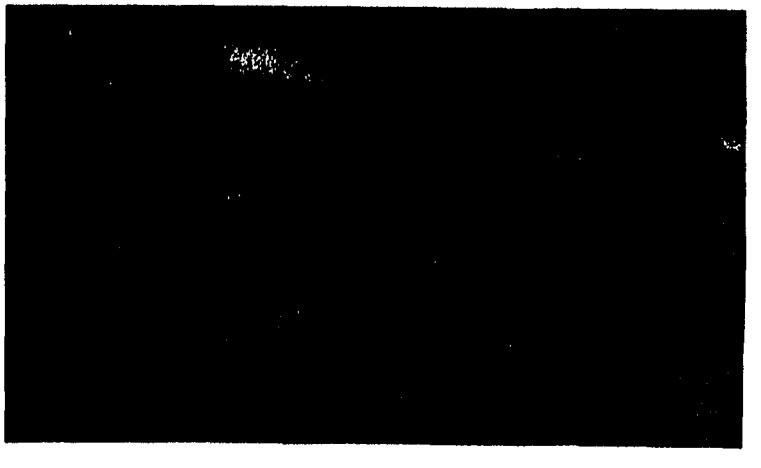
GRAND CANYON



B. Visibility on about 20% of days



C. Visibility on about 40% of days



D. Visibility on about 25% of days

These captions describe the approximate frequencies that a range of conditions represented by the photographs occur. For example, Photo A is approximately the 90th percentile photograph and is representative of conditions from the 85th to the 100th percentiles. Photo B is approximately the 75th percentile photograph and is representative of conditions from the 65th to the 85th percentiles. Photo C is approximately the 50th percentile photograph and is representative of conditions from the 25th to the 65th percentile. The Photo D is approximately the 10th percentile photograph and is representative of conditions from the 0th to the 25th percentile.

Additional information about the photographs is given in Section 3 of the questionnaire and reads as follows:

> Throughout the U.S., air pollution from outside the parks causes haze that reduces how well a person can see in national parks and into scenic vistas outside park boundaries.
>
> The enclosed photographs show different levels of air pollution at three national parks on days without rain or fog. The conditions at these parks are typical of summertime conditions at the national parks throughout the region in which each park is located.
>
> > Photograph A shows almost no haze. This occurs on about 18 summer days each year (about 15% of the time).
> >
> > Photograph B shows a little haze. This occurs on about 24 summer days each year (about 20% of the time).
> >
> > Photograph C shows average visibility conditions. This occurs on about 48 summer days each year (about 40% of the time).
> >
> > Photograph D shows a lot of haze. This occurs on about 30 summer days each year (about 25% of the time).

3.3 SURVEY IMPLEMENTATION PROCEDURES

The full study was implemented using a mailing of the final survey instrument and a telephone follow-up on non-respondents.

3.3.1 Survey Mailings

Random samples of residents of five states were selected to receive the questionnaire. The number of households from each state selected to receive each version of the questionnaire, and the response rates, are shown in Table 4.1-1. Five states were selected for the sample: Arizona, California, Missouri, New York, and Virginia. These states were selected, subject to project budget constraints, based upon a variety of considerations:

1. To include an adequate number of responses for individuals living both near and far from the national parks of interest because distance was expected to be a potentially important factor in the WTP responses (Sutherland and Walsh, 1985).

2. For each survey version, residents were sampled from the same state as the park that served to illustrate the national parks in the focus region. Home- state residents were oversampled to improve estimation accuracy for individuals with higher probability of future use. Residents in the home state are expected a priori to have a higher probability of previous and future visits compared to residents of the other four states in the sample.

3. For each survey version, residents were sampled from a state with one of the other national parks pictured on the photograph insert. In a sense, this allows for tests for "competing park" impacts.

4. For each survey version, residents were sampled from states located in regions not represented on the photograph inserts, and with relatively few prominent national parks. The two states selected in this category also represented a range of characteristics, as compared to each other and the rest of the sample, in terms of urbanization and distance from the focus parks.

The sample was selected from a list of U.S. residents maintained by Ed Burnett Consultants, Inc., Englewood, New Jersey. This list is based on sources that include the following:

- telephone books
- drivers license information
- car registration
- voters registration records
- survey information
- warranty card information
- mail order buyers information

Households from the master files were selected with an approximate equal probability of inclusion by first randomly selecting a set of zipcodes from each state (the number selected equaled the sample size and any zipcode could be sampled repeatedly), then randomly selecting a household from each zipcode. This approach was selected as the number of addresses per zipcode are targeted by the postal service to be roughly equal.

The questionnaire mailings followed a modified Dillman (1978) approach with an advance letter and three follow-up mailings. Copies of the letter or postcard sent with each mailing are include in Appendix B. The schedule of these mailings was as follows.

August 23, 1988: Introduction letter

September 6, 1988: First questionnaire copy

September 13, 1988: Reminder postcard

September 28, 1988: Second questionnaire copy

November 3, 1988: Third questionnaire copy

Figure 3.3-1 shows the responses received each week following the mailing of the first questionnaire copy. Subjects were removed from the mailing list as their responses were received.

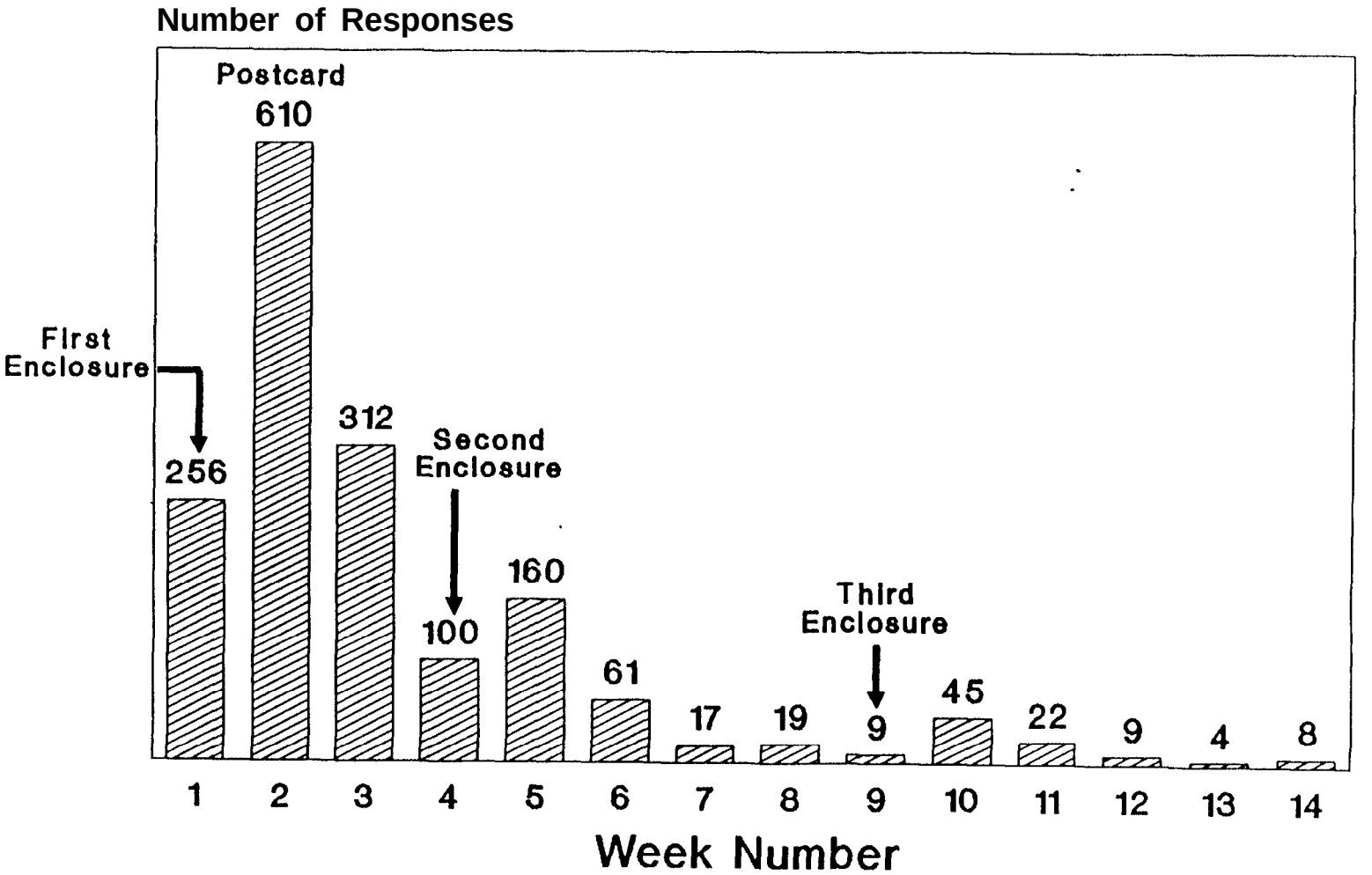
3.3.2 Telephone Follow-up

A sample of non-respondents was selected from each of the five states for a telephone follow-up in January 1989. This sample was taken from households originally sent Versions 2 (Southeast national parks) or 3 (Southwest national parks) of the questionnaire. Telephone directories were used to obtain telephone numbers for selected non-respondents. CIC Research of San Diego, California, randomly selected among the non-respondents until 300 names and numbers were obtained, and conducted the telephone interviews. The purpose of the telephone follow-up was to determine the rate of remaining bad addresses in the original sample, and to examine the likely sign and significance of any potential non-response bias.

A copy of the questions for the Grand Canyon version of the telephone follow-up is included in the Appendix. The first three questions concerned past and potential future visitation to national parks in the Southwest (or Southeast). All of the telephone respondents were asked if they thought it was "not at all important," "somewhat important," or "extremely important," to prevent visibility from getting worse at national parks in the Southwest (or the Southeast). They were also asked the same question about obtaining potential improvements in visibility.

Telephone respondents were asked if they still had the photograph insert that was sent with the questionnaire and, if so, a few specific WTP questions were asked. However, only four could quickly locate it. Telephone respondents who no longer had the photograph insert were asked whether they would be willing to pay anything in additional prices or taxes to (1) prevent visibility from getting worse at national parks in the Southwest (or Southeast), and (2) obtain improvement in visibility at national parks in the Southwest (or Southeast). Six questions about the respondent and the household were then asked to compare the sample characteristics to the mail respondents.

Figure 3.3-1
Responses Received Each Week



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:	TOTAL	BAD ADD	UNADJUSTED REC'D NET	% RECD
	CALIFORNIA PARKS (V1)			
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%

	TOTAL	BAD ADD	UNADJUSTED REC'D NET	% RECD
	SOUTHEAST PARKS (V2)			
	785	120	406	61.1%
	125	12	74	65.5%
	285	60	140	62.2%
	125	13	63	56.3%
	125	23	55	53.9%
	125	12	74	65.5%
	100.0%	15.3%	51.7%	61.1%

	TOTAL	BAD ADD	UNADJUSTED REC'D NET	% RECD
	SOUTHWEST PARKS (V3)			
	785	124	378	57.2%
	285	49	145	61.4%
	125	29	56	58.3%
	125	13	57	50.9%
	125	19	60	56.6%
	125	14	60	54.1%
	100.0%	15.8%	48.2%	57.2%

VERSION NAME:	TOTAL	BAD ADD	UNADJUSTED REC'D NET	% RECD
	MULTIPLE REGIONS (V4)			
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%

	TOTAL	BAD ADD	UNADJUSTED REC'D NET	% RECD
	LIMITED INFORMATION (V5)			
	330	49	166	59.1%
	110	18	60	65.2%
	110	15	58	61.1%
	0	0	0	
	110	16	48	51.1%
	0	0	0	
	100.0%	14.8%	50.3%	59.1%

	TOTAL	BAD ADD	UNADJUSTED REC'D NET	% RECD
	SINGLE REGION FOCUS (V6)			
	330	47	166	58.7%
	110	19	58	63.7%
	0	0	0	
	110	14	59	61.5%
	110	14	49	51.0%
	0	0	0	
	100.0%	14.2%	50.3%	58.7%

	TOTAL	BAD ADD	UNADJUSTED REC'D NET	% RECD
	TOTAL OF ALL VERSIONS			
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%	51.4%

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.

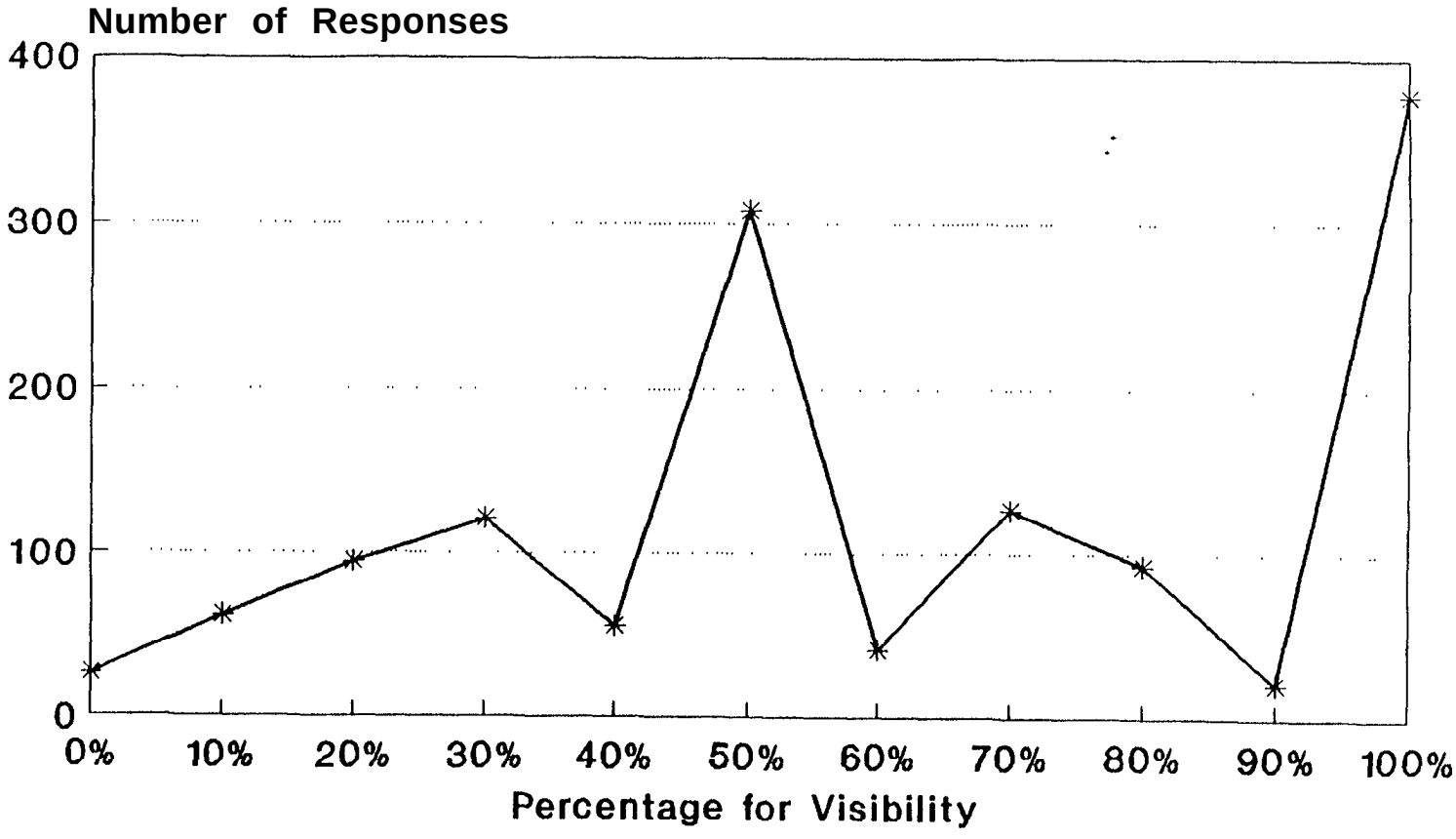
Figure 4.5-1 shows the frequency of the Question 17 responses regarding the percentage of the WTP response that the respondent said was specifically for visibility in and around national parks. About one-fourth of the respondents indicated 100 percent, and about one-fourth indicated 50 percent. Twenty-six 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:

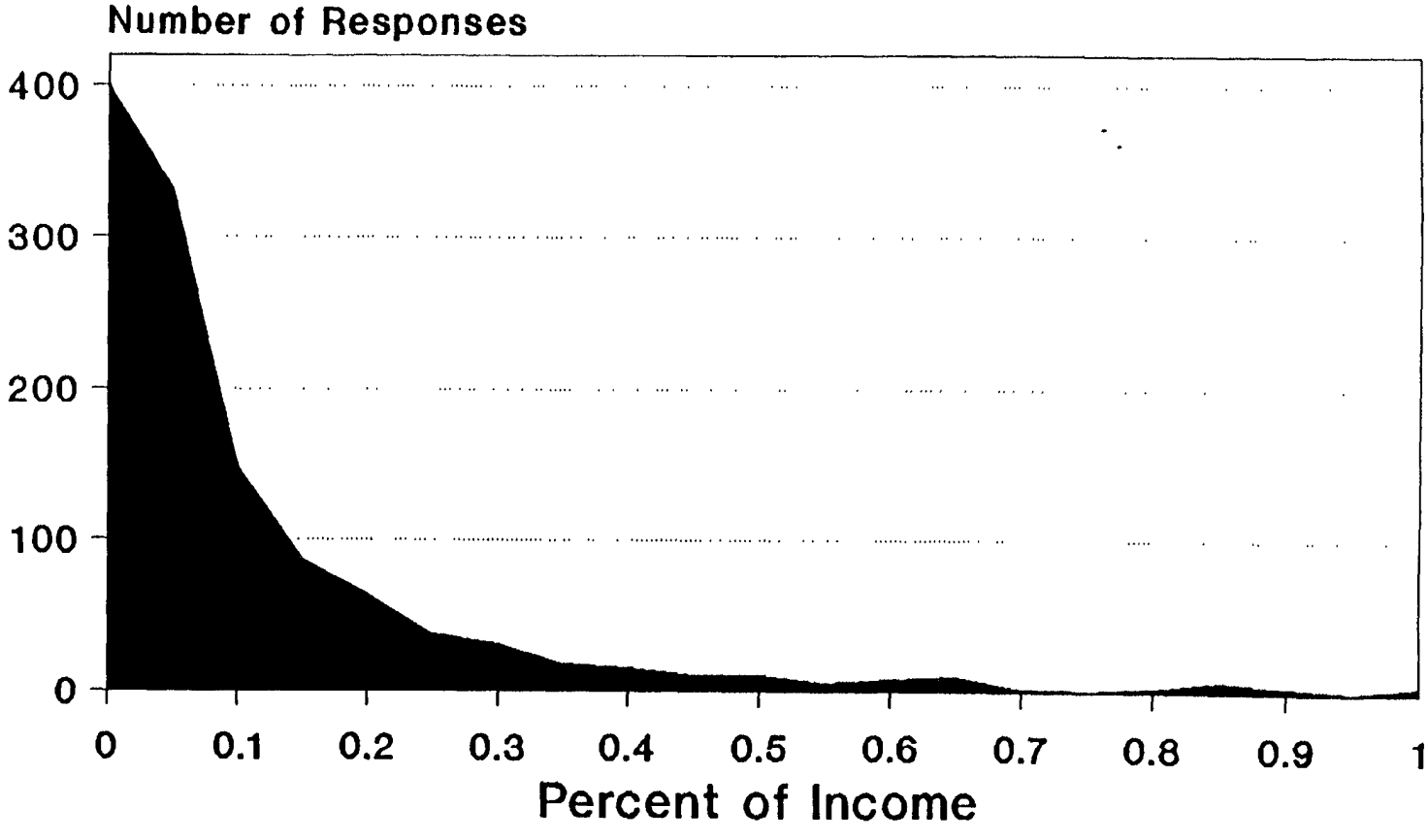
> Visibility at national parks is important. Protecting national parks is important. Everyone should help and that would pay for it. Environmental protection is important. I am willing to spend even more to improve air quality everywhere. If we don't clean up now, we will suffer later. Concern about 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 any 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)	-0.43 * (-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:

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

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:

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

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

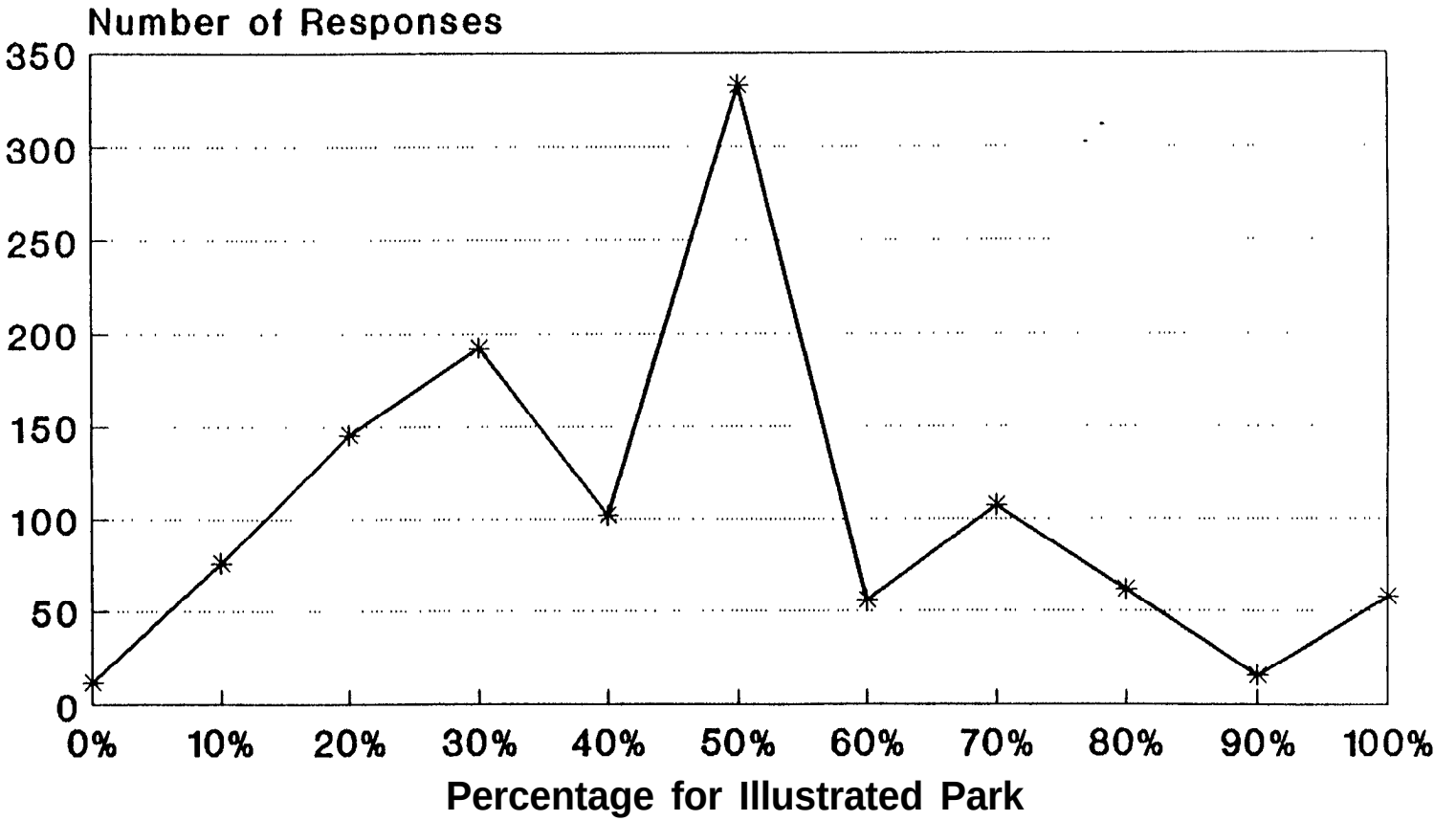
	Yosemite (Version 1)	Grand Canyon (Versions 3, 5, 6)	Shenandoah (Version 2)
Home-State Residents	46%	52%	54%
Residents of Other States	38%	41%	38%
All Respondents	41%	45%	44%

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	$20.5	$23.4
	(5.2)	(3.0)	(2.7)
	n=113	n=218	n=331
WTP2	$35.1	$24.4	$28.0
	(5.9)	(3.6)	(3.1)
	n=113	n=221	n=334
WTP3	$30.7	$23.9	$26.2
	(5.3)	(3.6)	(3.0)
	n=113	n=217	n=330
Grand Canyon			
WTP1	$31.0	$19.5	$23.8
	(5.2)	(2.6)	(2.6)
	n=241	n=395	n=636
WTP2	$40.8	$23.8	$30.2
	(6.0)	(2.7)	(2.8)
	n=240	n=398	n=638
WTP3	$35.4	$21.5	$26.8
	(5.8)	(2.6)	(2.7)
	n=241	n=391	n=632
Shenandoah			
WTP1	$39.6	$14.6	$23.3
	(9.8)	(1.8)	(3.7)
	n=120	n=226	n=346
WTP2	$48.8	$22.3	$31.7
	(11.1)	(3.4)	(4.5)
	n=124	n=226	n=350
WTP3	$42.4	$19.3	$27.6
	(8.5)	(3.1)	(3.7)
	n=124	n=223	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 ** (15.23)	0.64 ** (10.99)	0.39 * (1.88)	-0.17 (-0.66)
DP * AGE			-0.001 (-0.40)	0.001 (0.37)
DP * MALE			-0.08 (-0.70)	-0.09 (-0.80)
DP * INC			0.009 ** (4.32)	0.008 ** (3.60)
DP * FVIS				0.18 ** (3.95)
DP * PSTATE		0.24 ** (2.41)	0.24 ** (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

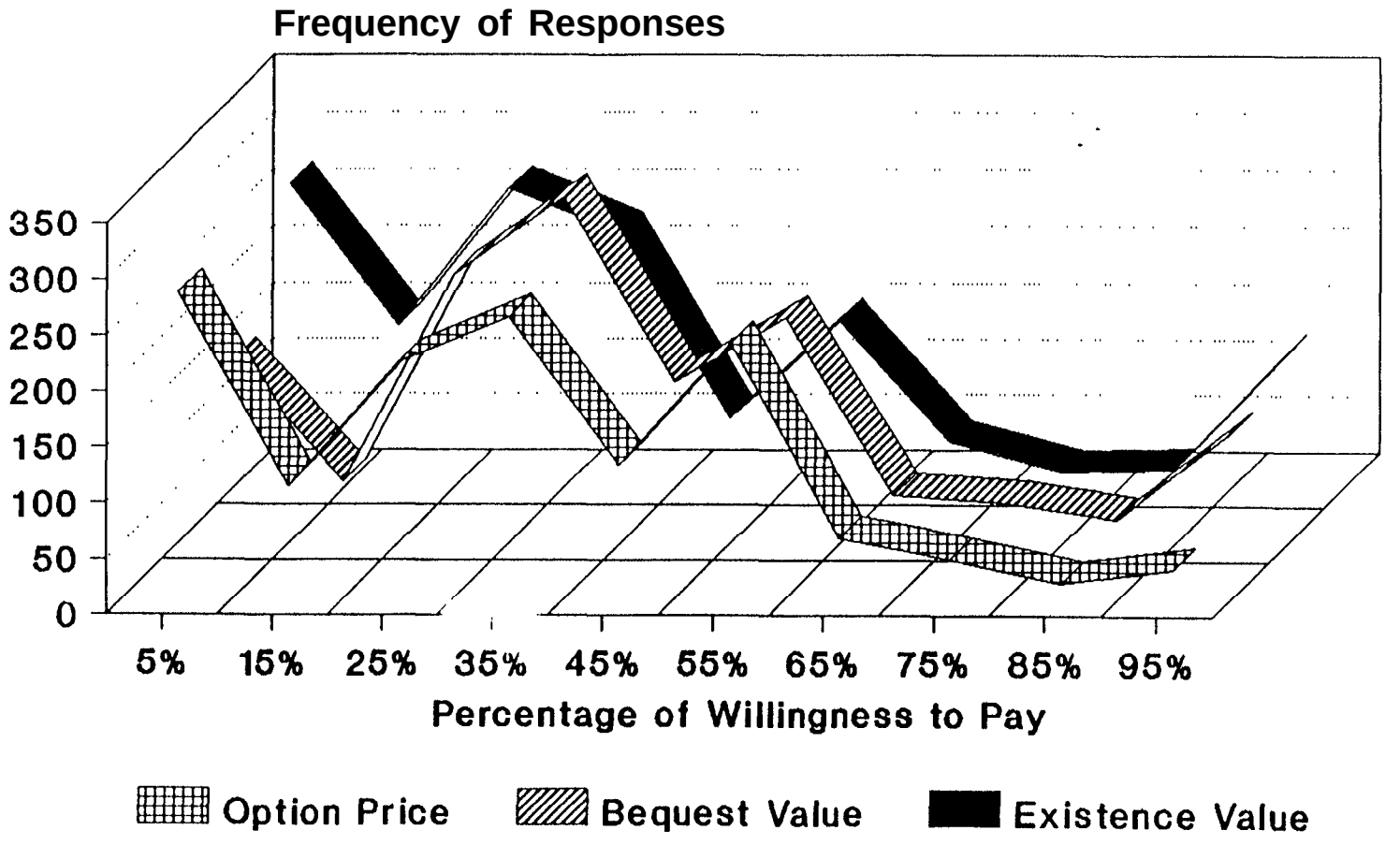


Table 4.5-34
Correlations Between Responses to Question 19 and Reasons for Visiting and Protecting National Parks

	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.

5.0 SUMMARY CONCLUSIONS AND DIRECTIONS FOR FUTURE RESEARCH

5.1 SUMMARY OF RESULTS

There are many conclusions of the research. Because the results presentation is extensive, a bulleted summary of key findings is presented in this section grouped by topic area. For each conclusion, the corresponding tables and figures are cited for easy follow-up reference. The text corresponding to each table should be consulted as well and can be found in the section with the two initial digits of the table. For example, Table 4.4-3 is discussed in Section 4.4.

5.1.1 About the Sample and Response Rates

- Over 70 percent of the valid sample was contacted. Response rates in individual states are not consistently or statistically significantly different whether the survey version focuses upon parks in the respondent's home state, or on parks in another region of the country. Any potential response bias due to interest in parks in the home region, versus elsewhere, appears to be minimal. (Tables 4.1-1 and 4.1-2).

- Variations examined in the survey design dealing with the amount of information, whether one or more parks were pictured, and whether WTP questions were asked for parks in one region or in three regions had no consistent statistical effect upon response rates. It is concluded that these features, in and of themselves, exerted little influence on the results through different response rates. (Table 4.1-3)

- Non-response bias was examined through a small telephone follow-up survey. Non-respondents have lower probability of visiting national parks and slightly lower income, which would decrease WTP responses. However, just as in the returned mail surveys, the large majority of telephone respondents felt protecting visibility at national parks is important, and would be willing to pay for visibility protection. Some non-response bias may exist, but the effect on the sample-wide WTP mean estimate appears to be relatively small. (Tables 4.3-1 through 4.3-4 and Section 4.4)

- The sample varies somewhat from national characteristics. It has a higher percentage of males and is somewhat older, which are characteristics that are related to lower WTP values. The sample also has somewhat higher income and education than the national average, which is related to higher WTP values. (Table 4.2-1) The effect of these sample characteristics can be adjusted for when applying the results in policy scenarios (Tables 4.5-16, 4.5-17, 4.5-18 through 4.5-22, 4.5-26 through 4.5-32).

5.1.2 Importance of Protecting Visibility at National Parks

- Protecting against air pollution decreasing the ability to see scenic vistas was a high priority for 72 percent of respondents and a medium priority for nearly all other respondents. (Table 4.4-7 and Table 4.6-1 where comments are summarized)

- Non-use related motives were as, or more, important, than use-related motives for protecting visibility at national parks. (Table 4.4-5)

- Improving visibility from current average conditions to somewhat above average conditions would enhance on-site enjoyment for about 95 percent of respondents. (Table 4.4-9)

- Over 90 percent of respondents would be willing to pay something for visibility protection at national parks. This sentiment was nearly equally strong for all three regions. Sentiment was strongest for protection in a region by residents of the same region. (Table 4.4-10)

- Preventing visibility degradation was felt to be slightly more important than obtaining improvements. (Table 4.4-11)

5.1.3 WTP for Specific Visibility Scenarios

- On the order of 83 percent stated non-zero WTP for the visibility scenarios presented. After deleting non-respondents and protest responses, the percent increases to 93 percent. Some respondents held very high values for visibility protection. Both the valid zero and high bids were highly correlated with income and with past and expected future national park visitation. (Tables 4.5-2, 4.5-4, Figure 4.5-2)

- The mean WTP values are quite similar for each of the three national park regions investigated. The mean WTP values (adjusted to the percent for visibility) are around $40 to $60 per year per household for the three scenarios considered. Values by residents of the same state as the illustrated park are typically higher than values for the same region by individuals who live outside the region. (Table, 4.5-10 and 4.5-12)

- Median bids are 25 to 50 percent of the means. This is to be expected as the distribution is necessarily truncated at zero and includes responses from individuals who have very large values, based upon income, visitation expectations and other reasons, for this visibility protection. (Table 4.5-14)

- The mean percent of the regional bid that is attributable to the specific park depicted in the photograph varies depending upon the park and whether respondents are from the same state or from other states. Residents from the same state assigned between 46 and 54 percent for pictured park while residents from other states assigned between 38 and 41 percent for the pictured park. These shares exceed 1/n, where n is the number of parks in each region. This may be because the pictured parks are more prominent than most of the other parks in the same region. (Tables 4.5-24 and 4.5-25, and Figure 4.5-3)

- Differences in characteristics of respondents appear to explain differences in mean WTP for residents of different states for protection at the three national park regions. These characteristics include income and the probability of visiting parks in the region of focus. The influence of these characteristics is consistent across different focus regions. (Tables 4.5-11, 4.5-13, Tables 4.5-16 through 4.5-23 and 4.5-26 through 4.5-32)

- WTP bids are found to follow ex ante expectations in terms of their correlations to attitudes and opinions about protecting national parks, protecting visibility at national parks and WTP for this protection. (Table 4.5-15)

- Visibility value functions were examined that relate WTP to changes in visibility conditions and socio-economic characteristics of the respondent. The use of four different visual air quality measures, in separate estimations of the selected functional forms, does not appreciably alter the explanatory power of the regressions. The four measures were: visual range, natural log of the ratio of new to old visual range, average atmospheric transmission coefficient and the percentile of annual visual range conditions. (Tables 4.5-19 through 4.5-23 for regional WTP regressions, and 4.5-27 through 4.5-32 for individual park WTP regressions)

- Values were partitioned, sample-wide, to option price (32%), bequest values (37%) and existence values (31%). Residents of the same state as the focus park assigned higher percentages to option price than did non-residents. As a result, the share of the WTP that is assigned to bequest values and existence values for each park region shows smaller variability across state of residence than does option price. This reflects the higher probability of one's own visitation to parks in the same region as one is currently residing in. (Tables 4.5-32 through 4.5-34, and Figure 4.5-4)

5.1.4 CVM Method Findings

- About 11 percent of the respondents did not answer the WTP questions or gave apparent protest responses. About 7 percent gave apparently valid zero value responses. These are within normal ranges for CVM studies. (Table 4.5-2)

- Ex ante attempts to lead respondents to value only visibility changes were insufficient. Over two-thirds stated, after answering the WTP questions, that only a portion of their WTP estimate was for visibility at national parks in the specified region. The average percent for visibility was 62 percent. The follow-up question readdressing the part-whole issue appears to have worked well in helping to separate values for visibility from values for other concerns. This adjustment was used to compute visibility WTP results used throughout the report. (Table 4.5-3, Figure 4.5-1)

- Over 80 percent stated a self perceived accuracy of their WTP answers as either "very accurate" or "within the ballpark." Only 19 percent felt their answers were "somewhat inaccurate" or "probably very inaccurate." Self reported accuracy was not related to past visitation. Some have argued that inaccuracy may lead to overstated WTP responses. However, mean WTP decreased significantly as self reported accuracy decreased. Deletion of those individuals with low self reported accuracy would significantly increase, not decrease, the mean bids. This deletion was not done to maintain conservative results. (Table 4.5-6)

- About 40 percent of the respondents providing WTP responses provided the same WTP response for all three scenarios presented to them (including 7 percent all zero bidders). This finding is only recently being reported in CVM studies. In this study it may be due to:

    1. Anchoring and lack of attention. Uncertainty and lack of attention (or effort to quantify values) may lead to all equal responses. If values are uncertain and have some reasonable error, the difference in values across scenarios may not merit small adjustments in bids. Some respondents may see improving conditions from photo C to photo A as having a small additional value as compared to just obtaining photo B. Similarly, preventing photo D may have similar value to obtaining photo B. Given edit behavior, or the lack of desire to deal with small differences, the respondent may fail to adjust to the second and third scenarios and the same value is reported for all three scenarios.

    2. Making a contribution. The all equal bids may reflect a tendency to make a contribution to visibility protection, regardless of the level of protection. Some individuals also state that "if everyone paid then the problem would be solved." Because this all equal tendency has been observed in other surveys where the making of contributions would be much less likely, we discount this explanation as being dominant.

The mean of the all equal responses tend to be anchored upon the first WTP response. Because the means of WTP2 and WTP3 for respondents who do not provide all equal bids are larger than WTP1, this anchoring may therefore downward bias the WTP2 and WTP3 results, and downward bias the estimated slope of the underlying visibility value functions. (Tables 4.5-7 through 4.5-9)

- Differences in the level of information provided did not consistently influence the WTP results. Relatively minor characteristics of the scenario were deleted in one survey version with no impact upon response rates or mean WTP results. Fischhoff and Furby (1988) have indicated a need for a very detailed scenario development. It may be the case that omitting some minor features has minimal or offsetting impacts. (Table 4.5-18) Potential explanations range from (1) the omitted information may be relatively less significant than other design features, (2) the impacts are offsetting, to (3) the information may not have been well understood (which contradicts the pretest findings) and therefore has no effect.

- It has been argued that respondents must be presented with information on many other goods simultaneous to the presentation of the good for which WTP values will be elicited. This, in part, is to address the potential part-whole bias. Presenting information on only one region (Version 6), versus on three regions (Version 3), in the form of maps, photographs and questions had some minor impacts upon the results, and did not appear to lead to any consistent increase in the WTP results. Further, when a bid was elicited separately, but in the same survey instrument, for each of the three regions (Version 4), the bids again did not show any consistent or statistical difference. Individuals appeared to have addressed each national park region independently. (Table 4.5-18)

- If individuals had to simultaneously pay their stated WTP for all three regions, rather than for just one region, it is uncertain whether the total WTP would decrease as compared to the sum of the bids for all three regions. Survey Version 4 elicited a separate WTP for each of the three regions stating that the WTP for each region would be paid each year. The results of Version 4 were not statistically different from the other versions. (Table 4.5-18) However, other recent evidence on these types of aggregation issues suggests that a single WTP for all three regions at once may obtain a lower value than the sum of values for three separate WTP questions. This alternative was not examined.

- The sample-wide mean percentages of the WTP bids allocated to different motives (option price, bequest value and existence value) are all generally between 30 and 40 percent. From this it might be inferred that many or most individuals pay little attention to (or do not know) their allocation and simply allocate equal shares to each of three motives. However, the individual data reveal that this does not appear to be the case. Rather, a wide distribution of allocations is reflected and correlation analysis reveals statistically significant relationships to previously stated behavior and attitudes related to each motive. (Tables 4.5-33 through 4.5-35 and Figure 4.5-4)

5.1.5 Comparisons to Prior Related Studies

- The results here are 25 to 32 percent as large as the comparable scenario values obtained in the Southwest Parklands study (Schulze et al. 1981). These differences are primarily attributed to the visibility adjustment questions (Q-17), asking for region-wide bids, then disaggregating to a Grand Canyon NP value component, using annual versus monthly bids, sample differences, and other CVM design characteristics.

- The results are 13 to 45 percent larger than those for the Grand Canyon NP in Tolley et al. (1986). However, the later study is for a substantially different policy package. Tolley et al. obtain values for visibility protection at the Grand Canyon NP as the 3rd identified component of a policy package that first request WTP estimates for simultaneously protecting visibility in Chicago and throughout the eastern U.S. As a result, the valuation scenarios are quite different.

5.1.6 Conclusions

Some conclusions can be based upon the statistical analyses presented in Chapter 4, while others are impressions gained through review of surveys responses and written comments, other statistical analysis not presented, and evidence from the literature.

In general, respondents seemed to perceive the survey issues as valid and to make a sincere effort to answer the WTP questions accurately. The WTP responses are generally quite consistent with expressed attitudes and behavior. Nonetheless, valuation of such changes is not an easy, or precise, task. While 80 percent of respondents felt their WTP responses were "within the ballpark" or better, only 15 percent felt their responses were "very accurate" and a third of those were zero bidders. Inaccuracy is also potentially reflected in that a large percent of individuals gave the same response to all WTP questions. I.e., responses may reflect a rough estimate of value for these types of visibility changes, but their WTP responses may not be so accurate as to merit refinement for the exact differences across the scenarios.

In formulating WTP responses, respondents appear to have focused upon key information about the visibility scenario and visibility conditions. Among these may have been the percent of time conditions exist at each of the different regions. When answering the WTP questions, respondents also had difficulty separating the visibility impacts at national parks from other resource protection concerns facing national parks, but the follow-up question served to help clarify this difficulty and its magnitude upon the visibility value estimates.

It goes without saying that the estimates must be used with care. The statistical precision of the estimates, as reported in the tables in Chapter 4, may overstate the accuracy of the valuation. For example, the statistical precision of predicted WTP values in the visibility

value regression analyses is on the order of ± 10 percent. However, other uncertainties in the respondents' formation of the WTP responses, and in the researchers' interpretation of the data suggest the uncertainty may be much larger. We would find it reasonable to suggest the values may be indicative of an accuracy no better than ± 50 percent. But this should not be taken as an opportunity to argue for "true values" half, or double, what is reported here based upon selective identification of potential biases. For each potential upward bias, there is an offsetting potential downward bias, and vice versa. Therefore, the estimates must be taken as indicative of the range respondents feel best reflects their monetary values for the visibility scenarios presented.

Use of the estimates in policy analysis must also account for the sample characteristics versus the characteristics of the population to which the estimates would be applied. For example, at a minimum, coefficients in the visibility value functions should be used to adjust predicted values for the population of interest.

5.2 DIRECTIONS

Many research efforts could be undertaken, some with minor modifications to the existing instruments, that would further the understanding of societal values for visibility protection at national parks. These might include a version that asks a WTP for all three regions at once, which might be compared to the sum of WTP's obtained in Version 4 to test the impact of different levels of aggregation when asking for component values.

The survey results indicate a diminishing marginal utility (as reflected by diminishing marginal WTP) for visibility improvements, which is consistent with the other preservation value literature reviewed in Chapter 2. This may be an accurate reflection of underlying values, or may be an artifact of the structure of the WTP elicitation. If some respondents think of their first response more as a general contribution than a payment for a specific quantity of a good, then asking them a second WTP for a larger change may suggest they should give the same or a slightly larger response. This may look like diminishing marginal utility, but may not really be. Additional survey versions could test these issues by excluding Photo B and asking for WTP for visibility changes from Photo C to Photo A. The results of this comparison may also aid in interpreting the "all equal" responses and their impact upon the valuation by examining whether these responses remain anchored upon the first scenario.

The survey focused upon fairly substantial changes in average visibility conditions. It would also be of interest to consider impacts to only a limited number of days, which would result in smaller average visibility changes, to more fully examine the shape of a visibility value function. It would also be of interest to examine the effect of variations in the season of impact on the value responses.

The current survey could also be easily modified to more fully examine the impact of alternative information upon response rates and WTP responses. One important and useful test would be to dramatically reduce the background motives questions and the CVM scenario development, which would reduce the complexity of the instrument development for the researcher and reduce the effort to complete the instrument for the respondent.

More substantive extensions could also be considered. This might include the examination of substantially different visibility impacts such as plumes, different colors of haze, etc., and different policy packages, such as visibility impacts at other parks, combined haze and plume control, etc.

In general, several design and evaluation issues have been initially addressed and merit additional research. This includes more investigations into: the "all equal" responses; the accuracy of responses, including how respondents perceive the accuracy of their responses; and the use of follow-up questions to partition natural resource protection values to obtain values for the visibility component. More research is also merited on the issue of what information is most important to CVM scenario development, and when too much scenario detail overloads respondents to the point of reducing the quality of responses.

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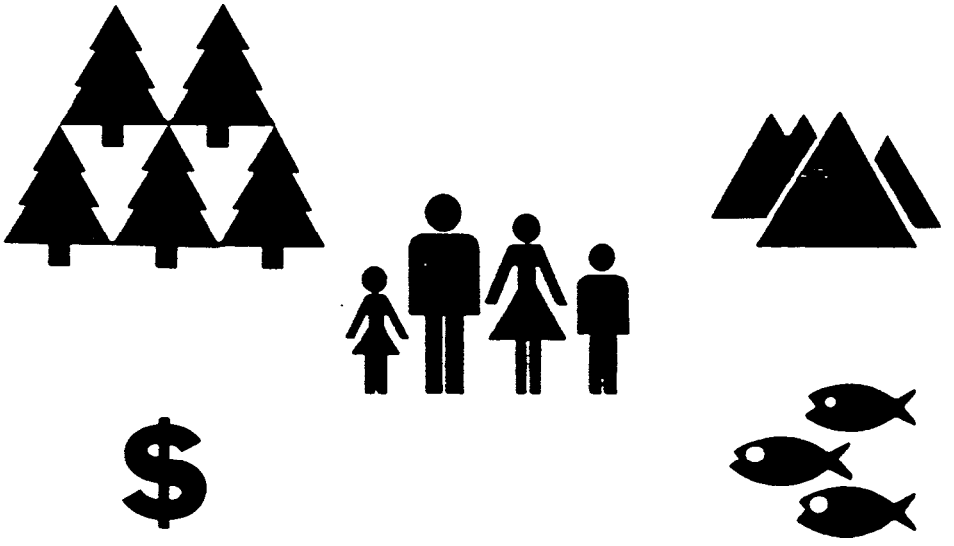
APPENDIX A

Sample Mail Survey Instrument

Managing Visibility at National Parks
What is Your Opinion?



Research conducted for
The Center for Economic Analysis
at the University of Colorado

ABOUT YOUR VISITS TO NATIONAL PARKS

Q-1 Have you personally ever visited any national park (including monuments and seashores)? (Circle number)

1 YES
2 NO ——→ If NO, then skip to Question Q-4

Q-2 The enclosed map shows national parks where visibility is considered to be an important resource. Have you personally ever visited any of the national parks shown on the map in each of the following regions?

Ever visited a national park in this region? (Circle YES or NO for each region)		If YES, how many days have you visited in just the last 2 years?
The Northwest	YES / NO	_____ DAYS
California?	YES / NO	_____ DAYS
The Southwest?	YES / NO	_____ DAYS
The Central U.S.?	YES / NO	_____ DAYS
The Northeast?	YES / NO	_____ DAYS
The Southeast?	YES / NO	_____ DAYS

Q-3 Have you personally ever visited the following national parks?

Ever visited this park? (Circle YES or NO for each park)		If YES, how many days have you visited in just the last 2 years?
Yosemite National Park in California	YES / NO	_____ DAYS
Grand Canyon National Park in Arizona	YES / NO	_____ DAYS
Shenandoah National Park in Virginia	YES / NO	_____ DAYS

Q-4 Thinking about the next 5 years, about how likely are you to visit any of the national parks shown on the map in each of the following regions? (Circle number of best response for each region)

	DEFINITELY WILL NOT VISIT	PROBABLY WILL NOT VISIT	MIGHT VISIT	PROBABLY WILL VISIT	DEFINITELY WILL VISIT
California	1	2	3	4	5
The Southwest	1	2	3	4	5
The Southeast	1	2	3	4	5

Q-5 Below are reasons some people have given for visiting national parks. How important is each of these reasons to you personally? (Circle number of best response for each reason)

	NOT AT ALL IMPORTANT	SLIGHTLY IMPORTANT	SOMEWHAT IMPORTANT	VERY IMPORTANT	EXTREMELY IMPORTANT
To experience unique natural places	1	2	3	4	5
To experience unique historic places	1	2	3	4	5
To do something enjoyable with other people (for example, family and friends)	1	2	3	4	5
To enjoy the vastness of nature	1	2	3	4	5
To take part in outdoor recreation, such as hiking, fishing, or camping	1	2	3	4	5
To have a change from my usual surroundings	1	2	3	4	5
Please list any other reasons you like to, or would like to, visit national parks:					
_____	1	2	3	4	5

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)

1 DEFINITELY NO ——————> If definitely no, Skip to Question Q-8
2 MAYBE NO
3 MAYBE YES
4 DEFINITELY YES

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	SLIGHTLY IMPORTANT	SOMEWHAT IMPORTANT	VERY IMPORTANT	EXTREMELY IMPORTANT
So other members of my family will have the opportunity to visit these areas now and in the future .	1	2	3	4	5
So people outside my family will have the opportunity to visit these areas now and in the future .	1	2	3	4	5
So there will be areas preserved in their natural condition, even if no one ever goes there	1	2	3	4	5
To allow scientific research on nature or history	1	2	3	4	5
To preserve our national heritage	1	2	3	4	5
So there is not development everywhere	1	2	3	4	5
Do you have any other reasons? (Please list)					
_____	1	2	3	4	5

ABOUT POLLUTION ISSUES FACING NATIONAL 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	MEDIUM PRIORITY	HIGH PRIORITY
Air pollution decreasing the ability to see scenic vistas	1	2	3
Air pollution injury to vegetation	1	2	3
Air pollution damage to historic structures	1	2	3
Water pollution in streams or lakes that harms fish or other aquatic life	1	2	3
Water pollution that muddies streams or lakes but does not harm fish or aquatic life	1	2	3
Park visitors being able to see or hear mining or industrial activities located outside park boundaries	1	2	3

Are there other types of effects of special concern to you? (Please list)

_____ 1 2 3

ABOUT VISIBILITY IN AND AROUND NATIONAL PARKS

Throughout the U.S., air pollution from outside the parks causes haze that reduces how well a person can see in national parks and into scenic vistas outside park boundaries.

The enclosed photographs show different levels of air pollution at three national parks on days without rain or natural fog. The conditions at these parks are typical of summertime conditions at the national parks throughout the region in which each park is located.

Photograph A shows almost no haze. This occurs on about 18 summer days each year (about 15% of the time).

Photograph B shows a little haze. This occurs on about 24 summer days each year (about 20% of the time).

Photograph C shows average visibility conditions. This occurs on about 48 summer days each year (about 40% of the time).

Photograph D shows a lot of haze. This occurs on about 30 summer days each year (about 25% of the time).

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)

	Having Visibility B Rather Than Visibility C Would:		
	HAVE NO EFFECT ON ENJOYMENT	SOMEWHAT INCREASE ENJOYMENT	VERY MUCH INCREASE ENJOYMENT
California ..... (Use Yosemite photos)	1	2	3
The Southwest ..... (Use Grand Canyon photos)	1	2	3
The Southeast ..... (Use Shenandoah photos)	1	2	3

Q-10 Federal and state governments are considering changes to air pollution control laws to protect and improve visibility in and around national parks. These changes could affect everyone, even those who do not visit the parks, because more air pollution controls could mean higher prices for electricity, transportation, home heating, and for many other goods and services, and could mean higher taxes.

How willing would you be to pay higher prices and taxes to support visibility protection at national parks in the following regions? (Circle number of best response for each region)

	NOT AT ALL WILLING		SOMEWHAT WILLING		EXTREMELY WILLING
California	1	2	3	4	5
Southwest	1	2	3	4	5
Southeast	1	2	3	4	5

Please list any other regions of particular importance to you.

_____

ABOUT VISIBILITY AT NATIONAL PARKS IN THE SOUTHWEST

Q-11 The photographs for Grand Canyon National Park show typical visibility conditions in the national parks of the Southwest. In the future, visibility at these national parks could improve or worsen depending on how much air pollution control is undertaken. How important do you think the following goals are for protecting visibility at national parks in the Southwest? (Circle number of best answer for both goals)

	NOT AT ALL IMPORTANT		SOMEWHAT IMPORTANT		EXTREMELY IMPORTANT
Improving visibility at some or all parks	1	2	3	4	5
Preventing visibility from getting worse at some or all parks	1	2	3	4	5

WHAT IS THE VALUE OF PROTECTING VISIBILITY AT NATIONAL PARKS IN THE SOUTHWEST?

New air pollution controls being considered for the protection of visibility at national parks in the Southwest could mean higher prices and higher taxes throughout the country. The next questions concern how much obtaining improvements and preventing worsening in visibility at national parks in the Southwest would be worth to your household.

These questions concern only visibility at national parks in the Southwest and assume there will be no change in visibility at national parks in other regions. Other households are being asked about visibility, human health and vegetation protection in urban areas and at national parks in other regions. For these questions, assume you could be sure that any change would occur next year and continue forever, and all households now and in the future would also pay the most it is worth to them to protect visibility.

Q-12 With additional air pollution controls, average visibility conditions in and around all national parks in the Southwest could improve. What is the most your household would be willing to pay every year in increased prices and taxes to have average visibility improve from Grand Canyon Photograph C to Photograph B at all national parks in the Southwest? (Circle best answer)

$0.00	$2	$8	$25	$60	$150	$400
$0.50	$3	$10	$30	$75	$200	$500
$1.00	$4	$15	$40	$100	$250	$750
$1.50	$5	$20	$50	$125	$300	MORE THAN $750

Q-13 What is the most your household would be willing to pay every year in increased prices and taxes to have average visibility improve from Grand Canyon Photograph C to Photograph A at all national parks in the Southwest? (Circle best answer)

$0.00	$2	$8	$25	$60	$150	$400
$0.50	$3	$10	$30	$75	$200	$500
$1.00	$4	$15	$40	$100	$250	$750
$1.50	$5	$20	$50	$125	$300	MORE THAN $750

Q-14 It is also possible that some additional air pollution controls may be needed just to keep visibility at national parks in the Southwest from getting worse. What is the most your household would be willing to pay every year in increased prices and taxes to prevent average visibility at all national parks in the Southwest from becoming like Photograph D for Grand Canyon rather than like Photograph C. (Circle best answer)

$0.00	$2	$8	$25	$60	$l5O	$400
$0.50	$3	$10	$30	$75	$200	$500
$1.00	$4	$l5	$40	$100	$250	$750
$1.50	$5	$20	$50	$125	$300	MORE THAN $750

Q-15 Please provide any information that helps explain your answers to Questions 12, 13, and 14 above. You may also use the back page of the questionnaire.

Q-16 We understand it may be difficult to determine the most you are willing to pay for changes in visibility at national parks. Would you say your answers to Questions 12, 13, and 14 are: (Circle number of best answer)

1 VERY ACCURATE?

2 WITHIN THE BALLPARK?

3 SOMEWHAT INACCURATE?

4 PROBABLY VERY INACCURATE?

Q-17 Would you say the dollar amounts you gave in answer to Questions 12, 13 and 14 are: (Circle number of best answer)

1 BASICALLY FOR THE STATED CHANGES IN VISIBILITY AT THE NATIONAL PARKS

2 SOMEWHAT FOR THE STATED CHANGES IN VISIBILITY AND SOMEWHAT TO HELP WITH OTHER NEEDS AT THE NATIONAL PARKS

3 BASICALLY TO HELP THE NATIONAL PARKS AND ARE NOT RELATED TO THE STATED CHANGES IN VISIBILITY

4 OTHER (Please specify) _____

→ About what percent of your dollar answers is for visibility at national parks in the Southwest? (Circle number)

NONE		SOME		HALF		MOST				ALL
0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

Q-18 Of the money you would be willing to pay to control haze in and around national parks in the Southwest, about what percent do you think should be spent to control haze in and around Grand Canyon National Park? (Circle best answer)

NONE		SOME		HALF		MOST				ALL
0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

Q-19 About what percent of the dollar amount you stated you would be willing to pay for improving visibility conditions in and around national parks in the Southwest can be explained by the following reasons? (Answers should total to 100%)

_____% SO MY HOUSEHOLD AND I COULD ENJOY CONDITIONS AS NATURAL AS POSSIBLE ON VISITS TO NATIONAL PARKS IN THE SOUTHWEST

_____% SO OTHERS, NOW AND IN THE FUTURE, COULD ENJOY CONDITIONS AS NATURAL AS POSSIBLE ON VISITS TO NATIONAL PARKS IN THE SOUTHWEST

_____% TO HAVE CONDITIONS AS NATURAL AS POSSIBLE AT NATIONAL PARKS IN THE SOUTHWEST, EVEN IF NO ONE WERE TO EVER VISIT

_____% OTHER (please explain) _____

=100 % _____

ABOUT YOU AND YOUR HOUSEHOLD

Q-20 "Where do you live? (Circle number of best answer)

1 A LARGE METROPOLITAN AREA (Over 1 million people)
2 A LARGE CITY (100,000 to 1 million people)
3 A SHALL CITY OR TOWN (10,000 to 100,000 people)
4 A VERY SMALL TOWN OR RURAL AREA (under 10,000 people)

Q-21 How far do you live from the nearest national park? (Circle number)

1 LESS THAN 50 MILES
2 50-99 MILES
3 100-199 MILES
4 200-499 MILES
5 500-999 MILES
6 1000 MILES OR MORE
7 I DON'T KNOW

Q-22 What is the name of the nearest national park? _____

Q-23 Your sex? (Circle number)

1 MALE 2 FEMALE

Q24 Your present age? _____ YEARS

Q-25 Are you presently? (Circle number of best answer)

1 EMPLOYED FULL-TIME
2 EMPLOYED PART-TIME
3 FULL-TIME HOMEMAKER
4 UNEMPLOYED
5 RETIRED
6 STUDENT

Q-26 Including yourself, how many members of your household are in each age group? (If none, write "0")

UNDER 18 YEARS Of AGE
18 TO 64 YEARS OLD
65 YEARS AND OVER

Q-27 How much formal education have you completed? (Circle number)

1 NO FORMAL EDUCATION
2 SOME GRADE SCHOOL
3 COMPLETED GRADE SCHOOL
4 SOME HIGH SCHOOL
5 COMPLETED HIGH SCHOOL
6 SOME COLLEGE OR TRADE SCHOOL
7 COMPLETED TRADE SCHOOL
8 COMPLETED COLLEGE
9 SOME GRADUATE WORK
10 ADVANCED COLLEGE DEGREE

Q-28 What was the approximate annual gross income (before taxes) received in 1987 by you and family members living with you? (Circle number)

1 UNDER 510,000
2 $10,000-19,999
3 $20,000-29,999
4 $30,000-39,999
5 $40,000-49,999
6 $50,000-59,999
7 $60,000-69,999
8 $70,000-79,999
9 $80,000-89,999
10 $90,000-99,999
11 MORE THAN 5100,000
12 CHOOSE NOT TO ANSWER

Is there anything we may have overlooked? Please use this space for additional comments you would like to make about managing natural resources and visibility at national parks.

Please return questionnaire to: Managing The Parks
RCG/Hagler, Bailly
P.O. Drawer O
Boulder, Colorado 80306-1906

Your help is greatly appreciated. If you wish to receive a summary of results, print "results requested" on this page. We will see that you receive it.

SW3

APPENDIX B

Sample Letters

RCG/Hagler, Bailly, Inc.

P. O. Drawer O
Boulder, Colorado 80306-1906
303/449 5515 ■ Fax: 303/443 5684

August 22, 1988

Dear

The national parks have been set aside as special resources. Yet, the management and protection of national parks involve costs to each of us. Therefore, decisions about how to protect and manage the parks should consider the opinions of all people in the country.

I have a favor to ask of you. In about a week you will receive in the mail a questionnaire and color photographs of national parks. The questionnaire asks about your visits to national parks and asks your opinions about managing and protecting national park resources. Your opinions are important, even if you do not visit national parks.

Because we can send only a few questionnaires, we have scientifically selected households to reflect the opinions of citizens from around the country. Your response is very important.

RCG/Hagler, Bailly, Inc. is a professional research firm hired to help conduct this study for the University of Colorado. You will receive your questionnaire from us along with a postage paid return envelope. The results will be provided to the National Park Service, and to all other interested parties.

Thank you in advance for any help you can provide.

Sincerely,

Robert D. Rowe
Project Manager

RCG/Hagler, Bailly, Inc.

P.O. Drawer O
Boulder, Colorado 80306 1906
303/449 5515 ■ Fax: 303/443 5684

September 6, 1988

Dear

Here is the questionnaire I told you about in my letter a few days ago. People have filled it out say it takes about 20 to 25 minutes to complete (sometimes more, sometimes less). Your responses will help provide an understanding of what all citizens want and don't want with regard to protection of the resources at national parks.

Your questionnaire should be filled out by either the male or female head of household. Your response is very important because you are part of a relatively small sample of people from around the country who have received this survey. The questions do not require scientific knowledge, only that you consider and answer each question as well as you can.

Your response will be confidential. Results will only be reported statistically, such as "20% have visited Yosemite National Park." The enclosed form has a number for mailing purposes only, so we may check your name off the follow-up mailing list when you return the questionnaire to us.

The results will be made available to the National Park Service and t all other interested parties. If you would like, we will send you a summary of the results. Simply write "results requested" on the back page of the survey and I will see that you get them.

RCG/Hagler, Bailly has been hired to help conduct this survey, so your completed questionnaire should be sent directly to our office. A postage paid, self-addressed envelope is enclosed for your convenience. I will be happy to answer any questions you might have. Please write or call. We appreciate your assistance.

Sincerely,

Robert D. Rowe
Project Director

P.S. Since we know that your time is valuable, we offer the enclosed gift as a token of our appreciation for your help.

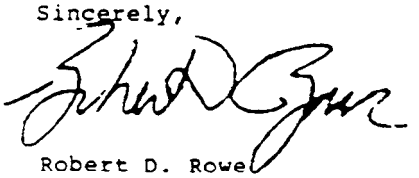
September 7, 1988

Last week a questionnaire was mailed to you seeking your opinions about the preservation and management of the national parks. Your name was drawn from a scientific random sample of U.S. citizens.

If you have already completed the questionnaire and returned it to us, please accept our sincere thanks. If not, please do so today. Because it has been sent to only a small number of households around the country, it is extremely important that your opinions be included in the study to accurately represent the opinions of all citizens nationwide.

If you did not receive the questionnaire, or if it got misplaced, please call me collect at (303) 449-5515, and I will put another one in the mail to you today.

Sincerely,



Robert D. Rowe
RCG/Hagler, Bailly, Inc.
Project Director

RCG/Hagler, Bailly, Inc.

P.O. Drawer O
Boulder, Colorado 80306 -,1906
303/449 5515 Fax: 303/443 5684

September 23, 1988

Dear

Three weeks ago I wrote to you asking for your opinions about the protection and management of national parks. As of today, we have not received your completed questionnaire.

The University of Colorado and RCG/Hagler, Bailly, Inc. are conducting this research to help decision makers in government and industry better understand how citizens like you want the air quality resources in and around national parks to be managed.

I am writing to you again because the opinions of each household selected are important to this study. For the results to be truely representative of households from around the country, it is essential that each person in the sample return the questionnaire. Even if you feel that you know very little about air pollution at national parks, your opinion is valuable and still counts.

In the event that our questionnaire was misplaced, a replacement is enclosed. If you should have any questions, please call me collect at (303) 449-5515.

Your assistance is greatly appreciated.

Sincerely,

Robert D. Rowe
Project Manager

RCG/Hagler, Bailly, Inc.

P O Drawer O
Boulder. Colorado 80306-1906
303/449 5515 ■ Fax. 303/443 5684

November 2, 1988

Dear

Some weeks ago I wrote asking for your help on a survey concerning visibility at National Parks. So far, we have not received your completed survey.

Several people have called me saying they wi11 probably never visit the parks we asked about. Even if you will never visit these parks, decision makers in government must learn if you feel it is important or unimportant to protect or improve visibility at national parks and why you feel this way. The decisions they make can affect the taxes and prices you pay, regardless of how often you visit the parks.

Other people have told me some of the questions are hard to answer. These are also hard questions for decision makers to answer without your input. We are asking you to answer the best you can. If you feel your answers are inaccurate, please tell us by writing this next to your answers.

Because you are part of a small group scientifically selected to represent all of the public's opinions, your response is very important to us. In case you have misplaced your survey, we have enclosed another. If you have any questions, please call me, collect, at (303) 449-5515. As I have indicated, all your responses wi11 be held strictly confidential.

Sincerely,

Robert D. Rowe
Project Manager, "Managing the Parks"

RDR; jlw

APPENDIX C

Sample Telephone Follow-up Survey Instrument

PARVU PHONE FOLLW-UP Version 2
Focus Region: Grand Canyon/Southwestern U. S.

Codes: 8 , 88 = Don't Know; 9,99 = Missing or Refused

Hello, is this _____ ? My name is _____, and I'm calling from CIC Research. We're working with the University of Colorado.

Several weeks ago we sent you a printed survey about visibility at the national parks. I'm calling as part of a short telephone follow-up to the mail questionnaire (but this is not the mail questionnaire.) This follow-up is being done to find out how people who did not respond to the mail survey differ from those who completed the survey. This information is important to help us understand the responses to the mail survey. We would appreciate if you could answer a few questions that will take about 5 minutes.

ID _____ (1-3)

Q1 It this a convenient time to talk? __1__ NO __2__ YES — AGREE _____ (4)

Q2 Have you ever personally visited any national park, (including monuments and seashores)? __1__ NO __2__ YES — VISIT _____ (5)
└──> **Skip to Q4**

Q3 Have you personally ever visited Grand Canyon National Park?

__1__ NO __2__ YES ——> (If Yes) How many days have you visited this park in just the last two years? _____ DAYS

VYOS _____ (6)
DYOS _____ (7-8)

Q4 In the next 5 years, do you think you "Definitely Will Visit", "Might Visit", or "Definitely Will Not Visit" a national park in the southwestern United States?

> Examples of parks in the Southwest are Bryce Canyon, Zion, Saguaro, Petrified Forest, and Carlsbad Caverns.

__1__ DEFINITELY WILL __3__ MIGHT __5__ WILL NOT
__8__ REFUSED __9__ DON'T KNOW

FVISIT _____ (9)

Q5Do you have the national park photographs we mailed you?

__1__ NO ——————————————————————> Skip to Q9.

__2__ NO, BUT I REMEMBER THEM. ——————> Skip to Q9.

__3__ YES ——> I would like to ask you a few short questions about the photographs. Could you get them? HAVE ____ 10

__1__ NO __2__ YES GET ____ 11

In the future, visibility at national parks of the southwestern U.S. could improve or worsen, depending upon how much air pollution control is undertaken. But any changes in air pollution control could affect everyone through higher prices for electricity, transportation, home heating and for many other goods and services or through higher taxes.

—————————— YES, THEY HAVE PHOTOS TO LOOK AT ——————————

The next questions concern only the pictures for Grand Canyon, which are typical of conditions at all national parks in the south. western U.S. The typical summer visibility is like Photograph C.

Q6 Do you think it is "Not At All Important", "Somewhat Important", or "Extremely Important" to prevent visibility from getting worse, like Photo D, at national parks in the Southwest?

__1__ NOT AT ALL __3__ SOMEWHAT __5__ EXTREMELY WORS1 ____ 12

Q7 Would you support new air pollution controls to prevent typical summer visibility from decreasing from Photo C to Photo D at all national parks in the Southwest if it cost your household $25 a year?

__1__ NO __2__ YES ——> Skip to Q8. WTP1 ____ 13

Would you support new air pollution control regulation to prevent typical summer visibility from decreasing from Photo C to Photo D at all national parks in the soutwest if it cost your household $5 a year?

__1__ NO __2__ YES WTP2 ____ 14

$ _____ (Provided, if any) WTP1S ____ 15-1

(Why/why not? If provided) WHY ____ 18-19

Q8 Do you think it is "Not At All Important", "Somewhat Important", or "Extremely Important " to improve visibility so it should be like Photo B, at national parks in the Southwest?

__1__ NOT AT ALL __3__ SOMEWHAT __5__ EXTREMELY IMPR1 ____ 20

Q9 Would you support new air pollution controls to increase typical summer visibility from Photo C to Photo B at all national parks in the Southwest if it *cost* your household $25 a year?

__1__ NO __2__ YES WTP$3 ____ 21

$ (provided, if any) WTP2$____ 22-24

Skip to Q14.

NO, THEY DO NOT HAVE PHOTOS

Q10 Do you think it is "Not At All Important", "Somewhat Important", or "Extremely Important" to prevent visibility from getting somewhat worse at national parks in the southwestern United States?

> Examples of parks in the Southwest are Bryce Canyon, Zion, Saguaro, Petrified Forest, and Carlsbad Caverns.

__1__ NOT AT ALL __3__ SOMEWHAT __5__ EXTREMELY WORS2 ____ 25

Q11 Would you be willing to pay any more in increased prices or taxes to support new air pollution controls that would prevent typical visibility from becoming somewhat worse at all national parks in the Southwest?

__1__ NO __2__ YES __3__ Don't Know WTP4 ____ 26

Q12 Do you think it is “Not At All Important", "Somewhat Important", or "Extremely Important" to improve visibility at national parks in the Southwest?

__1__ NOT AT ALL __3__ SOMEWHAT __5__ EXTREMELY IMPR2 ____ 27

Q13 Would you be willing to pay any more in increased prices or taxes for new air pollution controls that would somewhat improve typical visibility at all national parks in the southwest?

__1__ NO __2__ YES __3__ Don't Know

WTP5 ____ 28

Now, just a few last questions to help group your responses with those of others:

Q14 Do you live in:

1 A LARGE METROPOLITAN AREA of Over 1 million people
2 A LARGE CITY of 100,000 to 1 million people
3 A SMALL CITY OR TOWN of 10,000 to 100,000 people
4 A VERY SMALL TOWN OR RURAL AREA of Under 10,000 people

WHERE ___ 29

Q15 How far do you live from the nearest national park? Would you say it is:

1 LESS THAN 50 MILES
2 50 - 99 MILES
3 100 - 199 MILES
4 200 - 500 MILES
5 500 - 1,000 MILES
6 MORE THAN 1,000 MILES
(7 I DON'T KNOW)

MILES____ 30

Q16 What is the name of the nearest national park?

_____

PARK _____ 31-33

Q17 What is your present age? _____

AGE ____ 34-35

Q18 Including yourself, how many people are in your household?

HH _____ 36-37

Q19 What was your total household income in 1987 before taxes and deductions? Would it be:

1 - UNDER $20,000
2 - BETWEEN $20,000 AND $40,000
3 - BETWEEN $40,000 AND $60,000
4 - BETWEEN $60,000 AND $80,000
5 - OVER $80,000
6 - REFUSED TO ANSWER

INC _____ 38

Thank you. That's all the questions I have.

Interviewer, add:

Q18 Sex: 1 - MALE
2 - FEMALE

SEX _____
39

Q19 Comment:

COMM1_____
40-41

Q20 Interviewer number

INT#_____
42

Q21 Language

0 NO LANGUAGE BARRIER
1 POSSIBLE LANGUAGE BARRIER
2 DEFINITE LANGUAGE BARRIER

LANG_____
43

Q22 Other Comments:

COMM2_____
44-45