CONTINGENT VALUATION METHOD: AN INTRODUCTION

MAY 2000

U.S. Department of the Interior
Bureau of Reclamation

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave Blank)*

2. REPORT DATE
May 2000

3. REPORT TYPE AND DATES COVERED
Final

4. TITLE AND SUBTITLE
Contingent Valuation Method: An Introduction

5. FUNDING NUMBERS

6. AUTHOR(S)
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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
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Bureau of Reclamation
Technical Service Center
Denver CO 80225-0007

8. PERFORMING ORGANIZATION REPORT NUMBER
EC-2000-03

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Bureau of Reclamation
Denver Federal Center
PO Box 25007
Denver CO 80225-0007

10. SPONSORING/MONITORING AGENCY REPORT NUMBER
DIBR

11. SUPPLEMENTARY NOTES
na

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Available from the National Technical Information Service,
Operations Division, 5285 Port Royal Road, Springfield, Virginia 22161
(703) 487-4650

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*
This report provides the reader with an introduction to contingent valuation with a discussion of underlying theory in support of this method, comparisons to other methods of valuation, and issues that affect use of this methodology. It also discusses, briefly, the practical aspects related to using this method valuing resources.

14. SUBJECT TERMS--
nonmarket valuation, willingness to pay, use values, nonuse values, Principles and Guidelines, contingent valuation, endangered species

15. NUMBER OF PAGES
18

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UL	UL	UL	UL

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18
298-102

Technical Memorandum Number EC-2000-03

CONTINGENT VALUATION METHOD: AN INTRODUCTION

May 2000

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This work was funded by the U.S. Bureau of Reclamation's Science and Technology Program, project number A10-1541-3050-158-01-0-1 and General Investigation Program, project number A10-6520-0008-089-01-0-1; published as Chapter 7 in: *Handbook of Global Environmental Policy and Administration*, D. Soden and B. Steel, eds. Marcel Dekker, Inc. New York, NY.

I. INTRODUCTION

Contingent valuation is a survey based method of estimating how much individuals would be willing to pay for environmental or natural resource amenities, using a hypothetical market. These elicited values are contingent on the described market and quality of the good. Because these amenities are nonmarket goods, the economic value of these amenities are difficult to determine. Economists call these goods "nonmarket goods" because these goods are not sold in the normal manner as a priced good in a market, but they still provide economic benefits to individuals. These goods can be resources that are used or consumed during activities including hunting, fishing, skiing, and other recreational activities. These nonmarket goods can also provide benefits without being used, such as knowing that the Grand Canyon is preserved, even for persons who will never visit this site. For these types of nonmarket goods, CVM is the only procedure available for estimating value. By carefully describing hypothetical conditions, CVM surveys can measure unobserved behavior and this method is the only vehicle for measuring the effect of proposed changes in quality of the resource before the changes occur.

Sound management of public resources requires knowledge and use of all economic values provided by those resources. If decisions to use or alter resources are made using market values and fail to consider nonmarket values, such decisions may result in an uninformed or incorrect allocation of resources. Traditionally, resource managers may have considered only goods and services sold in markets, such as lumber, minerals, and oil, when determining economic values. However, economists recognize that value is received from goods that provide benefits to the individual, even when the user does not buy those goods in a market.

I.A. Why value nonmarket goods?

Capitalism is founded on a market-based economy. Individuals have goods and services to sell, and try to maximize their own well-being. They do so through transactions, trading for goods and services. Economists label this personal level of value with the term, utility. Utility is not observable nor measurable, however, and most people are not familiar with the term. Although it is not measurable or known, economic theory holds that each person instinctively understands how to increase utility for themselves and attempts to maximize it. Our society assumes a goal of trying to maximize the "collective" utility of all the members rather than maximize the opportunity of a few. For market goods, this goal is accomplished through competitive markets. For nonmarket goods understanding the economic value is necessary in order to maximize the collective value to society.

Many people have strong feelings toward the existence of natural resources, including wild rivers, old-growth forests, and salmon, even though they may never observe or use the resources. Many people have altruistic feelings and a sense of responsibility toward ensuring the future existence of these resources. They have sympathy and empathy for animals and feel some responsibility for loss of habitat due to human economic activities (15). Economic valuation recognizes that the continued existence of these amenities is important to many members of society (2).

The national park system provides an example of nonmarket goods: When consumers visit a park unit that does not charge an entrance fee, or charges a nominal fee, they receive a benefit from this public good without directly paying for the value, compared to the price if it were a private good. The lack of entry fee does not mean the park unit provides no value to visitors. To the contrary, the amount of money they would be willing to pay if it were a private good is the value of the nonmarket benefit provided by the park unit. Public goods exist because these types of goods could not be provided efficiently in a private market. Estimating the economic value of these resources helps preserve them for use as parks.

I.B. Measuring Economic Value

In a perfectly competitive market, the seller of a good prices the good at the same dollar amount for all customers even if some customers would be willing to pay more. If the seller could identify buyers those who would pay more and charge a price equal to their willingness to pay for each individual sale, greater profits would be earned. However, in competitive markets, this level of market segmentation and price control is not attainable. These profits lost to the seller are a benefit to the consumer and referred to as net willingness to pay (WTP). WTP measures economic sacrifice in terms of income or other goods an individual is willing and able to forgo. Net WTP is the difference between total WTP and the consumers' actual expenditure.

Figure 1 shows a graph of this concept. At different prices different quantities would be purchased. At higher prices individuals would purchase less quantity and at lower prices a greater quantity of the good would be demanded. These different combinations can be graphed by a line which economists call a demand curve, representing the quantity demanded for different price levels. Assuming that the good in question has a price (or value), P, then an amount Q is purchased. The shaded area below the price line and bounded by the line representing quantity Q represents the total cost of purchasing Q items at a price of P (this equals P*Q). As the consumer would be willing to pay a greater price for quantities less than Q, the consumer receives extra value for the good in addition to the value equaling the cost of purchase. This extra value, or net willingness to pay is represented by the area above the shaded portion and below the demand curve.

Total economic value for nonmarket goods can be broken into use and nonuse values. Use values are derived from employing resources in activities such as fishing, hunting, observing wildlife, hiking, skiing and boating. Hundreds of studies have established use values for wildlife and habitat resources used for these and many other activities. Examples of these studies can be found in Walsh et al. (22).

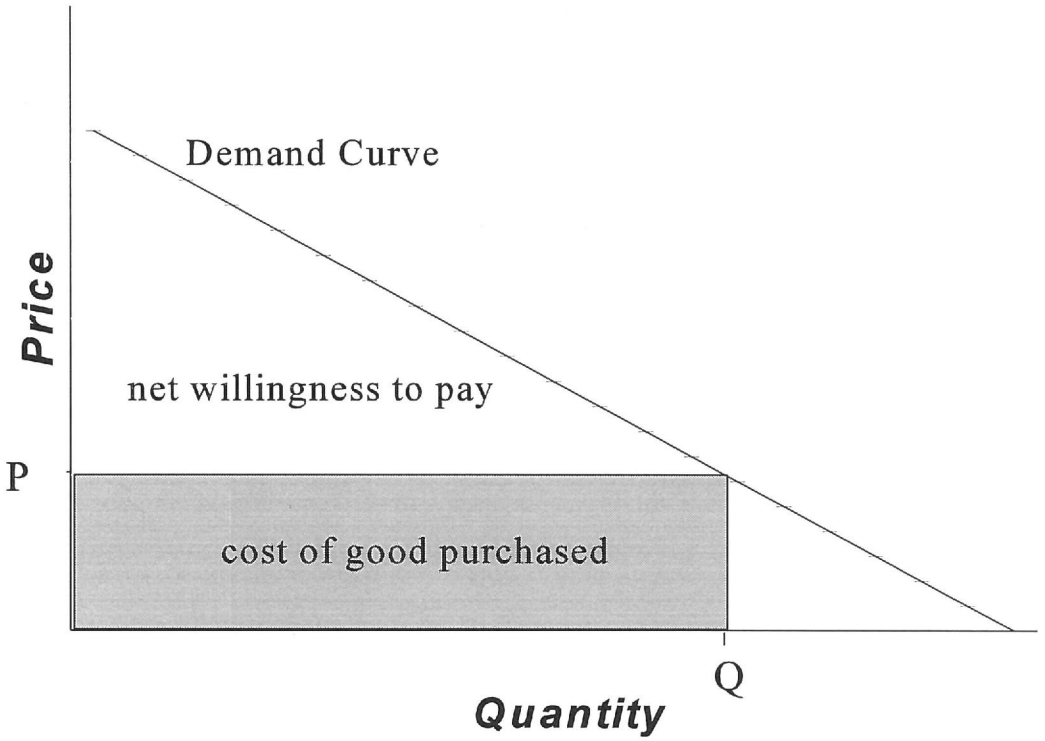

Figure 1

Use values can be further divided into consumptive and nonconsumptive components. Consumptive use refers to activities, such as hunting and fishing, that consume the resource. Nonconsumptive use are those in which the recreationist uses the resource without removing it from its environment. Common nonconsumptive uses include wildlife photography, bird watching, and wildlife feeding. The term nonconsumptive reflects the nature of the activity and should not be confused with the consumption of related goods used by the recreationist. Bird watchers, for example, who purchase (consume) binoculars, cameras, and other gear are still nonconsumptive users in regard to wildlife.

Some resources provide both consumptive and nonconsumptive uses. Many species of waterfowl, for example, could be hunted by one person and observed by a bird watcher.

Endangered species, however, usually provide nonconsumptive use rather than consumptive use (if any use exists for these species) due to low population levels and because it is illegal to hunt them. Occasionally, a species which is listed as threatened, but not classified endangered, could generate some use values such as fish species, if the angler does not harm the catch and returns it to the water immediately. It is more usual though that endangered species provide only nonuse values to society.

Nonuse value recognizes that the public benefits from the preservation of the resource even when individuals do not use them. People may benefit from knowing that the amenity continues to exist, is potentially available for future use, and will be preserved for future generations. Empirical studies have established that nonuse values exist in substantial amounts (3, 21). In some examples, nonuse values have represented from 70 to 95 percent of the total value for wildlife and wilderness areas (10, 21). Substantial nonuse values are more likely to exist when resources are unique or when loss would be irreversible. This may apply to resources such as endangered species and unique areas such as the Grand Canyon.

I.C. Revealed Preference Techniques for Valuation

The value of a market good can be determined by observing the price at which it is sold. The price is determined by numerous interactions between buyers and sellers. If the price is too high, the seller finds that some of the good remains unsold and the seller lowers the price. If all of the good is sold quickly, the seller may recognize that the good is underpriced and adjust accordingly.

As previously indicated, nonmarket goods have no prices, but economic values can be estimated with several techniques. In addition to the CVM, the most common and widely accepted methods are travel cost, and hedonic pricing. Hundreds of studies have used travel cost and contingent valuation to value nonmarket goods. Hedonic pricing has been used to some extent but is restricted due to data limitations. Both travel cost and hedonic pricing methods value goods by observing preferences expressed by behavior.

The travel cost method (TCM) gathers information about the user's preferences by observing behavior. This method has been used to value resources used for activities such as fishing, boating, hiking, and other recreational activities. The TCM is limited to measuring values based only on current conditions at the site and only the economic value for participants. The method fails to consider potential users who would recreate under different conditions of amenities or lower cost.

Economic values also can be estimated using the hedonic pricing method. The hedonic technique is limited by lack of data, because it requires using observed market prices for goods, such as real estate markets, to determine resource values. This method assumes that the price of a good is influenced by many attributes. Real Estate market prices are

affected by features such as size of the house, its location and construction date, and school district. Other amenities such as proximity to a lake, extent and type of vegetation, and other local resources may also affect the market price. The value of each attribute is estimated by unbundling the price of the market good such as real estate using statistical procedures. The researcher then uses the resulting coefficients to identify the value of the resource in question. The hedonic method is an excellent way to value some resources, but has limited applications in valuing environmental resources because there are few market goods which can be used in this way to price environmental amenities.

II. CONTINGENT VALUATION METHODOLOGY

The CVM is based on stated preferences for goods, rather than observed behavior of consumers. Whereas the CVM has the limitation that it does not use revealed preferences, it has the advantage that it can value nonmarket goods which other methods cannot. These include changes in quality for resources, non-participants, and valuing nonuse goods, which the public may value highly. There are many detailed references available on this method (5,13).

Support for comparing benefits and costs for nonmarket economic values for natural resources has been provided since 1950s with *The Green Book* (8). Additional support was added by *Principles and Standards* published by the U.S. Water Resources Council (20). The latest revision in 1983, referred to as *Principles and Guidelines*, specifically recognized the CVM. along with other techniques for valuing nonmarket goods (19). *Principles and Guidelines* also clearly described the "willingness to pay" principle underlying national economic development benefits and the CVM.

The CVM was validated for use in conducting natural resource damage assessments in federal court with the decision of *Ohio v. U.S. Department of the Interior* (18). During damage estimates from the oil spill of the *Exxon Valdez* in Prince William Sound, the National Oceanic and Atmospheric Administration (NOAA) asked a panel of renowned economists to review the CVM. This panel determined that this method produced estimates reliable enough for administrative and judicial determinations (1).

The CVM has been used to value many species of animals, particularly species federally listed as threatened or endangered. Table 1 shows estimated nonuse values from studies valuing selected species (11). Because these are values for federally protected species, they represent only nonuse values, because most listed species population are not large enough to allow use values, with a few exceptions. Values vary due to different study implementation methods, impacts to habitat proposed in the study, and impacts proposed to the species.

These values vary in magnitude because they are estimated for different goods and implement the method in different ways. More recent studies may have applied more sophisticated statistical techniques based on the experience of earlier research. Proposed impacts may vary among studies, too, including the level of restoration of the species' habitat, the level of certainty of preservation, and impact on other species. The studies' results provide insight into how society values preservation of these species.

Table 1: Nonuse Values Estimated Using CVM: For 16 Threatened and Endangered Species and Habitat[1]
(Converted to 1995 Dollars Using Consumer Price Index)

SPECIES	AVERAGE VALUE[2]
Atlantic salmon	$ 7.63
Arctic grayling/cutthroat trout	10.06
Bald eagle	26.01
Bighorn sheep	11.15
Blue whale	41.78
Gray wolf	71.00
Grizzly bear	35.96
Humpback whale	73.20
Monk seal	20.22
Red-cockaded woodpecker	15.56
Pacific salmon and steelhead	31.29
Sea otter	28.32
Northern spotted owl	92.65
Squawfish	8.42
Striped shiner	6.04
Whooping crane	33.07

1. Since some of these species (salmon) could have some use value in addition to nonuse value, these values may represent total value.
2. Source: Loomis and White 1995

II.A. Comparisons Between CVM and TCM Measures

Comparisons between the CVM and other techniques such as the TCM help validate CVM by showing the technique is reliable for estimating nonmarket values as the results of the two methods compare consistently. The sample of comparisons illustrated in this section are limited to studies determining use values since nonuse values can be estimated only with the CVM.

Davis' (6) study is considered to be the first application of the CVM and estimated economic benefits of recreation in the north woods of Maine. This study estimated economic values using both the CVM and the TCM for hunters, anglers, and campers. Besides providing their travel costs, these participants were asked if their decision to recreate would be affected if the cost of the experience increased. Using a bidding

process the researchers increased the hypothetical cost estimates to the level where respondents indicated that they would no longer recreate. From the survey responses, a demand schedule and total economic benefits were estimated. The $72,000 value resulting from the CVM estimates were similar to the $70,000 of benefits estimated with the TCM.

Other studies also help confirm the validity of CVM results through comparisons of methods. Sanders et al. (17) estimated economic values for water recreation activities and compared the CVM and the TCM values for stretches of 11 rivers in the Rocky Mountains of Colorado considered for protection under the Wild and Scenic Rivers Act. These researchers mailed surveys to a sample of households in Colorado to determine their preferences and travel costs. The study estimated mean values per visitor day ranging from $20.91 to $24.38 for both techniques, and they concluded that the estimates were sufficiently reliable to demonstrate consistent and reasonably stable recreational use values for both methods.

Carson et al. (4) compared results from 83 studies conducted from 1966 to 1994. The studies included 616 comparisons of CVM estimates to revealed preference estimates, including travel cost, hedonic pricing, expenditure function, and household production function models. The authors compared summary statistics of the ratio of values indicated by CVM to values indicated by revealed preferences (RP) methods and found the mean ratio of CVM/RP was 0.89 with a confidence interval between 0.81 and 0.96. Most individual CVM/RP ratios ran from 0.25 to 1.25, with 80 percent less than 1.25. A number of CVM estimates exceeded the revealed preference values, a few by as much as 10 times, but these represent a small portion of the sample. The review concluded that on average CVM produces values which are slightly lower than estimates made by revealed preference techniques.

Estimating slightly lower values by the CVM compared to revealed preferences are not unexpected. CVM often is used to measure a slightly different activity, or one carried out under different conditions, than revealed preference techniques. For example, TCM and CVM studies could be used to estimate the value of benefits received by an angler fishing for a weekend fishing at a favorite lake. Whereas TCM measures the economic value for the fishing trip, which may include secondary benefits such as camping, the CVM study could be estimating a value specifically for the fishing component of the trip. The activity valued by CVM is a major portion of, but not the same as, the activity valued with TCM.

II.B. Controversies related to the Contingent Value Method

There is an ongoing debate among economists over the CVM. Some CVM critics oppose the very concept of nonuse values and contend the method does not reflect values held by all of society, and suggest the results lack validity. Most of the controversy centers on

the techniques used by CVM to estimate nonuse values. Opposition to using CVM as a vehicle for estimating nonuse values escalated following the *Exxon Valdez* oil spill. Environmentalists argued the oil industry used this opposition to CVM as an attempt to reduce the size of economic damages awarded following the oil spill in Prince William Sound.

Critics contend the sum of nonmarket values estimated for environmental amenities is implausibly large. They suggest nonmarket values are not accurate economic values but some highly inflated number. CVM supporters counter that this argument also could be applied to millions of market goods. While aggregate prices of market goods are substantial, individuals choose among myriad of choices to allocate their limited resources (2).

CVM studies of endangered species suggest there is substantial value for protecting these species. This results in significant values per individual (animal or plant) for species with small populations. These values appear large in part because consumers tend to compare the value per unit in terms of use or market values (2). Consumers may think of all salmon in terms of dollars per pound when it is sold in the grocery store. However, for existence values for an endangered stock of salmon, a handful of fish may be assigned the aggregate existence value from thousands of persons.

Large values can also be thought of as indicative of the scarcity of the population and how close it is to extinction (15) just as scarcity elevates the price of market goods such as diamonds. As the species population recovers, the value per individual would rapidly decrease. Failure to recognize this relationship overlooks the benefits provided by the public goods portion of the species, and results in undervaluing the good.

Opponents to CVM argue questionnaires are not sensitive instruments and cannot detect small changes in availability of a resource. Desvousges et al. (7) estimated the nonuse value of preventing the accidental death of migratory waterfowl in California. The questionnaire asked respondents to value protection of varying populations of waterfowl, ranging from 2,000 to 200,000, ranging from a fraction of one percent to less than 2 percent of waterfowl in the U.S. The study found positive values for protecting the birds, but little correlation between the waterfowl population level and value of the protection. Even when the number of birds changed by a factor of 10 the values did not vary significantly. The authors concluded that respondents had difficulty expressing values for these changes in population, a necessary condition for valuing resource damages.

Proponents of CVM contend that this and other studies used to refute CVM used surveys that were not carefully designed. This resulted in large variances, generated large confidence intervals, and lead to these reached inconclusive findings. Proponents also suggest that one study cannot prove or disprove the reliability of CVM.

Because the CVM is based on stated preferences rather than revealed preferences, some economists have expressed concern the method's ability to reach unbiased results. Criticisms include strategic bias, hypothetical bias, implausibly large values, and bias introduced by the design of the survey vehicle. The validity of research depends on how the study is conducted and how the results are analyzed. Specific recommendations for implementing CVM studies have been made by the NOAA panel.

Strategic bias results from the respondent intentionally answering the CVM survey questions in a misleading way. Strategic bias may arise when respondents have an incentive not to reveal their true demand. For example, if the respondent recognizes that the scenarios described in the questionnaire are hypothetical in nature, he may respond with an answer other than his true WTP. The respondent, for example, may believe that a higher value would promote a public good which is used for recreation or other purposes. On the other hand, if the respondent believes that entrance and other assessed fees in the future will depend on one's answer, the respondent may state a value that is lower than true WTP in an attempt to lower user fees. In either case, the respondent has incentive to provide biased information.

However, there is no empirical evidence supporting the concern about strategic bias. If a significant number of respondents routinely answered questions with strategic intent, CVM values would not correspond so closely to revealed preference values. Also, analysis of CVM findings supports that CVM results follow economic theory. Bids obtained from CVM studies have been shown to be statistically significant and related to income and other demographic characteristics, and affected by the availability of substitute and complementary commodities (15).

Hypothetical bias refers to the inability of respondents to accurately predict how they would behave if an actual market for the good was created. Opponents to using the CVM suggest that respondents may not be able to assess the values without the experience in an actual market; that it takes repeated exposure in the marketplace to accurately price a good. Actual markets allow for repeated transactions so that the buyer can acquire information, learn about substitutes, and discuss the potential purchase with others in order to define actual willingness to pay. This argument assumes that respondents, prior to receiving a CVM survey, have never considered their willingness to pay for these goods and have problems determining these values on only one try and that this is especially true for nonuse goods such as endangered species, wetlands, and pristine wilderness areas.

Positive economic values can be identified for goods using CVM even if the respondent was not aware of the good prior to learning about it in the survey. Critics argue this is another example of the failure of CVM. Proponents of the technique counter that this exemplifies the process by which consumers determine preferences. Consumers seek information to help determine which goods and services to purchase within their budget

constraints. In markets, consumers usually do not attempt to learn about goods that are unavailable. Consumers acquire additional information about the new product only after the product becomes available (2).

Prior to executing the actual survey, the researcher should conduct focus groups, pretests, and pilot studies. These steps help the researcher understand how respondents will interpret the questions in the actual survey, and allow for redesign of the questionnaire. After focus groups have helped sharpen questions, and identified the need for background information, a pretest or pilot study can be administered. Providing evidence of these helps show that public response and proper communication are being achieved (13).

II.C. Future Direction: Measuring Respondent Certainty

Uncertainty is significant to the valuation estimates because respondents are accustomed to buying goods which have pre-determined prices rather than offering a price without some suggestion of value. When consumers purchase goods in real markets they are able to compare sources for the best price and consider the utility the good will provide. Similar information is not available for nonuse goods because answering a CVM survey may be the only opportunity respondents have for estimating their value for these goods. Respondents may think the nonuse good in question, whether an endangered species, wilderness area, or other environmental good, provides positive economic values, but not be certain of their response to the WTP amount they are asked to respond to without repeated opportunities to value the good. This is particularly true if survey recipients are asked to respond to a mid-range value for a good. Respondents who face either extremely high or extremely low values of goods may be more certain in their responses. Incorporating the level of certainty in the estimation provides additional information for use in the valuation process and may lead to more defensible values.

To improve the reliability of survey results, researchers have begun asking how certain the respondents are to their answers to CVM questions. Researchers have found this approach reduces the estimate of WTP relative to values estimated in the more traditional approach (9, 14). Others have found that using knowledge of the respondents' certainty reduces the variance of the estimate (16, 23). Incorporating this information may hold promise for developing better methods of measuring nonuse values.

III. DESIGNING A CONTINGENT VALUATION QUESTIONNAIRE

A well-designed CVM survey clearly identifies the resource involved in the survey, conveys to the respondent the current condition of the resource, and describes the consequences of actions proposed in the survey. The respondent must be asked clearly to state his value for causing the action to occur (or preventing the action, depending on the situation). The questionnaire must provide additional information, including describing

the proposed payment method, and other background or technical information relevant to the situation.

A CVM questionnaire must convince the respondent that the project is feasible, and must sufficiently inform the respondent so he or she understands clearly the issue in question. The mechanism for payment, usually a method of taxation, payment into a special fund, or an increase in the cost of a related product purchased by the respondent, is an especially sensitive item. If the respondent does not buy into the payment mechanism, the respondent may question the validity of the study and fail to participate honestly. The study also must convey how and when the specified resource will be provided in a way that is acceptable to the respondents.

Statistical techniques should be followed when selecting the sample used in the study. The sample needs to represent the overall characteristics and demographics of the population within the region of the study if the results are projected to the population at large. If the sample diverges from the demographic characteristics the results may require adjustments in order to project the results to the population. Samples often are drawn from telephone directories or voting roles. Because these sources will exclude persons without listed phone numbers or are not registered voters, the resulting sample may not reflect the targeted population. The researcher must be aware of this and correct for biases in the study results.

Sample design requires choosing bid amounts such that the maximum WTP for the respondents is included in the bid amount. The bid amounts should reflect the information provided by focus groups and pretest respondents. Because of the type of data and probability distributions received from a CVM questionnaire, large sample sizes are required. The researcher often needs to be sure that the minimum number of respondents in the final analysis is large enough, a minimum being 500 observations or more, an amount necessary to keep the confidence intervals small enough so that conclusions can be reached.

The NOAA panel considered mail surveys unreliable because of low response rates, difficulties with sample frames, literacy problems with respondents, and the lack of control over interview process with self-administered surveys. The panel preferred in-person surveys because these permit more visual materials, can help maintain respondent motivation, and can help monitor respondent performance. Telephone surveys may be satisfactory if the respondent is already informed about the resource or can be informed during the interview or with materials provided in advance.

Despite the NOAA panel recommendation, mail surveys are used frequently to administer CVM studies. Mail surveys are considerably less expensive, and allow gathering information over a much larger geographic area. Mail surveys also allow researchers to sample much larger populations than can be achieved with personal or telephone

interviews. However, a common problem with mail surveys may be low response rates. This may result from low respondent motivation or because of outdated mailing lists. If the respondent is informed properly, and the survey is designed well, including timely follow-up contacts, response rates often increase to acceptable levels. Following proper survey methods improves results, as does the use of focus groups and pretesting.

Mannesto and Loomis (12) compared the effectiveness of mail-in questionnaires and in-person surveys in a CVM survey of boaters and anglers in California. They found that in-person interviews had a much higher response rate than mail-in surveys. However, for individual questions, the response rates may be higher for mail survey respondents. For sensitive (income) and CVM (complex, future-oriented) questions, the authors concluded that the mail method may be better suited as it provides the respondent the opportunity to contemplate and reduces pressure for an immediate answer. The researchers found little difference in resource values regardless of how the survey was administered.

III.A. Proper contingent valuation design and administration

The good being valued must be adequately identified for a survey to be effective. For example, if the researcher is interested in determining willingness to pay to preserve habitat for the northern spotted owl, then a summary of information about the owl and its habitat is needed. This may include information on owl population, trends related to nesting sites and other habitat, the availability of its food source, and resource management actions which will affect the viability of owl populations. This information must be presented in a manner that the reader can easily understand within a limited time that they are likely to spend responding to the questionnaire. Text should be supplemented with maps, photographs, and charts to help the respondent visualize the material in the text.

In addition to the describing current conditions, the researcher must identify hypothetical condition in a manner realistic enough to elicit a realistic response to the WTP questions. Conveying technical information about water quality, resource management practices, or environmental degradation in a manner that all respondents will be able to comprehend can be challenging. Conveying this information is necessary, however, for the respondent to answer accurately.

III.B. Asking the valuation question

After the reader has reviewed the background material about the subject provided with the questionnaire, the reader is asked to estimate the dollar amount he or she is willing to pay for the good. A relevant payment mechanism, such as increased taxes, contribution to a trust fund, or increased cost for a good, must be proposed. This payment vehicle must be related to the good to be credible. For example, funding for proposed enhanced forest habitat could be collected through increased hunting license fees, if the result is increased

hunting. Another example is measuring willingness to pay higher utility rates to mitigate environmental degradation caused by generating electricity.

If the resource involved in the survey is preservation of a nonuse good, then contribution to a trust fund or a tax increase may be the appropriate payment vehicle. It is important that the payment vehicle be emotionally neutral to the respondents. If respondents react to the payment vehicle rather than the good in question, their value estimate may be biased. For example, if the proposed payment vehicle is a tax increase but the respondent opposes higher taxation, this will cause a negative reaction even if it the cost is minimal compared to the value placed on the good in question. The purpose of the payment vehicle is to provide a means of creating a market without being disruptive to the respondent. A poorly chosen payment vehicle can cause the respondent to refuse to answer, in protest of the payment vehicle.

The CVM researcher must also decide how to pose the valuation question. Current alternatives include the referendum approach, a bidding process, open-ended questions, payment cards, and comparison ranking. The most popular method currently used is the referendum approach and was suggested as the method of choice by the NOAA panel for conducting natural resource damage assessments (1).

The referendum approach is popular because it is easy to administer and the payment vehicle is similar to voting on a bond issue and therefore familiar to most survey recipients. The referendum question asks the respondents to answer YES or NO to a specific dollar amount. The value provided in questionnaires varies across the sample to allow calculating the estimate of the probability of a YES answer at each amount. Because this technique is asserted to provide accurate responses of value, it creates reasonable incentives to the respondent. A referendum question may be stated as: *"Would you vote in favor of program ABC if it costs your household $X per year in higher federal taxes?"*

With the referendum method, each respondent answers YES or NO to the referendum question. Because the respondent is asked a single valuation question the survey does not directly identify the maximum WTP for an individual. The WTP for the full sample can be estimated by analyzing all of the responses from the sample set. From this analysis a probability distribution is determined, each amount having a probability of a YES response for the respondents.

The bidding game technique was developed early in CVM research (6) and widely used for many years. This method requires the researcher to pose questions in a context similar to markets to elicit behavioral responses. The bidding begins with the respondent being asked to pay a given amount for a given resource. If the answer is YES, the amount is raised and the question posed a second time. These iterations continue until a negative response is made. If the respondent's original answer is NO, the amount is

reduced until a YES answer is made. The bidding game can be used only with personal interviews, a costly research strategy to implement. The method also carries "starting point bias," which holds that the respondent can be influenced by the starting bid amount. Respondents may alter their answers if they think that this amount is an appropriate value for the resource.

In open-ended questionnaires, the respondents are asked to determine their own maximum values with a question such as: *"How much would you be willing to pay annually in higher taxes to affect this change: $____?"* Respondents fill in the amount. This method can be used with mail surveys, thereby avoiding costly personal interviews, and it eliminates the starting point bias of the bidding game. Open-ended surveys, however, typically produce lower values relative to other methods (5). Some researchers contend values are understated because the respondent has no incentive to contemplate a maximum WTP.

A modification of the open-ended and bidding game formats is the payment card. The payment card contains values ranging from a low amount such as $0 or $1 and increasing in increments up to a predetermined maximum amount. Respondents mark the amount they are willing to pay for the resource. The researcher may provide a context for respondents, such as the amount that is already paid in taxes or the price of a related market good.

Comparison ranking is another alternative, though its application has been limited due to the time and cost of administering the survey. The respondent is asked to compare and choose between two goods. These choices can involve cash, market goods, environmental amenities, and the specific goods in question. The respondent indicates a value for goods by the choices made. By carefully choosing the pairings and placing different dollar amounts within the choices, the researcher can rank the goods to estimate a value.

Following the valuation question, the researcher should ask the respondent to answer follow-up questions to determine the legitimacy of the response, especially for very low and very high bids. Many respondents who bid zero amounts do so for reasons other than they truly do not value the good. Zero responses may be protesting the valuation process, have problems with the questionnaire, or the payment vehicle. Zero bids may be excluded from the data set if the researcher concludes the response is a protest. Very high values also may be excluded although no standard technique has been accepted for excluding excessively high values.

In addition to the valuation question, other information about the respondent may be collected. This may include asking whether the respondent had heard or read about the resource prior to the survey. The researcher may wish to know the respondents' viewpoint on issues such as conservation of environmental resources, government

ownership of lands affected by actions proposed in the survey, how the respondent views human impacts of the proposed action, and other general issues. CVM surveys typically end with questions regarding age, gender, education level, membership in organizations, and activity preferences. These data are useful in providing insights about why the respondents answer the valuation question as they do.

IV. CONCLUSION

Environmental and natural resource amenities have economic value even if they are not priced or exchanged in an open market. These environmental goods range from wilderness areas to endangered species to recreation activities. Valuing these nonmarket goods is a challenge facing economists and the CVM is one tool available for economists to use for overcoming this challenge. This method is based on the paradigm that economics is not just the study of markets, but the study of human preferences and behavior. Many individuals highly value the existence of natural resources, whether these resources are used for recreation or not used at all.

CVM is a survey-based technique used to establish the value of a given nonmarket good, and is the only technique available for estimating nonuse values. The researcher asks respondents to value a good or scenario by stating their willingness to pay for a good or change in conditions. The good or change in conditions which is being valued must be carefully described in information that accompanies the survey. Surveys can be administered by mail, telephone, or in person, and should follow specific design criteria established in other research, such as procedures recommended by the NOAA panel. Much of the controversy surrounding CVM, including potential introduction of different biases, can be countered with a properly designed and administered survey instrument.

The most common technique for asking respondents their willingness to pay is the referendum format. This is similar to questions voters face when considering a referendum question on a ballot. The respondent is asked to respond either yes or no to the question containing a dollar amount. From these responses, the researcher can statistically determine an economic value for the natural resource or environmental good in question.

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MISSION STATEMENTS

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally-owned public lands and natural resources. This includes fostering wise use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. Administration.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.