Broadening the Concept and Measurement of Existence Value

John Loomis

Recent efforts to refine the concept of existence value and to empirically measure it has led to an unnecessary narrowing of the concept of existence value. This paper uses the literature on public goods to argue that existence value is a much broader concept than proposed by several authors. Two commonly used but different empirical approaches to measuring existence values are compared and shown to lead to statistically different decompositions of total value between use and existence categories.

Evaluation of the changes in economic welfare due to a policy action normally relies on comparisons of the value of resources in alternative uses. The economic value of natural resources has steadily been broadened from a commodity view to one that includes recreation values (Clawson). More recently, the flow of benefits from preservation of unique and irreplaceable natural environments has been expanded to include benefits to consumers who wish to maintain the opportunity for future visitation (option value) and consumers who derive satisfaction knowing the resource exists but may never expect to visit (existence value). The various benefits have been aggregated together to form what Randall and Stoll call "total economic value". This total has become the appropriate measure of aggregate benefits of preservation to be compared to commodity uses of natural environments (Randall).

Current Narrowness of the Concept of Existence Value

Much effort has been devoted to investigation of the option value component of total economic value. The concept of option value as first put forward by Weisbrod has been broadened from only the demand side to include the supply side by Bishop. Freeman has recently presented four cases which relate the sign of option value under different combinations of supply uncertainty. While much of the research on option value has broadened the concept the little available literature on existence value seems to have *narrowed* the concept from what was initially suggested by Krutilla. While existence value is believed to be a pure public good, little of the literature on pure public goods has been used to operationalize the concept of existence value. Present approaches to empirical measurement of existence value versus option and recreation values take two fundamentally different approaches: (1) individuals may have *either* option value or existence value but not both (Brookshire, et al, 1983; Stoll and Johnson) or (2) individuals may have both option and existence values (Walsh, et al).

This study utilizes the public goods literature to argue that the concept of existence value should be broadened back to something more closely resembling the original notion of existence value put forth by Krutilla. Secondly, an empirical comparison is made of option and existence values calculated under approaches (1) and (2) for preservation of Mono Lake in California.

Knowing the proportions of a respondent's bid for resource preservation attributable to recreation use versus existence may often be important. On the practical side, the U.S. Department of Interior's regulations for valuing natural resource damage require exclusion of option and existence values from estimates of the social benefits of resources which have on-site recreation values. Recent discussions about recreation user fees and financing of National Park management have involved the notion of splitting the financial burden of the Park between visitors and society (as a whole) based on the split of Park benefits between recreation use and existence values.

Assistant Professor, Division of Environmental Studies, Department of Agricultural Economics, University of California, Davis.

I would like to thank Michael Welsh in the Department of Agricultural Economics at Oklahoma State University for sharing his work on this subject with me and for his comments on an earlier version of this paper. However, sole responsibility for what follows rests with the author and the author alone. This research was supported by funds from the Agricultural Experiment Station, Regional Project W-133.

Evolution of Existence Value as a Public Good

Krutilla's (p. 781) original suggestion that gave rise to the concept of existence value was: "There are many persons who obtain satisfaction from the mere knowledge that part of the wilderness of North America remains even though they would be appalled by the prospect of being exposed to it." Consumption of this knowledge was characterized as a public good (Krutilla, p. 782). Krutilla indicated that *one* source of satisfaction from this knowledge might be in the form of a "bequest motivation" toward one heirs.

The concept of existence value has been extended to include altruistic values toward others of the current generation (McConnell, p. 258; Randall and Stoll p. 268; and Boyle and Bishop, pp. 11–12) as well as future generations (bequest value). Altruism can be modeled as a utility interdependence. An interdependent utility function that makes these authors' assumptions about permitted behavior is presented in equation 1:

$$(1) \quad Ua = Fa[f_1a(Xa,Ra) + f_2a(Rb,Qb)],$$

where Ua is a weakly separable utility function relating a's utility to a's own consumption of private goods X, private good R that represents visitation to the natural environment and another person's (represented here by b) visitation to the natural environment (Rb) or b's consumption of the knowledge that Q exists even if b does not plan to visit it.

Since the natural environment (Q) is a public good, providing it to b also allows person a to consume the knowledge of the existence of the natural environment. In the current literature, the selfish enjoyment of the knowledge that Q exists seems to be ignored (Randall and Stoll, p. 268; Boyle and Bishop, p. 11) or bleieved to be "farfetched" (McConnell, p. 258). The value of knowing the resource exists could be even larger than the value of altruistic reasons, owing to the dominant role "self interest" plays in a person's valuation of goods he consumes versus goods he provides for others to consume.

The public goods literature provides little support for the idea that "self consumption" of a public good is "farfetched". For example, the initial writings on Pareto Optimal distributions of income took the view that concern about the income distribution could be traced to interdependent utility functions. Hochman and Rogers viewed concern about income distribution to be one of concern about the income levels of specific other persons. Brookshire, et al. (1986) argue that a concern for specific persons relates to vicarious consumption rather than an existence value per se. However, Thurow extended the income distribution analysis by adding that the income distribution itself might enter an individual's utility function irrespective of income of specific individuals: "There may be no externalities (interpersonal interdependencies); the individual is simply exercising an aesthetic taste for equality or inequality similar in nature to a taste for paintings" (Thurow, p. 327). This would imply that characteristics of a society, whether the income distribution or presence of natural environments, could generate utility to individuals consuming those characteristics. The resulting preference ordering for these characteristics allow for derivation of economic demands for alternative levels of characteristics. Therefore a more general form of the utility function that places fewer prior restrictions on behavior is:

$$(2) \quad Ua = Fa[f_1a(Xa,Ra) + f_2a(Qa,\{Rb,Qb\})],$$

where an individual derives benefits from their own consumption of private goods X, their own visitation (Ra), knowledge that others can visit the natural environment (Rb), knowledge that others can consume the existence of the natural environment (Qb) and now the satisfaction they personally derive from knowing the site exists (Qa). This would seem to be a more general formulation, in which equation (1) is a special case of (2) when $dUa/dQa = 0$. Of course, Qa = Qb due to characteristics of preservation being a public good (i.e., nonrivalry).

Support for the concept that a person's own off-site consumption of resource attributes can provide utility can be found in the writings of Brookshire, et al., (1986, p. 1514). These authors suggest that off-site consumption of the attributes of natural environments for one's own personal enjoyment is, in fact, the relevant definition of existence value. However, Brookshire, et al. (1986) go one step further and claim that Randall and Stoll's altruistic motivations for knowing the resource exists relates to an option value for the current generation and a bequest value for future generations. Brookshire, et al., (1986, p. 1513) therefore conclude that altruistic motivations are not really components of existence value but rather "intratemporal vicarious consumption" in the first case and "intertemporal vicarious consumption" in the second case.

However, these authors indicate that markets will likely not reflect the values of these two forms of vicarious consumption when multiple parties derive vicarious benefits from the same recreator (Brookshire, et al., 1986, p. 1513). Instead some preference revealing mechanism must be used to ensure these values are measured as part of total

economic value. For a commonly used preference revealing mechanism such as Contingent Valuation, there may be diminishing returns from estimating a separate value for each possible motivation. With as many as six different motivational categories proposed, in total, by various researchers, the complexity of the survey itself would become quite cumbersome. Since the goal is to measure total value, a less complex classification system reflecting basic motivations and relevant to different policy issues would seem desirable.

One manageable classification scheme of some policy relevance relates to whether the values are realized on-site or off-site and whether recreational access is required. Therefore three main categories of value would be elicited: (1) current recreation use; (2) option value for maintaining right to future recreation use and (3) existence value for knowing the resource exists without a requirement for on-site visitation. The advantages of this classification scheme include a definition of user benefits that ties to the approach taken by Federal and State agencies as well as providing just the minimum number of functional categories for policy analysis. Specifically, preservation of some environments or species may require no on-site human use or the location of the species or environment is such that it would be extremely unlikely that anyone would ever see it in the wild. For these cases existence value would be the appropriate category (U.S. Department of Interior). In addition, a separate category for recreation benefits would allow for cross-validation of such benefits using the Travel Cost Method (Randall).

Two additional points are worth noting about this classification system. First, all of the motivations for existence value (altruistic or self-consumption) would be measured in one category. For policy analysis this is appropriate since presence of the natural environment makes possible one's own existence consumption as well as other's. Second, there is no reason to believe that a person would hold only one of these categories of value: a person could obtain utility from planning to visit and existence value during the periods he does not visit.

Narrowness in Measurement of Existence Value

Another narrowing of the concept of existence (and option) value appears to have occurred in the empirical measurement of these values by Brookshire, et al, 1983 and Stoll and Johnson (hereafter BSJ). Here the authors develop a categorization of benefits scheme that allows a person to have *either* option value for future use or existence value but not both. In the survey the respondent is queried about the possibility of ever seeing the species in the wild (or visiting the site where the species is concentrated). If the respondent indicates he would expect to see the species in the future, his bid is interpreted solely as option price (sum of expected consumer surplus for recreation and option value) for future visitation. If the individual indicates he never expects to see the species his entire bid is interpreted as existence value.

If the temporal period of analysis is reduced to a day or week, cannot a potential visitor have existence value? Someone may expect to visit the site at some indefinite time in the future but each day he does not visit, its existence may still provide some satisfaction. This satisfaction may be partly option value, but it could include simultaneous satisfaction of the pure existence of a site on the days in which the site is not visited, particularly when no definite visitation plans have been made. McConnell (p. 261) seems to indicate a user could have both values but many empirical applications ascribe all of the value to one or the other categories.

The source of this narrowing may be related to these authors' survey design to eliminate double counting of benefits. Throughout the literature on option and existence values is the legitimate concern about overlapping categories of benefits leading to double (even triple) counting of the same benefits under different names (in the same or different time periods). However, there are survey designs which preclude double counting and yet allow an individual to simultaneously possess user, option and existence values. Such a design is present in the empirical work of Walsh, et al.

This design first elicits an annual total willingness to pay from respondents for preservation of the natural environment. Then, the respondent is asked to prorate his bid (in the form of percentages) between: recreation use this year, maintain the option for future recreation use next year (option value), value from knowing this natural environment exists even if it could not be visited or used by the respondent (pure existence value) and value from knowing future generations will have the natural environment (a bequest value which can be included with existence value). Since the respondent is constrained to 100% there is no double counting between the existence value categories and other categories. However, each person is allowed to possess both option values and existence values, with the relative amounts being determined by the individual not the researcher.

The approach of BSJ places an added restriction on the utility function in (2): that if positive levels of visitation are planned or anticipated, then existence value is assumed to be zero (i.e., dUa/dQa = 0). This is quite restrictive. Surely it is tenable that persons planning to visit also receive utility from the existence of the resource over and above their expected value of visitation. In addition, empirical work should allow the respondent rather than the researcher to determine whether the bid is solely option value or existence value or both (as long as double counting is precluded). An empirical comparison of the BSJ and Walsh, et al. approaches for classifying benefits as option and existence follows.

Case Study of Mono Lake

Survey Design

Mono Lake represents an unusual ecosystem in eastern California. It is a large hyper-saline lake that is an important breeding and resting stop for thousands of California gulls, earred grebes and Wilson's phalaropes. Currently, diversion of streams that feed Mono Lake is reducing the size of the lake and thereby exposing an alkali lake bottom with a known potential for serious dust storms. The reduction in the lake's water volume is expected to raise the salinity of the water to the point it will no longer produce several major components of the birds food supply (brine shrimp and brine flies). However, the diversion of water provides the City of Los Angeles with 17% of its water. The conflict has been raised to state (and national) attention in recent years by court cases (Audubon Society vs Superior Court of Alpine County) and publicity in the news media, particularly newspapers. Since the City of Los Angeles' diversion of streams feeding another saline lake (Owens Lake) had transformed that lake into an alkali flat, some persons are very concerned about Mono Lake.

From a recreational standpoint, Mono Lake is a great distance from most population centers (about 250 miles from L.A. and largely inaccessible from Northern California during the winter months). The lake's primary recreation activities are birdwatching and viewing large mineralized towers called "tufa towers" formed by the lake's water. There is no fishing, and the hot dry summers (along with scarcity of trees) limit hiking and camping during the summer months. While Mono Lake does receive about 145,000 visitors each year, many visitors are stopping enroute to other destinations. The cost of replacement water and hydropower associated with leaving the minimum amount of water necessary to sustain the bird populations of Mono Lake would be approximately $18.7 million annually (Los Angeles Department of Water and Power). Each visitor would have to be willing to pay $129 a year to make preservation of Mono Lake economically feasible.

Since Mono Lake represents an unusual ecosystem threatened with irreversible loss, off-site values such as option and existence may play a pivotal role in determination of whether benefits of preservation exceed costs. As such, a mail survey of randomly selected California households was performed during the Spring of 1986 using the Contingent Valuation Method to determine the economic value of Mono Lake to California residents. This short questionnaire (4 pages of questions) had a two color cover and the text was typeset to provide a professional look. The booklet form of the survey followed the basic approach suggested by Dillman. Also following Dillman, an original cover letter addressing each sampled household was used. The repeat mailing procedures specified by Dillman (with the exception of the certified mailing due to expense) were also employed. The return rate of 44% of deliverable questionnaires was obtained. This return rate is about average for household mail Contingent Valuation Surveys preformed in the past (Loomis, 1987b) and above the response rate found in a similar mail contingent value survey performed in California (Hagemann). The sample does have above average education and income levels and the resulting sample willingness to pay values were adjusted downward using weighted least squares regression (Loomis, 1987b). However, the relevant details for the purpose of this paper relate to comparative evaluation of two alternative approaches for classifying the total dollar bids into recreation use this year, option value and existence/bequest values. The reader interested in details of the complete study and survey instrument should see Loomis (1987a).

Experimental Design of Empirical Comparisons

Respondents recorded their maximum willingness to pay for preservation of Mono Lake using an open-ended willingness to pay question. Following this, questions were asked to allow testing of the alternative approaches for classifying the different types of values. First, respondents were asked to record percentages of their dollar bids into four categories similar to those described above and in Walsh, et al.: recreation use this year, option for recreation use next year, knowing the site exists even if you could not visit it, and knowing that

Table 1. Classification of Total Willingness to Pay into Components

	Recreation this year	Option next year	Existence	Bequest	N
Certain Visit This Year					
Percentage	22.5	22.5	23.9	31.1	9
Willingness to Pay	$19.65	$19.65	$20.87	$27.16	
Visit in Future					
Percentage	4.8	9.5	44.7	40.9	112
Willingness to Pay	$3.28	$6.50	$30.57	$27.97	
Never Expect to Visit					
Percentage	2.7	3.6	52.3	41.4	99
Willingness to Pay	$1.82	$2.42	$35.21	$27.87	

Mono Lake will be preserved for future generations. The percentages were required to total 100%. The average percentages and associated average dollar values are shown in Table 1.

Following the approach of BSJ, respondents were also asked two additional questions about their possible use of Mono Lake: (1) probability of visiting this year and if this is zero, do you ever expect to visit Mono Lake in the future? Following BSJ if a person expressed a positive probability of visiting this year or expected to visit in the future his entire bid would be designated as option price. If respondent indicated he never expected to visit, the entire value would be assigned to existence/bequest.

The null hypothesis is that these two approaches (Walsh, et al., and BSJ) provide the same classification or distribution of respondent benefits between option price and existence. The alternative hypothesis is that *respondent's own* distribution of values (Walsh, et al.) is statistically different from the *researcher's* distribution of the respondent's value using the BSJ assignment rules. In essence this is a contingency table between methods of classification and percentage option price and existence value with each method. Rather than one large contingency table, controls must be provided to account for each distinct (mutually exclusive) type of respondent: those expecting to visit this year, those not expecting to visit this year but expecting to visit sometime in the future and those that never expect to visit. Therefore, three separate contingency tables are formed, one for each of these groups. The Chi-Square test can be used to make inferences about independence of classification in a contingency table (Glass and Stanley, p. 329).

Unlike the Walsh, et al. approach shown in Table 1, which has four categories, the BSJ approach, in essence, has two categories of value (option price and existence value). However, since option price reflects both the value of recreation and option value, these two categories in Table 1 can be treated as option price for purposes of statistical comparisons of percentage distribution of values. As discussed earlier the BSJ approach subsumes bequest value as a type of existence value. Therefore, percentage existence and bequest values in Table 1 will be summed into the existence value category for the purposes of constructing the contingency table and statistical comparisons.

Results

There are three cases that need to be explored using the two approaches. The first case relates to whether persons who are certain they will visit this year should be allowed by the researcher to have existence value. The persons in the sample who indicated a probability of one that they would visit this year, still reported 55% of their total willingness to pay in the combined existence/bequest categories and 45% in the option price category. With the BSJ approach all of their bid (100%) would have been attributed to on-site recreation use (option price) and none to existence/bequest. The test of independence between method of classification and distribution of value resulted in Chi-Square statistic significant at the 99% level ($\chi^2 = 75.86$).

The next group are respondents who said they were very unlikely to visit this year (probability equal to .01 to 0), but that they *did expect to visit* Mono Lake sometime in the future. This group reported 85.7% of their value as existence/bequest, with 14.3% being considered option price for future visitation. In the BSJ approach all (100%) of the respondents willingness to pay would be assigned to option price since they did plan to visit in the future. The test of independence between method of classification and distribution of value resulted in a Chi-Square statistic significant at the 99% level ($\chi^2 = 150.88$).

The third case reflects respondents who indicated

they were very unlikely to visit this year (probability equal to .01 to 0) and did *not* ever expect to visit Mono Lake in the future. This group reported 93.7% of their willingness to pay as existence/bequest values. They reported 6.3% of their value as option price. Using the BSJ approach, all of the respondents value would have been attributed to existence/bequest value. The test of independence between method of classification and distribution of value resulted in a much smaller Chi-Square statistic ($\chi^2 = 6.19$) than in the other two cases. However, this is statistically significant at the 95% level.

Since the Chi-Square statistics are significantly different from zero, the null hypothesis of independence of distribution of willingness to pay with respect to method is rejected. The methods of classification appears to result in statistically different classifications. However, this result should be considered tentative until the comparison is tested using an open-ended survey approach.[1]

Relating Types of Benefits to Distribution of Willingness to Pay

Table 1 also displays the distribution of willingness to pay. The distribution of willingness to pay follows the percentages because the mean willingness to pay of each sub-sample group is partitioned into the four categories using the sub-sample mean percentage in each category. Comparison of visitor benefits with the off-site preservation values such as option, existence and bequest illustrates the importance of including these values in benefit-cost analysis of irreversible decisions regarding unique natural environments. A separate visitor survey using an open-ended willingness to pay question (with trip costs as the payment vehicle) estimated average trip consumer surplus as $40 per trip (Loomis, 1987a). With 145,000 visitors to Mono Lake, this translates into $5.8 million annually. This is slightly less than one-third the cost of replacement water and power. However, a weighted average of the households' recreation, option, existence and bequest values in Table 1 ($68) for California households results in benefits exceeding this cost even if the 56% sample non-respondents are conservatively assigned a zero willingness to pay in the calculations. More statistically sound approaches for adjusting for non-respondents results in benefits greatly exceeding costs (Loomis, 1987b).

Conclusion

When given the opportunity in a survey, respondents appear to simultaneously hold option and existence/bequest values toward natural environments such as Mono Lake. More precisely, when presented with the opportunity to split their willingness to pay into as many as four categories, few respondents choose to allocate their entire value into just the current/future use category or the existence/bequest category as implied by the mutually exclusive categories used by Brookshire, et al., or Stoll and Johnson. Therefore it is important to recognize that current and future visitors still derive satisfaction from knowing the resource exists even if they could not visit the resource. While this satisfaction may stem from altruism toward the current or future generation, it may also stem from the selfish enjoyment received by the respondent from consumption of the knowledge the resource is preserved. The concept of existence value should be broadened to include the possibility that people simultaneously hold option and existence values.

[1] An anonymous reviewer suggested that listing the four possible categories (recreation, option, existence and bequest) in the questionnaire could result in a "presentation bias" equivalent to "leading the witness". For example, if the survey could have been conducted by means of an in-person interview, the respondent could have been asked an open ended question regarding the reason he would be willing to pay the dollar amount he stated. It is possible in this setting that a person's reasons would have fallen into one of the two categories proposed by BSJ. Instead, the availability of four reasons may have resulted in respondents splitting up their values more than they would have otherwise. The reviewer speculated that some respondents did not even consider the possibility of putting in zero in some of the blanks. To determine how serious this concern was, the distribution of percentages was analyzed with particular attention paid to the zero percent category for the largest sub-sample, the "Visit in Future" group. As might be inferred from Table 1, a fair percentage of respondents did fill in 0% for recreation use and/or option value categories. In particular, 24% of the responses for the "for recreation use this year" reason were 0%. About 15% of the option value responses were 0%. However, 1.6% of existence value and less than 1% for bequest value were given 0% by respondents in this group. Whether this represents a presentation effect or not is difficult to say. Certainly many respondents allowed themselves to put zero into a category, but a majority of respondents in this grouping expressed all four of the reasons for valuing Mono Lake.

References

Bishop, Richard. "Option Value: An Exposition and Extension." *Land Economics* 58(1982):1–15.

Boyle, Kevin and Richard Bishop. "The Total Value of Wildlife Resources: Conceptual and Empirical Issues". Paper presented at the AERE workshop on Recreational Demand Modelling, Boulder, CO. 1985.

Brookshire, David, Larry Eubanks and Alan Randall. "Estimating Option Prices and Existence Values for Wildlife Resources." *Land Economics* 59(1983):1–15.

Brookshire, David, Larry Eubanks and Cindy Sorg. "Existence Value and Normative Economics: Implications for Valuing Water Resources." *Water Resources Research* 22(1986): 1509–1518.

Clawson, Marion. "Methods of Measuring the Demand for and Value of Outdoor Recreation". Reprint #10, Resources for the Future, Washington DC. 1959.

Dillman, Don. *Mail and Telephone Surveys*. John Wiley and Sons, New York, NY. 1978.

Freeman, Myrick. "Supply Uncertainty, Option Price and Option Value." *Land Economics* 61(1985):176–181.

Glass, Gene and Julian Stanley. *Statistical Methods in Education and Psychology*. Prentice Hall, Englewood Cliffs, NJ. 1970.

Hageman, Rhonda. Valuing Marine Mammal Populations: Benefit Valuation Experiments in a Multi-Species Ecosystem. Administrative Report LJ-85-22. Southwest Fisheries Center, National Marine Fisheries Service, La Jolla, CA. 1985.

Hochman, Harold and James Rodgers. "Pareto Optimal Redistributions", *American Economic Review* 59(1969): 542–557.

Krutilla, John. "Conservation Reconsidered." *American Economic Review* 57(1967):777–786.

Loomis, John. "An Economic Evaluation of Public Trust Resources of Mono Lake." Institute of Ecology Report #30. University of California-Davis. 1987a.

Loomis, John. "Expanding Contingent Valuation Sample Estimates to Population Values". *Land Economics* 63(1987b): 396–402.

Los Angeles Department of Water and Power. "Los Angeles' Mono Basin Water Supply". Briefing Document. 1985.

McConnell, Kenneth. "Existence and Bequest Value". In *Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas*. Edited by R. Rowe and L. Chestnut. Westview Press, Boulder, CO. 1983.

Randall, Alan and John Stoll. "Existence Value in a Total Valuation Framework." In *Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas*. Edited by R. Rowe and L. Chestnut. Westview Press, Boulder, CO. 1983.

Randall, Alan. "Total Economic Value as a Basis for Policy." Paper presented at W-133 State Agricultural Experiment Station meeting, San Diego, CA. 1986.

Stoll, John and Lee Ann Johnson. "Concepts of Value, Nonmarket Valuation and the Case of the Whooping Crane." Transactions of the Forty-ninth North American Wildlife and Natural Resources Conference, Wildlife Management Institute, Washington DC. 1984.

Thurow, Lester. "The Income Distribution as a Pure Public Good." *Quarterly Journal of Economics* 85(1971):327–336.

U.S. Department of Interior. *Natural Resource Damage Assessments; Final Rule*. Federal Register, Vol 51(1986). Washington DC.

Walsh, Richard, John Loomis and Richard Gillman. "Valuing Option, Existence and Bequest Demands for Wilderness." *Land Economics* 60(1984):14–29.

Weisbrod, Burton. "Collective-consumption Services of Individual-consumption Goods." *Quarterly Journal of Economics* 78(1964):471–477.