NONUSE ECONOMIC VALUE: EMERGING POLICY ANALYSIS TOOL

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ABSTRACT: Nonusers, or individuals who never visit or otherwise use a natural resource may nonetheless be affected by changes in its status or quality. Monetary expression of their preferences for these resources is known as nonuse or passive-use economic value. Empirical estimates indicate that nonuse value may be substantial for some resources. Inclusion of nonuse value in economic efficiency analyses may alter the outcome of these analyses in some cases. So far, applications have remained largely in the research realm. However, changes in the legal and institutional framework and recent policy pronouncements make it probable that nonuse value will play an important role in natural resource decision making in the future. We briefly discuss the concept of nonuse economic value and its relevance in water resource decision making. The current institutional framework and the applicability and integration of nonuse value within the National Environmental Policy Act (NEPA) process are explored. Details of an ongoing application for the Glen Canyon Environmental Studies Program are described.

KEYWORDS: passive-use value, nonmarket goods, contingent valuation methodology (CVM), National Environmental Policy Act (NEPA), environmental impact statement (EIS), Glen Canyon Dam, Grand Canyon National Park.

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INTRODUCTION

Broadly interpreted, the concept of nonuse value may be traced back at least as far as the U.S. conservation movement of the early 1900's. Beginning with Weisbrod (1964) and Krutilla (1967), economists have more narrowly defined the concept and have employed it within the context of economic theory. Economists acknowledge that nonusers, or individuals who may never visit or use a natural resource, can be affected by changes in its status. Expression of their preferences for the state of these resources is called nonuse value. Economists also use the terms passive-use value and intrinsic value to describe these preferences.

Until quite recently, quantification of nonuse economic value has remained largely an academic exercise. Neither the concept of nonuse value nor estimates of its magnitude have played a substantive role in decisions regarding resource allocation. As a result of several proposed regulations and pronouncements (U.S. Department of the Interior 1991, 1994; U.S. Department of Commerce 1990, 1991, 1992a, 1993, 1994), nonuse value is likely to be an important component of the natural resource decision making process in the future. We briefly discuss the concept and its implications for water resource decisions, describe the current institutional framework, and detail an ongoing application for the Glen Canyon Environmental Studies Program.

NONUSE VALUE

Early writings on nonuse value focussed on two topics: existence value and bequest value. Existence value is the benefit generated today by knowing that a resource exists even if no onsite use is anticipated. Bequest value is the value individuals gain from the preservation of the resource for use by their heirs. Although the distinction between existence and bequest value still persists in parts of the literature (e.g., Loomis 1989), the term nonuse value is used here in a more general manner that encompasses both of these constructs.

A third concept often associated with nonuse value is option value. Although this topic has generated considerable debate in the literature, it now is generally acknowledged that option value is not a component of nonuse value. In the modern literature the term option value is used to describe the difference between two alternative measures of economic welfare under conditions of uncertainty (Ready 1993).

Nonuse value: concept and origin

The concept of nonuse economic value has its origins in both the classic literature and in more recent works. In his seminal article on nonuse value, Krutilla (1967:781) made the often quoted observation that, "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."

In a later work, Bishop and Heberlein (1984) noted that nonuse value could be motivated by sympathy for and empathy with people and animals, environmental linkages, feelings of environmental responsibility, and bequest goals. They pointed out (p. 10): "Even if one does not plan to personally enjoy a resource or do so vicariously through friends and relatives, he or she may still feel sympathy for people adversely affected by environmental deterioration and want to help them. Particularly for living creatures, sympathy may extend beyond humans."

The discourse on the factors that underlie nonuse value is extensive (Boyle and Bishop 1987; Madariaga and McConnell 1987). In lieu of a lengthy discussion we offer the following summary: a frequently discussed basis for nonuse value is the desire to maintain the functioning of specific ecosystems. The preservation of the natural ecosystem to allow for future use is also regularly cited. Still other authors cite a feeling of environmental responsibility or altruism toward plants and animals as a possible motivation for nonuse value.

Nonmarket value, total value, use, and nonuse value

Values for goods traded in the market are called use values and are the traditional measure of value for changes in water resource management. Familiar water resource examples are irrigation benefits and hydropower benefits. Theoretically similar measures of use values for nonmarketed goods, such as recreational use, are also routinely used to support decision making (U.S. Water Resources Council 1983). Nonuse values are a special case in which the nonmarket good is the status of the natural or physical environment.

To define these measures in a rigorous way, we presume that individual consumers use their income to purchase marketed goods, combine these marketed goods with time, human knowledge, and those nonmarketed goods that are available to them to produce a particular quality of life. Couched in these terms, it is clear that an individual's perception of his or her own well-being is determined by the interaction of preferences and the availability of market and nonmarket goods.

This can be more formally illustrated within the context of neoclassical economic theory. First, let $U(\mathbf{x},R)$ be a utility function describing individual preference as a function of the vector of goods which can be purchased in the market, $\mathbf{x}$, and a nonmarket resource, R. Let $\mathbf{p}$ be the vector of market prices corresponding to $\mathbf{x}$. Assume that the quality or state of the resource, R_i, is known with certainty. By making the usual assumptions about the properties of utility functions and including R as if it were a conventional good, we may define an expenditure (cost) function as shown in [1] where u^* is some reference level of utility.

$$c(\mathbf{p},R,u^*) = \min\{\mathbf{xp} \mid U(\mathbf{x},R) = u^*\} \qquad [1]$$

In [1], $c(\cdot)$ expresses the minimum cost of achieving u^*, given some resource level, R. Assume that R_1 and R_2 are two different levels of the resource such that $R_2 > R_1$ and $U(R_2) > U(R_1)$. Using this framework, further assume that there is an improvement in the resource from R_1 to R_2.

The total economic value (TV) of this increase in the level of the resource is given by:

$$TV = c(\mathbf{p}_1,R_1,u^*) - c(\mathbf{p}_2,R_2,u^*) \qquad [2]$$

Where $\mathbf{p}_1$ is the initial vector of prices and $\mathbf{p}_2$ is the relevant vector of prices under the improved situation.

If $\mathbf{p}^c$ is a vector of (choke) prices which drives Hicksian demands for nonmarket use of the resource R to zero, the existence value (EV) of the change in the resource is then defined as shown in [3].

$$EV = c(\mathbf{p}^c,R_1,u^*) - c(\mathbf{p}^c,R_2,u^*) \ \$ \ 0 \qquad [3]$$

Note that when the price vector is $\mathbf{p}^c$, there is no in situ use of the resource regardless of the quality or level available. As shown in [3], existence value (EV) can exist independently of resource use. From this independence springs the term "nonuse" value.

Subtracting existence value (EV) from total value (TV) yields use value (UV).

$$UV = TV - EV \quad [4]$$

When resource states, R_i, are known with certainty, it is easily demonstrated using [4] that an economic analysis that focuses only on use value will understate the true economic implications of management options affecting resources for which there is nonuse value.

Indicators of significant nonuse value

The literature emphasizes that nonuse value is most likely to be greater where the resource in question is unique and/or where adverse impacts are irreversible. Indicators of nonuse value are described in the proposed U.S. Department of Interior rules for damage assessment (U.S. Department of the Interior 1991), which state:

"... an injury to a common natural resource with many substitutes (eg., a typical small stream), may not generate large nonuse values, particularly for those residing outside the area where the injury occurred, even if the recovery takes a long time. However, a permanent injury to a unique resource (eg., **the Grand Canyon** [emphasis added]) may generate significant nonuse values, even for those residing in areas far removed geographically from the site where the injury occurred."

To elaborate, the significance of nonuse value may depend on the irreversibility of the action; the irreplaceability of the resource; whether the resource is regionally, nationally, or internationally significant; whether threatened or endangered species or their habitats are involved; and whether use is rationed. That is not to say that nonuse value does not exist for mundane lesser known resources, only that the case for nonuse value is strongest in these instances.

Proposed management activities that result in either a long-term or an irreversible impact on a natural resource suggest a change in nonuse value. The analysis of hydropower development in Hell's Canyon by Krutilla and Fisher (1975) is a classic example. This work provides a compelling and often cited argument for including nonuse value in applicable economic analyses.

An irreplaceable resource is one for which there are few or no substitutes available. A common example of an irreplaceable resource is an archeological site. Once an archeological site has been disturbed or destroyed it cannot be replaced. Management actions that affect irreplaceable resources suggest that changes in existence and/or bequest value may result from the proposed action.

Some proposed management actions may impact resources that are widely acknowledged to be of regional, national, or international significance. An example of such a resource is Old Faithful Geyser in Yellowstone National Park. As a result of the widespread interest in this site, the population potentially impacted by any contemplated management action affecting this site is potentially quite large. Contemplated actions may generate public and political controversy that provides a fairly reliable indicator of the geographic scope of the impact. All other things being equal, the greater the scope of this impact, the more likely it is that nonuse value is a significant component of the total economic value of the site.

Management actions that affect threatened or endangered species, sub-species, or populations may be presumed to involve nonuse value. This is particularly true in the case of a well known species, such as salmon, Oncorhynchus spp., where nonuse value is likely to be large and significant (Olsen et al. 1991) but has also been demonstrated for lessor known species such as the striped shiner, Notropis chrysocephalus (Boyle and Bishop 1987).

At times, the physical use of a resource may be rationed or restricted by regulations. These measures often are implemented for safety reasons, to diminish crowding, and to prevent overuse of the resource at the effective entry price. As a consequence of rationing, the number of resource users is smaller than it would be if price were the only barrier to entry and the population of nonusers is larger. When use is rationed, the use value component of total value is reduced and the nonuse value component assumes relatively greater importance.

Estimating nonuse value

Although other techniques may emerge (Larson and Loomis 1993), the contingent valuation method (CV or CVM) is the only methodology currently available for estimating nonuse value. In its simplest terms, contingent valuation is a means of eliciting the maximum amount (in dollar terms) that an individual would be willing to pay for a resource of a specified quantity and quality.

Many recent contingent valuation studies make use of a dichotomous or binary choice questioning format. In this questioning format, a contingent or hypothetical program is described to the respondent. The respondent is then asked a single question: "If this program cost your household $X.00 per year, how would you vote for this program; YES or NO." Dichotomous choice contingent valuation is now widely applied because it closely resembles a referendum or voting situation in which the respondent is faced with the decision of whether or not to vote for a ballot initiative that has some specified cost.

Rather exhaustive descriptions of the contingent valuation methodology are found in Cummings et al. (1986) and Mitchell and Carson (1989). Carson et al. (1992) provide a very useful bibliography of contingent valuation studies and related subjects.

NONUSE VALUE AND WATER RESOURCE PLANNING DECISIONS

The role that nonuse value might play in water resource planning decisions is at least partly a function of the relative magnitudes of use and nonuse value. Fisher and Raucher (1984) provide a review of early water quality studies in which both use and nonuse value were estimated. A very useful paper by Brown (1993) reviews 31 nonuse value studies published since 1981. Of particular relevance are a subset of recent studies that have explored the nonuse value for water resources.

In one such study, Loomis (1987a, 1987b) estimated both use and nonuse value for Mono Lake in California. He reported that use value was approximately $40.00 per visit. Aggregated over 145,000 visits, use value totaled $5.8 million annually (Loomis 1987b:109). For households, estimated nonuse value was $42.71 per year. Aggregated over 9,988,060 households in California, nonuse value was approximately $422 million annually (Loomis 1987b:49).

Sanders et al. (1990) estimated the total value of preserving fifteen wild and scenic rivers in Colorado. They reported that Colorado residents expressed a use value of $19.16 and a nonuse value of $81.96 per household per year. The total (use and nonuse) value of protecting 15 Colorado rivers aggregated over the 1,185,000 households was approximately $120 million annually. The nonuse component of total value was approximately four times the recreation use value component.

Olsen et al. (1991) estimated the use and nonuse value of increasing salmon and steelhead stocks in the Columbia River Basin. In their study, 2,907 Pacific Northwest households were interviewed to determine whether they were users or nonusers of these fish stocks. Approximately 56% of the sample were classified as nonusers and 44% as resource users. Using a smaller subsample of the individuals who answered a willingness-to-pay survey, the authors report that the regional benefit of doubling the salmon stocks is over $171 million annually. Of this total, nonusers plus nonusers with some probability of future use, were willing to pay $60.255 million annually and users were willing to pay $110.943 million annually.

Whitehead and Groothuis (1992) estimated the total value of water quality improvements in North Carolina's Tar-Pamlico River. They reported that the sample mean willingness-to-pay for users was approximately $35.00 and for nonusers was $25.00. Aggregated over the 105,948 households in the basin, the total annual value of the proposed water quality improvement was approximately $1.62 million. At least 84% of this total value was ascribed to nonuse value.

The examples cited here are by no means a comprehensive list of recent studies. However, they serve to illustrate the findings of many such studies: that nonuse value is a sizable component of total economic value.

INSTITUTIONAL AND LEGAL SETTING

The Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (1983), known as the "P&G's," guide the project planning efforts of various Federal water resource agencies. The P&G's clearly recognize both market and nonmarket economic benefits. However, the P&G's were published before many nonuse value studies appeared in the literature. While the estimation techniques and underlying theoretical precursors to nonuse value are described, the P&G's contain no explicit reference to the estimation, use, or display of nonuse benefits in the water resource planning process.

Under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Clean Water Act, parties responsible for the discharge of oil and hazardous substances into the environment are liable for resulting damages to natural resources. The U.S. Department of the Interior (DOI) was assigned to promulgate rules for assessing such damages. The original rules for damage assessment, published by DOI in the Federal Register on August 1, 1986, allowed the inclusion of existence value provided that use value could not be measured.

Several aspects of the original damage assessment rules were challenged in court in State of Ohio v. Department of the Interior (880 F.2d 432 [D.C. Cir. 1989]). In a 1989 ruling on this case, the U.S. Court of Appeals for the District of Columbia Circuit further strengthened the case for including the values held by nonusers in determining the magnitude of damages resulting from oil spills and toxics. The decision states that nonuse values "may represent 'passive' use, but they nonetheless reflect utility derived by humans from a resource, and thus prima facie ought to be included in damage assessments." This same decision rejected the notion that nonuse value could be counted only if use value could not be measured.

Proposed modifications to DOI rules that would implement the Court of Appeals decision explicitly recognize that public resources damaged by oil or toxics may have "compensable values" that include nonuse values (U.S. Department of the Interior 1991, 1993). Compensable values are subdivided into two parts: use value and nonuse value. Nonuse values are defined as the difference between (total) compensable value and use value. One example of nonuse value discussed in the proposed rule is stated as, an individual's "... willing[ness] to pay to avoid the loss associated with knowing wildlife were injured, even though they will never visit the injured area."

The Oil Pollution Act of 1990 (OPA) directed the National Oceanic and Atmospheric Administration (NOAA) to develop procedures for natural resource trustees to use in the assessment of damages for injury to, destruction of, loss of, or loss of use of natural resources covered by OPA. OPA also provides for the trustees to present a claim, recover damages, and develop and implement a plan for the restoration, rehabilitation, replacement, or acquisition of the equivalent of the natural resources under their trusteeship.

In a series of Federal Register notices (Department of Commerce 1990, 1991, 1992a), NOAA requested information and comments regarding possible approaches for damage assessment and future regulatory procedures. Subsequently, NOAA extended the comment period and announced the formation of an expert panel headed by two Nobel Laureates, Dr. Robert Solow and Dr. Kenneth Arrow (Department of Commerce 1992b).

The January 15, 1993 issue of the Federal Register (Department of Commerce 1993) contained the findings of the NOAA expert panel. The panel found that, "...CV studies can produce estimates reliable enough to be the starting point of a judicial process of damage assessment, including lost passive-use values." (Department of Commerce, 1993:4610). The panel also issued a set of guidelines for conducting acceptable studies for this purpose. Subsequently, NOAA issued their proposed damage assessment rules (Department of Commerce 1994) and DOI followed shortly thereafter (Department of the Interior 1994)

These events are important for two reasons. First, the findings of the NOAA panel lend support to the use of contingent valuation methodology and to nonuse or passive-use value as a measure of impact. Second, the guidelines offered by the panel and suggested in the proposed rules will provide direction and standards against which the adequacy of contingent valuation studies may be measured in the future. As such, the findings of the panel and these proposed regulations are likely to lead to a more widespread application of nonuse value in the policy arena.

PHILOSOPHY, STRATEGY, AND OTHER ARGUMENTS

Heretofore, the concept of nonuse value was regarded by all but a small group of researchers as a theoretical curiosity, a subject to be written about by economists in specialized journals without import to the real world decision making process. As such, the concept, its potential applications, and the implications of these applications were largely ignored. Movement of this construct beyond the realm of mere theory, into empirical research, and now (potentially) into application in management decisions, has created considerable controversy.

Interestingly enough, the most vociferous objections have come from constituencies such as advocates for agricultural and hydropower development projects which have traditionally been supporters of economic efficiency based decision making. In addition, oil companies, chemical companies, and various industrial groups have made a concerted effort to block the admission of nonuse economic value in damage assessment proceedings. These objections are, in the economist's view, primarily strategic in nature. Inclusion of nonuse benefits in efficiency analyses may well call into doubt the outcome of analyses following historical approaches which- in the absence of nonuse benefits- could be expected to support the position of these constituencies. Similarly, estimates of damage to natural resources which include lost passive-use value- will be higher.

Apart from the strategically based objections described, academics, professionals, and resource managers have continued a lively dialogue on the subject of nonuse value. Philosophical objections and technically based objections are commonly voiced. Although these concerns are often genuine it is difficult at times to discern the difference between them. Moreover, both philosophical and technical arguments have sometimes been advanced to conceal an underlying strategic position.

Some arguments against the application of nonuse value are based on what might be described as a different philosophical view of the world. For instance, it is the view of some that individuals do not place a value on nationally significant irreplaceable resources which they do not use. Therefore, in their view, nonuse value simply does not exist.

This philosophical stance has, in fact, found little support in the empirical literature. The preponderance of statistical evidence instead supports the alternate hypothesis. As concluded by Fisher and Raucher (1984:60), "...empirical efforts to measure intrinsic [nonuse] benefits consistently show these nonuse values to be positive and nontrivial."

The majority of reasoned arguments against the incorporation of nonuse value into benefit/cost analyses and damage assessments are based primarily on technical concerns. Specifically, these arguments focus on the broad question of whether nonuse value can be accurately and scientifically estimated using contingent valuation techniques.

The validity and reliability of the contingent valuation method has been examined extensively in the literature (Heberlein and Bishop 1986; Loomis 1989; Kealy, Montgomery, and Dovidio 1990). Nonetheless, substantive questions about the use of CVM remain. Challenges to its use are commonplace and well documented (Cambridge Economics Inc. 1992). While few economists discount nonuse value on theoretical grounds, valid questions about CVM's accuracy and reliability exist and have given rise to vigorous debate among economists and non-economists alike. A nontechnical overview of this discourse is found in the exchange between Carson, Meade, and Smith (1993), Desvousges et al. (1993), and, Randall (1993). We expect that the findings of the NOAA expert panel will focus the nonuse value debate on these technical aspects and away from less fruitful philosophical discussions and strategy based arguments.

NONUSE VALUE AND THE NEPA PROCESS

Applicability

The National Environmental Policy Act of 1969 (NEPA) is triggered when a Federal action is contemplated which may significantly affect environmental quality. "Significantly," as used in NEPA, requires consideration of both context and intensity. Examples of actions which may be considered significant are described in the Council on Environmental Quality's (CEQ) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 C.F.R. pt. 1500-1508). Indicators of significance include the existence of unique geographical characteristics in the affected local, the degree to which the action is likely to be controversial, the degree to which the action may adversely affect scientific, cultural, or historical resources, and, potential impact on endangered species or their habitats (40 C.F.R. pt. 1508.27(b)). The similarity between the indicators of significance cited in the CEQ regulations and the indicators of nonuse value discussed here and in the literature is remarkable.

If a contemplated Federal action is judged to have significant environmental effects, NEPA prescribes preparation of an environmental impact statement (EIS). The CEQ regulations specify that, "... economic or social effects are not intended by themselves to require preparation of an environmental impact statement. When an EIS is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment," (40 C.F.R. pt. 1508.14). For impacts to resources for which there is nonuse value, failure to estimate it and report its magnitude would appear to be contrary to the language of the regulations.

Impact assessment and schedule

Development of an effective and technically adequate contingent value survey instrument is conditional on the development of concise and understandable descriptions of expected physical and environmental impacts. Determination of the cultural, physical, biological, and, ecological impacts of the alternatives being examined in an EIS is a substantial undertaking which may require primary data collection, extensive research, and analysis. This dependence has a very important implication for the integration of nonuse value studies in an EIS. Since fact-based, neutral depictions of expected impact cannot proceed until this underlying work has been completed, this necessarily places completion of a nonuse value study at the end of the sequence of EIS activities.

Identification and quantification of resource impacts is the most difficult, most subjective, and quite possibly the most controversial aspect of EIS preparation. Consequently, impact analyses are often not completed until late in the EIS process. If a nonuse value study was contemplated at the outset of the EIS process, sufficient time must be allocated in the schedule to allow for its completion. If completion of a nonuse value study was not envisioned, the study manager is presented with a difficult set of decisions.

In the latter circumstance, one choice open to the NEPA manager is to delay release of the draft EIS until the nonuse value study is completed. This is probably the most conservative course of action, but it may entail substantive delays in the release of the draft EIS document for public comment.

An alternative strategy is to pursue a parallel schedule. Under this strategy, the methodology to be employed in the nonuse value study is described in the draft EIS, but no quantitative results are presented. Typically, for a period of months following the release of the draft document, public meetings are held, comments are accepted and addressed by the EIS team, and revisions to the draft EIS are made. A nonuse value study may be completed during this period presuming that it is initiated as soon as the expected physical and biological impacts have been identified. The quantitative results of the nonuse value study can then be incorporated in the final EIS.

There are two potentially important drawbacks to this course of action. First, public comment is precluded when the quantitative results are reported only in the final EIS. Second, if the results of the nonuse value study are determined to be, "... significant new circumstances or information relevant to the environmental concerns and bearing on the proposed action or its impacts," a supplement to the final EIS may be required (40 C.F.R. pt. 1509(c)ii).

Potential focus of criticism and/or legal challenges

The national debate over the inclusion of nonuse values in natural resource damage assessments and policy applications has focused previously unprecedented scrutiny on all aspects of the topic. Most economists are willing to agree that nonuse value is a theoretical possibility but even among the ranks of economists there are divisions over measurement issues and questions of precision. Among the general public and members of other disciplines there is even less common ground. Consequently, estimation of nonuse value, its classification with other benefits or costs, and the treatment of nonuse value in subsequent analyses must be expected to generate considerable controversy. The possibility exists that such controversy may play into the hands of critics and/or provide a basis for litigation designed to discredit an environmental impact study.

Funding

An important component of the decision to initiate a nonuse value study is the cost of such a study. Significant expenditures must be made on the design and testing of an appropriate survey instrument. Since the resource at issue is presumably one of national significance, it is not unrealistic to envision that the survey instrument will be administered to a random sample of the U.S. population. Survey administration costs and data analysis costs will, of course, reflect this. These costs are likely to be comparable to the costs of research on the environmental consequences of the contemplated action.

For complex EIS's, experience has shown that the costs of necessary hydrological, engineering, biological, geological, and, other physical studies are considerable. In the past, we have observed asymmetric funding of economic investigations compared to studies in these other disciplines. Frequently, large sums are spent on these physical and biological studies and little funding is devoted to economic investigations. As we acknowledge, these economic investigations are critically dependent on the identification of impacts. However, given the potential importance of nonuse value studies in the decision process, a reluctance to devote comparable funding to such investigations seems peculiar and shortsighted.

AN ONGOING APPLICATION

Glen Canyon Dam, on the Colorado River near Page, Arizona, was completed by the U.S. Bureau of Reclamation in 1963 before the passage of NEPA. Even at that time, this project was the subject of an unprecedented nationwide environmental protest.

The daily water release regime at Glen Canyon Dam reflects its operation for the production of peaking power. Historically, this regime has resulted in large daily fluctuations in flow and river stage. Because of concerns that these fluctuations were negatively impacting the downstream environment and recreational use of the Grand Canyon, the Commissioner of the Bureau of Reclamation authorized the Glen Canyon Environmental Studies (GCES) Phase I in 1982. Over 40 separate technical studies were completed by 1988. These interagency studies focussed on the underlying physical and biological processes but also included an extensive study of recreation use value in the area (Bishop et al. 1987).

In July 1989, as a result of impacts to the riverine ecosystem identified in the GCES Phase I program and subsequent concerns expressed by the Congress and the public, then Secretary of the Interior, Manuel Lujan, directed that an EIS be prepared. The Bureau of Reclamation was designated as the lead agency and the National Park Service, the Bureau of

Indian Affairs, the U.S. Fish and Wildlife Service, Western Area Power Administration, the Arizona Game and Fish Department, the Hopi Tribe, the Hualapai Tribe, the Navajo Nation, the San Juan Southern Paiute Tribe, the Southern Utah Paiute Consortium, and the Pueblo of Zuni are cooperating agencies (Department of the Interior, Bureau of Reclamation 1994). Additional research, termed the Glen Canyon Environmental Studies Phase II, was commissioned partly to support the EIS.

The majority of the indicators of nonuse value discussed in the literature are present in the Grand Canyon. In 1975, the Grand Canyon was declared by the Congress to be "a natural feature of national and international significance" (Pub. L. 93-620, 16 U.S.C. 228a). It was designated as a World Heritage Site in 1979. The Colorado River in the Grand Canyon has been proposed as critical habitat for two species of endangered native fish (U.S. Department of the Interior, Fish and Wildlife Service 1994). Visitation to the Grand Canyon National Park is quite extensive and reached 4,547,027 visitors in 1992 (J.M. Mitchell, personal communication). In order to prevent resource damage, alleviate crowding, and ensure public safety, the National Park Service regulates the amount and timing of recreation use in the Canyon. Those on the waiting list for private white-water boating permits must wait approximately eight years, indicating considerable demand in excess of the number of trips allowed through this rationing system.

A National Academy of Science Committee reviewed the scientific adequacy of the Glen Canyon Environmental Studies Phase I. Among other comments, the committee noted that the Phase I GCES economic studies had not considered nonuse value (Committee to Review the Glen Canyon Environmental Studies 1987:94). To address this issue, the cooperating agencies agreed to systematically investigate the feasibility of estimating nonuse value for the Phase II studies.

The Bureau of Reclamation retained an independent consulting firm to evaluate the feasibility of estimating nonuse value for changes in dam operations. As part of this effort, a panel of well known economists was convened to review the consultant's work, to provide written commentary on its technical adequacy, and to provide their views on the prospects for successfully completing a nonuse value study for GCES Phase II. Although some technical and practical concerns were noted, the findings of this panel were in favor of initiating a nonuse value investigation (HBRS 1991). Based on these findings, the cooperating agencies jointly agreed to continue the investigation in a stepwise fashion.

In the next step, a series of focus groups or group discussions were held at eight locations around the country to explore the feasibility of estimating nonuse value for the specific resources affected by operational alternatives. These focus groups were held with small groups of randomly selected individuals in New York, Tennessee, Nebraska, Arizona, and Utah (HBRS 1992).

Participants in these discussions were presented with a summary of the impacts to the affected physical environment resulting from Glen Canyon Dam operations. They were then asked to predict how changes in flow patterns might have affected the river ecosystem in the Grand Canyon. Participants were also asked to indicate the impacts about which they cared most.

Participants were able to distinguish impacts to the river corridor from impacts to the Grand Canyon as a whole. They were able to predict, in a general way, the impacts of releases from Glen Canyon Dam on the downstream ecosystem. Indications were that they care about impacts to vegetation, wildlife, native fish, archeological sites, and, Native American groups currently living near the Grand Canyon. Participants in these discussions expressed a clear desire to undertake actions that would reduce or eliminate the impacts of dam operations.

During the course of this investigation, the question of whether there is some nonuse value for hydroelectric power—a good sold in the market—arose. Potentially, nonuse value could be relevant in this context because of the renewable nature of hydropower, because of impacts on local communities, or due to empathy for the affected population (Department of the Interior, Bureau of Reclamation 1994).

There is only one example that suggests that there may be nonuse value for market goods (Lockwood et al. 1994). Nevertheless, this possibility remains an open question. Consequently, enhancements to the surveys were made to allow this question to be more rigorously examined. Additional focus groups and intensive one-on-one debriefings were held to facilitate these design changes.

The pilot testing phase of the GCES nonuse value study is now underway. The goals of this phase are to (1) explore suitable sampling scheme(s), (2) design appropriate survey instruments, and, (3) test these survey instruments. The findings of this phase of the research are expected to be available in 1994 and will be described in subsequent GCES reports and in the Glen Canyon Dam final EIS. Based on the outcome of this phase of the research, the cooperating agencies will consider whether or not to proceed with a full scale study of nonuse value as described in Bishop and Welsh (1992a).

CONCLUSIONS

Existing empirical studies demonstrate that nonuse value for resources in which there is widespread interest may be quite large both absolutely and relative to estimates of economic use value. For this reason, inclusion of estimates of nonuse value in economic efficiency analyses may have important implications with regard to water resource management and decision making.

There is a very close correspondence between the indicators of nonuse value discussed in the economic literature and indicators of significant environmental impact that trigger the preparation of an EIS under NEPA. Consequently, at least some subset of Federal actions requiring an EIS may require a treatment of nonuse value. Quantification of nonuse value, if any, along with other economic effects may provide important quantitative information to the decision maker. Potentially, this should allow for a comparison of impacts using the same metric, resulting in a more reasoned assessment of the alternatives being examined.

Our ongoing GCES application has uncovered some technical, practical, and procedural impediments that hinder the smooth integration of nonuse value with the NEPA process. The most important of these factors is the impact on EIS scheduling and work flow. Although these problems have now been identified, solutions and allowances within the NEPA process remain to be developed.

REFERENCES

Bishop, R.C. and T.A. Heberlein. 1984. Contingent Valuation Methods and Ecosystem Damages From Acid Rain. Staff Paper No. 217. Madison, Wisconsin: Department of Agricultural Economics, University of Wisconsin.

_____, and M.P. Welsh. 1992a. Strategy for Estimating Total Value: A Case Study Involving Grand Canyon Resources. in R.B. Rettig, compiler. W-133, Benefits and Costs in Natural Resource Planning: Fifth Interim Report. Corvallis, Oregon: Department of Agricultural and Resource Economics, Oregon State University.

_____, K.J. Boyle, M.P. Welsh, R.M. Baumgartner, and P.C. Rathbun. 1987. Glen Canyon Dam Releases and Downstream Recreation: An Analysis of User Preferences and Economic Values. Glen Canyon Environmental Studies Report no. 27/87. Springfield, Virginia: National Technical Information Service. NTIS no. PB88-183546/AS.

Boyle, K. and R.C. Bishop. 1987. Valuing Wildlife in Benefit Cost Analyses: A Case Study Involving Endangered Species. Water Resources Research 23(5):943-950.

Brown, T.C. 1993. Measuring Nonuse Value: A Comparison of Recent Contingent Valuation Studies. in J.C. Bergstrom, compiler. W-133 Benefits & Costs Transfer in Natural Resource Planning. Sixth Interim Report. Athens, Georgia: Department of Agricultural and Applied Economics, University of Georgia.

Cambridge Economics Inc. 1992. Contingent Valuation: A Critical Assessment. Cambridge, Massachusetts: Cambridge Economics Inc.

Carson, R.T., N.F. Meade, and, V.K. Smith. 1993. Introducing the Issues. Choices 8(2):4-8.

_____, N. Carson, A. Albernini, N.E. Flores, and, J. Wright. 1992 A Bibliography of Continent Valuation Studies and Papers. La Jolla, California: Natural Resource Damage Assessment, Inc.

Committee to Review the Glen Canyon Environmental Studies, National Research Council. 1987. A Review of the Bureau of Reclamation's Glen Canyon Environmental Studies. Washington, D.C.: National Academy Press.

Cummings, R.G., D.S. Brookshire, and W.D. Schulze (Eds.) 1986. Valuing Environmental Goods: A State of the Arts Assessment of the Contingent Valuation Method. Totowa, New Jersey: Rowman and Allanheld.

Desvousges, W.H., A.R. Gable, R.W. Dunford, and, S.P. Hudson. 1993. Contingent Valuation: The Wrong Tool to Measure Passive-use Losses. Choices 8(2):9-11.

Fisher, A.C. and R.L. Raucher. 1984. Intrinsic Benefits of Improved Water Quality: Conceptual and Empirical Perspectives. Pages 37-66 in, Advances in Applied Micro-Economics 3. Edited by V. Kerry Smith and Ann D. Witte. Greenwich, Connecticut: JAI Press Inc.

HBRS, Inc. 1991. Assessing the Potential for A Total Valuation Study of Colorado River Resources. Final Report. Madison, Wisconsin: HBRS, Inc.

_____. 1992. Results of the Nonuse Value Focus Group Discussion. Draft Report. Madison, Wisconsin: HBRS, Inc.

Heberlein, T.A. and R.C. Bishop. 1986. Assessing the Validity of Contingent Valuation: Three Field Experiments. Science of the Total Environment 56:99-107.

Kealy, M.J., M. Montgomery, and J.F. Dovidio. 1990. Reliability and Predictive Validity of Contingent Values: Does the Nature of the Good Matter? Journal of Environmental Economics and Management 19(3):244-263.

Krutilla, J.V. 1967. Conservation Reconsidered. American Economic Review 57(4):777-786.

_____, and A.C. Fisher. 1975. The Economics of Natural Environments. Baltimore, Maryland: Johns Hopkins University Press.

Larson, D.M. and J.B. Loomis. 1993. Toward Measuring Use and Nonuse Values From Related Market Behavior: Some Preliminary Results. in J.C. Bergstrom, compiler. W-133, Benefits and Costs Transfer in Natural Resource Planning: Sixth Interim Report. Compiled by Athens, Georgia: Dept. of Agricultural and Applied Economics, University of Georgia.

Lockwood, M., J.B. Loomis, and T. De Lacy. 1994. The Relative Unimportance of a Nonmarket Willingness to Pay for Timber Harvesting. Ecological Economics No 9():145-152.

Loomis, J.B. 1987a. Balancing Public Trust Resources of Mono Lake and Los Angeles' Water Right. Water Resources Research 23(4):1449-1456.

_____. 1987b. An Economic Evaluation of Public Trust Resources of Mono Lake. Institute of Ecology Report #30. Davis, California: University of California.

_____. 1989. Test-Retest Reliability of the Contingent Valuation Method: A Comparison of General Population and Visitor Responses. American Journal of Agricultural Economics 71(1):76-84.

Madariaga, B. and K.E. McConnell. 1987. Exploring Existence Value. Water Resources

Research 23(5):936-942.

Mitchell, R.C. and R.T. Carson. 1989. Using Surveys to Value Public Goods: The Contingent Valuation Method. Washington D.C.: Resources for the Future.

Olsen, D., J. Richards, and R.D. Scott. 1991. Existence and Sport Values for Doubling the Size of Columbia River Basin Salmon and Steelhead Runs. Rivers 2(1):44-56.

Randall, A. 1993. Passive-use Values and Contingent Valuation- Valid for Damage Assessment. Choices 8(2):12-15.

Ready, R.C. 1993. The Choice of a Welfare Measure Under Uncertainty. American Journal of Agricultural Economics 75(4):896-904.

Sanders, L.D., R.D. Walsh, and J.B. Loomis. 1990. Toward Empirical Estimation of the Total Value of Protecting Rivers. Water Resources Research 26(7):1345-1357.

U.S. Department of Commerce, National Oceanic and Atmospheric Administration. 1990. Natural Resource Damage Assessments; Advance Notice of Proposed Rulemaking. Federal Register 55(250):53478-53479.

_____. 1991. Natural Resource Damage Assessments Under the Oil Pollution Act of 1990. Federal Register 56(40):8307-8308.

_____. 1992a. Natural Resource Damage Assessments; Advance Notice of Proposed Rulemaking. Federal Register 57(50):8964-8988.

_____. 1992b. Natural Resource Damage Assessments Under the Oil Pollution Act of 1990. Federal Register 57(105):23067-23068.

_____. 1993. Natural Resource Damage Assessments Under the Oil Pollution Act of 1990. Federal Register 58(10):4601-14.

_____. 1994. Natural Resource Damage Assessments; Proposed Rules. Federal Register 59(5):1062-1191.

U.S. Department of the Interior. 1991. Natural Resource Damage Assessment: Notice of Proposed Rulemaking. Federal Register 56(82):19752-19773.

_____. 1993. Natural Resource Damage Assessments: Proposed Rule. Federal Register 58(139):39328-39357.

_____. 1994. Natural Resource Damage Assessments; Final Rule. Federal Register 59(58):14262-14288.

U.S. Department of the Interior, Bureau of Reclamation. 1994. Operation of Glen Canyon Dam: Draft Environmental Impact Statement. Denver, Colorado: Bureau of Reclamation.

U.S. Department of the Interior, Fish and Wildlife Service. 1994. Endangered and Threatened Wildlife and Plants: Determination of Critical Habitat for Four Colorado River Endangered Fishes; Final Rule. Federal Register 59(54):13373-13399.

U.S. Water Resources Council. 1983. Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. Washington, D.C.: U.S. Government Printing Office.

Weisbrod, B.A. 1964. Collective-Consumption Services of Individual-Consumption Goods. Quarterly Journal of Economics 78(3):471-477.

Whitehead, J.C. and P.A. Groothuis. 1992. Economic Benefits of Improved Water Quality: A Case Study of North Carolina's Tar-Pamlico River. Rivers 3(3):170-178.