USE OF NON-MARKET VALUATION STUDIES IN WATER RESOURCE MANAGEMENT ASSESSMENTS

John B. Loomis
Professor
Colorado State University
jloomis@ceres.agsci.colostate.edu

How valuable is valuation is a good question, and one frequently heard (Vatn and Bromley, 1994). Posed a different way, Are the benefits of these studies, in terms of more efficient use of water resources, worth the costs of these studies? This is a tough question, one asked in many fields including weather forecasting and flood prediction. Given that policy decisions are influenced by economics, political concerns, existing laws and concerns over distributional equity, it is rare to be able to point to any one information source in the policy process and say it was the definitive factor.

Nonetheless, non-market valuation studies have played a significant role in major water resource debates of the last decade. In many cases, these valuation studies have changed the nature of those debates. Perhaps the best example of this is in the public trust case involving water flows into Mono Lake in California. The Los Angeles Department of Water and Power cast the debate in terms of "300 Fish versus 28,000 People." The implication was that providing water for fish in the tributary streams flowing into Mono Lake deprived people of benefits. Besides being an unproductive way to view the resource allocation of issue, surveys of the California citizenry showed this was a false dichotomy. People cared about the fish, and the birds and the Mono Lake ecosystem. Using the hypothetical market method described below, the dollar sacrifice these people would make to provide water for fish and birds could be quantified and compared to the replacement cost of water from other sources including agricultural and municipal water conservation.

The State of California's Water Resources Control Board was sufficiently impressed with the initial household survey measuring the existence values from just knowing Mono Lake would be preserved that they required the contractor preparing the state Environmental Impact Report (EIR) to perform a far more thorough hypothetical market analysis. The economic values from that survey were published in the EIR. These dollars of willingness to pay to protect the Mono Lake ecosystem were counted dollar for dollar as equivalent to hydropower and water supply benefits and costs in the economic analysis of the different water allocation alternatives (Jones and Stokes Associates, 1993). In the end, the State ordered the flows into Mono Lake be increased and L.A.'s water right be reduced by nearly half. While air and water quality concerns were the driving force in this decision, being able to show that such water reallocations were not uneconomic probably aided in making such a dramatic change.

WHAT IS NON-MARKET VALUATION?

Non-market valuation attempts to estimate the economic value, in dollar terms, that members of society receive from uses of water resources which society has chosen not to allocate through markets. Most recreational fishing and boating provides a benefit to its participants. It is a benefit for which they would, if they had to, pay more than the current nominal fishing license fee or launch fee. The fact that they do not have to pay "what the market will bear" results in the visitor retaining a "consumer surplus" as extra income in their wallet or purse. In the case of recreation, economists rely on visitor travel behavior to trace out a demand curve for water-based recreation at a particular site. From the demand curve, we can estimate the additional amount a visitor would pay, if they had to, for continued access to the water-based recreation resource. By observing travel behavior across sites with high instream flow versus low instream flow, the analyst can estimate the incremental value that additional instream flow provides to fishing or rafting.

Studies of the recreation value of fishing have been instrumental in decisions by Montana Fish, Wildlife and Parks in acquiring public access for fishing (Duffield, 1989). In states such as California, this information has been very useful in Federal Energy Regulatory Commission relicensing decisions for dams.

Recreation, however, is only part of the story. As mentioned in the Mono Lake case, many individuals who may never fish or boat, still receive some benefits from just knowing that free flowing rivers exist (Sanders, *et al.*, 1990) or that salmon migrations will continue as part of the cycle of life in that region (Olsen, *et al.*, 1991). In these cases, all households would be asked to pay for

protection of water resources. Today, this is done in the form of a hypothetical referendum, where households are asked if they would vote in favor of a particular resource protection action, if it cost their household $X. The amount of $X varies across households, so that a demand curve can be traced out. From this demand curve, willingness to pay is calculated. This technique is commonly referred to as the contingent valuation method (CVM).

There is of course some skepticism regarding the reliability of these household's statements of willingness to pay. As such CVM has been subjected to more testing and scrutiny than most methods in economics. For estimating the non-market benefits of recreation, CVM results in estimates of willingness to pay that are slightly less than estimates based on actual behavior methods such as the travel cost method (TCM). This has been a fairly consistent finding over dozens of CVM studies covering fishing, rafting, hunting, camping, etc. See Carson *et al.* (1996) for a summary of these comparisons.

The validity of CVM-derived estimates of WTP for existence values is less encouraging. In part, this is due to the difficulty in arriving at a valid criterion for actually collecting existence value. Nonetheless, the few experiments that exist have resulted in stated WTP amounts which may be 2-10 times higher than actual contributions or payments. Recent developments have suggested inclusion of additional questions in the CVM survey that appear to allow calibration of stated WTP amounts to be more equal to actual cash contributions (Champ, *et al.* 1997). Thus it is not surprising that decisionmakers often use results from CVM surveys of the general public as indicative of their intensity of preferences, but the exact dollar values may not be as heavily relied upon as they are in recreation analyses.

However, in many of the studies cited below, the public good nature of the existence values often dwarf the recreation use values and the opportunity costs of protecting water resources. For example, in the original Mono Lake CVM analysis (Loomis, 1987) even the lower bound estimate of the benefits exceeded the cost by far more than the hypothetical bias possible in CVM (e.g., $1,525 million in benefits versus $26.5 million in costs). The large amount of benefits is partly a result of what economists call the public good nature of existence values. Small values per household of $30-150 per year when multiplied by 10 million households in California, result in substantial aggregate estimates of total benefits. Recent empirical analyses suggest that for many natural resources such as protection of salmon in the Pacific Northwest, the benefits extend nationally to nearly 100 million households (Loomis, 1996).

AGENCY AND COURT ACCEPTANCE OF NON-MARKET VALUATION

Besides the State of California's continuing use of CVM and measurement of existence values not only for water resources such as Mono Lake, but also in assessing the damages of oil spills, there are numerous federal agencies that rely upon CVM. Beginning in 1979, Federal agencies such as the U.S. Army Corps of Engineers and Bureau of Reclamation were required to use the travel cost method and contingent valuation methods to value recreation benefits at projects with high visitation levels (U.S. Water Resources Council, 1979). When Congress passed the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), the U.S. Department of Interior adopted TCM and CVM as two methods for valuing the loss in both recreation and existence values from toxic waste sites and hazardous materials spills (U.S. Department of Interior, 1986). When industry challenged the use of CVM, the Court of Appeals upheld CVM and ordered the Department of Interior to broaden its use to measure existence values (what the court called passive use values) even when there was direct, on-site recreation use of the resource (State of Ohio vs. U.S. Dept. of Interior, 1989). Consistent with economic theory, the court saw recreation use and existence values as additive.

The Exxon Valdez oil spill put CVM in the spotlight. When Congress passed the Oil Pollution Act of 1990, the responsible agency, the National Oceanic and Atmospheric Administration (NOAA) recommended CVM be used to measure both the recreation and passive use values lost due to oil spills. Given the controversy surrounding this, NOAA appointed a "blue ribbon" panel chaired by two Nobel Laureates to assess the reliability of the CVM for measuring passive use values. In its report in 1993, the panel concluded that carefully designed and implemented CVM studies could provide estimates of passive use/existence values that would serve as a useful starting point for administrative and judicial decisions (Arrow, *et al.*, 1993). We now turn to examples of the use of non-market valuation in several water resource management assessments.

EXAMPLES OF NON-MARKET VALUATIONS USED IN WATER RESOURCE POLICY ANALYSES

Glen Canyon Environmental Studies

Perhaps one of the most prominent uses of CVM has been sponsored by the U.S. Bureau of Reclamation in its evaluation of the economic effects of re-regulating the flow releases from Glen Canyon Dam. Due to the dam being upstream from Glen Canyon National Recreation Area (GCNRA) and Grand Canyon National Park (GCNP), peaking power operations at the dam were having a deleterious effect on downstream fishing and rafting. As always, the million dollar question was "just how much is this recreation worth" as compared to the market value of the peaking power. The first studies carried out used CVM to quantify how the value of fishing in GCNRA and rafting in GCNP would change with more even base flows as compared to peaking power. Visitors were surveyed in the mid-1980's. The economic effects were substantial, representing changes of $2 million annually (Bishop *et al.*, 1989). The impact of this analysis was far more than the magnitude of the values, as it helped change the nature of the policy discussion. Rather than recreation versus hydropower, the focus turned to finding a release pattern that could increase the economic value of all the multiple purposes. For a variety of reasons, more even flows were put in place while the final environmental impact studies took place. Congress, formalized these flows when it passed the Grand Canyon Protection Act of 1992.

In fact the impact of the Grand Canyon recreation study was sufficient to result in one of the first, major passive use value studies being funded by a federal agency. As it became clear that more than recreation was at stake in re-regulation of the dam, it also became more obvious that citizens throughout the U.S. cared about how dam operations affected the natural resources of the Grand Canyon. In particular, people were concerned about Threatened and Endangered (T&E) fish, erosion, native vegetation and birds, which were all being adversely affected by unnatural flows and lack of high spring flows. The Bureau of Reclamation funded a major non-use value study of households throughout the U.S. to estimate their WTP for flow regimes that would protect the natural resources in the Grand Canyon. These results showed strong support for a more natural flow regime. While it is difficult to point to any one study as definitively affecting management of Glen Canyon dam, the public support combined with concerns over T&E fish have resulted in substantial changes in the management of the dam. For example, a large water release was carried out during the spring of 1995 to emulate the natural high spring flows.

Federal Energy Regulatory Commission Relicensing Decisions

Non-market valuation has also been used in Federal Energy Regulatory Commissions (FERC) deliberations over the level of minimum instream flow conditions to attach to 50 year operating licenses. One of the strongest indications of the difference that non-market valuation can make was in the FERC case involving whether to permit construction of a dam at Kootenai Falls in Montana. The permit application was rejected. According to Dr. John Duffield, who performed the CVM analysis and presented it before the administrative law judge: "The judge's decision turned on the aesthetics and recreation values. This is an interesting case in that not only was contingent valuation the primary method, but additionally, a compensation-demanded measure was apparently accepted as plausible. The utility appealed the judge's decision to the full Federal Energy Regulatory Commission, which upheld the rejection of the application. Our understanding is that this is one of only two or three cases where FERC has not approved an application for a major hydroelectric project" (Duffield, 1992, p. 314).

Pacific Gas and Electric (PG&E) in California has repeatedly relied upon non-market valuation studies to estimate the recreation benefits associated with alternative instream flow requirements when making their FERC license renewal applications. One such study was carried out on the North Fork of the Feather River in California (Loomis and Cooper, 1990). More recently, Idaho Power Company commissioned a CVM study of the economic benefits of alternative flow releases over Shoshone Falls on the Snake River. Their intention is to evaluate whether the gain in recreation benefits from more water passing over the falls is worth the power foregone from not running that water through the turbines. A preliminary analysis suggests that during the summer months, triple the current minimum rate of 50 cfs would be economically efficient (Loomis and Feldman, 1995). This of course illustrates the "double edge sword" of non-market valuation. While it demonstrates that huge increases in minimum instream flow requests are not justified, it also suggests more than trivial increases in flows are often efficient. Thus neither environmentalists nor the utility may fully support reliance on the CVM results, as it may be viewed alternately as too little or too much.

Dam Removals for Fishery Benefits

As more and more anadromous fish species have been added to the Endangered Species list, serious consideration has been given to complete removal of dams blocking salmon migration. Not only do the dams block upstream migration of adult salmon, but the reservoir pools behind the dams substantially slow the migration of juvenile salmon to the ocean. Adding to this the mortality at the dams themselves, there has been a groundswell of support from newspaper editors in Boise, Idaho to citizens in Washington to remove dams on rivers used by anadromous fish.

The first dams to receive a formal environmental impact analysis for removal are the Elwha and Glines dams on the Elwha River in the State of Washington. These old dams, have no fish ladders. These 200 foot dams are in such a narrow canyon that fish ladders would be very costly and probably ineffective. Given the age of the dams and the fact that they block migration of fish to 70 miles of pristine spawning grounds in Olympic National Park, their removal could more than triple salmon populations on the Elwha River.

However, being biologically effective is not the same as being economically efficient. The cost to remove the dams and remove the 50 years of sediment build-up has been estimated to cost in the neighborhood of $100-$125 million. The economist (Phil Meyer) coordinating the economic analysis of the National Park Service, Bureau of Reclamation and Indian Tribes recognized that recreational and commercial fishing benefits would likely be insufficient to cover these costs. A CVM survey was conducted in Washington State and nationwide to estimate these benefits. The survey response rate in Washington was quite high at 68%, and 55% for the rest of the U.S. The values per household ranged from $73 for Washington households (the 90% confidence interval ranges between $60-$99) to $68 for the rest of U.S. households (90% confidence interval of $56-$92). Even just considering Washington residents, the $73 per household times the number of households in Washington would nearly cover the cost of removing the dams and restoring the river. Given the 86 million households in the rest of the U.S., national willingness to pay was in excess of a billion dollars. Thus, even if there is a upward bias to the CVM estimates of willingness to pay, the national benefits are far in excess of the costs.

These results were included in the draft and final Environmental Impact Statement (EIS) prepared by the National Park Service on dam removal. The recommendation in both the draft and final EIS was to remove both dams and restore the Elwha River. This is consistent with the economic analysis, although many factors contributed to the National Park Service's recommendation. The Clinton Administration has

included in their budget request to Congress the money to purchase the dams from the private owners, with the intent to request funds for dam removal and restoration in subsequent fiscal years.

CONCLUSION

Does valuation matter? I believe a reasonable case can be made that economic valuation in general, and non-market valuation in particular does contribute to better informed public decisions. The nature of the contribution is often case specific. In some cases reviewed, the non-market valuation changed the character of the debate from being a "people vs the environment" to one of recognizing people care about the environment in the same way they care about cheap water or electricity. In other cases, non-market valuation helped diffuse the often heard mantra that "while we would like to protect the environment, we simply can't afford it. Protecting the environment is just too costly." What the non-market valuation studies often show is that protecting the environment often provides more benefits than the value of commodities foregone. Finally, in the Elwha example, contingent valuation was used to estimate the benefits to society as a whole from salmon restoration. Viewing salmon restoration narrowly as increased commercial fishing revenues or even sport fishing benefits, would reflect just a fraction of the public benefits from increasing salmon populations.

What is the value of valuation? The value lies in providing a more complete accounting of all of the benefits and costs to all of the people. For *without* valuation, the predictions of the public choice economists are frequently realized: (1) those who would bear concentrated costs can block resource reallocations that benefit society as a whole and (2) those few that stand to gain concentrated benefits can spread even larger costs out over millions of taxpayers. Valuation studies can make possible a "dollar democracy" in which every citizen's voice is heard through their benefits and costs, regardless of how small they are per person. Without valuation studies, only those with sufficiently concentrated costs or benefits to attend hearings, committee meetings or make large campaign contributions will be heard. Valuation studies have the potential to provide an effective way to diminish the often bemoaned role of "special interests" in the current policy process. For this reason alone, valuation studies are tremendously valuable.

REFERENCES

Arrow, K., R. Solow, P. Portney, E. Leamer, R. Radner and H. Schuman. "Report of the NOAA Panel on Contingent Valuation." *Federal Register* 58(10): 4602-4614. 1993.

Bishop, R. , C. Brown, M. Welsh and K. Boyle. "Grand Canyon and Glen Canyon Dam Operations: An Economic Evaluation," in K. Boyle and T. Heekin, Eds., W-133, Benefits and Costs in Natural Resources Planning, Interim Report #2. Department of Agricultural and Resource Economics. University of Maine, Orono, 1989.

Carson, R., W. Hanemann, R. Kopp, J. Krosnick, R. Mitchell, S. Presser, P. Ruud, V. Smith, M. Conaway, and K. Martin. "Temporal Reliability of Estimates from Contingent Valuation." *Land Economics* 73(1997):151-163.

Champ, P., R. Bishop, T. Brown and D. McCollum. "Using Donation Mechanisms to Value Nonuse Benefits from Public Goods." *Journal of Environmental Economics and Management* 33(1997):151-162.

Duffield, J. "Nelson Property Acquisition: Social and Economic Impact Assessment." Report for Montana Department of Fish, Wildlife and Parks. Helena, MT, 1989.

Duffield, J. "Contingent Valuation: Issues and Applications," in K.Ward and J.Duffield, *Natural Resource Damages: Law and Economics*. New York: John Wiley and Sons, 1992.

Jones and Stokes Associates. Draft Environmental Impact Report for the Review of the Mono Basin Water Rights of the City of Los Angeles. Prepared for California State Water Resources Control Board, Division of Water Rights, Sacramento, CA, 1993.

Loomis, J. "Balancing Public Trust Resources of Mono Lake and Los Angeles' Water Right: An Economic Approach." *Water Resources Research* 23 (1987):1449-1456.

Loomis, J. and J. Cooper. "Economic Benefits of Instream Flow to Fisheries: A Case Study of California's Feather River," *Rivers* 1(January 1990):23-30.

Loomis, J. and M. Feldman. "An Economic Approach to Giving 'Equal Consideration' to Environmental Values in FERC Hydropower Relicensing," *Rivers* 5(April 1995):96-108.

Loomis, J. "Measuring the Benefits of Removing Damsd Restoring the Elwha River: Results of a Contingent Valuation Survey." *Water Resources Research* 32(1996):441-447.

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

Sanders, L., R. Walsh and J. Loomis. "Toward Empirical Estimation of the Total Value of Protecting Rivers." *Water Resources Research* 26(1990):1345-1358.

State of Ohio vs. U.S. Department of Interior. U.S. District Court of Appeals (for the District of Columbia). Case number 86-15755. July 14, 1989.

Vatn, A. and D. Bromley. "Choices without Prices, Without Apologies." *Journal of Environmental Economics and Management* 26(1994):129-148.

U.S. Department of Interior. "Natural Resource Damage Assessments; Final Rule." *Federal Register* 51 (4):27674-27753. Washington DC. 1986.

U.S. National and Oceanic and Atmospheric Administration. "Oil Pollution Act Damage Assessments, Final Rule." *Federal Register* 61. (4):439-510. January 5, 1996.

U.S. Water Resources Council. "Procedures for Evaluation of National Economic Development (NED) Benefits and Costs in Water Resources Planning. Final Rule." *Federal Register* 44(242):72892-72976. December 14, 1979.

U.S. Water Resources Council. Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. Washington DC: U.S. Government Printing Office, March 10, 1983.

John Loomis is a Professor in the Department of Agricultural and Resource Economics at Colorado State University. He specializes in valuation of non-marketed natural resources and its incorporation into benefit-cost analyses. Previously he worked for the U.S. Bureau of Land Management and U.S. Fish and Wildlife Service.