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MEASURING THE TOTAL ECONOMIC VALUE OF RESTORING ECOSYSTEM SERVICES IN AN IMPAIRED RIVER BASIN: RESULTS FROM A CONTINGENT VALUATION METHOD SURVEY

--WORKING PAPER*--

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ABSTRACT

Five ecosystem services that could be restored along a 45 mile section of the Platte River were described to respondents using a building block approach developed by an interdisciplinary team. These ecosystem services were dilution of wastewater, natural purification of water, erosion control, habitat for fish and wildlife, and recreation. Households were asked a dichotomous choice willingness to pay question regarding purchasing the increase in ecosystem services through a higher water bill. Results from nearly 100 in-person interviews indicate that households would pay an average of $21 per month for the additional ecosystem services (95% confidence interval is $20.50 to $21.65). Generalizing this to the households living along the river yields a value of $30 million to $70 million depending on whether those refusing to be interviewed have a zero value or not. Even the lower bound benefit estimates greatly exceed the high estimate of water leasing costs ($1.13 million) and Conservation Reserve Program farmland easements costs ($12.3 million) necessary to produce the increase in ecosystem services.

IMPORTANCE AND CONTROVERSY IN ECOSYSTEM VALUATION

Valuation of ecosystem services is controversial because of the potential importance such values may have in influencing public opinion and policy decisions. As noted by Costanza, et al. (1998:68) "To say that we should not do valuation of ecosystems is to deny the reality that we already do, always have and cannot avoid doing so in the future". Failure to quantify ecosystem values in commensurate terms with opportunity costs often results in an implicit value of zero being placed on ecosystem services. In most cases, ecosystem services have values larger than zero (Daley, 1997).

Attempts at valuing ecosystem services go back several decades. Notable early examples include energy based approaches of Costanza (1981) and Odum (1983). *Ecological Economics* ran a special issue on the topic in 1995. A recent effort by Costanza, et al. (1997) published in *Nature* to estimate the value of the world's ecosystem services has focused a great deal of attention on this topic (see the 1998 special issue of *Ecological Economics* on The Value of Ecosystem Services for some of

this debate). This ambitious effort by Costanza et al. was partly a challenge "..that ecosystem services are 'big potatoes' and we had better get busy and pay more attention to them—from many different conceptual and methodological perspectives at once" (Costanza, et al., 1998:69).

There were several critiques in this recent special issue of *Ecological Economics* of the analysis by Costanza, et al. (1997). One commentator was concerned that adding up estimates from separate studies on the value of various individual ecosystem services might result in some double counting of benefits (Serafy, 1998:25). However, there can be potentially more than double counting when adding up independently derived estimates of willingness to pay, as substitution effects and budget constraints are often incompletely accounted for, leading to over-valuation even in absence of double counting (Hoehn and Randall, 1989). In addition, Toman (1998:58) notes that for ecosystem valuations to provide more useful information to decision makers faced with trade-offs, that "One needs a specified baseline, a specified measure of changes…"

Our approach attempts to rise to the challenge posed by Costanza, et al. (1998) and these commentators by addressing all three of the above suggestions. First by eliciting a comprehensive value from the public for a set of ecosystem services and thereby reducing the possibility for double counting as well as avoiding the independent valuation and summation noted by Hoehn and Randall. Further we provide respondents a specified baseline and specified measure of change as suggested by Toman. This is done by adapting the contingent valuation method (Mitchell and Carson, 1989) to the valuation of ecosystem services. Such comprehensive valuation critically depends on communicating the nature of ecosystem services to the respondent. This paper reports on an interdisciplinary effort to develop visual aids and text that communicates the ecosystem services of a Great Plains river and the results of nearly 100 in-person interviews with those visual aids. As is obvious, this refinement in ecosystem valuation is far less ambitious than the Costanza et al. (1997) effort in both the number of services that were relevant to value in this ecosystem and the geographic scope of the analysis. We believe future efforts may be able to apply our approach to larger ecosystems with a broader range of the ecosystem services to be valued.

SPECIFIC ECOSYSTEM SERVICES OF A PLAINS RIVER

Rivers can provide many services to humans, including water supply for municipal, industrial and agricultural users, fish habitat and recreation. When demands from all these uses are low, at times these uses can be complementary. However, with excess demand by historic uses resulting in an over appropriated river basin, the uses become competitive. A dynamic society requires monitoring and adjusting the mix of these ecosystem services as society's priorities change (Bromley, 1997) to insure that the highest valued mix of services is produced. Since uses like fish habitat and recreation are not priced, this presents a challenge to water managers.

Like many river basins throughout the world, the South Platte, near Denver, Colorado, has been modified by diversions, adjacent land use and pollution to the point where the river's ecosystem, including its fishes, are severely imperiled. Today the river is operated as a plumbing system with about 500 irrigation ditches and 70% of water withdrawals for agriculture (Strange, et al., 1998). Much of the river's remaining flows are irrigation return flows, with additional inflows from the sewage treatment plant in Denver. Due in part to the lack of riparian vegetation to filter irrigation return flows and feedlot run-off, the South Platte ranks first in contamination by ammonia and nitrates of 20 major rivers in the U.S. and it ranks second among the 20 major rivers in contamination by phosphorous (Strange, et al., 1998). In addition to polluted water, erosion of the streambanks, irrigation return flows, and reduction of instream water by agriculture use has greatly diminished the natural ecosystem of the South Platte River. As a result of these changes in flow regime, habitat, and water quality, six of the remaining native fish species are at risk and are being considered for the endangered species list. Due to the unnatural hydrograph resulting from waterflows timed for irrigation, non-native Russian olive trees are encroaching upon and replacing native cottonwoods. Birds prefer the cottonwood for nesting and the higher abundance of insects. As the number of cottonwoods decrease, bird species are expected to decrease by a third of their present number.

In essence, one ecosystem service from the watershed, irrigation water supply, along with "edge to edge" agriculture has greatly diminished other ecosystem services such as:

- dilution of wastewater
- natural purification of water
- erosion control
- habitat for fish and wildlife
- recreation use

Of course there would be opportunity costs to irrigated agriculture from reducing diversions and replacing cropping and grazing at the river's edge with native vegetation. The question that must often be answered is what are these non-marketed ecosystems worth? It is to answering that question to which we now turn.

WHAT ARE ECONOMIC VALUES OF ECOSYSTEM SERVICES?

Ecosystem services provide many benefits to people. Dilution of wastewater, as well as erosion control and water purification effects from riparian vegetation and wetlands improves water quality. Increased water quality reduces water treatment costs to downstream cities (Moore and McCarl, 1987), increases the aesthetics of water for visitors and supports native fish and wildlife that different people like to view or harvest or simply know exist. Since all of these uses of clean water benefit people, and are scarce, these services have an economic value.

These ecosystem services have characteristics of **public goods**. Specifically, it is difficult to exclude downstream users from receiving the benefits of improved water quality and many of the benefits are non-rival in nature. Many individuals can view the same wildlife or enjoy knowing they exist without precluding others from doing the same thing. Given these public good characteristics, it is difficult for the private sector to market or sell these ecosystem services.

While these ecosystem services are often without prices, they do contribute utility to individuals and therefore have value. In fact, the absence of a price charge increases the individual's consumer surplus. Consumer surplus is also known as the individual's net willingness to pay. It is represented by the area under the individual's demand curve but above any cost to the user of the

ecosystem service.

TECHNIQUES TO MEASURE THE ECONOMIC VALUE OF ECOSYSTEM SERVICES

There are several techniques that can be used to value the benefits of improved water quality or stream restoration. If restoration of water quality or recreation occurs in an urban setting where there are residences nearby the river, the hedonic property method may be applied. The hedonic property method isolates the property value differential paid by a household for having a home along a river with improved water quality as compared to degraded water quality. Research in California, indicates that water quality can increase property values by at least 3% for bank stabilization and up to 11% for improving fishing habitat (Streiner and Loomis, 1996).

If the primary gain in ecosystem services is recreation, the variation in visitors travel costs to the river can be used to trace out the demand curve for recreation at the river. From this demand curve the consumer surplus of recreation with improved water quality can be estimated (Freeman, 1993; Loomis and Walsh, 1997).

When river restoration and water quality improvements result in both on-site recreation and increases in populations of rare or endangered fish, there will often be an existence and bequest value (Krutilla, 1967; Loomis and White, 1996). By **existence value** we mean the amount an individual would pay to know that a particular native fish exists in its natural habitat. By **bequest value** we mean the amount an individual would pay for preservation today, so that future generations will have native fish in their natural habitat. Collectively, existence and bequest values are sometimes called non-use or passive use values. While these benefits are often quite small per person, the non-rival nature of these public good benefits results in simultaneous enjoyment by millions of people. Therefore, the total social benefits can be quite large.

The only methods currently capable of measuring these passive use values of ecosystem services are conjoint, choice experiments and the contingent valuation method (CVM). CVM uses a questionnaire or interview to create a realistic but hypothetical market or referendum, which allows

respondents to indicate their WTP (Mitchell and Carson, 1989). The first part of the survey conveys the description of the resource under current conditions, as well as proposed conditions if the respondent pays. Then respondents are told the means by which they would pay for these proposed changes, e.g., in a higher water bill or taxes. Finally, the respondents are asked whether they would pay a certain dollar amount, which varies randomly across respondents.

The concern with this method is the reliability and validity of the responses. Would these individuals really pay the amount stated in the interview? This question has been subjected to a great deal of empirical testing. The literature finds that CVM passes the tests of the validity involving comparisons of values derived from actual behavior methods such as hedonic pricing (Brookshire, et al., 1982) and travel cost recreation demand model (Carson, et al., 1996). All the published studies to date have shown CVM derived responses of WTP for both use and passive use values to be reliable in test-retest studies (Loomis, 1989; Carson, et al., 1997). CVM has been recommended by federal agencies for performing benefit-cost analysis (U.S. Water Resources Council, 1983) and valuing natural resource damages (U.S. Department of Interior, 1986, 1994). The CVM has been upheld by a federal court (U.S. District Court of Appeals 1989) and was recommended as being reliable enough to provide initial estimates of passive use values by a blue ribbon panel co-chaired by two Nobel Laureate economists (Arrow, et al., 1993).

Nonetheless, CVM derived estimates of public good values such as existence and bequest values may overstate actual cash WTP by a factor of 2-10 in some cases (Brown, et al., 1996). Recent efforts at calibrating stated WTP values show promise at producing equality of stated and actual cash WTP (Champ, et al., 1997).

The only previous application of CVM to the South Platte River involved an in-person survey of 200 residents of Denver and Fort Collins, Colorado in 1976 by Greenley, Walsh and Young (1982). Individuals were asked to pay a higher water bill to reduce heavy metal pollution in the South Platte

River. The average household would pay $4.50 per month in 1976 dollars or $12.50 in 1996 dollars. About half the value was recreation use, with the other half being existence and bequest values.

SURVEY DESIGN

Obtaining accurate benefit estimates using contingent valuation method require detailed descriptions of the resource being valued. This is evident from the name of the method, which produces values, contingent upon, the description of the good and method of payment. Therefore a great deal of effort was expended to carefully define and clearly display the current and proposed levels of ecosystem services to respondents.

During the first year of the project three ecologists worked with two economists to define what the ecosystem services were being provided by the South Platte River and how these could be conveyed in words and figures. Background data was acquired from U.S. Geological Survey and U.S. Fish and Wildlife Service as well as a site visit were conducted. The ecologists have summarized this background analysis of the South Platte in Strange, et al., 1998. The study section of the South Platte River was also selected based on an actual policy proposal (e.g., the Centennial Land Trust). This rural stretch of river extends from Kersey to Fort Morgan, Colorado. The first step was definition of ecosystem services that could be provided by the South Platte River: dilution of wastewater, natural purification of water, erosion control, habitat for fish and wildlife, and recreation.

Once the key ecosystem services were identified, we developed management actions necessary to increase the level of ecosystem services. These management actions included: a ten mile wide conservation easement along 45 miles of the South Platte River, downstream of Greeley. This area is 300,000 acres in size. Next, restoring native vegetation along the river in the form of buffer strips and eliminating cropland and cattle grazing in the buffer strip area. Livestock grazing would be allowed in the remainder of the conservation easement. Finally, water diversions to agriculture were reduced from their current 75% to 50% of the total flow with the corresponding increase in instream flow from 17% to 42%. In terms of acre feet of water, this is an annual gain of 37,820 acre feet of water for instream

flow, wastewater dilution, and aquatic habitat. The payment mechanism was an increase in household water bill.

The interdisciplinary team worked jointly to develop drawings and narrative that conveyed the concept of increased ecosystem services. An initial set of drawings illustrating a natural level of ecosystem services as compared to the current condition of degraded ecosystem service was prepared.

FOCUS GROUPS

To test the validity of these drawings and narrative to convey the desired concepts, we presented them at two focus groups in Denver and one in Greeley. The individuals attending the focus groups were asked to write down their description of what each diagram indicated. We asked them to point out any elements that were not clear. After each focus group, we made modifications to the diagrams and the narrative wording. We found that including a summary diagram that was a composite of all of the ecosystem services presented individually helped to improve comprehension.

PRETESTING OF IN-PERSON SURVEYS

After further revisions following the focus groups, an entire survey script and revised set of diagrams were prepared and pre-tested. We pre-tested the entire script and drawings on four individuals, two of which served as interviewer training. Further changes were made and we believe we have a fairly effective script and diagrams to elicit household willingness to pay for increasing ecosystem services in the South Platte River.

SYNOPSIS OF ECOSYSTEM SERVICES BEING VALUED IN SURVEY

(1) Restoring vegetation buffer strips along streams to increase ecosystem services such as erosion control, water quality, fish and wildlife habitat along with limited recreation opportunities. This is illustrated in Figure 1.

(2) Leaving more water in the South Platte River. This shift in water use was illustrated by comparing two pie charts shown to respondents. The top pie chart presented "Current Water Use" where 75% of water supply is now primarily for agriculture. Respondents were told that additional instream flows in the river can be obtained by: (a) purchasing water rights from agricultural users ; (b) paying farmers to grow crops that use less water ; {c} convert cropland away from the river into fenced pastureland. Farmers would make at least as much income, if not more, from selling the water and growing less water intensive crops or switching to livestock. Respondents were then directed to the lower pie chart which illustrated 50% of the water being used by irrigated agriculture and instream flow increasing from 17% to 42% of the water.

The second action needed to increase ecosystem services is to make changes in land management. Land management actions necessary to restore ecosystem services were illustrated on a schematic map of the study area. Along 45 river miles of the South Platte River shown on the map, the government would purchase conservation easements on both sides of the river over a 10 year period from willing farmers (5 miles on either side for a total of 300,000 acres shown on the map). Respondents were told conservation easements keep the land in private ownership but would pay farmers to manage this land to improve wildlife habitat and water quality. For example, cows would be fenced out of the area along the river banks so vegetation could regrow and the stream banks could be stabilized. This area will be restored to natural vegetation such as grasslands, wetlands and streamside trees (see Figure 1). Some areas would be replanted with native vegetation. The revegetated streamside would: reduce erosion; increase natural water purification by plants; improve water quality and river habitat ; help increase native fish populations so they will not go extinct; provide public access to restored natural areas for wildlife viewing including 5 miles of hiking trails.

These changes were compared to the current condition which is illustrated in Figure 2. Note, all of the figures used in the interviews were in color to better illustrate the change in water quality. The specific wording of the willingness to pay scenario read to respondents was:

"*The purchase of water and 300,000 acres of conservation easements along 45 miles of the South Platte River from willing farmers as well as restoring these areas in natural vegetation costs a great deal of money. To fund these actions a South Platte River Restoration Fund has been proposed. All citizens along the Front Range from Denver to Fort Collins would be asked to pay an increased water bill (or rent if water is included in your rent) to:*
One, purchase water from farmers to increase water for fish and wildlife from 17% shown in the top pie chart to 42% as shown on the lower pie chart (point to).
Two, to manage the South Platte River as shown in the Increased Ecosystem Services (point to Figure 1) along the 45 miles of the South Platte River shown on the map (point to area). The funds collected can only be used to restore natural vegetation along 45 miles of the South Platte River and purchase water from willing farmers to increase instream flow to improve habitat for six native fish so the are not in danger of extinction.

If the majority of households vote in favor of the South Platte River Restoration Fund the 45 miles of river would look like the Figure Increased Ecosystem Services with increased water quality and fish and wildlife (point to Increased Ecosystem Service—Figure 1).

If a majority vote against, these 45 miles of the South Platte River would remain as they are today, as illustrated in Current Management (Point to Current Management—Figure 2).

If the South Platte River Restoration Fund was on the ballot in the next election and it cost your household $__ each month in a higher water bill would you vote in favor or against?
____I would vote Yes ___I would vote No"

The $__ was randomly filled in with one of 12 dollar amounts ($1,2,3,5,8,10,12,20,30,40,50,100).

STATISTICAL MODEL OF WTP

Given that individuals simply respond with a "yes" or "no" response to a single dollar amount, the probability they would pay a given dollar amount is statistically estimated using a qualitative choice model such as a logit model (Hanemann, 1984).

The basic relationship is:

(1) $\text{Prob (Yes)} = 1-\{1+\exp[B_0 - B_1(\$X)]\}^{-1}$

where B's are coefficients to be estimated using either logit or probit statistical techniques and $X is the dollar amount the household was asked to pay. At a minimum, the coefficients include the bid amount the individual is asked to pay. Additional coefficients may include responses to attitude questions or the respondent's demographic information such as age, education, membership in environmental organizations, etc.

From equation 1, Hanemann (1989) provides a formula to calculate the expected value of

WTP if WTP must be greater than or equal to zero (as is logical for an improvement). The formula is:

(2) Mean WTP = $(1/B_1) * \ln(1+e^{Bo})$

where B_1 is the coefficient estimate on the bid amount and B_o is either the estimated constant (if no other independent variables are included) or the grand constant calculated as the sum of the estimated constant plus the product of the other independent variables times their respective means. Confidence intervals around mean WTP were calculated using the variance-covariance matrix and a simulation approach of Park, et al., (1991).

PILOT SURVEY IMPLEMENTATION

Sufficient funds were available to allow for a pilot test of the survey using in-person interviews of about 100 individuals during the spring and summer of 1998. The sample frame were individuals living in towns nearby or along the portions of the South Platte River under study. From February to July 1998, we mailed 462 introductory letters to households in the South Platte River Basin in the following locations: two suburbs of northern Denver (Thorton and Northglenn), Fort Lupton, Fort Morgan, Greeley, Longmont, and Platteville. Thorton and Northglenn were combined into one location identified as north Denver, since both of these since both of these suburbs are suburbs of Denver. To increase the chances for a completed interview, we reminded the participants with a phone call shortly before the interview. As a result, only five people or 5% failed to show for the interview. The disposition of these mailings is indicated in Table 1.

Table 1 Disposition of Initial Contacts

Category	**Number**	**Percentage**
Letters Mailed	462	100
Moved out of area, Undeliverable	89	19.3
Ineligible due to illness, language	54	11.7
No Answer after repeated calls	87	18.8
Net Sample Size	**232**	
Refusals (e.g., no time, lack of trust, etc.)	131	28.4
No Show	5	5
Accepted & Interviewed	**96**	
Response Rate		**41**

Female and Male

Since the majority of the households are listed in the man's name, if a household listed both the husband's and wife's name, the wife's name was given preference. Even so, 56.5% of the letters mailed went to males. However, we had a slightly higher cooperation rate from females, and giving us a nearly balanced sample of male (52%) and female (48%) respondents.

STATISTICAL RESULTS

A full statistical model including all survey demographic and attitude variables was initially estimated. To conserve space, only the model with independent variables significant at the .05 level or better were retained. Demographic variables such as income, education or age were consistently insignificant and these were not included in the final model.

The final statistical model was:

(3) [log(Yes)/(1-Yes)] = Bo - B1(Bid) - B2(Unlimited Water) +B3(Gov't Purchase) +B4(Environmentalist) - B5(Average Water Bill) + B6(Urban)

where:

Yes : Dependent variable records if a person was or wasn't willing to pay the amount asked during the interview. The number 1 records a yes vote, and 0 records a no vote.

Bid specifies the increase in water bill the person was asked to pay.

Unlimited Water "Do you agree or disagree with the statement 'Farmers should be allowed to use as much water as they are entitled to even if it temporarily dries up portions of streams'?" Agree =1 and Disagree = 0.

Gov't Purchase "Do you agree or disagree with the statement, 'Government purchase of land along the South Platte River to increase fish and wildlife is something I would support'?"Agree=1 and Disagree=0.

Environmentalist Are you a member of a conservation or environmental organization? Yes = 1 and No = 0.

Average Water Bill The average indoor use monthly water bill for each community.

Urban Equals 1 if lives in urban/suburban area, equals zero if live in rural/farm area.

Table 2 presents the final statistical model.

Table 2. Logit Regression Model of Probability Would Pay Increased Water Bill

Variable	Coefficient	T-statistic	Mean
Constant	2.483	1.48	1
Bid Amount ($)	-.144	-4.32***	14.79
Unlimited Water	-1.485	-2.01**	.452
Gov't Purchase	1.846	2.46**	.78
Environmentalist	3.383	2.868***	.189
Average Water Bill	-.063	-2.05**	35.80
Urban	1.803	2.55**	.747
McFadden R^2	.45		

** significant at the .05 level; *** significant at the .01 level.

Interpretation of the Regression Results

Bid The bid is statistically significant at the .01 level. The negative sign denotes that the higher the dollar amount the respondent was asked to pay, the lower the probability that the respondent would vote for restoration of ecosystem services.

Unlimited Water This variable's coefficient is negative indicating those that agreed with the right of farmers to use their entire water right even if it dries up the stream, were less likely to agree to pay for restoration of ecosystem services.

Gov't Purchase Respondents supporting government purchase of land along the Platte River were more likely to vote for a higher water bill to carry out such a program.

Environmentalist Respondents belonging to an environmental group were more likely to agree to pay the higher water bill.

Average Water Bill The negative sign suggests the higher the household's average water bill the more likely they were to vote against an increase in their water bill for this project.

Urban Suburban and Urban residents were more likely to vote in favor of this program than rural or farm residents.

ECONOMIC BENEFIT ESTIMATES

Using the formula in equation (2), mean WTP was calculated at the mean of the other independent variables. The resulting mean monthly willingness to pay per household was $21 per month with a 95% confidence interval of $20.50--$21.65, for the increase in ecosystem services on this 45 mile stretch of the South Platte River. The resulting logit curve is well balanced and does not exhibit any "fat tail" at the high bid amount. This is evidenced by median WTP being $20.72 nearly equal to the mean. This value is about 1.5 times the inflation adjusted value of what Greenley, et al. (1982) estimated for the benefits of improving just water quality in the South Platte River in 1976.

We make two expansions of these benefits to the population of regional households living along the South Platte River. The first treats our mean WTP as the best estimate of what the average household would pay. The second, is a far more conservative estimate that accounts for the 59% of households that did not respond to the survey. The proportion of households that refused to be interviewed regarding the South Platte River are conservatively treated as having zero WTP.

The counties of the cities interviewed were determined to be the pertinent areas to which the preservation benefits pertain. These counties include: Adams, Boulder, Weld, and Morgan. Mean willingness to pay per household was multiplied by the number of households in this area of the South Platte River Basin. To estimate the more conservative lower bound of WTP assuming the proportion of non-responding households had zero WTP, the mean WTP was applied only to the proportion of households that responded to the survey (41%).

Table 3 Annual Benefits per Household and Along the River

Scenario	WTP	# of Households	Monthly (Millions)	Annual
Apply Mean to all Households	$21.06	281,531	$5.93	$71.148
Apply Mean to only Responding Households	$21.06	115,427	$2.43	$29.171

COMPARISON OF BENEFITS AND COSTS OF RESTORING ECOSYSTEM SERVICES

The annual WTP can be compared to the cost of the conservation easements and water rental necessary to deliver the ecosystem management practices in the study area. The U.S. Department of Agriculture's Conservation Reserve Program (CRP) pays farmers to idle their farmland to reduce erosion and improve water quality. Rental rates in northeastern Colorado average $41 per acre (Page and Skold, 1996). Given the 300,000 acres of easements in our ecosystem management scenario, $12.3 million would be required. Since even the conservative estimate of the amount responding households would pay is $29.17 million, households could pay the CRP rental rate to farmers and have $16.87 million remaining annually to rent the 37,820 acre feet of water needed to increase instream flow, dilution of pollution and aquatic habitat as well as pay any one-time on-site restoration costs such as fencing and replanting native vegetation. Brown (1991) shows market transactions for instream flow in California and Nevada that give annual average values of $9.75 (in 1996 dollars) per acre foot. More recently, Landry (1998) summarized annual lease prices of water for instream flow in the west at $30. Using the more recent higher cost of $30 per acre foot, the annual water leasing cost would be $1.13 million per year. Thus total costs would be $13.43 million, about half the conservative estimate of WTP. Thus, up to $15 million per year could be spent for on-site restoration with native vegetation, riparian improvements and fencing. Therefore, it is clear, that willingness to pay of responding households along the South Platte River far exceeds the typical costs of the conservation easement and leasing the water rights. If one were to include all the households living in the entire South Platte River watershed, WTP would exceed the costs by an order of magnitude.

CONCLUSION

Mean willingness to pay to increase five ecosystem services (dilution of wastewater, natural purification of water, erosion control, habitat for fish and wildlife, and recreation) along 45 miles of the South Platte River was $21 per month in a higher water bill. When the $21 is generalized to households living along the river, this is sufficient to pay for the conservation easements on agricultural land along the river and the leasing of water for instream flow. Thus, the policy to increase ecosystem services meets the economic efficiency criteria that the gaining public could compensate the farmers and ranchers for the conservation easement and water and still come out ahead.

Areas for further improvement include systematically varying the number of ecosystem services to be valued and the level of each ecosystem service to be provided. This can be done using multiple scenarios within a contingent valuation survey or through the use of contingent choice or conjoint analysis (Adamowicz, et al, 1998). In this way the incremental value of specific ecosystem services could be valued and compared to the cost of providing that ecosystem service or higher level of ecosystem service.

References

Adamowicz, W., P.Boxall, M. Williams, J. Louviere. 1997. Stated Preference Approaches For Measuring Pasive Use Values: Choice Experiments and Contingent Valuation. 4th Annual Canadian Resources and Environmental Economics Workshop.

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

Barrens, R.. P. Ganderton and C. Silva. 1996. Valuing the Protection of Minimum Instream Flows in New Mexico. Journal of Agricultural and Resource Economics, 21(2): 294-309.

Bromley, D. 1997. Constitutional Political Economy: Property Claims in a Dynamic World. Contemporary Economic Policy 15:43-54.

Brookshire, D., M. Thayer, W. Schulze and R. d'Arge. 1982. Valuing Public Goods: A Comparison of the Survey and Hedonic Approaches. American Economic Review 72(1): 165-177.

Brown, T., P. Champ, R. Bishop, D. McCollum. 1996. Which Response Format Reveals the Truth About Donations to a Public Goods. Land Economics 72(2):152-166.

Brown, T. 1991. Water for Wilderness Areas: Instream Flow Needs, Protection and Economic Value. Rivers 2(4):311-325.

Carson, Richard, Nicholas Flores, Kerry Martin and Jennifer Wright. 1996. Contingent Valuation and Revealed Preference Methodologies: Comparing Estimates for Quasi-Public Goods. Land Economics 72(1):80-99.

Carson, Richard and 9 others. 1997. Temporal Reliability of Estimates from Contingent Valuation. Land Economics 73(2):151-163.

Champ, P., R. Bishop, T. Brown and D. McCollum. 1997. Using Donation Mechanisms to Value Nonuse Benefits from Public Goods. Journal of Environmental Economics and Management 33(2):151-162.

Costanza, R. 1981. Embodied Energy, Energy Analysis and Economics. In: Daly, H.E., Umana, A.F., (eds). Energy, Economics and the Environment: Conflicting Views of an Essential Relationship. AAAS Selected Symposium No. 64. Westview Press, Boulder, CO. pp119-145.

Costanza, R., et al. 1997. The Value of the Worlds Ecosystem Services and Natural Capital. Nature 387:253-260. (reprinted in Ecological Economics 25(1):3-15).

Costanza, R., et al., 1998. The Value of Ecosystem Services: Putting the Issues in Perspective. Ecological Economics 25(1):67-72.

Daley, Gretchen. 1997. Nature's Services: Societal Dependence on Natural Ecosystems. Island Press, Covelo, CA.

El Serafy, Salah. 1998. Pricing the Invaluable. Ecological Economics 25(1): 25-27.

Freeman, Myrick. 1993. The Measurement of Environmental and Resource Values: Theory and Practice. Washington DC. Resources for the Future.

Greenley, D., R. Walsh and R. Young. 1982. Economic Benefits of Improved Water Quality: Public Perceptions and Preservation Values. Westview Press, Boulder, CO.

Hanemann, M. 1984. Welfare Evaluations in Contingent Valuation Experiments with Discrete Responses. American Journal of Agricultural Economics 67(3):332-41.

Hanemann, M. 1989. Welfare Evaluations in Contingent Valuation Experiments with Discrete Response Data: Reply. American Journal of Agricultural Economics 71(4):1057-1061.

Hoehn, John and Alan Randall. 1989. Too Many Proposals Pass the Benefit-Cost Test. American Economic Review 79:544-551.

Krutilla, John. 1967. Conservation Reconsidered. American Economic Review 57:787-796.

Landry, Clay. 1998. Saving Our Streams Through Water Markets. Political Economy Research Center, Bozeman, MT.

Loomis, J. 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.

Loomis, John and Douglas White. 1996. Economic Benefits of Rare and Endangered Species. Ecological Economics 18: 197-206.

Loomis, John and Richard Walsh. 1997. Recreation Economic Decisions, 2nd. Ed. Venture Press, State College, PA.

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

Moore, Walter and Bruce McCarl. 1987. Off-Site Costs of Soil Erosion: A Case Study of the Willamette Valley. *Western Journal of Agricultural Economics* 12(1):42-49.

Odum, H.T. 1983. Systems Ecology: An Introduction. Wiley, New York.

Page, S. and M. Skold. 1996. Crop Prices and CRP Participation—Some Analyses for Northeastern Colorado. Agricultural and Resource Policy Report, Dept of Agricultural and Resource Economics, Colorado State University, Fort Collins, CO.

Park, Timothy, John Loomis and Michael Creel. 1991. Confidence Intervals for Evaluating Benefit Estimates from Dichotomous Choice Contingent Valuation Studies. Land Economics 67(1): 64-73.

Strange, Elizabeth , Kurt Fausch and Alan Covich. in press. Sustaining Ecosystem Services in Human Dominated Watersheds: Biohydrology and Ecosystem Processes in South Platte River Basin. *Environmental Management*

Streiner, Carol and John Loomis. 1996. Estimating the Benefits of Urban Stream Restoration Using the Hedonic Price Method. Rivers 5(4):267-278.

Toman, Michael. 1998. Why Not to Calculate the Value of the World's Ecosystem Services and Natural Capital. Ecological Economics 25(1):57-60.

U.S. Department of Interior. Natural Resource Damage Assessments; Final Rule. Federal Register 51 (148). Washington DC. 1986.

U.S. Department of Interior. Natural Resource Damage Assessments; Final Rule. Federal Register 59(58). Washington DC. 1994.

U.S. National and Oceanic and Atmospheric Administration. Oil Pollution Act Damage Assessments; Final Rule. Federal Register 61. January 5, 1996.

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

Numbers, Values, and Decisions: Using Constructed Preference Approaches to Value Watershed Management Policies

--WORKING PAPER*--

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* This is a working paper developed for the US Environmental Protection Agency Office of Economy and Environment, Office of Research and Development and Region 10, for their workshop, "Economic Policy and Research Concerning Water Use and Watershed Management," held on April 21-22, 1999, at the Crowne Plaza Hotel in Seattle, Washington.

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Prepared for the EPA workshop, "Economic Research and Policy Concerning Water Use and Watershed Management," Seattle, April 1999.

A. Introduction

Researchers interested in how people assign values in the context of environmental choices often end up shaking their heads in frustration at the messiness of the venture. The challenges are numerous: identifying the relevant stakeholder groups without omitting any significant parties; defining a manageable set of issues and understanding enough of the relevant context and science to ask meaningful questions of participants; establishing the key dimensions of the problem; deciding whether to work with small groups or large, a random survey or clustered sample; determining how tradeoffs should be addressed, whether in monetary or other units; establishing an appropriate time frame; and speaking effectively to multiple audiences, including interested public and expert and government listeners or readers. The prescriptive basis for addressing any of these issues is often weak and generally controversial, with a variety of approaches in widespread use and few experiments that direct compare alternative methods.

A constructed preference approach to evaluating watershed management policies acknowledges many of these sources of frustration. It is based on insights from cognitive psychology, behavioral economics, and multiattribute utility analysis and, in essence, makes the point that the process of assigning values to the multiple dimensions of many environmental policies is a novel and difficult task that requires help (Gregory, Lichtenstein & Slovic, 1993). Because these values typically are not known a priori, participants in a survey or group are thought to work with available cues and signals to construct a value (Payne, Bettman, & Johnson, 1992). These cues and signals include factual information about the item, the values placed on similar goods, the scale or metric being used for the valuation, and the social and historical context within which the valuation takes place.

A careful construction process should increase the validity of a response; in particular, consideration of the multiple dimensions of a proposed action should improve the fit between the good being valued (by an individual) and the good thought to be under consideration (by policymakers). Careful construction also should decrease the influence of the embedding effect and other judgmental biases, although the success of the construction process will vary across survey or group participants. The perceived precision of a constructed response also will vary across participants; some will think that they can express their value(s) closely, whereas others (more critical of the construction process, or simply less sure of what they believe) will interpret their own response as only a vague estimate or subject to substantial error.

This variation in the precision of responses matters to analysts, because some circumstances call for ballpark estimates of value (either quantitative or qualitative) that can support a defensible decision process whereas others require quite precise numbers to support a more exact evaluation (Gregory et al, 1995). In the former, ballpark category I'd place suggested actions that have significant nonmonetary impacts (e.g., cultural and affective dimensions) as well as those that are either clear winners (i.e., high benefits to costs ratio) or clear losers. In the latter category, I'd place actions that compete closely with other alternatives or ones that have strong support but imply irreversible consequences (e.g., significant increases in the probability of extinction of a species). In general, I believe that the usual economic methods for estimating willingness to pay (including contingent valuation methods) fail to provide a level of precision in value estimates that is sufficient to be much help to the decisions faced by policy makers. In many cases, the resulting number may only be indicative of a general attitude rather than an economic value (as suggested in recent studies such as Ritov and Kahneman, 1994). In these situations, I believe that an explicitly constructive approach can help to refine participants' expressions of preference and thereby increase the usefulness of study results for policy development.

B. Case-study Examples

Consider a hydroelectric water-licensing project on the Alouette River in southern British Columbia, where in 1996 I co-led an expert-public stakeholder Management Committee (with Tim McDaniels). Higher water flows and a more natural hydrologic regime meant better fish habitat and improved recreational opportunities, but also lower electric power production and altered flood risks. Our task was to facilitate a multi-stakeholder committee of about 20 representatives, to consider the pros and cons of alternative water flows across a broad range of impact categories, and to make flow recommendations to the local utility. For some of the actions under consideration, there was no reason to conduct detailed quantitative analyses across impact categories because they were either clear winners (e.g., occasional "flushing flows" to aid salmon habitat) or clear losers (e.g., removing the dam, which would imperil neighboring residents). Stated differently, the values of stakeholders led to a clear decision even though the associated numbers were vague. For other actions, the group quickly focused on consideration of a range of options (e.g., desired water flows of 70 - 100 cfs) but required detailed quantitative analyses to aid in distinguishing the distribution of anticipated benefits, costs, and uncertainties. For these cases, impacts were considered across the five value categories using simplified objectives by alternative matrices, which simultaneously organized the available information on the pros and cons of competing alternatives and served as a reference for coming up with suggestions for mitigation and compensation (McDaniels, Gregory & Fields, in press).

Although it would have been possible to calculate the relative utility of these alternatives, the decision process adopted by the Management Committee instead led to decisions being made on the basis of explicit tradeoffs across key objectives: questions, for example, of the type "Is it worthwhile to decrease electricity production by X mw/year in order to increase salmon production by Y fish/year." Quantitative (including monetary) values were used to help in making these comparisons but only to the extent necessary; power production effects were closely modelled but, for other value dimensions, broad distributions were often sufficient

because at either end of the anticipated impact range the same decision was clearly preferred. Thus, time and money was spent in structuring the decision and in identifying the various impact categories rather than in coming up with more precise numbers to feed into a larger analysis.

A similar approach was used to assist the National Estuary Program in Tillamook Bay, Oregon to develop a community-supported estuary protection plan. In this project (co-led with Katharine Wellman of Battelle Memorial Institute), the focus was again to find a way for local residents and technical experts to consider the multiple components of value that would be affected if any of a set of alternative actions were undertaken. The focus of our project was to evaluate several key consequences of actions proposed in the draft Comprehensive Coastal Management Plan (CCMP) in terms of their associated costs and benefits. This required the use of standard tools of economic and ecological impact analysis as well as the development of new, constructive methods for estimating tradeoffs across multiple components of value. In addition, new approaches were developed for encouraging the broad-based participation of community residents, along with key local and state agencies, in the development and assessment of priority NEP actions. These efforts included a series of structured interviews to help estimate the values placed by community stakeholders on water quality and habitat improvements and, linked to these, the intensity of action (e.g., the amount of resources allocated to an action, or the designated time frame) desired for specific proposed CCMP initiatives.

In some cases, the values information provided by our study is expressed as a dollar measure in terms of social willingness to pay (e.g., is this action viewed as a good use of society's scarce funds, resulting in additional state and/or federal taxes?). In other cases, values are reported in terms of the tradeoffs that participants are willing to make or in terms of the preferences that are implied by their choices. When designing the evaluation tasks, we therefore supplemented the use of dollar-based questions with pair-wise choices and, at other times, asked participants to assign points to each of two or more competing options. As shown in Figure 1, a branching pattern of questions was used to permit participants to address tradeoffs and levels of intensity in the course of considering their responses. Particularly when watershed management policy initiatives involve a mix of economic, environmental, and social/cultural impacts, we believe the quality of information that can be provided by the direct choices and preference judgments of participants often will be higher than if individuals are required to undertake the additional step of translating expressed values into a monetary measure of worth.

A mixture of small-group input, expert interviews, and literature sources were consulted in designing the evaluation tasks. Based on the results of an initial prioritization exercise, we selected three of the most significant and controversial actions proposed by the Tillamook Bay National Estuary Program (TBNEP) for inclusion in an evaluation workbook:

- protecting and restoring tidal wetlands
- limiting livestock access to steams
- upgrading forest-management roads

The final format for each of the actions used a matrix and identifying logos to present the tradeoffs implied by each alternative in terms of three benefits and two costs. Two different levels of intensity were shown for each of these three actions. This focus on options is due in part to the critical nature of decisions about timing and scale for estimating the consequences of actions and, in part, reflects extensive research in judgment and decision making which shows that the quality of a choice typically is improved to the extent that alternatives are offered. Additional questions asked participants to review the proposed plans after further changes had been made and to provide suggestions for desired future communication about, and input to, decisions of this type.

Eight groups were held over the course of two days in mid-January, 1999. A total of 89 people took part in these groups, with 79 surveys (89%) completed and analyzed. Although the number of participants involved in this experimental study is obviously much smaller than the number typically involved in a CV survey, we believe that the care taken in value construction and the additional depth of valuation insight has the potential to result in more useful results. In the Tillamook Bay example, each group was led by a local facilitator, with one member of the project team and one member of the TBNEP staff on hand to answer questions. A one-page information sheet, prepared by the locally-based Performance Partnership, was passed out and discussed briefly at the start of the session to give participants an initial, shared perspective on local environmental and economic issues.

Restore Tidal Wetlands

These results have important implications for the design of the TBNEP initiatives. First, they suggest that linking restoration of tidal wetlands to floodwater storage is likely to increase public acceptance of proposed expenditures (e.g., for the purchase of marginal farmland and the conversion of this acreage to wetlands). Second, they suggest a local willingness-to-pay for these improvements that is quite high, supportive of payments on the order of at least $3 - 5,000 per acre. The upper end of this value is approximately equivalent to the price of medium-quality farmland in Tillamook County (based on an estimated annual value for the services provided by moderate-quality pasture lands of about $500/acre, or -- when capitalized at an interest rate of 10% -- roughly $5,000 per acre), and suggests that the restoration of former (and now degraded) wetlands may be a popular initiative at a scale well beyond the 750 acres of marginal farmland planned for in the current high-intensity Plan B.[1]

[1] There exists an important caveat to this statement: Historically, both the image and economic prosperity of Tillamook County are so closely tied to a healthy dairy industry that proposed reductions in the amount of available pasture land that were sufficiently large so as to threaten the continued well-being of dairy farming would probably be met with vocal and strong resistance.

Limit livestock access to streams
This action is the most controversial of the three key actions under consideration, as demonstrated by the close results between participants selecting the "fencing + 15-foot riparian buffer" lower-intensity plan (13 of 28) and those selecting the "fencing + 50 foot" higher-intensity plan (15 of 28).[2] Both plans are shown to improve the image of the dairy industry significantly. Even though the anticipated expenses to farmers and local agencies could be large (since only 50% of costs are shown to be covered through grants and offsets), answers to the workbook questions reveal that the primary concern was the loss of farmland: a large reduction (from $6.0 to $4.5 million) in the financial costs of the higher-intensity plan had no effect on participants' choice of plans, whereas a 90% reduction in the loss of productive farmland (from 3,000 to 300 acres) resulted in a substantial increase in the number of participants choosing the wider buffer width. Thus, so long as land losses can be kept to a minimum, these results suggest that a strong majority of local residents (14/17 participants in these groups, or 82%) would support the use of substantial public funds (as much as $1.2 million for each of 5 years) as part of a plan to build new fencing and to plant 100-foot (counting both stream sides) riparian buffers.

Upgrade forest management roads
Over two-thirds of respondents (8/11) in this group chose the higher-intensity Plan B option, implying that they support payments of $7 million per year to improve water quality, increase fish passage, and reduce the risks of flooding in lowland areas. When Plan A was improved to include either additional reductions in sediment delivered to streams or higher levels of fish survival, only one person switched their choice. Thus, the majority of participants believe the proposed reductions in sedimentation and increases in fish survival are worth the substantially higher cost of Plan B (an additional $3.8 million per year for each of ten years), which suggests a high level of support among local residents for an enhanced forest road-improvement program.

With modest changes in the instructions and background information provided at the start of the workbook, it would be appropriate to consider obtaining information of this type using a mail survey format rather than the group-based evaluation effort that is reported here. This extension would improve the accuracy of the results and provide for further insights due to the inclusion of additional proposed actions as well as further questions concerning the specific tradeoffs and choices that local citizens are wanting to make in the course of shaping the environmental, social, and economic future of the Tillamook Bay watershed.

C. Research Issues
These examples provide the basis for both a theoretical and a practical argument in support of approaches to evaluating watershed management policies that recognize preference construction. The theoretical argument is that dollar-scaled attributes involved in the decision (as measured by

[2] As explained during the group discussions, these buffer widths refer to only one side of the stream whereas work would be done on both sides; thus, 500 miles of fencing with a 50 foot buffer would translate to 250 miles of fencing on both sides of the stream and a total of 100 feet (50 feet on both sides) removed from pasture land or other current uses.

willingess-to-pay) form only one of several, simultaneously valued components of well-being. Asking community residents to collapse these other values into dollar terms is too heroic a task; as Paul Slovic and colleagues noted in the context of selecting a nuclear repository site, we would be "asking them to tell more than they can know" (Slovic et. al, 1991). The practical argument is that, in the context of this type of social/ecological/economic decision, no survey asking for willingness to pay responses alone would make sense to local citizens (or, in these situations, be permitted by community leaders). Thus, a constructive multi-attribute approach is required to integrate the environmental valuation process with community-based participation.

Would more precise numerical information on benefits or costs help these evaluation exercises? Perhaps, but I expect only a little. The real stumbling blocks are more the framing of the valuation and decision contexts and finding ways to encourage broad-based and informed debate among local citizens about the multidimensional impacts of the actions under consideration.

Despite this overall endorsement of the approach, many questions still remain concerning the application of constructed preference approaches. One of the more interesting issues has to do with selection of either a choice or pricing mode for value construction. If the evaluation question considers different levels of an action (e.g., different levels of stream clean-up), then typically an individual will invoke a set of similar alternatives whose major differences will be at the margin, expressed in terms of peripheral or secondary alternatives. If an action is instead considered in contrast to other, unlike items (e.g., spending money on stream clean-up versus keeping the money for personal use), then the evaluation task is more likely to focus on prominent or central attributes of the choice. For many environmental assets, this latter framing or mode of construction -- emphasizing choice rather than a direct evaluation of worth -- may result in the assignment of a significantly higher value because it emphasizes the more attractive attributes of the environmental alternative (e.g., its ethical foundations or the provision of benefits for future generations). People may want the things they personally can buy but think that they ought to prefer the public good, so the weight of the arguments favoring the environmental option will increase when a choice is required. Although laboratory results on this topic are quite compelling, I haven't yet seen any tests of this hypothesis from community participants involved in real environmental decisions.

Another issue has to do with the time frame for the analysis, since people are being asked now to make choices about the future (in Tillamook, for example, our valuation efforts follow closely a separate community survey to "vision" alternative futures for the region). This requires guesses about the future consequences of present actions, but it also requires (as noted by March, 1978) making guesses about future preferences for these consequences. If this element of additional uncertainty is brought explicitly into the preference construction process, experience suggests that individuals are more likely to adopt a precautionary (risk-averse) attitude. In part, this is due to the heightened salience of responsibility costs: people feel worse about a negative outcome they have had a part in choosing than if it simply occurs. In addition, the act of making uncertainty about future preferences explicit appears to have the result of making the future more

real, which could lower an individual's discount rate or change what a person wants to know and value regarding the range of possible future consequences. I know of very little research about how explicit preference construction affects inter-temporal choices, but I think that the topic is important.

D. Conclusion

In conclusion, I am struck by the complexity of many of the environmental decisions we typically ask individuals to make and the lack of training or insight they are given in how to make these decisions responsibly. The fact that we can obtain a number and attach it to a valuation priority -- $30 for an individual's extra day of freshwater fishing, or $3 million for a community's efforts to clean up a polluted estuary -- means little if the stated context for the decision is either poorly understood or inappropriate. In most cases, I believe that the complexity of the environmental valuation tasks requires a deliberate, thoughtful process of value construction across multiple dimensions and across multiple metrics in order to help individuals arrive at an informed decision.

This comment, however, raises a final issue, which is how little I believe we know about what constitutes a sufficiently "well-formed" value. I might decide to lead a group of stakeholders through a preference construction exercise, asking them to delineate and measure value attributes and even to assign these components priorities (i.e., weights) in the context of the decision at hand, in hopes that their environmental choice will benefit from a "well-formed" expression of value. But who is to say that this value is well-formed? What criteria exist for measuring the progress that has been made on defining the participants' values? Payne, Bettman, and Schkade (in press) have made a start in asking questions such as this, following the analogy of developing a "building code" for the construction of values. But it is only a start.

Currently, I'm wondering whether the universe of values important for watershed management policy decisions might not be divided into two parts. The first is composed of all those things that we assign values to on the basis of readily at-hand cues and social discourse. The second is composed of those things that are fundamental to who we are and to our sense of well-being. It may that that the first set of values can be constructed more or less well but they always will be susceptible to alternative framings; given the informational equivalent of a minor earthquake, these constructed values will either shake a whole lot or fall over. The second set of values may in fact be very solid and may survive the cognitive earthquake with no problem. If this is true, perhaps we want to focus more of our evaluation efforts on understanding and correctly eliciting this second, "bedrock" category of values, so that they can be more fully represented in watershed management policy decisions.

References

Gregory, R., Lichtenstein, S. & Slovic, P. (1993). Valuing environmental resources: A constructive approach. *Journal of Risk and Uncertainty* 7: 177-197.

Gregory. R., Flynn, J., Johnson, S., Satterfield, T., Slovic, P. & Wagner, R. (1997). Decision pathway surveys: A tool for resource managers. *Land Economics* 73: 240-254.

March, J. (1978). Bounded Rationality, Ambiguity, and the Engineering of Choice. *Bell Journal of Economics*, 587-608.

McDaniels, T., Gregory, R., & Fields, D. (In press). Democratizing risk management: Successful public involvement in local water management decisions. *Risk Analysis.*

Payne, J., Bettman, J. & Johnson, E. (1992). Behavioral decision research: A constructive processing perspective. *Annual Review of Psychology* 43: 87-131.

Payne, J., Bettman, J. & Schkade, D. (In press). Measuring Preferences in a Constructive World: Towards a Building Code. *Journal of Risk and Uncertainty*.

Ritov, I. & Kahneman, D. (1997). How People Value the Environment: Attitudes versus Economic Values. In *Environment, Ethics, and Behavior: The Psychology of Environmental Valuation and Degradation*. Eds. M. Bazerman, D. Messick, A. Tenbrunsel & W. Wade-Benzoni. New Lexington Press, San Francisco.

Slovic, P. et. al. (1991). Perceived Risk , Stigma, and Potential Economic Impacts of a High-Level Nuclear Waste Repository in Nevada. *Risk Analysis*, 683-696.

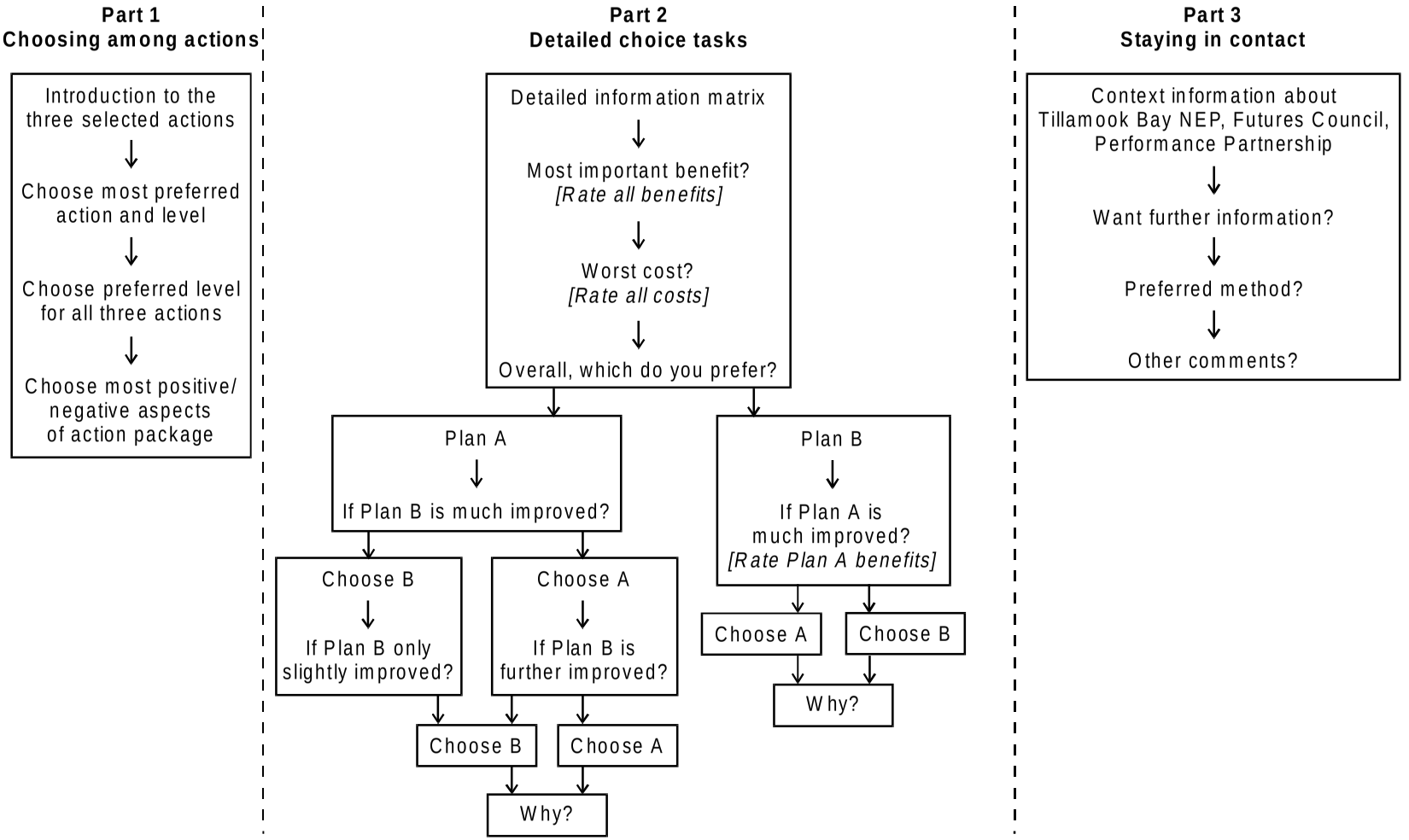

Figure 1. Flowchart for Tillamook Evaluation Workbooks.

Alternatives to Traditional CVM in Environmental Valuation: Applied Research Challenges

--WORKING PAPER*--

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* This is a working paper developed for the US Environmental Protection Agency Office of Economy and Environment, Office of Research and Development and Region 10, for their workshop, "Economic Policy and Research Concerning Water Use and Watershed Management," held on April 21-22, 1999, at the Crowne Plaza Hotel in Seattle, Washington.

Alternatives to Traditional CVM in Environmental Valuation: Applied Research Challenges

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September 17, 1998

Alternatives to the contingent valuation methodology (CVM) to determine the value of natural resources and resource services (especially passive uses) have become more prevalent in applied research in the last three years. Referred to as stated preference methods by some, these models take the form of ratings, rankings, and stated choice. Conjoint analysis, multi-attribute utility theory (MAUT), and attribute based stated choice methods have all been suggested to be superior in one way or another to the more traditional CVM.

From an applied perspective, the taxonomy of alternatives to traditional CVM in environmental valuation shouldn't really matter. These alternative direct elicitation methods should not be viewed as substitutes for CVM or one-another, or competing in terms of their position in the hierarchy of "acceptable" economic practice. Rather, I believe they should be viewed as complementary. Traditional CVM and its alternatives are all based in utility theory and they all involve ordinal and or cardinal rankings. The primary difference at hand is that each method asks respondents to perform a different task. In this light it is important to consider combining methods or choosing the appropriate method depending on the ends one wishes to achieve and the makeup of the group (general population, agency, firm, etc.) whose values are being assessed. The choice of a specific approach should depend on whether one is engaged in policy making, planning, natural resource damage assessment, public involvement, decision making under uncertainty or some combination of the above. For example, under current regulation, CVM is the method accepted in courts of law for the measurement of passive use values in damage assessment cases. While variations to the approach are expected, few lawyers will accept value estimates from an economist that strays far from CVM guidance outlined under the OPA rule. On the other hand, if the goal of some applied research is to involve multiple stakeholders in the prioritization of actions to be included in a watershed management plan, then a pairwise-choice or decision analytic approach may be more appropriate.

What factors come into play in the choice of method(s) to apply in a particular circumstance? Three candidates are outlined below:

- Level of respondent's familiarity with the good or service they are being asked to value.

  Traditional applications of CVM have included the assessment of values for such goods and services as scenic views, marine mammals, and recreational fishing – all fairly specific and relatively well understood. Current applications involve broader questions of ecological functions and services, environmental restoration policies, and conservation and management plans – complex goods with which people are less familiar.

  This factor is one that will not go away with choice of valuation approach.

- Level of Heterogeneity of the Population.

  When dealing with complex environmental issues that involve multiple stakeholders, average willingness to pay estimates across a population may not provide sufficient information to decision-makers who must respond to equity issues and to shifting values based on conflicting objectives and preferences.

  Constructed preference or multi-attribute/decision analytic approaches can offer valuable information about the context of, and reasoning behind, individual values.

- Level of Decision-Makers' and Community Members' Comfort with Researchers "From Away".

  There exists an inevitable tension between local communities' desire for increased participation in resource management decision-making and their frequent need for "outside expertise". Decision-makers and community members involved in complex environmental management issues may be leery of individuals purporting to be able to "help" them deal with difficult decisions. Suspicion or concern may arise as a result of the insider versus outsider or expert versus lay difference in perspectives. In addition, local decision-makers and community members may be concerned about the potential imposition of the outside researcher's values driving the decision process.

  Any approach that distances the researcher from the community (such as a standard telephone or mail CVM survey and analysis) will eliminate this issue, at the expense, however, of valuable information about community objectives, opinions, and values.

Familiarity with the good or level of information has received a great deal of attention in the theoretical and applied literature. The other two factors, heterogeneity of the population and discomfort with researchers, however, have not received much research attention, especially in the context of attempts to involve multiple stakeholders in complex decision-making concerning natural resources.

I wish to illustrate these considerations in choosing a method for environmental valuation using a current case study, the Tillamook Bay Estuary in Oregon State.

Tillamook Bay is located in northwestern Oregon, tucked between the rugged Coastal Range and the Pacific Ocean. It is subject to high rainfalls during the winter months and mild temperatures throughout the year. It supports diverse living resources, including shellfish, runs of salmon and trout, groundfish, and numerous bird species. It is integral to the local and regional economies that are largely based on natural resources, including forestry, agriculture (dairy farming), tourism/recreation, and commercial fishing.

Tillamook Bay, however, suffers from several environmental problems including (1) critical habitat degradation, affecting salmon spawning, increasing stream temperatures, and contributing to bay sedimentation, (2) pathogen contamination affecting shellfish and water-contact uses, and (3) excessive sedimentation in the bay and tributaries affecting fresh and saltwater flows and

living resources. With the support of Governor Roberts in 1992, the U.S. Environmental Protection Agency designated the Tillamook Bay as an estuary of national significance and included it in the National Estuary Program (NEP). As part of the NEP, the Tillamook Bay National Estuary Project (TBNEP) is in the process of developing a Comprehensive Conservation and Management Plan (CCMP) to protect the ecological integrity of the estuary. To achieve this objective the TBNEP has convened a Management Conference, consisting of citizen and government agency stakeholders, that has characterized the estuary, defined priority problems, and is now outlining solutions (actions) in the CCMP.

The goals of the TBNEP are: (1) to achieve water quality standards to protect beneficial uses of the bay; (2) protect and enhance anadromous fish habitats; (3) restore the bay from impacts of sedimentation; (4) develop a comprehensive plan for Tillamook County's economically important industries, while improving and maintaining water quality and living resources; and (5) apply lessons learned there to other Northwest estuaries.

Robin Gregory and I were asked to assist the project in identifying stakeholder (public and expert) values for the Tillamook estuary area, linking these values to specific resource-management actions and ultimately assisting in the prioritization of actions to be included in the TBNEP CCMP. Our strategy has involved a combination of multi-attribute utility theory and decision analytic approaches to identify underlying objectives, define a small set of key CCMP action alternatives, and design and implement a value integration instrument to elicit and compare stakeholder tradeoffs and values relating to these action alternatives. Our goals are: (1) to inform decision-makers of key tradeoffs across conflicting objectives; (2) to estimate numerical values for water quality and habitat improvements in Tillamook Bay; and (3) to lay the foundation for continuing and expanding dialogue among key user groups.

In conducting our work we have faced several challenges. First, the demographic characteristics of the Tillamook Bay area are varied. While natural resource based industries (dairy farming, forestry, and commercial fishing) have driven past socio-demographic trends, in recent years other income sources have substantially affected job growth and the subsequent demographic make-up of the Tillamook Bay community. For example, the number of retirees whose incomes are not dependent on local industries has risen, and tourists or vacationers have become an increasingly important part of the seasonal population and revenue base. There are significant differences, in terms of values and beliefs that define the social and political structure of the area. Clearly, this high degree of heterogeneity of the population makes any decision-making process more complicated and difficult. Our work, accepted as credible and important by some, is viewed as confusing, unnecessary and intrusive by others. We have had to deal with posturing on the part of various stakeholder groups (as opposed to fruitful conversations or interactions) and varying degrees of skepticism and outright hostility; in some cases, discussions about management actions have been cut short by politically induced fears.

A relatively more straightforward mail or telephone CVM approach might have avoided some of these interpersonal conflicts. However, in using such an approach we would not have learned all that we did in terms of individual objectives, how those objectives link to acceptable actions or how the actions link to alternatives, and in general, the fundamental rationale for the tradeoffs expressed. The latter information is all critical to managers (especially those operating in small,

close-knit communities) faced with making decisions that affect a variety of groups in a variety of different ways. No CCMP is likely to be unanimously accepted by all members of the community. On the other hand, if community members are not allowed to be involved in the decision process, it is also clear that any efforts to implement the plan will be fruitless. The result of our approach, however, should be better-informed public citizens and a process that more fully incorporates their views and concerns.

Although a broad cross-section of the community was willing to share ideas, deeply held beliefs, and opinions with each other and with us early in the process, as we moved closer to the actual value elicitation part of the project there developed a clear lack of trust within the community in researchers "from away". Resistance to involvement from outside the Tillamook community was present across all stakeholder groups. There was concern about the amount of time that we, as researchers, were willing to spend on site, and stated desire for local participation or local community member involvement in the implementation phases of our work. In general, it was felt that it was costly to educate researchers from away about local politics, issues and concerns, and participants were wary that the information they provided would be used to make decisions rather than (as promised) to provide insights. This response is understandable. In rural resource-based communities of the Pacific Northwest change has been constant, and generally perceived as negative for the past 15-25 years. Industries have declined, decisions have been made in state capitals and Washington, D.C., and people and ecosystems have suffered. For some stakeholders, our offer of a "place at the table" is seen as too little and as coming too late, feelings that are exacerbated by the need for facing up to tough choices as part of the analysis of plan actions.

A MAUT process can help clarify the values of participating stakeholders and how these relate to action alternatives, allowing affected groups to discuss a broader set of policy options. Community reaction to our work, however, is different than that experienced in corporate or agency settings. This suggests, in part, that the successful application of MAUT/decision process approaches may be situation specific and depend in large part on social and cultural receptivity. Another necessary ingredient to transfer MAUT-based approaches (as an alternative to traditional CVM) to small communities is the leadership of a trusted local group with ties to many parts of the community, and an open and scientific process for collecting information about the consequences of specific policies and decisions. It is critical that the local group has a broad, interdisciplinary understanding of research and decision-making methods and information being used and trusts the process. We had assumed that the TBNEP was that trusted leader, but learned otherwise, eventually recognizing that members of the TBNEP were considered as much outsiders as ourselves. As a result, we recently have begun to coordinate more closely with a respected local group known as the Tillamook Futures Council. Taken as a whole, this 3-way combination of consultant analysis, NEP staff, and the Futures Council link to the community, may result in the elicitation of defensible estimates of public preferences for resource management alternatives, our ultimate goal. We will know more about the outcome of this approach by later this fall.

Discussion of Loomis paper

by Dr. Linda Fernandez, University of California at Santa Barbara

The study offers an important contribution to valuing ecosystems. It is useful to review the quality of the work according to the six fundamental components of a contingent valuation (CV) survey developed by Michael Hanemann.

1) Description of the change (increase) in environmental goods from the proposed ecosystem restoration action. The study makes use of visual aids to help depict ecosystem services under the two scenarios described: (a) the current case with degraded ecosystem services and (b) the natural, healthy ecoystem services from restoration efforts. It would be useful to add more incremental changes to the scenarios that distinguish between different levels of different services (water purification, fish biomass) in order to derive existence values separate from use values and indirect use values. The visual aids and description lend towards the goods bundled into only two levels of the ecosystem, degraded and not degraded. With more levels and distinction between the different services it is possible to distinguish between values and avoid the embedding problem. The description of the management actions to restore the ecosystem is clear and tangible for respondents to understand.

2) Clear means of eliciting value. The survey used in the study presents a plausible payment scheme represented by an increase in the public water bill to all residents. It would be helpful to provide more detail in terms of whether the increase would be a higher fixed amount or tiered and/or block rate pricing. The survey conveys neutrality by explaining various stakeholders and effects (agricultural use, urban water users, instram habitat). It is not likely that there is starting point bias in terms of the range of values for payment to implement the management actions for restoration.

3) Survey Administration. The researchers use a combination of mail, in person, and telephone forms of communicating with respondents to insure the maximum participation for the survey. This is good from the standpoint of maximizing participation.

4) Sample Design. It appears that there is an effort to select a random sample of people to participate in the survey. It would be helpful to provide actual details of the randomness in the sample. What kind of procedure was actually used to select the random sample? Were they stratified or clustered random samples?

5) Experimental Design. The logit model is valid and the variables chosen are useful to account for variation amongst the respondents. It would be helpful to find out more details of possible correlations between key variables. For example, the correlation between the rural dwellers and those respondents favoring unlimited water use by the agricultural sector could be influential. Why not retain the variables of income, education and age instead of dropping them from the model? These seem like they should be included and discussed for interpreting different types of responses. It would be useful to include summary statistics about the respondents.

6) Estimation of Willingness to Pay. The treatment of the non-response data as a value of zero for willingness to pay does not add much to the study so it is probably not worth including. The

comparison of the annual willingness to pay with costs of conservation easements and water diversion purchase is useful for gauging the economic efficiency of policies by a cost/benefit analysis. There is a positive consumer surplus for the public in compensating farmers for conservation easement and water. It would be useful for the study to include some discussion of any substitution effects related to other sites as substitutes for the stretch of the river that the study focuses on.

In summary, the study is useful and well executed. The paper needs to include some details about the components of the contingent valuation components.

Discussion of Gregory paper

by Dr. Patricia Koss, Portland State University

Numbers, Values, and Decisions: Using Constructed Preference Approaches to Value Watershed Management Policies: Comments

This paper primarily discusses the advantages of a constructed preference approach over a willingness to pay approach to estimating valuation. It is asserted that by explicitly asking individuals to make pair-wise comparisons across the multiple attributes of a product, we are more likely to arrive at a much more refined preference ordering than that supplied by a willingness-to-pay study. This is, of course, likely to be the case, but is not surprising since the ***objective*** of a willingness-to-pay study is ***not*** a preference ordering, but a monetary measure of value. These approaches should not be viewed as substitutes for one another. Indeed, it may be appropriate, as indicated in the paper, to use both methods in a single valuation study, depending on the attribute we seek to value.

The paper acknowledges that there is often variation in the precision of responses across respondents: that is, that some people will perceive their own response as a vague estimate, while others are quite sure of their response. It is unclear whether Dr. Gregory is implying that a constructed preference approach is better able to deal with this issue than a willingness-to-pay approach. It would be interesting to consider how the two approaches differ in terms of the variation in the precision of responses across respondents.

The paper points out that the constructive approach itself can help refine participants' expressions of preferences. As respondents are led through a series of pair-wise comparisons, they are forced to acknowledge and understand trade-offs. Large volumes of information are presented in small doses, making it easier for people to analyze options and trade-off consequences. At the same time, this suggests that the researcher must take care not to influence preferences themselves. This can be a particular concern for trade-off analyses. In general, it is not possible to present all possible alternatives, implying that survey bias is unavoidable to some extent.

The paper has acknowledged that offering environmental alternatives in order to determine their place in a preference ordering may bias responses in favor of the alternative respondents feel they "ought to" value. I believe this is a valid concern, but with careful survey design can be tempered. For example, the respondent can be asked to make a pair-wise comparison between two public goods A and B; then between each public good against a private good. We want to ensure that we are truly measuring the value placed on the good itself, not the esteem associated with observed choices.

I am somewhat familiar with an approach called the Analytic Hierarchy Process (AHP) which I believe would be categorized as a constructed preference approach. Under this approach, a valuation exercise is organized as a hierarchy with the overall goal on top, followed by actors/stakeholders, then attributes and subattributes, and finally policy actions. Stakeholders are asked to make pair-wise comparisons across attributes and subattributes. This allows us to derive

a weighted preference ordering for each individual and finally an aggregate weighted preference ordering. Some studies use AHP in conjunction with a contingent valuation, or willingness-to-pay, follow-up study. By enduring the AHP analysis, respondents essentially become familiar with the preferences, allowing them, perhaps, to give better informed contingent valuation estimates.

Question and Answer Period for Session III

John Loomis, Colorado State University, offered some responses to the comments made by Linda Fernandez in her discussion of Mr. Loomis's paper. Mr. Loomis remarked that the juxtaposition posed by his paper and Robin Gregory's paper is the comparison between an individual buildup of willingness to pay versus directly asking for a willingness to pay for an aggregate good. Mr. Loomis stated that their study considered the individual components of their aggregate good, and constructed the aggregate good using focus groups. With respect to the questions Ms. Fernandez raised regarding the use of a higher water bill as a payment scheme, Mr. Loomis responded that the payment was posed as a fixed flat fee to be included with the respondents' water bill. A researcher even obtained the average water bill amount from each town in which the survey was administered to establish a reasonable baseline. Mr. Loomis explained that the sampling was accomplished by choosing communities along the Platte River and randomly choosing names out of phone books. In terms of demographic statistics of respondents, Mr. Loomis stated that income was not included in their model because it was not significant. Since the bid amounts were small, it should not be surprising that income did not significantly influence willingness to pay. There were some correlations among independent variables, but they were small. Finally, in her discussion, Ms. Fernandez had asked what possible substitutes the respondents might have had available. Mr. Loomis noted that like most other places in the arid parts of the West, there are few substitutes in terms of rivers. A paper by Hoehn and Loomis on the willingness to pay for wetland restoration in the San Joaquin valley illustrates this point. Substitution may come into play, however, in the Snake River region.

Robin Gregory, Decision Research, provided some responses to comments made by Patricia Koss in her discussion of Mr. Gregory's paper. Mr. Gregory noted that he is now doing a study on preferences regarding endangered species issues and trying to find ways to ask preference ordering questions so as to capture the increase or decrease of a probability of survival of the species. Mr. Gregory also found that possible commercial exploitation of species creates an emotional response, in the sense that people do not want to pay money to save fish if fishermen are going to catch them for profit. Ms. Koss remarked in her discussion that the goal is not to arrive at a preference ordering but a dollar value. Mr. Gregory responded that the point of the constructed preference (CP) approach is that in order to justify a dollar value, one must address preference ordering issues. CP is thus more precise than contingent valuation (CV). CV has made progress, but asking about attributes is more useful, as making respondents go through the process helps them better understand their preferences. Another reason that CP is more useful than CV to the policymaker is that it examines variation across respondents, rather than simply providing a mean value or a median value for a sample population. Decision-makers often want to understand the preferences of the top 5-10% or bottom 5-10%.

With respect to the remark made by Ms. Koss regarding the Analytic Hierarchy Process (AHP), Mr. Gregory stated that he felt that this technique worked well in structured situations, and was good at producing estimates, but was weak at defining problems. For example, finding and examining preferences for nuclear waste disposal is a policy problem appropriate for AHP.

In sum, Mr. Gregory noted that typically a CP study will only have one-quarter to one-half of the number of respondents that a CV study will have, but will provide different, perhaps more useful information.

John Tanaka, Oregon State University, posed a question to Mr. Loomis regarding his coding non-respondents as having a zero willingness to pay. Mr. Tanaka asked if this led to an underestimate of the willingness to pay, and if it might not be appropriate to provide a weighted average of willingness to pay. Mr. Loomis replied that it is possible that there would be an underestimation in some cases, but he looked at the demographics of the non-respondents, estimated their willingness to pay based on his model, and found that their estimated willingness to pay was in fact quite low.

Mr. Tanaka posed a question for Mr. Gregory regarding participation in the USDA Conservation Reserve Program, whereby farmers are paid to retire farming acreage. Participants are often paid $100-$150 per acre, but farmers in the Tillamook Valley (where Mr. Gregory's study was conducted) often complain that their land was worth as much as $800 per acre. Mr. Tanaka asked if Mr. Gregory separated out farmer responses in his study because of the possibility that they might take a dim view of watershed management plans, especially if they have animal feeding operations. Mr. Gregory replied that he did not, since their sample included only 100 respondents. Mr. Gregory noted that respondents did not have much difficulty working through the survey workbook, and that it might be possible to boost the sample size in the future by not personally administering the survey.

Tony Bynum, Yakama Nation, asked Mr. Gregory how he dealt with the issue of trust on the part of respondents. That is, how did Mr. Gregory deal with the need of respondents to know who else was willing to pay, who they would pay to if they paid, and how this affected respondents' willingness to pay? Mr. Gregory remarked that the question illustrates one of the strengths of the CP approach. As respondents worked through a workbook, it became clear to them what the objective of the survey was, and who the stakeholders were. Mr. Gregory noted that respondents were usually impressed if a client organization (in this case, British Columbia Hydro) was willing to pay for watershed management measures. Mr. Loomis added that this was an issue in CV studies. For example, a survey administered in Puerto Rico, where public trust in government is exceptionally low, failed to obtain usable results. Another manifestation of the issue of trust pertains to concerns about free-riding, which CV researchers have handled by stipulating that everyone will pay for the provision of a public good. There are other mechanisms that can be built into the hypothetical, such as stipulating that contributions must reach a certain provision point or all the money is refunded. The important step is to make sure that the rules for contribution are stated clearly and credibly.

Tom Leschine, University of Washington, commented that estimating willingness to pay functions using demographic variables fails to capture the trade-off that the respondent must make in order to make the payment. A survey that linked willingness to pay not to demographics but to lifestyle changes that need to be made might be more useful. Mr. Gregory agreed that this was a promising direction for CV to take, and that it moves CV towards the CP process by making respondents follow up and forcing them to understand their answers and calculations. This also moves CV away from vague, abstract hypotheticals and into specific lifestyle changes.

Paul Jakus, University of Tennessee, expressed surprise that the mean willingness to pay estimate obtained by Mr. Loomis's study was only $21. Mr. Jakus also asked what would happen if the payment was expressed as a 60% increase in their water bill. Mr. Loomis stated that many residents in the area have had large increases in their water bills, and that he found that those that had experienced increases in water bills in the past had a lower willingness to pay. Mr. Loomis remarked that the sample of 98 respondents was one of the most economically consistent and "best-behaved" samples he has ever used. Another of the factors that was highly significant was the strength of the respondent's belief in the environmental issue posed to them (watershed management) – those that felt strongly about it were willing to pay more.

Edna Loehman, Purdue University, remarked that it was important to keep in mind how policymakers use economic analysis. Benefit-cost analysis is a tool used for welfare analysis, but a common criticism is that it ignores distributional consequences. Ms. Loehman added that CP was therefore promising because it better simulates how a community makes decisions, and asked if it was possible to combine CP and CV in one study. Mr. Gregory agreed that consensus-based decisions were desirable. However, the biggest problem with CV is not with the decision-making process, but that it lacks a structure as to what to do with the information that is provided. Mr. Loomis commented that Ms. Loehman might have been suggesting the use of a CP process to develop a CV instrument, to which Mr. Gregory replied that the weakness is that the information gained from CP can be used more efficiently than as input into a CV process.

Mitchell Mathis, Center for Global Studies, asked about the decision process of the workgroup in Mr. Gregory's study. Mr. Gregory replied that it was decision by consensus, which was a byproduct of the desire of the client (BC Hydro) to obtain the assent of the community. Mr. Mathis posed a second question to Mr. Loomis regarding the upstream/downstream issue, and how one determines the geographic distribution of benefits of a watershed management project. Mr. Loomis replied that this is always a difficult balance to strike. On the one hand, many resources have much more than just a local value. On the other hand, one survey that Mr. Loomis conducted of the willingness to pay of New England residents to preserve the California Spotted Owl was frequently met with the response: "why are you asking us?" Ultimately, a study must have some empirical base for determining the geographic breadth of benefits that accrue from an environmental good.

Mark Plummer, Discovery Institute, noted that one study phrased the hypothetical conservation measure in terms of that which was "necessary to avoid listing" of the species under the Endangered Species Act (ESA). Mr. Plummer asked if this phraseology was meant to avoid triggering a stronger response pertaining to feelings about the ESA. Mr. Loomis acknowledged that his study avoided mention of the ESA in order to avoid stigmatizing the watershed management plan. Mr. Gregory suggested that the effect of the mention of the ESA by splitting the sample into those who are faced with ESA phraseology and those who are not.