Field Testing Existence Values:
An Instream Flow Trust Fund for Montana Rivers

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INTRODUCTION[1]

This paper describes a theoretical framework for the comparison of individual responses in a hypothetical contingent valuation setting and a simulated market (or actual cash transaction setting). The total valuation framework includes both direct use as well as existence services. The model is applied to valuation of several instream flow resources for which the existence motive is anticipated to be significant. The payment vehicle is a trust fund that was set up through the cooperation of The Montana Nature Conservancy. To our knowledge, this is the first time a field test has been implemented to examine the validity of contingent valuation for measuring primarily nonuse values.

In this introductory section, we provide an overview of the policy setting and issues. Also in this section we define the concept of validation and provide a brief overview of our application. Following sections describe the theoretical model, survey methods and instruments, and some preliminary results.

Contingent valuation is a tool that is increasingly important for public policy applications. In addition to being endorsed by the U.S. Water Resources Council (1983) for use in federal water and land implementation studies, this approach is an approved method for use in natural resource damage assessments under current Department of Interior (DOI) rules (U.S. Department of Interior 1986). Contingent valuation has recently been upheld in court rulings

challenging the validity of this approach in "superfund" applications.[2] While there has been considerable interest in the validation of the contingent valuation method in the past, most previous work on validation has focused on applications involving direct (in situ) use of a given resource, such as outdoor recreation. However, it is apparent that for some resources the primary service derived is of the nonuse or existence variety. This has been shown, for example, with regard to protection of bald eagles and striped shiners in Wisconsin (Boyle and Bishop 1987), for wolf recovery in Yellowstone National Park (Duffield 1991) and for protection of the Mono Lake resource in California (Loomis 1987) as well as many other wildlife resources and unique natural environments. One can speculate that recent natural resource damage assessments such as the those related to the Exxon Valdez oil spill also have a substantial existence component.

Existence values, as first articulated by Krutilla (1967), are the values associated with knowing that a resource exists. Existence services have the attributes of being both nonrival and nonexcludable. These services are nonrival because there are zero marginal costs associated with additional individuals knowing that the given resource exists in a healthy viable state. This is the attribute generally used to define a pure public good or commodity (Samuelson 1954). Because existence services are also nonexcludable it is very costly or impossible to establish property rights or entitlements to these services and thereby create viable markets. The absence of observable market or even market-related behavior for these services means that revealed preference measures cannot be used to measure value. In fact the only approach available for measuring existence or nonuse values is contingent valuation.

This fact has been recognized by DOI in the original 1986 CERCLA regulations as well as in a more recent set of proposed revisions released in a Notice of Proposed Rulemaking (NOPR) in April, 1991.[3] However, DOI's emerging guidelines for use of contingent valuation for nonuse values are somewhat controversial. Because there is no research "comparing nonuse values to values based on revealed preference approaches", DOI has characterized contingent valuation when used to measure nonuse values "as the least reliable method".[4] As noted by Carson, Hanemann and Kopp (1991), because revealed preference methods fail (by definition) to measure nonuse values they are an unlikely criterion for assessing the reliability of contingent valuation for these types of values.[5]

This brief characterization of the larger policy setting begs the question of what is meant by "reliability" or "validity". Mitchell and Carson (1989) provide a good overview of these concepts. Very briefly, reliability generally refers to the extent to which the variance of an estimate, such as mean willingness to pay, is due to random sources or "noise".[6] Reliability can be examined from the perspective of either the classical test-retest approach (Loomis 1987 provides an example) or sample theory. In short, reliability is closely related to the issue of precision and is a function of survey design elements such as sample size. Only recently have these issues begun to be addressed for nonmarket valuation measures (Kealy, Dovidio and Rockell 1988; Adamowicz, Fletcher and Graham-Tomasi; Park, Loomis and Creel 1991; Duffield and Patterson 1991). By contrast, validity measures the extent to which an instrument measures the concept under investigation.[7] From a statistical standpoint validity is the absence of systematic error or the extent to which a measure is unbiased. This

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is likely to be a more serious concern for contingent valuation measures.

There are actually several different types of validity. Mitchell and Carson (1989) reference the taxonomy suggested by the American Psychological Association (1974), which includes content, criterion and construct validity.[8] Our concern is with criterion validity. Criterion validity is evaluated by comparing the measure of the construct (eg. a contingent valuation estimate of willingness to pay) to another measure that can be regarded as criteria. The obvious problem for evaluating nonmarket measures is that substantive criteria, such as market prices, are unlikely to be available. However, some very interesting work has been done in creating actual markets for some resource services in side-by-side experimental applications with contingent valuation. In these cases the cash transaction prices can provide a criteria for evaluating the nonmarket measure. The first such study was Bohm's (1972) study of willingness to pay to see a television program. In another well-known study, a simulated market was developed for goose hunting permits for access to the Horicon area in Wisconsin (Bishop and Heberlein 1979). Bishop, Heberlein, Welsh and Baumgartner (1984) also conducted a series of experiments regarding deer hunting permits for the Sandhill Wildlife Demonstration area in Wisconsin. Dickie, Fisher and Gerking (1987) in 1984 conducted experiments regarding purchases of pints of strawberries. In general, these studies show a good correspondence between the hypothetical and simulated markets, particularly for willingness to pay measures.

In our investigation of criterion validity for contingent valuation we also use a cash transaction-simulated market criteria. The specific resource services we examine are increased stream flows in two Montana streams, Swamp Creek and Big Creek, which are small tributaries of the Big Hole and Yellowstone Rivers respectively. The streams are currently badly dewatered but are potentially important spawning tributaries for two important endangered fisheries: the only fluvial population of Arctic grayling in the lower 48 states and the population of Yellowstone cutthroat trout. It is anticipated that the existence services of these resources are much more important than direct use. The grayling resource in particular is located only the headwaters of the Big Hole and attracts very little direct angler use. Unlike the previous hypothetical-simulated market experiments, such as Bishop and Heberlein (1979), the services at issue are not excludable in the way that goose hunting or deer hunting permits are.[9] The specific market that we construct is for membership in an instream flow trust fund.[10] The trust fund payment vehicle is one that has been widely used for valuing goods with significant nonuse components (eg. Boyle and Bishop 1987; Walsh, Loomis and Gillman 1984; Bowker and Stoll 1988).

We will briefly described the specific policy setting of the application before turning to the next section. Instream flows are a controversial policy issue in many western states. Historically only diversionary uses of water have been recognized as "beneficial uses" under the prior appropriation doctrine. In Montana instream flow for recreation or fisheries was not recognized as a beneficial use under state law until 1975. While instream flow reservation policies are being developed and implemented in many states (McKinney and Taylor 1988),

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these policies at best maintain the status quo. Only by creating at least limited markets in instream rights can potentially efficient transfers occur. This issue has long been debated in the Montana legislature. In 1989, the legislature passed House Bill 707, which gives the Montana Department of Fish, Wildlife and Parks (DFWP) the authority to lease water from willing sellers to keep water in a given stream to benefit fish populations. Water could be leased on up to five streams during the four years of the initial pilot program. This program was extended by Senate Bill No. 425 in 1991 to allow for leasing of water on up to ten streams for periods of up to 20 years. The streams mentioned above, Big Creek and Swamp Creek, were sites of the first potential water leases identified by Montana DFWP under this program. This institutional setting provided an opportunity to implement the trust fund experiment which we describe below.

THEORY AND METHODS

The value individuals place on increased stream flow and protection of specific fisheries can be derived from responses to both a hypothetical and actual cash trust fund. As noted, a trust fund payment vehicle has been used successfully in a number of other studies related to wildlife valuation. In this section a simple model of total value for instream flows is described that includes direct as well as existence services. The conceptual basis for measuring existence values in a total valuation framework has been previously examined by Randall and Stoll (1983) and Peterson and Sorg (1987). Only modeling of the choice problem under conditions of certainty is examined; option values are not investigated. The model

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presented here utilizes an indirect utility function[11] to define the welfare measures at issue. This treatment is similar to one developed by Boyle and Bishop (1987) for analysis of values related to bald eagles in Wisconsin. For brevity, only the main elements of the model are presented.

A compact way of describing the satisfaction that individuals derive from consumption of goods and services is a utility function. The level of well-being that respondents would experience with increased streamflows (water) is a function of their level of nonconsumptive or other direct uses (Nw), the water level which results in a viable restored fishery (W) which provides them with existence value, and a vector of all other goods and services ($\bar{Z}$) not expected to be affected by increased streamflow. An individual's utility function, assumed to have the properties required by consumption theory, is then given by:

$$U(N_w, W, \bar{Z}) \tag{1}$$

The visitor is assumed to maximize her level of well-being subject to her budget constraint (income) and prices corresponding to the set of goods and services modeled (Pw,Pz) where Pz is a vector and the existence service (being a pure public good) is unpriced. The solution to the consumer's constrained maximization problem results in optimal levels of goods and services. This optimal solution can be equivalently expressed in terms of an indirect utility function, V(.), where the arguments are prices and income, Y. For example, in the current situation where there are inadequate streamflows for viable fishery populations, let (Nw, W = 0), the maximum attainable level of well-being for an individual is given by:

$$U(0, 0, Z^*) = \overline{U} = V(P_w^m, 0, P_z^0, Y) \tag{2}$$

Where $\overline{U}$ is the reference or current level of utility. Note that the price of in situ water

related uses, P_w^m, is a price sufficiently high to make direct use services zero. This model

provides a compact way of describing the value associated with changes in the current

situation. If streamflow and hence fishery resources were present at some viable recovery

level $\overline{W}$, and direct use of the water resource was possible at a finite price, then there is

some amount, WTP[1], which would make an individual ambivalent between the current level

of services and one with adequate streamflow:

$$V(P_w^1, \overline{W}, P_z^0, Y-WTP^1) = V(P_w^m, 0, P_z^0, Y) \tag{3}$$

Because WTP[1] is willingness to pay for an improvement, this is a compensating variation

welfare measure (Hicks 1943). This measure provides a total valuation estimate for increased

streamflow, since it includes both nonconsumptive and other direct uses of the resource as

well as existence value. WTP[1] can be estimated using contingent valuation or an actual cash

transaction trust fund. We have previously implemented a trust fund valuation for several

Montana rivers using a dichotomous choice question format (Duffield, Brown and Allen

forthcoming). For the case at hand we chose to use a payment card question format. The

latter is a feasible approach for the cash transaction instrument and in fact corresponds to the

common practice of fund-raising mailings on the part of conservation organizations.

Unlike dichotomous choice, payment card responses are fairly straightforward to analyze in that the responses can be interpreted as discrete approximations to the true WTP_1. As is the usual practice, we anticipated examining the extent to which the variation of WTP_1 across respondents could be explained by measures of preferences and income. We basically postulated two different kinds of hypothesis. One hypothesis could be called the "naive economist" hypothesis that both contingent valuation and the cash trust fund would elicit the same values. The other hypothesis was suggested by a social-psychologist, Stewart Allen, who participated in survey design. Allen's perspective was that contingent valuation responses measure behavioral intent (to pay a cash contribution at some future date) while the cash responses are the actual behavior at issue. Allen's hypothesis, based on the psychology literature, is that the more similar the setting for the behavioral intent is in time and circumstance to the actual behavior, the more similar will be the measures resulting from the two methods. This hypothesis did not specify the direction of differences, but implies that differences may occur.

In order to explore the latter hypothesis (as described in greater detail in the following section), we chose to implement three different treatments: cash-TNC, hypothetical-TNC, and hypothetical-UM. The first two treatments correspond to mailings that went out under Montana Nature Conservancy letterhead and are an actual cash trust fund request and a hypothetical (contingent valuation) request respectively. These two treatments were as similar as possible, differing only in the actual request for cash. Both included a brochure describing the "Montana Water Leasing Trust Fund". In other words, the setting for the behavioral

intent in the hypothetical request was very similar to the setting for the actual cash donation behavior. The third treatment went out under University of Montana letterhead and was more hypothetical in that it lacked a brochure and referenced only a "trust fund" that "could be established". This treatment was intended to be similar to the "typical" academic contingent valuation study.

To this point in the discussion we have implicitly focused on willingness to pay (amount contributed) as the key measure of validity. As it turned out, another behavioral dimension that is quite interesting is the participation level in the various treatments. We were aware that the free rider problem might be an important phenomena for the resource services at issue. However, we had no prior hypothesis how this might affect willingness to pay across treatments. We also had no theoretical basis for predicting a priori how response rates would vary across the survey instruments. Because it was apparent from our pre-test (described below) that the response rate to the cash survey would be fairly low, we considered ways to sample and analyze nonrespondents. We felt it was unethical to recontact the cash subsample participants. Our approach was to aim for a high response rate for the University of Montana subsample as a way of characterizing the population. In order to address issues like the choice to respond or not respond to the cash survey, we anticipate using the pooled subsamples in a selection function approach (Manly 1985). We may also implement this procedure for analysis of the choice to contribute. While previous contingent valuation studies have focused on explaining willingness to pay, for our data set the choice to participate is equally important.

A final methodological issue is the extent to which the total valuation responses for our application actually relate to existence uses as opposed to direct use. This issue is beyond the scope of this discussion but is addressed elsewhere.[12]

SURVEY METHODS AND INSTRUMENTS

As noted previously, we developed three different treatments. The general characteristics of each treatment are summarized in Table 1 and the three corresponding survey instruments and cover letters are provided in Appendices A,B and C. The three treatments include a cash trust fund mailing (Cash-TNC) that went out under The Montana Nature Conservancy letterhead and included a brochure (Appendix D) and payment card (Appendix E). This treatment solicited actual cash contributions to a trust fund that was established for purposes of this study through an agreement between The Montana Nature Conservancy and the Montana Department of Fish, Wildlife and Parks. This trust fund is called the Montana Water Leasing Trust Fund and was described in the brochure and cover letter. The second treatment was a contingent valuation survey that went out under The Montana Nature Conservancy letterhead (Hypo-TNC) and included the same descriptive materials as the cash mailing. The third treatment was a contingent valuation survey that went out under University of Montana letterhead and made reference only to a trust fund that "could be established".

All three surveys contained five sections (see Appendix A). The first section asked general

questions about recreational use, particularly relating to fishing. The second section contained questions about specific past and expected future use of the Big Hole and Yellowstone Rivers. The third section contained a series of Lickert-scaled questions designed to measure preferences and attitudes. For example, respondents were asked if they agreed or disagreed with the statements: "I have little concern for endangered species" and "I would be willing to contribute money or time to help Montana rivers even if I could never visit them". The attitude questions were designed to measure independent dimensions of individual preferences relating to use and valuation of natural resources. The first three sections are identical on all survey instruments. The fourth section contained the cash or contingent valuation question series. This section was structured to include a lead-in question asking about familiarity with trust funds, a section describing the resources at issue, the payment card question, and a follow-up question to help interpret responses (including identification of protest responses). The fourth section differs slightly across all three treatments, primarily in the actual wording of the payment question (Appendices A,B, and C). The fifth section included questions on respondent socio-economic characteristics, including residence, age, gender and education. On the Hypo-UM treatment only, a question on household income was included. Our general aim in survey design was to have a fairly compact survey that would not be burdensome and would result in high question item-participation.

The sample frame was Montana resident and nonresident fishing license holders. In a recent year, 1987, there were 231,134 licensed Montana resident anglers and 103,974 nonresident (out of state) licensed anglers. This sample frame was selected for several reasons. One

consideration was that the names and addresses for these populations were readily available in computerized form (and could be randomly drawn) from Montana DFWP records. Secondly, this group was likely to be interested in the resource. Particularly for nonresidents, there is no other readily available sample frame that includes a fairly large population that might be concerned with the resource at issue. Selection of a user group like anglers diminishes the probability that contributors would be motivated entirely by existence motives. Nonetheless, our judgement was that given the nature of the resource (small spawning tributaries for endangered species), existence motives would be dominant even for this user group. It may be noted that a licensed angler sample frame in Montana includes a fairly substantial proportion of the population - about 37 percent based on the U.S. Fish and Wildlife Service national fishing and hunting survey for 1985.

The survey instrument was initially drafted in June/July 1990 and refined through focus group sessions with Missoula-area residents in August 1990. The focus groups were used to insure that the questions were understood by respondents and to refine the choice of language and level of information. Initial payment card levels ($10, $25, $50, $100 and $250) were selected based on earlier related work on Montana instream flows (Duffield, Brown and Allen forthcoming). The survey instruments were pretested in September 1990, with 100 mailings of the Cash-TNC instrument and 50 each of the hypothetical instruments. Because actual cash contributions were received for bid levels ranging from $10 to $250, the initial bid levels were retained in the final survey instruments.

The main finding from the pre-test concerned survey response rates (percent of surveys

returned compared to surveys mailed). The response rate to the cash survey instrument was only around 10 percent. We suspect that low response rates may well be typical for other actual conservation organization solicitations. We used our pre-test response rates to allocate our "survey budget" so as to receive about an equal number (400 to 500) of responses for each treatment. Our budget permitted about 9,000 individual mailings and we chose to do half to residents and half to nonresidents. The allocation among the three instruments was about 5300 to Cash-TNC, 2400 to Hypo-TNC and 1200 to Hypo-UM (Table 2).

The University of Montana mailing was relatively small reflecting our assumption (based on previous studies including Duffield and Allen 1988) that a fairly high response rate for this subsample would be achieved even without followup mailings. In fact we chose to implement follow-up mailings for the University of Montana subsample as the most efficient way to characterize the overall populations. We used the Dillman (1978) total design method including an initial mailing, postcard reminder, second mailing to nonrespondents and a third (certified) mailing to nonrespondents. As noted, we felt that for ethical reasons it would be inappropriate to recontact individuals responding to the cash treatment. We also felt it would be, if not unethical, at least impolite (and certainly burdensome on The Montana Nature Conservancy) to recontact the Hypo-TNC subsample.

The initial mailing for all instruments went out on November 25, 1990. The followup postcard was mailed one week later (December 3) and the second mailing three weeks after the initial mailing (December 14). The certified mailing went out six weeks after the second

mailing, on January 29, 1991. The time profile of the responses to all three instruments are shown in Figures 1, 2, and 3. Note that for the University of Montana subsample there are peaks in the relative frequency of daily responses following the initial mailing (day 1), the second mailing (day 18) and the certified mailing (day 64). The Dillman procedure mailing date for the postcard reminder (day 7) is before the response to the initial mailing has fully died out.

About 13 percent of the University of Montana mailing proved to be undeliverable, either due to bad addresses or individuals having moved. Undeliverables from the initial and following mailings were noted and not included in subsequent mailings. However, it was somewhat surprising to find that undeliverables continued to be a fairly substantial share of each successive mailing, including the certified mailing. While some of this may indicate that certain individuals moved between mailings, it appeared to be primarily due to the failure of the postal service to return all undeliverable pieces. We interpolated the undeliverable rate to the TNC subsamples.

RESULTS

Comparisons of response rates and willingness to contribute

Table 2 compares the response rates for the three survey types for nonresidents and residents separately. The response rate was lowest for TNC-Cash and highest for University both within the first seven days (before the first follow-up postcard) and overall. These differences were statistically significant between all pairs for both residents and nonresidents

(P < .001, based on log-linear models and follow-up chi-square tests) for both the first wave and overall. Nonresidents had higher response rates for each type of survey, both overall and in the first seven days. For the overall response rate, the differences were statistically significant (P < .001) for the TNC-Cash and TNC-Hypothetical, but not for the University survey. For the first seven days, the differences were not statistically significant. However, the higher response rate for nonresidents occurs despite the expectation that it would be lower than for residents, all other things equal, because of differences in mail delivery times.

The percent of respondents expressing a willingness to contribute to the trust fund (in the TNC-Cash survey, this means they actually contributed money) varied widely among the survey types and between residents and nonresidents (Table 3). Nonresidents had significantly higher contribution rates than residents in all three surveys (P < .001, loglinear models, chi-square tests). The rate for the TNC-Hypothetical was significantly higher than for the TNC-Cash and the University in both the first seven days and overall. The University rate was significantly higher than the TNC-Cash in the first 7 days, but not overall. There was no significant difference between waves for the TNC-Hypothetical and the University surveys; the TNC-Cash rate was significantly higher for nonresidents in the second wave (51.2% vs. 36.6%, P = .010); it was also higher for residents in the second wave (19.1% vs. 9.5%, P=.051).

When the number of contributors is expressed as a percent of all deliverable surveys, the TNC-Hypothetical and University did not differ significantly for either residents or

nonresidents for the first wave. They did differ significantly overall, but this reflects the higher response rate for the University survey. The TNC Cash was significantly lower than the others for both residents and nonresidents and for both the first wave and overall. The TNC-Hypothetical rate was 6 times higher for residents and 3 to 4 times higher for nonresidents, in both waves.

The distributions by category of dollar contribution amounts for those who said they would contribute and the average amounts per contributor were very similar for the three surveys when residents and nonresidents are looked at separately (Table 4). The differences between survey types are not statistically significant for either residents or nonresidents (chi-square test on distributions and ANOVA on log of amounts). The differences between waves (not reported here) were also not statistically significant. The nonresident/resident differences are statistically significant ($P < .001$, chi-square and ANOVA) with nonresidents contributing about twice as much per contributor on average. For both residents and nonresidents, the average contribution per respondent does not differ significantly between University and TNC-Cash, but TNC-Hypothetical is significantly greater than both (ANOVA; Newman-Keuls); it is almost twice as large as TNC-Cash for residents. Finally, the average contribution per deliverable survey was much greater for University than for the others, as expected because of the high response rate. The average per deliverable for TNC-Hypothetical is several times larger than for TNC-Cash.

We next compare the respondents and the contributors (those expressing a willingness to

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contribute) across the three surveys on the use, attitude and demographic variables. A full-scale comparison is beyond the scope of this paper; a summary of preliminary univariate results is presented.

Comparison of respondents

A comparison of the respondents to the three surveys by residence reveals that there are some large differences between residents and nonresidents, but surprisingly minor differences between the surveys. Even respondents to the University survey, in which individuals were contacted several times and which had over a 70% response rate, was not very different from the other two. A brief summary follows of the results of comparisons between the three surveys, controlling for residence.

1. Use: There was little difference (none statistically significant) between the use levels of rivers in general and of the Big Hole/Yellowstone. For example, the percent who had ever visited the Big Hole or Yellowstone ranged from 63% to 67% for residents and from 70% to 73% for nonresidents. There was also almost no difference between the percents saying they intended to visit the Big Hole or Yellowstone in the next 3 years (65% to 68% for both residents and nonresidents).

2. Fishing: There was little difference in the ratings of fishing as a favorite activity and on the type of equipment used.

3. Attitudes: The only attitude question on which there were was a significant difference was the response to the statement "Rivers have enough water already." Respondents to the TNC surveys were more likely to strongly disagree with this statement than respondents to the University survey (residents: 19% and 17% for TNC-Cash and Hypothetical, respectively, versus 11% for University; nonresidents: 23% and 21% versus 12%).

4. Conservation groups: TNC-Cash respondents were more likely to be a member of a conservation group (residents: 26%, 22% and 20% for TNC-Cash, TNC-Hypothetical and University, respectively; nonresidents: 58%, 47%, 49%), though the difference was statistically significant only for nonresidents.

5. Demographic variables: There were no significant differences in the age distributions. For residents only, there was a much higher proportion of females responding to the University survey (32% versus 22% for TNC-Cash and 15% for TNC-Hypothetical). Again for residents only, there was lower proportion of respondents with at least a college degree than for the TNC surveys (25% versus 38% for TNC-Cash and 36% for TNC-Hypothetical).

Overall, the only statistically significant difference between TNC-Cash and Hypothetical respondents was on membership in conservation groups for nonresidents, and this was only marginally statistically significant.

The similarity of the three groups was also confirmed by some preliminary multivariate analyses; for example, in a linear discriminant analysis with some of the major variables there was only marginal improvement in predicting which survey type an individual had responded to.

A comparison of resident and nonresident respondents is not of particular interest at this point, other than to say that, as expected, there were major differences in a few areas. Nonresident respondents rated fishing as an activity much higher, they were much more likely to be fly-only fishermen, they were much more likely to be a member of a conservation group, and tended to be older and better educated. Differences in attitudes tended to be smaller, but still apparent.

Comparison of contributors

We also compared contributors across the three surveys, a "contributor" being a respondent who expressed a willingness to contribute to a trust fund. There tended to be larger differences than when comparing respondents. However, the sample sizes were much smaller, particularly for residents (since the proportion of respondents indicating a willingness to contribute ranged from 13% to 56% across groups). Therefore, statistical tests are less sensitive to small differences than with respondents. A summary of the results follows.

1. Use: TNC-Cash contributors tended to be slightly heavier users of rivers than

TNC-Hypothetical and University, but the difference was not statistically significant. There was little difference between the percents who had ever visited the Big Hole or Yellowstone or who said they intended to visit in the next three years.

2. Fishing: There was little difference in the ratings of fishing as a favorite activity. Contributors in the TNC-Cash survey were more likely to be fly-only fisherman (residents: 54% for TNC-Cash versus 24% for TNC-Hypothetical and 28% for University; nonresidents: 75% versus 62% and 60%), but the differences were only marginally statistically significant.

3. Attitudes: There was only one statistically significant difference, though the observed differences on many questions were in the direction one would expect. TNC-Cash contributors were more likely to strongly disagree with the statement that rivers have enough water already (residents: 42% for TNC-Cash versus 23% for TNC-Hypothetical and 18% for University; nonresidents: 36% versus 26% and 18%), though only the difference for nonresidents was significant (chi-square test, P=.004). Contributors were more likely to strongly agree with the statement that private groups play a major role in protecting the environment and with the statement that "I am willing to give even if I cannot visit," though the differences were not statistically significant.

4. Conservation groups: TNC-Cash respondents were more likely to be a member of

a conservation group (residents: 54% for TNC-Cash, versus 33% for TNC-Hypothetical and 34% for University; nonresidents: 74% versus 62% and 63%), though the difference was statistically significant only for nonresidents.

5. Demographic variables: Among residents, TNC-Cash contributors tended to be the oldest best educated and University contributors the youngest and least educated (52% age 50 or over for TNC-Cash, 28% for TNC-Hypothetical and 15% for University, P=.03; 71% with at least a college degree for TNC-Cash, 37% for TNC-Hypothetical and 26% for University, P=.005). The proportion of females was significantly lower among the TNC contributors (14% and 13%) than among the University contributors (34%, P=.011). Among nonresidents, there were no significant differences between the three surveys on the demographic variables.

Preliminary multivariate analyses confirm that there are not large differences among the contributors to the three surveys.

Further analyses will attempt to identify which characteristics are most associated with the decision to contribute, both conditional on the decision to participate in the survey and unconditionally. The latter will use the University respondents as the "population" of potential respondents and contributors for all surveys.

CONCLUSIONS

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The preceding provides a discussion of preliminary results. We will briefly summarize our interpretation of these findings, addressing five basic questions.

1) Do the CVM-based measures of WTP differ from the criterion WTP measure (cash)? The answer is, that it depends on which treatments are being compared and whether willingness to pay is computed per contributor, per respondent or per delivered mailing. The findings on the hypothesis of no difference across treatments for WTP is summarized in Table 5 B). We cannot reject the hypothesis of no difference across treatments for WTP per contributor either for the frequency distribution of the WTP amounts or for the means. We also cannot reject the hypothesis of no difference for WTP means per respondent for the Cash v. Hypo-UM treatments. However, the Cash v. Hypo-TNC and the two hypothetical treatments do show significantly different mean WTP per respondent. WTP per deliverable mailing differs across all treatments, because of very different response rates (see also Table 5A). It is worth noting that there are significant differences in WTP between residents and nonresidents as measured by the criterion (cash). Significant differences between WTP for these two subsamples also are found with the CVM measures (Table 6).

2. Where there are differences in mean WTP between CVM and the criterion, how large are these differences? Table 7 shows the ratio of mean WTP between treatments, again on a per contributor, per respondent and per deliverable basis. On a per contributor basis, the ratios are between .89 and 1.19 across treatments (no significant differences). On a per respondent basis, the Cash/H-TNC ratio is .48 for residents and .73 for nonresidents. In other words, on

a per respondent basis the CVM measure is higher than the cash measure by about 40% (nonresidents) to 100% (residents). None of the per respondent comparisons differ by more than a factor of two. We feel that the comparisons to the Hypo-UM responses should be interpreted with caution because this treatment was implemented with follow-up mailings. (Recall that the Hypo-UM follow-up mailings were done in order to characterize the population for purposes of our selection function analysis. All comparisons are reported here for the sake of completeness.) The comparison of the two single-mailing treatments (Cash and Hypo-TNC) are the most straightforward to interpret. On a per deliverable basis, the Hypo-TNC mean WTP are higher than the cash by a factor of about 3 to 4. The per deliverable comparisons are influenced to a large extent by response rates; the comparisons to the Hypo-UM treatment should be interpreted with caution as the response rate for Hypo-UM is much higher due to follow-up mail contacts.

3. <u>What are the implications of these findings for aggregation and for interpretation of other CVM studies?</u> We would be cautious in using these preliminary findings to infer how other CVM studies might compare to a cash criterion, particularly those with other question formats, payment vehicles and for very different resources. Our mean WTP estimates could be used to infer aggregate population WTP under at least three major sets of assumptions (Table 8) having to do with nonrespondent WTP and interpretation of WTP for respondents indicating zero contributions. These assumptions are detailed in Table 8 and would imply using, respectively, the per contributor, per respondent and per delivered mailing estimates, respectively. It would seem difficult to justify the first set of assumptions. The choice across

assumption sets highlights our lack of information on the Cash and Hypo-TNC nonrespondents and on the importance of free rider behavior.

4. <u>What are the implications of the results for the use of a trust fund institution for this resource</u>? This study provides evidence of positive willingness to pay as elicited by the Cash treatment. However, this study also suggests that a trust fund is not an efficient way to capture this willingness to pay. The WTP per deliverable for the cash treatment varies from $.20 for residents to $1.63 for nonresidents (Table 4). Clearly, mailings to residents would not even cover postage one way let alone the cost of a return envelope, printing, and development costs. Trust funds as part of a resource allocation system for the resources at hand do not appear to be feasible, at least when based on a single mail contact. The potential Pareto improvement measured by WTP for the trust fund payment vehicle, when considered net of transaction costs, is not positive for residents and perhaps only marginally so for nonresidents.

REFERENCES

Bishop, R.C. and T.A. Heberlein. 1979. "Measuring Values of Extra-Market Goods: Are Indirect Measures Biased?" American Journal of Agricultural Economics 61:926-30.

Bishop, R.C., T.A. Heberlein, M. P. Welsh, and R. Baumgartner. 1984. "Does Contingent Valuation Work? Results of the Sandhill Experiment." Paper presented at a meeting of the American Agricultural Economics Association, Cornell University.

Bohm, P. 1972. "Estimating Demand for Public Goods: An Experiment." European Economic Review 3:111-30.

Bowker, J. M., and J. R. Stoll. 1988. Use of dichotomous choice methods to value the Whooping Crane resource. American Journal of Agricultural Economics 70:372-381.

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

Boyle, K.J., M.P. Welsh, and R.C. Bishop. 1988. "Validation of Empirical Measures of Welfare Change: A Comparison of Nonmarket Techniques: Comment and Extension." Land Economics 64:94-98.

Brookshire, David S., Larry S. Eubanks and Alan Randall. 1983. Estimating Option Price and Existence Values for Wildlife Resources. Land Economics 59(1):1-15.

Carson, R.T., W.M. Hanemann, and R.J. Kopp. 1991. Comments on the United States Department of Interior's Notice of Proposed Rulemaking 43 C.F.R. Part 11, Natural Resource Damage Assessments (June 25).

Cummings, R., D. Brookshire, and W. Schulze. 1986. Valuing environmental goods. Rowman and Allenheld, Totowa, N.J. 270pp.

Dickie, M., A. Fisher, and S. Gerking. 1987. "Market Transactions and Hypothetical Demand Data: A Comparative Study." Journal of the American Statistical Association 82:69-75.

Dillman, D. A. 1978. Mail and telephone surveys: the total design method. John Wiley & Sons, N.Y. 325pp.

Duffield, J. 1991. Existence and nonconsumptive values for wildlife: application to wolf recovery in Yellowstone National Park. Pages 1-39 In C.L. Kling, ed. Benefits and Costs in Natural Resources Planning, Fourth Interim Report. Department of Agricultural Economics, University of California, Davis. 270pp.

Duffield, J. and S. Allen. 1988. Angler Preference Study Final Economics Report: Contingent Valuation of Montana Trout Fishing by River and Angler Subgroup. Montana Department of Fish, Wildlife and Parks, Helena.

Duffield, J.W., T.C. Brown and S.D. Allen (forthcoming). Economic Value of Recreation and Preservation Benefits of Instream Flow in Montana. Research Paper __ Rocky Mountain Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture.

Duffield, J., and D. Patterson. 1991. Inference and optimal design for a welfare measure in dichotomous choice contingent valuation. Land Economics 67(2):225-39.

Fisher, A. and R. Raucher. 1984. "Intrinsic Benefits of Improved Water Quality: Conceptual and Empirical Perspectives." Advances in Applied Micro-Economics 3:37-66.

Hicks, J. R. 1943. The four consumers' surpluses. Review of Economic Studies 11(1):31-41.

Kealy, M.J., J.F. Dovidio, and M. L. Rockel. 1988. "Accuracy in Valuation is a Matter of Degree." Land Economics 64:158-171.

Krutilla, J. 1967. Conservation reconsidered. American Economic Review 57(4):77-86.

Loomis, John B. 1987. Broadening the Concept and Measurement of Existence Value. Northeast Journal of Agricultural Economics.

Loomis, J.B. 1989. "Test Re-test Reliability of the Contingent Valuation Method: A Comparison of General Population and Visitor Responses." American Journal of Agricultural Economics 71(1).

Manly, B.F.J. 1985. The Statistics of Natural Selection. London: Chapman & Hall.

McKinney, M.J. and J.G. Taylor. 1988. Western State Instream Flow Programs: A Comparative Assessment. Instream Flow Information Paper No. 18. U.S. Fish and Wildlife Service Biol. Rep., 89(2), 78pp.

Mitchell, R. C. and R. T. Carson. 1989. Using surveys to value public goods: the contingent valuation method. Resources for the Future, Washington, D.C. 463pp.

Peterson, G. L. and C. F. Sorg. 1987. Toward the measurement of total value. U.S.D.A. Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-148.

Randall, A., and J. R. Stoll. 1983. Existence value in a total valuation framework. in R. D. Rowe and L. G. Chestnut, eds., Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas. Westview, Boulder. 270pp.

Samuelson, P. 1954. The pure theory of public expenditure. Review of Economics and Statistics 36:387-389.

Stoll, J.R. and L.A. Johnson. 1984. Concepts of Value, Nonmarket Valuation and the Case of the Whooping Crane. Transactions of the Forty-ninth North American Wildlife and Natural Resources Conference 49:382-93.

Sutherland, Ronald J. and Richard G. Walsh. 1985. Effect of Distance on the Preservation Value of Water Quality. Land Economics 61(3):281-291.

U.S. Department of Interior. 1986. Natural resource damage assessment rules and regulations. Federal Register 51(148):27725-27753 (August 1).

U.S. Department of Interior. 1991. Natural resource damage assessments; notice of proposed rulemaking. Federal Register 56(82):19752-19773 (April 29).

U.S. Water Resources Council. 1983. Economic and environmental principles for water and related land resources implementation studies. U.S. Government Printing Office, Washington, D.C. 137pp.

Walsh, Richard G., John B. Loomis and Richard A. Gillman. 1984. Valuing Option, Existence and Bequest Demands for Wilderness. Land Economics 60(1):14-29.

Table 1. Summary of survey instruments.

Item	Cash-TNC	Hypo-TNC	Hypo-UM
Payment	cash	hypothet.	hypothet.
Named/existing trust fund	yes	yes	no
Brochure on trust fund in mailing	yes	yes	no
Letterhead	TNC	TNC	UM
Followup mail contacts	no	no	yes

Notes: Cash-TNC refers to The Montana Nature Conservancy mailing requesting actual cash donations to the Montana Water Leasing Trust Fund; Hypo-TNC refers to the contingent valuation survey that was sent out under The Montana Nature Conservancy letterhead; Hypo-UM refers to the contingent valuation survey that was sent out under the University of Montana letterhead.

Table 2. Sample size and response rates for Montana Water Leasing Trust Fund mailing.

| | | | Returned | | | |
| | | | First 7 days | | Overall | |
	Mailed	Delivered	N	%	N	%
Residents						
Cash	2622	2278°	137	6.0	205	9.0
Hypo.	1166	1013°	130	12.8	193	19.1
Univ.	603	524	98	18.7	388	74.0
Nonresidents						
Cash	2682	2372°	145	6.1	306	12.9
Hypo.	1192	1054°	159	15.1	288	27.3
Univ.	597	528	127	24.1	407	77.1

° Estimated from nondeliverable rate for University survey.

Table 3. Number and percent of respondents and of deliverables willing to contribute to Montana Water Leasing Trust Fund.

	First 7 days				Overall		
	n	% of resp.	% of deliv.		n	% of resp.	% of deliv.
Residents							
Cash	13	9.5	0.6		26	12.7	1.1
Hypo.	44	33.8	4.3		64	33.2	6.3
Univ.	21	21.4	4.0		77	19.8	14.7
Nonresidents							
Cash	53	36.6	2.2		136	44.3	5.7
Hypo.	87	54.7	8.3		162	56.3	15.4
Univ.	59	46.5	11.2		171	42.0	32.4

Table 4. Relative frequency distribution (in %) of contributions and average contribution per contributor, per respondent and per deliverable mailing.

	N	Amount ($)*					Average Contribution		
		10	25	50	100	250	Per Contrib.	Per Resp.	Per Deliv.
Residents									
Cash	26	54	42	4	0	0	17.69	2.24	0.20
Hypo.	60	75	18	7	0	0	14.92	4.64	0.88
Univ.	77	71	23	5	0	0	15.26	3.03	2.24
Nonresidents									
Cash	136	41	35	17	6	1	28.43	12.60	1.63
Hypo.	157	39	36	17	8	1	31.85	17.36	4.74
Univ.	170	38	39	14	8	1	31.18	13.02	10.04

* The 5% of contributions which were not one of the amounts listed were put into the nearest category.

Table 5. Reject hypothesis of no difference in participation and WTP across treatments.

Item	Cash v. Hypo. TNC	Cash v. Hypo. UM	Hypo. TNC v. Hypo. UM
(A) Participation			
(1) Survey response rate			
Residents	yes	yes	yes
Nonresidents	yes	yes	yes
(2) % contributors of respondents			
Residents	yes	no	yes
Nonresidents	yes	no	yes
(3) % contributors of deliverables			
Residents	yes	yes	yes
Nonresidents	yes	yes	yes
(B) Willingness to pay			
(1) WTP frequency distribution for contributors			
Residents	no	no	no
Nonresidents	no	no	no
(2) WTP means per contributor			
Residents	no	no	no
Nonresidents	no	no	no
(3) WTP means for respondents			
Residents	yes	no	yes
Nonresidents	yes	no	yes
(4) WTP means per deliverable			
Residents	yes	yes	yes
Nonresidents	yes	yes	yes

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Table 6. Reject hypothesis of no difference between resident and nonresident subsamples, given treatment.

	Cash	Hypo. TNC	U of M
(A) Participation			
(1) Survey response rate			
First 7 days	no	no	no
Overall	yes	yes	no
(2) Percent of respondents willing to contribute			
Overall	yes	yes	yes
(B) Willingness to pay (overall)			
(1) Freq. Dist. of amounts contributed	yes	yes	yes
(2) Mean amounts contributed	yes	yes	yes
(3) Mean amounts per respondent	yes	yes	yes
(4) Mean amounts per deliverable	yes	yes	yes

Table 7. Ratio of average WTP measures between treatments for overall sample.

	Cash/H-TNC	Cash/H-UM[1]	H-TNC/H-UM[1]
(A) Per Contributor			
Resident	1.19	1.16	0.98
Nonresident	0.89	0.92	1.02
(B) Per Respondent			
Resident	0.48*	0.74	1.53*
Nonresident	0.73*	0.97	1.33*
(C) Per Deliverable[2]			
Resident	0.23*	0.09*	0.39*
Nonresident	0.34*	0.16*	0.47*

* Significantly different from 1 based on the means used to develop the ratios.
[1] Compares overall responses to single mailing (TNC cash and hypothetical measures) to responses including follow up mailings (hypothetical UM).
[2] Ratios are strongly influenced by overall survey response rates.

Table 8. Interpretation: Implications for aggregation.

Possible assumptions	Nonrespondents	Respondents giving zero contribution
Set 1	are like contributors	are free riders, have WTP of contributors
Set 2	are like respondents	WTP = 0
Set 3	WTP = 0	WTP = 0

Note: Use of assumption sets 1,2 or 3 correspond to using WTP per contributor, WTP per respondent or WTP per deliverable, respectively, for aggregation.

Figure 1. UM – Responses by day
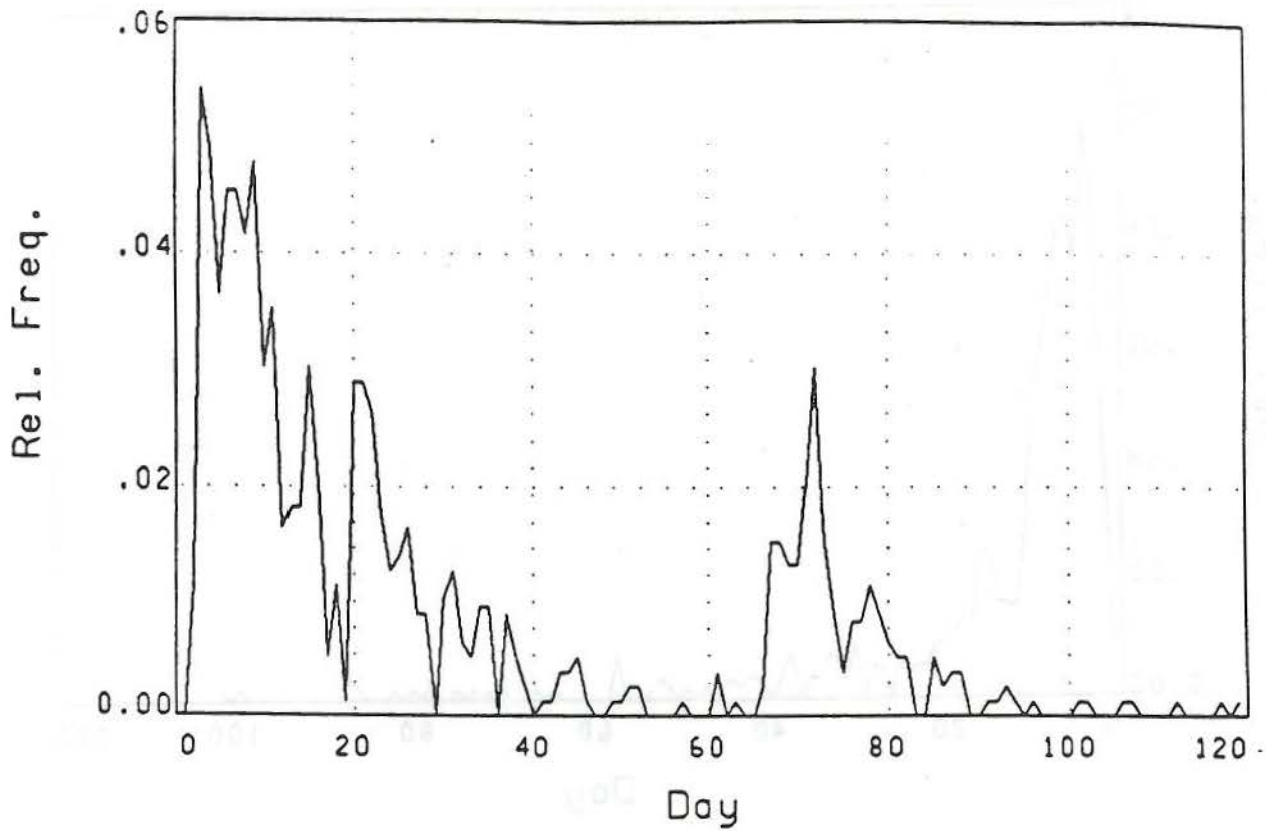
Figure 2. TNC Hypothetical – Responses by day
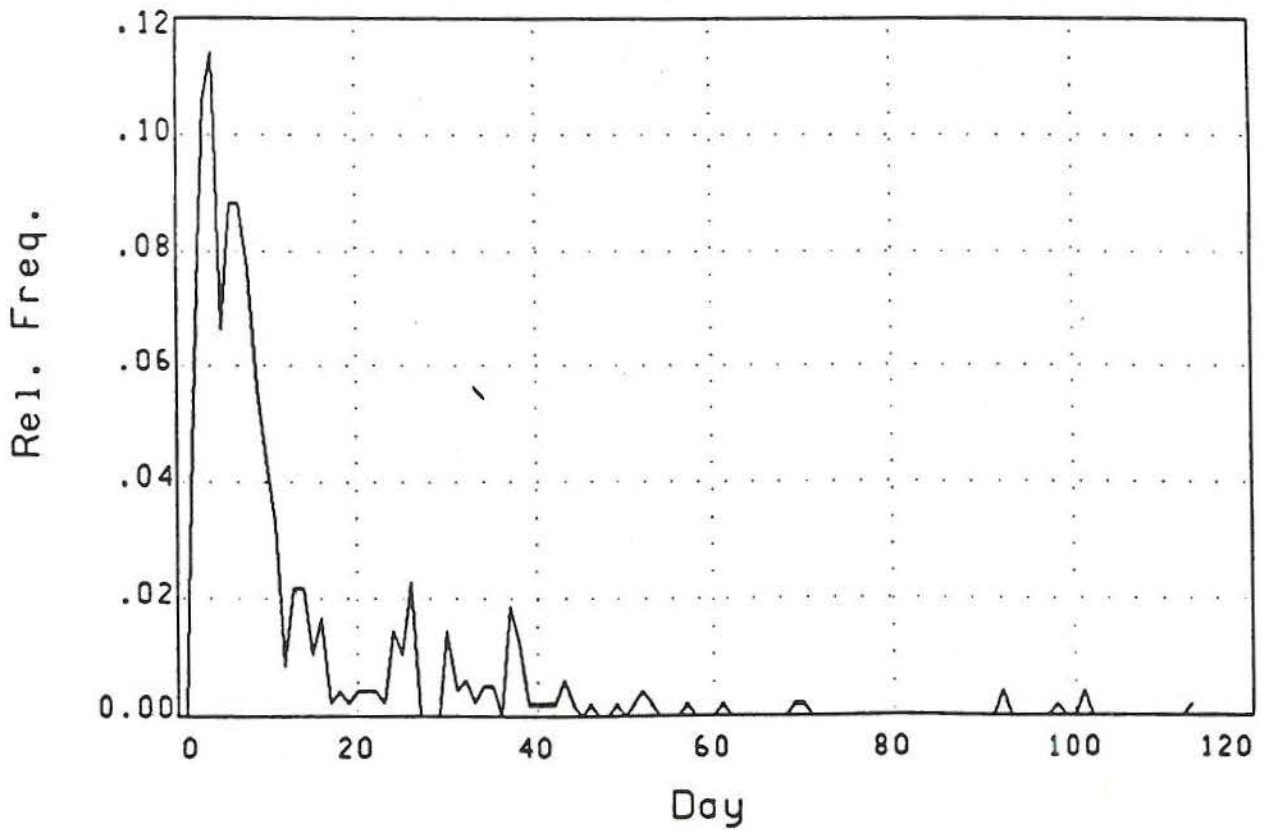
Figure 3. TNC Cash - Responses by day

2. Ohio v. United States Dep't Interior, 880 F.2d 432 (D.C. Circuit 1989).

3. See 56 Federal Register 82:19752-19762 (April 29, 1991).

4. 56 Federal Register 19762 (29 April 1991).

5. Carson, Hanemann and Kopp (1991) also note that one could just as well state that CVM is the "most reliable" method for estimating nonuse values given that it is the only available method.

6. See Mitchell and Carson (1989) at 122 and Chapter 10.

7. Mitchell and Carson (1989) at 123 and Chapter 9.

8. Mitchell and Carson (1989) at 190-191. Content validity or face validity is the issue of whether the measure adequately covers the construct's domain. The basic theoretical construct at hand is the maximum amount of money respondents would actually pay for the given resource service if an appropriate market for the service existed. Content validity can only be evaluated subjectively, for example by examining the wording of questions. Construct validity involves the extent to which a given measure is related to other measures predicted by theory. The comparison of contingent valuation estimates to revealed preference measures, such as those from travel cost or hedonic models, falls in this category. In this case, neither of the measures is sufficiently similar to the construct to be a criteria.

9. Mitchell and Carson (1989) call the class of goods which are similar to private goods (excludable, rival) but not actually traded in organized markets "quasi-private" goods. Fishing access is a good example. In many European countries such as Norway there are highly developed markets for the right to fish.

10. The fact that the services at issue are nonexcludable raises some issues of interpretation. Recall Mitchell and Carson's (1989) definition of the basic theoretical construct in the contingent valuation context: "the maximum amount of money the respondents would actually pay for the public good if the appropriate market for that public good existed" (p. 190). Does an actual cash trust fund provide a criteria for this construct? The problem is that given

nonexcludability, there is a strong likelihood of free rider behavior. In a sense there is no imaginable "appropriate market" for goods lacking the excludability criteria. In this sense, it could be argued that our actual cash trust fund measure is not a criteria, but another measure and that this exercise is one in "construct validity" or more precisely, a subcategory of construct validity called "convergent validity".

11. An alternative and equally accessible approach is to instead utilize the consumer's expenditure function. See, for example, Mitchell and Carson (1989) at 26-27.

12. A final report on this project is forthcoming.

MONTANA WATER LEASING TRUST FUND

c/o Montana Nature Conservancy • P.O. Box 258 • Helena, MT 59624

Dear Montana Angler:

The recent drought years and resulting record low flows have dramatically reduced fish populations on many Montana rivers and streams. In 1988, the reports of declining fish populations read like this:

> More than 2000 fish were killed in Montana's lower Madison River last weekend as water temperatures hit a record 82.5 degrees, and state biologists are concerned about weekend forecasts for air temperatures in the 90s. . . brown trout weighing up to 3 pounds were killed (Associated Press report, June 30, 1988).

> Fishing prospects grim around most of the State: An approximate ten mile stretch of the Red Rock River between Lima and Dell is dry. . . flow near the Big Hole's mouth is a mere trickle. The Jefferson River remains very low and what water is there is heating to fish-killing levels. (*The Missoulian*, August 5, 1988).

We're writing to people who have purchased Montana fishing licenses for two reasons. First, we're asking you to consider a tax-deductible contribution to the newly-established Montana Water Leasing Trust Fund. All of the money collected will be used to lease water for instream flows on Montana streams during critical periods of low flows. Second, we're asking you to complete a brief survey on your recreational use of Montana rivers and your attitudes toward the trust fund. Even if you decide not to make a contribution, please complete the survey booklet. We think you will enjoy completing the survey; it will take only about 5 minutes and we've included a stamped, addressed return envelope for your convenience.

The enclosed brochure describes the trust fund, how it came about, and how it will work to save fish populations and habitat that need the most help right now. If you wish, we'll send you a newsletter to inform you on how the water leasing trust fund is helping Montana streams.

Thank you for your help in ensuring the future of Montana's stream fisheries. If you have any questions about the water leasing program, please contact the Montana Department of Fish, Wildlife, and Parks at (406) 444-2449.

Sincerely,

Brian Kahn
Montana Director
The Nature Conservancy

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V. THIS SECTION WILL HELP US TO UNDERSTAND YOUR RESPONSES.

1. Where do you live? City_____ State_____

2. What is your age _____ years.

3. Are you: ☐ male ☐ female

4. What is the highest year of formal education you completed?

☐ Some grade school   ☐ Some college
☐ Finished grade school   ☐ Finished college
☐ Finished junior high   ☐ Some postgraduate
☐ Finished high school   ☐ Finished postgraduate

Is there anything else you would like to tell us about flow levels in Montana's rivers, or other related issues? We would appreciate any comments.

THANK YOU FOR YOUR HELP!

Please enclose this survey in the postage paid envelope provided.

Would you like to receive a summary of the results of this survey and keep informed on the progress of the Water Leasing Program through The Montana Water Leasing Newsletter? If so, please fill in your name and address and check the appropriate box on the enclosed pledge form. Your name will never be associated with your survey response. You are welcome to join our mailing list whether or not you choose to contribute at this time. **THANKS!**

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SURVEY

MONTANA WATER LEASING TRUST FUND
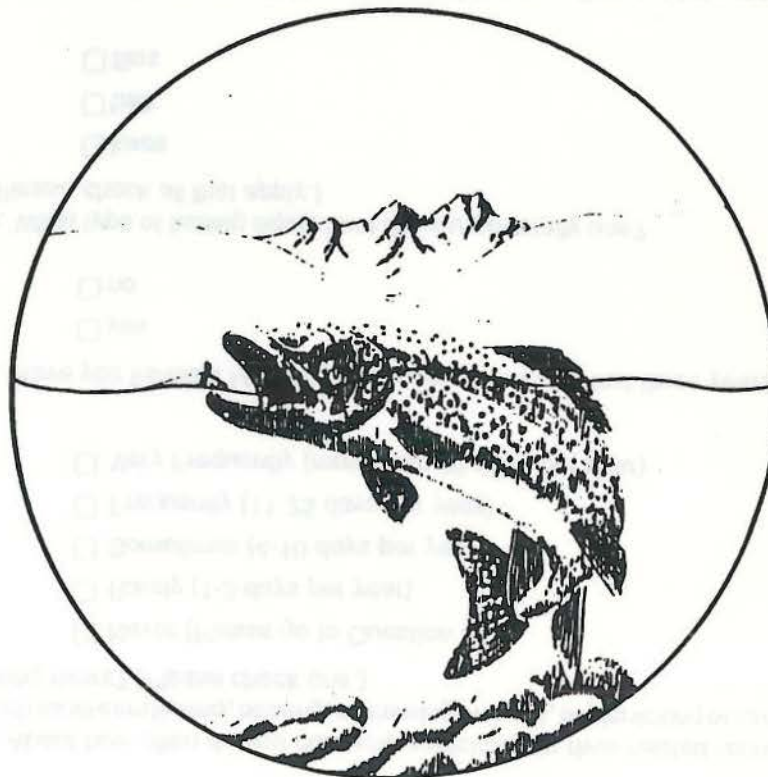
THE NATURE CONSERVANCY

I. FIRST WE HAVE SOME GENERAL QUESTIONS ABOUT YOUR RECREATIONAL USE OF RIVERS; PLEASE ANSWER EVEN IF YOU RARELY OR NEVER VISIT RIVERS FOR RECREATION.

1. About how often do you currently participate in river-related recreation such as stream fishing, boating, swimming in rivers, or picnicking or camping along rivers? (Please check one.)

☐ Never (Please go to Question 5.)

☐ Rarely (1-3 days per year)

☐ Sometimes (4-10 days per year)

☐ Frequently (11-25 days per year)

☐ Very Frequently (more than 25 days per year)

2. Have you fished a Montana stream or river in the last three years?

☐ yes

☐ no

3. What type of fishing equipment do you generally use? (Please check all that apply.)

☐ lures

☐ bait

☐ flies

4. How would you rate fishing compared to your other outdoor recreation activities? (Please check one.)

☐ It's my favorite outdoor recreation activity

☐ It's one of my favorite outdoor recreation activities

☐ It's just one of several outdoor recreation activities that I do

☐ I prefer other outdoor recreation activities

5. Are you a member of any conservation, sport, fishing, or boating organizations?

☐ yes

☐ no

II. THIS SECTION ASKS ABOUT YOUR FAMILIARITY WITH THE BIG HOLE AND YELLOWSTONE RIVERS.

1. Have you ever visited the Big Hole or Yellowstone rivers for recreation?

☐ no (If no, please go to question number 4.)

☐ yes

2. If yes, what recreation activities have you participated in at these rivers? (Please check all that apply.)

☐ fishing ☐ sightseeing ☐ boating ☐ picnicking

☐ swimming ☐ camping ☐ observing wildlife

☐ other _____

3. How many days have you spent recreating at these two rivers in the last three years?

_____ days on the Big Hole River

_____ days on the Yellowstone River

4. Do you plan to visit either of these two rivers for recreation in the next three years?

☐ yes ☐ no

III. THE NEXT QUESTIONS ASK HOW YOU FEEL ABOUT RIVERS AND VARIOUS ENVIRONMENTAL ISSUES.

1. For each statement, check the box that shows how you feel about the statement. You always have an opportunity to agree with the statement, disagree with it, or say you have no opinion.

	strongly agree	agree	no opinion	disagree	strongly disagree
a. I enjoy knowing that my friends can visit rivers for recreation if they want to.	☐	☐	☐	☐	☐
b. I have little concern for endangered species.	☐	☐	☐	☐	☐
c. I'm glad there's wilderness in Montana even if I never get to see it.	☐	☐	☐	☐	☐
d. I feel I should be doing more for Montana's rivers and streams.	☐	☐	☐	☐	☐
e. Protecting the environment should be largely the responsibility of state and federal government.	☐	☐	☐	☐	☐
f. Private conservation organizations should play a major role in protecting our environmental resources.	☐	☐	☐	☐	☐
g. I think most Montana rivers already have enough water in them to be a healthy resource.	☐	☐	☐	☐	☐
h. Rivers have spiritual or sacred values for me.	☐	☐	☐	☐	☐
i. I would be willing to contribute money or time to help Montana rivers even if I could never visit them.	☐	☐	☐	☐	☐

IV. THIS SECTION ASKS HOW FAMILIAR YOU ARE WITH EFFORTS TO CONSERVE NATURAL RESOURCES — AND ABOUT YOUR OWN WILLINGNESS TO BECOME INVOLVED.

1. In various parts of the country, trust funds have been set up to purchase water or land resources to conserve unique natural resources. The Nature Conservancy, Ducks Unlimited, and the Rocky Mountain Elk Foundation are examples of the types of groups that can do this. How familiar are you with these efforts? (Please check one.)

☐ I have never heard of such trust funds

☐ I have heard of them but don't know much about them

☐ I know a fair amount about them

☐ I know a great deal about them

2. As you may be aware, many Montana rivers typically have low summer-time flows. In recent years, many rivers had record low flow levels that harmed fisheries and recreational use. Montana Department of Fish, Wildlife and Parks recently identified two high priority streams for improved instream flows:

Swamp Creek, near Wisdom, is one of only three spawning tributaries which contributes recruits to the currently declining Big Hole River arctic grayling population, the last stream dwelling population of this species in the lower forty-eight states as well as a "Species of Special Concern" in Montana.

Big Creek, a tributary of the Yellowstone near Emigrant, is a spawning stream for the Yellowstone cutthroat trout, a "Species of Special Concern" in Montana that has been reduced to only eight percent of its original range.

You can help support this program by a tax-deductible donation to the Montana Water Leasing Trust Fund, being administered by The Nature Conservancy. Through an agreement with the Montana Department of Fish, Wildlife and Parks, funds from the trust are transferred to the agency only when needed to acquire a water lease. Every dollar you contribute will go directly to increasing flows in these Montana streams. All administrative costs as well as the costs of this survey are being covered by other funds. Through your support, this experimental program has the potential to benefit streams in all regions of Montana..

We hope you are able to contribute. Please check the amount that you are enclosing and complete the pledge form provided:

☐ $10   ☐ $25   ☐ $50   ☐ $100   ☐ $250   ☐ $_____Other

If you are able to contribute, could you please tell us the most important reason(s) why you are supporting this program:

_____

_____

If you choose to contribute at this time, we would like to know the most important reason(s) for this decision:

_____

_____

Appendix B. Hypothetical-Nature Conservancy survey instrument, Part IV.

MONTANA WATER LEASING TRUST FUND

c/o Montana Nature Conservancy • P.O. Box 258 • Helena, MT 59624

Dear Montana Angler:

The recent drought years and resulting record low flows have dramatically reduced fish populations on many Montana rivers and streams. In 1988, the reports of declining fish populations read like this:

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> Fishing prospects grim around most of the State: An approximate ten mile stretch of the Red Rock River between Lima and Dell is dry. . . flow near the Big Hole's mouth is a mere trickle. The Jefferson River remains very low and what water is there is heating to fish-killing levels. (*The Missoulian*, August 5, 1988).

In response to this problem, the Montana legislature in 1989 passed a bill authorizing Montana Department of Fish, Wildlife and Parks to lease water to augment instream flows. As the enclosed brochure describes, this agency and the Montana Nature Conservancy are now developing a trust fund to pay for these leases.

We're writing to a small sample of individuals who have purchased Montana fishing licenses. We are asking you to complete the enclosed brief survey on your recreational use of Montana rivers and your attitude toward the trust fund. This is not a request for money. The information you provide will help us in developing the trust fund.

We think you will enjoy filling out the survey; it will take only about five minutes and we've included a stamped, addressed return envelope for your convenience. We need to hear from you even if you don't have strong feelings about instream flows. For our results to be accurate and representative, we need your opinion. Your response is completely anonymous as there is no way your name can be associated with your response.

Thank you for your help in ensuring the future of Montana's stream fisheries. If you have any questions about the water leasing program, please contact the Montana Department of Fish, Wildlife, and Parks at (406) 444-2449.

Sincerely,

Brian Kahn
Montana Director
The Nature Conservancy

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IV. THIS SECTION ASKS HOW FAMILIAR YOU ARE WITH EFFORTS TO CONSERVE NATURAL RESOURCES — AND ABOUT YOUR OWN WILLINGNESS TO BECOME INVOLVED.

1. In various parts of the country, trust funds have been set up to purchase water or land resources to conserve unique natural resources. The Nature Conservancy, Ducks Unlimited, and the Rocky Mountain Elk Foundation are examples of the types of groups that can do this. How familiar are you with these efforts? (Please check one.)

☐ I have never heard of such trust funds

☐ I have heard of them but don't know much about them

☐ I know a fair amount about them

☐ I know a great deal about them

2. As you may be aware, many Montana rivers typically have low summer-time flows. In recent years, many rivers had record low flow levels that harmed fisheries and recreational use. Montana Department of Fish, Wildlife and Parks recently identified two high priority streams for improved instream flows:

Swamp Creek, near Wisdom, is one of only three spawning tributaries which contributes recruits to the currently declining Big Hole River arctic grayling population, the last stream dwelling population of this species in the lower forty-eight states as well as a "Species of Special Concern" in Montana.

Big Creek, a tributary of the Yellowstone near Emigrant, is a spawning stream for the Yellowstone cutthroat trout, a "Species of Special Concern" in Montana that has been reduced to only eight percent of its original range.

Suppose that you could help support this program by a tax-deductible donation to the Montana Water Leasing Trust Fund, being developed by The Nature Conservancy. Through an agreement with the Montana Department of Fish, Wildlife and Parks, funds from the trust would be transferred to the agency only when needed to acquire a water lease. Assume that every dollar contributed would go directly to increasing flows in these Montana streams. This experimental program has the potential to benefit streams in all regions of Montana.

If you were contacted in the next month, would you be willing to make a donation to this trust fund?

☐ yes   ☐ no

If yes, please check the amount that you would be willing to contribute:

☐ $10   ☐ $25   ☐ $50   ☐ $100   ☐ $250   ☐ $_____ Other

If you would choose to contribute, could you please tell us the most important reason(s) why you would support this program:

_____

_____

_____

If you would not choose to contribute, we would like to know the most important reason(s) for this decision:

_____

_____

_____

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Appendix C. Hypothetical-University of Montana survey instrument,
Part IV.

University of Montana

Missoula, Montana 59812

Dear Montana Angler:

I'm sure you are aware that the recent drought years have had many effects on Montana. Farmers, ranchers, towns and cities, and industries suffer when there isn't enough water to go around.

The low water levels in many rivers have damaged fish and wildlife that depend on rivers and streams. Anglers, boaters, and other people who use rivers for recreation have not been able to pursue their activities. This also has affected residents and communities relying on tourism as a source of income.

The University of Montana is studying the effects of drought and low water levels in rivers, and we need your help. The questionnaire enclosed asks you about your use of rivers for recreation and how you feel about related environmental issues.

We think you will enjoy filling out the survey; it will take only about five minutes and we've included a stamped, addressed return envelope for your convenience.

You are one of a small number of Montana fishing license holders randomly selected to receive this survey. For our results to be accurate and representative, we need your opinion. We need to hear from you even if you don't have strong feelings about these issues. Your opinions will be completely confidential because your name will never be associated with your responses. The surveys are numbered so that we can keep track of who has responded.

Thank you for your help. If you would like a summary of the results of this study, please write your name and address on the return envelope (not on the questionnaire) and we will make sure you get one. If you have any questions, call Becky Hanway or me at (406) 243-2925.

Sincerely,

John Duffield
Study Director

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Equal Opportunity in Education and Employment

V. THIS SECTION WILL HELP US TO UNDERSTAND YOUR RESPONSES.

1. Where do you live? City_____ State_____

2. What is your age _____ years.

3. Are you: ☐ male ☐ female

4. What is the highest year of formal education you completed?

☐ Some grade school   ☐ Some college
☐ Finished grade school   ☐ Finished college
☐ Finished junior high   ☐ Some postgraduate
☐ Finished high school   ☐ Finished postgraduate

6. Please check your household's income before taxes last year:

☐ under $5,000   ☐ $20,000-24,999   ☐ $50,000-74,999
☐ $5,000-9,999   ☐ $25,000-29,999   ☐ $75,000-125,000
☐ $10,000-14,999   ☐ $30,000-39,999   ☐ $125,00-250,000
☐ $15,000-19,999   ☐ $40,000-49,999   ☐ over $250,00

Is there anything else you would like to tell us about flow levels in Montana's rivers, or other related issues? We would appreciate any comments.

THANK YOU FOR YOUR HELP!

Please enclose this survey in the postage paid envelope provided.

If you would like to receive a summary of the results of this survey, please write your name and address on the outside of the return envelope — not on the survey. Your name will never be associated with your survey response. THANKS!

Water Now and for the Future

The Value of Montana Rivers
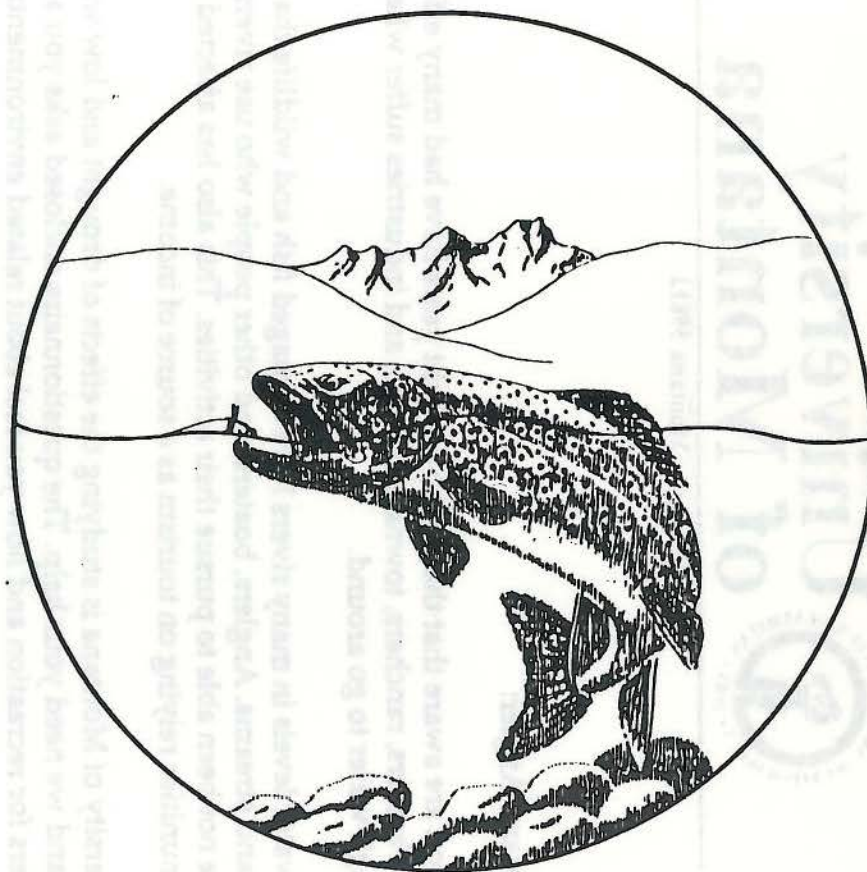
University of Montana

IV. THIS SECTION ASKS HOW FAMILIAR YOU ARE WITH EFFORTS TO CONSERVE NATURAL RESOURCES — AND ABOUT YOUR OWN WILLINGNESS TO BECOME INVOLVED.

1. In various parts of the country, trust funds have been set up to purchase water or land resources to conserve unique natural resources. The Nature Conservancy, Ducks Unlimited, and the Rocky Mountain Elk Foundation are examples of the types of groups that can do this. How familiar are you with these efforts? (Please check one.)

☐ I have never heard of such trust funds

☐ I have heard of them but don't know much about them

☐ I know a fair amount about them

☐ I know a great deal about them

2. As you may be aware, many Montana rivers typically have low summertime flows. In recent years, many rivers had record low flow levels that harmed fisheries and recreational use. Montana Department of Fish, Wildlife and Parks recently identified two high priority streams for improved instream flows:

Swamp Creek, near Wisdom, is one of only three spawning tributaries which contributes recruits to the currently declining Big Hole River arctic grayling population, the last stream dwelling population of this species in the lower forty-eight states as well as a "Species of Special Concern" in Montana.

Big Creek, a tributary of the Yellowstone near Emigrant, is a spawning stream for the Yellowstone cutthroat trout, a "Species of Special Concern" in Montana that has been reduced to only eight percent of its original range.

Both of these streams have critical spawning habitat that is severely dewatered in most years. To help improve flows on these streams, a trust fund could be established to lease water at levels that would maintain these fisheries. If you were contacted within the next month, would you contribute to a trust fund to buy water needed to maintain summer flows on these streams?

☐ yes   ☐ no

If yes, please check the amount that you would be willing to contribute:

☐ $10 ☐ $25 ☐ $50 ☐ $100 ☐ $250 ☐ $_____ Other

If you would choose to contribute, could you please tell us the most important reason(s) why you would support this trust fund:

_____

_____

_____

If you would not choose to contribute, we would like to know the most important reason(s) for this decision:

_____

_____

_____

Appendix D. Brochure.

THE MONTANA WATER LEASING TRUST FUND

Our Goal is to Protect Fish Habitat Through Instream Flows.

Montana Water Leasing Trust Fund
c/o Montana Nature Conservancy
Power Block West • 3rd Floor
Post Office Box 258
Helena, MT 59624

The Montana Water Leasing Program has the potential to solve one of Montana's biggest problems — the allocation of water to instream flows — in a way that is fair to all concerned.

- Authorized by House Bill 707, 1989 Montana Legislature
- Recognizes and protects existing water rights and uses
- Uses the market process to identify willing parties
- Leases paid by private donations to the Montana Water Leasing Trust Fund
- Potential for improving instream flows for fisheries and recreation
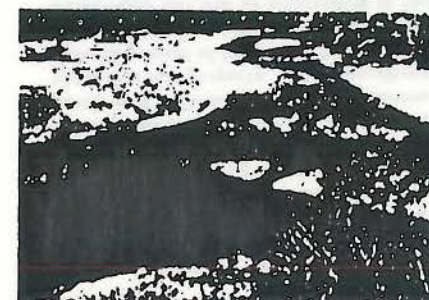
A Montana stream with and without adequate instream flows.
—photos by Joe M. Halterman

Early Summer — adequate flows

Late Summer — inadequate flows

Q. What is the Montana Water Leasing Program?

A. It is a program administered by the State of Montana that provides a means for leasing water that would otherwise be diverted for irrigation. The leased water remains instream to benefit fish, wildlife, and recreation.

Q. What is the legal authority for this program?

A. House Bill 707, passed by the Montana legislature in April, 1989 and signed into law by Governor Stan Stephens on May 11 of that year.

This bill gives the Montana Department of Fish, Wildlife and Parks the authority to lease water from willing parties to keep water in a given stream to benefit fish populations. Water can be leased on up to five streams during the four year life of this pilot program which expires in 1993.

Q. Why is this program necessary?

A. The existing use of surface water in Montana is based on a "first in time, first in right" legal principle. The first user of a given stream has the priority right. Reflecting Montana's pioneer past, these rights are mainly held by ranchers.

Today, just one year after our State Centennial, Montana is a different place than it was in 1889. Now, along with agriculture, recreation is a major use on our rivers and streams. Also, people have begun to value healthy rivers for their own sake—for the beauty, the fisheries and the wildlife.

Montana is blessed with an abundance of unique rivers and tributaries—the Smith, the Clark Fork, the Musselshell, the Big Hole — but portions of these and many other streams are nearly dry in poor water years.

Q. Why is there a Montana Water Leasing Trust Fund?

A. The legislature did not provide funding for the actual leasing of water, but allowed public and private groups to contribute funds to enable Montana Department of Fish, Wildlife and Parks to pay for leases.

Q. Why would a rancher be willing to lease his or her water rights?

A. Ranches are business enterprises. The ranch manager must continually make decisions, such as whether to lease a given field or pasture. However, from the business standpoint, water is also a renewable resource—like grass or timber.

In some situations, the value of the water to the rancher, for example to irrigate a second cutting of hay in July or August, may be less than the value of the water left instream for fish and recreation. In such cases the rancher may choose to be a willing lessor.

Q. How does Montana Department of Fish, Wildlife and Parks choose streams to be leased?

A. The agency's professional staff identifies streams where there are substantial benefits to fisheries from increased streamflow and where there is a history of dewatering. The staff recommendations must then be approved by the Fish and Game Commission and the Board of Natural Resources and Conservation must approve the streams for leasing before the leasing process can further proceed.

Big Creek is a tributary of Yellowstone River near Emigrant. Upstream view from bridge on Highway 89 shows a part of the one-mile stream reach that goes dry below six irrigation diversions. —photo by Chris Clancy

Q. What streams have been recommended for leasing to date?

A. The agency has identified two critical spawning streams in southwest Montana: Swamp Creek, a tributary to the Big Hole River near Wisdom and Big Creek, a tributary to the Yellowstone River near Emigrant.

Swamp Creek is one of just three tributaries to the Big Hole that has significant spawning runs of Arctic grayling. The Big Hole has the only stream-dwelling population of Arctic grayling left in the lower 48 states. A lease arrangement would assure sufficient flows during critical spawning and fry-rearing stages.

Water leasing on Big Creek will improve spawning conditions for Yellowstone cutthroat trout. Currently the lower part of this stream is severely dewatered in summer months, when eggs should be incubating and the fry emerging to migrate to the Yellowstone River. Pure-strain Yellowstone cutthroat trout occupy only eight percent of their original range in Montana.

Q. Why was The Nature Conservancy chosen to administer the trust fund?

A. Aside from being one of the most respected conservation organization in the U.S., The Nature Conservancy is also perhaps the most unique. It pursues its goal of protecting natural diversity not by lobbying in the political arena, but by working quietly and effectively within our market system.

The Nature Conservancy has, through outright purchase, negotiation of conservation easements, or cooperative agreements with public agencies, protected over 5.5 million acres in the U.S. and Canada. It administers the largest system of private nature reserves — 1,100 such areas — in the world.

Q. Is The Nature Conservancy active in Montana?

A. Yes. The Nature Conservancy has an active presence in Montana through the Big Sky Field Office in Helena. To date about one third of a million acres have been protected in this state, including 28 specific properties.

Recently The Montana Nature Conservancy obtained an easement on Ted Turner's Flying D ranch near Gallatin Gateway. The easement ensures that this property, which constitutes more than 10 percent of the privately held lands adjacent to Yellowstone National Park, will never be subdivided but will be maintained in historical agricultural uses. This easement is the single largest easement in U.S. history.

Q. What are the potential benefits of the water leasing program?

A. This experimental water leasing program will provide critical spawning habitat in Big Creek and Swamp Creek. Healthy fisheries generate recreation-related business that many small Montana communities have come to depend on.

In the long run, if the water leasing program is successful and receives strong public support, the Montana legislature will be more likely to continue and expand the program in the future.

As one fishery manager put it: "Montana has a lot of 'instant' trout streams — just add water." There is a good potential for improving stream-based fisheries throughout Montana, particularly on smaller, cold water streams.

Q. What will determine the success of this water leasing program?

A. Success will depend on the willingness of individuals — ranchers, recreationists, and others who value instream flow — to participate.

There are already individuals who have come forward in the ranching community and shown their willingness to begin negotiating leases. It is now up to recreationists and others who want healthy streams to do their part.