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STAKEHOLDER PREFERENCES FOR WATER MANAGEMENT ALTERNATIVES IN THE RED RIVER BASIN

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ABSTRACT

Effective and efficient water management implies understanding the wants and desires of the human populations through its key stakeholder groups. As a valuable resource that involves many regulating and managing players, the Red River of the North basin is an excellent case for studying stakeholder preferences and presenting them to involved managers. The primary goal of this research was to analyze stakeholder preferences for hypothetical Red River basin fresh water management alternatives. Specific objectives included comparing preferences across key stakeholder groups and estimating residents' willingness to pay for additional water management programs.

Initial experts' and focus group meetings were used to select appropriate attributes and levels to be used within a stated choice experiments analysis. The final list of attributes included: additional recreation opportunities, water supply augmentation projects, water quality initiatives, and the type of institution that would be trusted. An additional levy upon annual property taxes, ranging from $20 to $240, was used as the price of these additional programs. Mail surveys were sent to three main stakeholder groups: informed stakeholders, who had attended the Red River Basin Commission water management conference; decision-makers, including county commissioners and mayors in basin constituencies; and random residents. An overall response rate of 34% was achieved.

One interesting result was the general homogeneity of opinions across stakeholder groups. A log likelihood test failed to reject the hypothesis that stakeholders' preferences were the same across groups. Results from the pooled nested logit model show younger respondents, males, non-farmers and those categorized as pro resource conservation in favor of additional water management projects. Initiatives that were favored by respondents included: phosphorous and nitrogen reduction and enhanced fishery management. Because the population of random residents did not demonstrate a preference for any additional water management option as opposed to the *status quo*, willingness to pay was not estimated.

Keywords: choice experiments, stakeholder analysis, Red River of the North, stated preferences, water resources management

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David R. Torpen and Robert R. Hearne[1]

INTRODUCTION

Many regions and river basins experience water management challenges including: drought-like conditions, floods, poor surface water quality, threatened water and wetland habitats, changing demand for water, and inadequate infrastructure. These concerns do not necessarily confine themselves to any particular political constituency, nor can they be readily addressed by any agency or organization dedicated to any sector or special interest. Proper comprehensive management often requires the collaboration of multiple governments, levels of government, and non-government organizations. The strain of upstream-downstream relations, ill-defined property rights, and institutional limitations contribute to the challenges of water management.

The Red River of the North basin is one such example of a watershed that requires the commitment of various levels of government and non-government players to maintain its water resources. Containing land in three states in the United States and one Canadian province, the basin contains approximately 45,000 square miles, of which about 39,200 square miles are in the United States (Krenz and Leitch, 1998). The Red River forms at the junction of the Otter Tail and Bois de Sioux rivers in Breckenridge, Minnesota and Wahpeton, North Dakota. The river flows in a northerly direction between North Dakota and Minnesota, meandering approximately 550 miles. In Canada it joins up with the Assiniboine River in Winnipeg, Manitoba, and then empties into Lake Winnipeg (Minnesota Department of Natural Resources, 2007).

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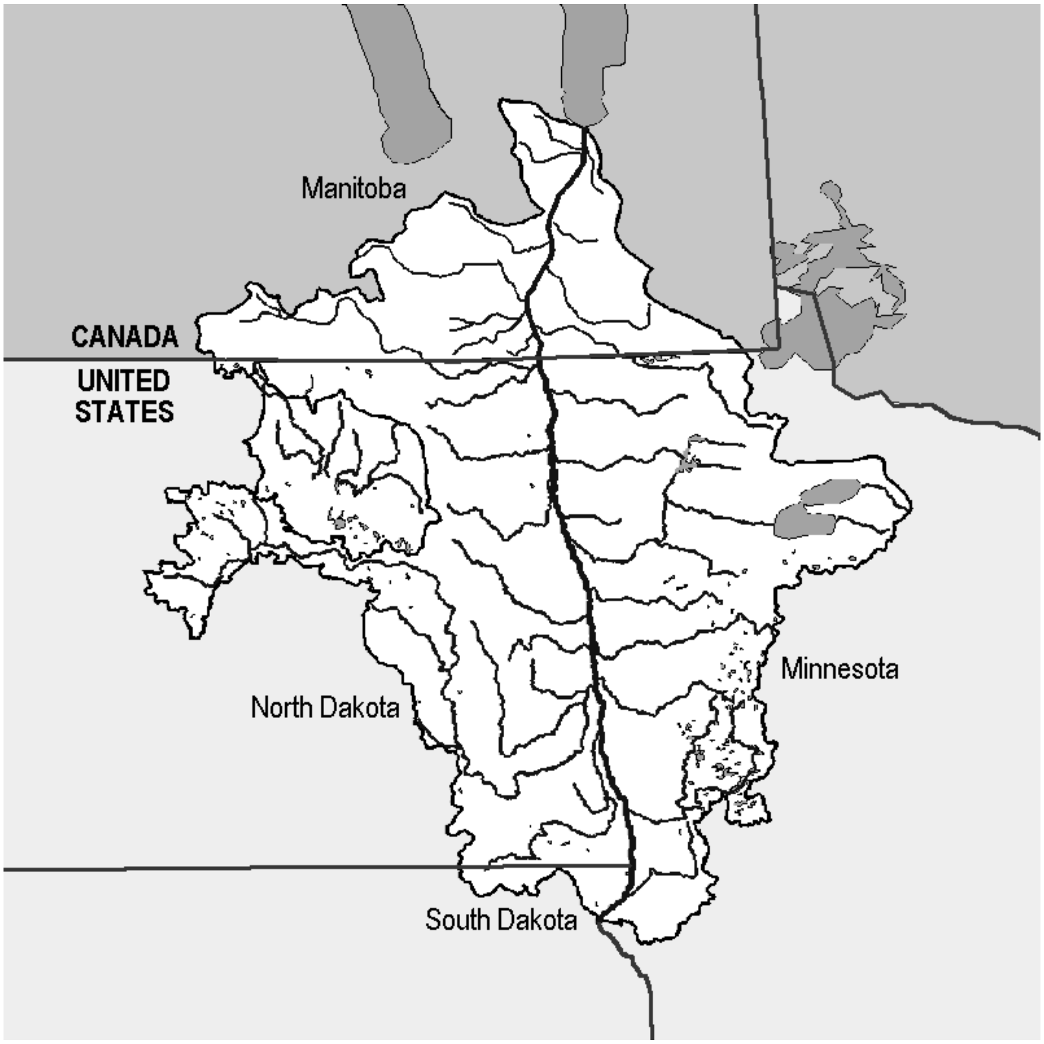

Figure 1. Red River of the North Basin Map.
Source: Red River Basin Decision Information Network (www.rrbdin.org).

Much of the basin occupies land once covered by ancient Lake Agassiz. The basin inherited its fertile soil and flat topographical features from sedimentation in this lake (Krenz and Leitch, 1998). The average slope of the Red River is one half foot per mile. The majority (roughly 84%) of land in the basin is used for agriculture and livestock production. Major crops in the area include sugar beets, wheat, soybeans and corn (USDA ERS, 2007). Cattle are the major livestock produced. In North Dakota, the top five counties in the value of agricultural production all border the Red River. These are Cass County, Richland County, Walsh County, Grand Forks County, and Pembina County. Marshall County, which is one of two South Dakota counties that contain land in the basin, is one of the top five producing counties in South Dakota. None of the top five agricultural-producing counties in Minnesota have territory within the Red River Basin (USDA ERS, 2007).

Society receives a number of benefits as a result of water resources in the Red River basin. But there are also inherent costs associated with mitigating the impacts of the basin's droughts and floods as well as costs associated with watershed and water resources management. Some of these benefits and costs can easily be measured in terms of market process. But other benefits and costs are for non-market environmental goods and services. It is important that water management agencies manage resources in a way that balances society's desire to consume market goods and to reduce government expenditure with the alternative desires for healthy ecosystems, outdoor recreation, and water quality. It is specifically important to bridge the information gap so that local stakeholders can express their preferences for market and non-market environmental good and services to water managers.

As a valuable resource that involves many regulating and managing players, the Red River basin is an excellent case for studying stakeholder preferences and presenting them to involved agencies and decision-makers. The primary goal of this research is to analyze stakeholder preferences for hypothetical Red River basin fresh water management alternatives. Specific objectives include: (1) to identify issues relevant to stakeholders within the basin of the Red River of the North; (2) to estimate stakeholder willingness to pay for Red River basin water-related initiatives; and (3) to compare preferences among different groups of stakeholders.

The next section of this paper will present the methodology employed for a stated choice stakeholder analysis of water management alternatives. Results are presented in the paper's third section. This is followed by the paper's conclusions which discuss some of the implications of stakeholder analysis.

BACKGROUND

The Red River of the North's basin contains territory in both the United States and Canada (Krenz and Leitch, 1998). The United States portion of the basin includes land in Minnesota, North Dakota, and South Dakota and contains roughly 39,200 square miles (Figure 1). Parts or all of 24 counties in North Dakota, parts of 2 counties in South Dakota, and parts or all of 21 counties in Minnesota lie in the basin. About 11% of the Red River drainage area is in Canada. Approximately 41% of the drainage area lies in Minnesota, 47% in North Dakota, and the remaining 1% in South Dakota.

While most of the land supports rural living, the population of the Red River basin is becoming more urbanized (ERS, 2007). The river bordering cities of Fargo-Moorhead-West Fargo and Grand Forks-East Grand Forks comprise a large and growing percentage of the residents living in the U.S. portion of the basin. Winnipeg has the majority of residents in the Canadian portion.

The river is a valuable fresh water resource to the people that live within its watershed. The Red River serves as the primary of household water for most urban residents of the U.S. portion of the basin. Settlers were attracted to the area in part due to the available water and the fertile soil of the basin. In the past the river was used as a transportation hub, with steamboats traveling north and south. The river has also been used for recreation such as boating and swimming in the summer, and for snowmobiling in the winter. Recreational fishing services are attractive, as large catfish and other game fish are a part of the wildlife. The river supports habitat for wildlife, plants, and animals.

The Red River basin is susceptible to droughts and floods. A drought in the 1930s reduced water supply to long lasting no-flow conditions, and less-severe droughts in the 1970s and 1980s also required conservation practices to be put into place for 3 and 2 years, respectively. A flood in 1950 devastated the city of Winnipeg, Manitoba. A historic flood of the Red River in 1997 caused about $5 billion dollars in damages in the United States and Canada, and required emergency intervention (International Joint Commission, 2000). Two major floods subsequent to 1997, in 2003 and 2006, produced negative impacts on communities in the basin. Because of better preparation and mitigation practices, these impacts were minor.

Fish kills occurred in the Red River in 2003, 2006, and 2007 and occasionally occur in other basin lakes and streams (Dokken 2007; Olson 2006). These can occur as a result of weeks of dry weather that are followed by a rainstorm. The combined low-flow conditions and rapid runoff, including sediments and urban residue, result in decreased dissolved oxygen levels for fish. Fish kills can also occur when not enough oxygen gets into the water during long and cold winter months. This most often occurs in shallow lakes.

Water quality impairments include excessive phosphorous and nitrogen (Paakh, Goeken, and Halvorson 2006). These nutrients from city and farm runoff enter the Red River either directly or first into one of its tributaries. As these nutrients flow downstream, excess amounts have been linked to the buildup of algae strains in Lake Winnipeg. The buildup of blue-green algae on over 13,000 square kilometers of the surface area of the lake has impeded commercial fishing, caused lake water to be aesthetically undesirable, and put five species on the endangered or threatened species list (Lake Winnipeg Implementation Committee, 2005).

Federal, state, and local governments allocate specific water management duties to specific agencies. At a federal level, the Soil Conservation Service, Fish and Wildlife Service, the U.S. Geological Survey, Army Corps of Engineers, Environmental Protection Agency, and National Park Service, among many others, are involved in natural resource management issues (Krenz and Leitch 1998). The United States' Clean Water Act was originally enacted in 1972 as a result of growing public awareness about water pollution (U.S. EPA, 2007). Section 303.d requires each state to develop ambient pollution standards, ranking impairments in terms of priority and developing action plans for pollution mitigation. When waterways exceed ambient pollution criteria, the state must then develop a total maximum daily load (TMDL), which estimates the maximum amount of every identified pollutant that a water body can receive and still meet water quality standards. The Red River has two separate lists of water quality impairments– one prepared by Minnesota and the other prepared by North Dakota (Hearne 2007).

At a state level, Minnesota utilizes its Department of Natural Resources, the Minnesota Pollution Control Agency, and the Department of Health to deal with water and natural resource administration. In 1955 the Minnesota Watershed Act established watershed districts for local water management. Soil and water conservation districts in Minnesota are other local entities that aid in water management. These local special districts have the power to levy property taxes and to charge special assessments as a way to obtain funding for relevant projects (Kritsky forthcoming).

In North Dakota, the State Water Commission, Department of Health, and the Game and Fish Department deal with water quality and supply issues as well as ecosystem and wildlife issues. Local water resource districts and soil conservation districts have the power to levy the property tax for funds to complete projects (Kritsky forthcoming).

In South Dakota, the Department of Environment and Natural Resources, the Department of Game, Fish, and Parks, and the Department of Health are state-level authorities over water resources. There are also local conservation districts and water project districts that help manage water-related issues. Conservation districts in general receive most of the funding, although occasionally a water project district will implement a project when deemed necessary. Both have the ability to levy property taxes in order to receive funding. In addition to government institutions, there are non-government organizations that work and lobby as a voice of the people. These also provide management services and advice for basin water resources. They range from local grassroots involvement all the way to the international level.

Water supply issues, runoff storage, wetland restoration, drainage, and environmental protection are all significant issues when it comes to managing water resources. Structural and non-structural measures can be put in place to help mitigate the effects of these water quantity and quality issues, but leadership and cooperation among all groups of stakeholders is needed (Krenz and Leitch 1998). The management system is complex due to the number and roles of involved institutions. For instance, there are separate water quality standards for each state (Hearne 2007). Also, the U.S. Army Corps of Engineers implements projects through two offices, the St. Paul office for the Minnesota side and the Denver office for the North Dakota side. Additionally, watershed districts in Minnesota receive more funding than their North Dakota water resource district counterparts (Kritsky forthcoming). Soil and water conservation districts in Minnesota receive less funds than their North Dakota soil conservation district counterparts (Kritsky forthcoming). A number of involved agencies at the local, state, federal, and international level have different focuses, different goals, and sometimes conflicting tasks and information (Krenz and Leitch, 1998).

The Red River basin includes a long list of institutions that are involved in managing its water and natural resources (Hearne 2007). Institutional organization of the Red River basin is a complex system partly because Minnesota, North Dakota, and South Dakota have different water laws. Minnesota's water law is based upon riparian rights – landowners whose property borders a body of water have the right to use the water for reasonable purposes (Hearne 2007). North Dakota's and South Dakota's water law is based primarily upon prior appropriation rights – the first person to use the water for a beneficial purpose is allowed to continue using the water for that purpose (Hearne 2007). Other stakeholders may then use the water so long as they don't infringe on the person who was first there.

LITERATURE REVIEW

Since many people care about and use the natural environment for a variety of activities, it is important for decision-makers to adequately develop policies that reflect the preferences of society. Society's values are dynamic, and one pillar of democratic public policy is to reflect these values as closely as possible. Measuring these values provides information for decision-making and project planning. While ideally public policy would quickly adapt to match society's preference changes, it is acknowledged that the policy-making process is often time consuming. The following are articles that are pertinent to multiple attribute stated choice experiments' of stakeholder preferences for water management options.

Estimating the value of non-market goods is different from estimating the value of goods and services traded in a market-like setting (Louviere et al., 2000). Revealed preference data are often not available for non-market goods, so stated preference techniques are frequently utilized to estimate stakeholder willingness to pay for the good. When analyzing willingness to pay for non-market goods, stated preference techniques elicit responses from people based on answers to questionnaires. Stated preference data can include hypothetical and existing alternatives (Louviere et al. 2000). Firms and researchers often use stated preference techniques to study the effect that new product attributes have on quantity demanded. Stated preference techniques have been used extensively in marketing, transportation and environment studies. Indeed, organizations have shown a revealed preference for stated preference data (Louviere et al., 2000).

Blamey et al. (2000) studied the valuation of remnant vegetation and species in the Desert Uplands of Central Queensland, Australia. Their model yielded marginal rates of substitution among attributes and levels, predicted market share for sets of alternatives, and provided the monetary equivalence of the utility difference among choice sets. The authors estimated a positive willingness to pay for protecting endangered species, preventing loss of regional income, and maintaining unique ecosystem attributes.

Carlsson et al (2003) studied the value of wetlands in Staffanstorp, Sweden. In addition to being a cost-effective retention strategy, wetlands also promote biodiversity, recreation, and landscape diversity. Staffanstorp had experienced a 90% reduction of wetlands due to urban and rural expansion. This expansion increased overall nutrient runoff, which resulted in eutrophication of coastal waters and groundwater. Thus, constructing a wetland was proposed in order to mitigate the impairments. Due to the variety of uses of wetlands the authors sought to estimate marginal willingness to pay for various attributes of wetland restoration. The authors surveyed a random group of residents in Staffanstorp. Attributes included total cost, surrounding vegetation, biodiversity, fish, fenced waterline, crayfish, and walking facilities. Results showed that stocking crayfish and building fenced waterline were undesirable. Respondents were willing to pay for improved conditions for fish, biodiversity, walking facilities around the wetland, and the surrounding vegetation.

Collins, et al (2005) studied the economic value that residents place on restoration projects of Deckers Creek in West Virginia. Specifically the authors estimate the value of mitigating the effects of acid mine drainage (AMD). Other water impairments to Deckers Creek included trash and sewage. The authors created a survey instrument to collect data for valuation within an AMD watershed, and used the data to estimate economic values for different levels of stream restoration. They compared the results across populations of users and non-users in the Deckers Creek watershed. Aggregate welfare of the watershed population was estimated to be $1.87 million per year for the complete restoration of aquatic life, swimming, and scenic quality.

Alberini, Longo and Riganti (2006) compared and contrasted the preferences of residents with the preferences of public officials for urban regeneration and transformation projects. The two stakeholder groups were selected to find out where infrastructure proposals were controversial. Results enabled the authors to identify the extent to which public officials agreed with their constituents and how communication could be improved.

METHODOLOGY

Choice experiments are a stated preference technique that allows analysts to assess preferences and estimate willingness to pay from respondents' responses to a hypothetical market solicitation. Choice experiments are based upon two theoretical foundations, Lancasterian consumer theory and random utility theory. Lancasterian theory posits that utility is derived from the attributes of a particular product. Random utility theory posits that individual utility ($\boldsymbol{U}$) is unknown but can be decomposed into a systematic or deterministic component (***V***) and an unobserved or stochastic component (ε). Thus, for individual ***j*** in scenario ***i***, utility can then be expressed as

$$U_{ij} = V_{ij} + \varepsilon_{ij}. \tag{1}$$

Since the systematic component can be expressed as a linear function of explanatory variables, V_{ij}, can be referred to as

$$V_{ij} = \beta' \mathbf{x}_{ij}. \tag{2}$$

The analysis of multiattribute choice experiment data requires maximum likelihood estimation. Assuming independently and identically distributed Type 1 extreme value error terms with a scale factor μ and a variance σ^2, where $\mu > 0$ and $\sigma^2 = \pi^2/ 6\mu^2$, it is possible to use the multinomial logit model, such that the conditional probability of alternative ***A*** being selected out of a set of alternatives $\Phi = (\boldsymbol{A}, \boldsymbol{B}, \boldsymbol{C})$ is estimated as

$$P(A|\Phi) = \frac{\exp(\mu V_A)}{\sum_j \exp(\mu\, V_j)} \qquad \forall j \in \Phi\,. \tag{3}$$

The multinomial logit model requires the assumption of independence of irrelevant alternatives (IIA), which implies that the probability of choosing one alternative over another is unaffected by the presence or absence of additional alternatives (Louvierre et al, 2000; Hensher et al, 2005).

The nested multinomial logit model is used when the scenarios are logically grouped into a decision tree and the respondents' decision making process is seen to be iterative. In this case, a respondent must first decide whether to opt for an alternative water management option or to maintain the *status quo*. If an alternative water management option is chosen, then the respondent can decide which of the presented options to select. One advantage of the nested logit model is that it does not require the IIA assumption. The nested logit model assumes that an individual's probability of choosing a new proposed alternative ***i*** is a function of the probability of choosing any new alternative, as opposed to the *status quo* option, as well as the preference toward alternative ***i*** over the other proposed alternatives in the choice set J_s. Thus, the proposed trip alternatives are considered to be nested into one branch, ***s***, in a decision tree that includes an alternative branch, ***n***, for *status quo* (see Figure 2). Assuming an extreme value distribution of the error term in the utility function, this probability can be expressed as:

$$P_{is} = P(i|s)P(s) = \left[\frac{\exp(V_{is}|\alpha_s)}{\exp(I_s)}\right]\left[\frac{\exp(\alpha_s I_s)}{\sum_{k=s,n}\exp(\alpha_k I_k)}\right] \text{ with} \tag{4}$$

$$I_s = \log\left[\sum_{i=1}^{J_s}\exp\left(V_{is}/\alpha_s\right)\right] \tag{5}$$

where ***P(s)*** is the probability of choosing an alternative water management option, ***P(i|s)*** is the probability of choosing alternative ***i*** once the decision to choose a new water management option was made, V_{is} is the indirect utility of alternative ***i***, α_s is the inclusive value coefficient which measures the substitutability across alternative water management options. $\boldsymbol{I_s}$ is known as the inclusive value and is a measure of the expected maximum utility of the alternatives $\boldsymbol{J_s}$ (Green, 2003; Kling and Thomson, 1996).

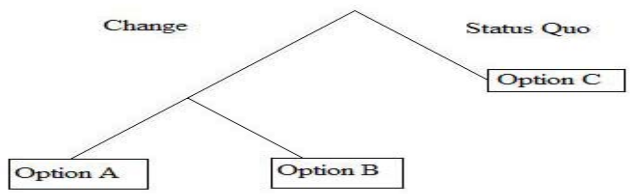

Figure 2: Nested decision structure.

Designing the Choice Experiment

Designing the choice experiment is important because it lays the groundwork for ensuring that the results are feasible (Alpizar, et al 2001). Researchers using CE present alternative bundles of attribute levels to individuals, asking them to choose from among options from each choice set. Respondents are asked to choose whichever choice profile they prefer the most, keeping in mind the tradeoffs that each set presents. Following Alpizar, et al. (2001), there are four steps in designing a choice experiment: 1) defining the attributes and levels; 2) experimental design; 3) questionnaire development; and 4) sampling strategy.

The first step in designing a choice experiment is to define the pertinent attributes and levels. This is done through a variety of mediums, including focus group meetings, expert group meetings, personal interviews, research of the topic of interest, and trial surveys. The selected attributes and levels are then arranged into choice sets within the experimental design.

In order to proceed with this research, approval was granted from the North Dakota State University Institutional Review Board (IRB) to gather data from human subjects. Expert group and focus group meetings and personal interviews were conducted in order to identify relevant issues related to the Red River Basin. At first, discussions were broad. Questions were open-ended in order to avoid biasing group members towards any attribute or level. Meetings were scheduled with local business people, science teachers, county commissioners, and representatives from NGOs and state government agencies. Agencies that were represented included the Red River Basin Commission, River Keepers, the International Water Institute, Lake Agassiz Water Authority, the Buffalo-Red watershed district in Minnesota, the North Dakota Department of Health, and the Minnesota Pollution Control Agency. Conferences organized by the Red River Basin Commission (Fall 2006) and the International Water Institute (March 2007) were also attended in order to get more information.

Expert meetings resulted in a greater understanding of the difficulty of managing basin water resources. The primary reason given for this difficulty was that there are so many involved institutions that are soliciting funds from the same stakeholders and not communicating about or coordinating their projects. Some people stated that they desired improved communication among existing institutions. Some also wanted to limit the number of involved institutions in order to manage the basin water resources more efficiently. Expert groups also identified recreation, water quality, and water supply as key issues facing the Red River basin.

Discussions with science teachers and local business people tended to focus on water-based recreation issues. Ideas for increasing river-based recreation included: creating additional bike trails; enhancing fish populations by stocking key species; and organizing a variety of skiing, boating, and swimming activities. Education activities and beautification were also identified as possible initiatives. An initial list of attributes and levels was developed after these discussions. Later, the focus group meeting questions began to be more specific in order to narrow down the list of attributes and levels. This led to more specific discussions about the attributes and levels, populations of interest, and survey questions.

Based on two sets of trial surveys, the attributes and levels were narrowed to those featured in Table 1.

Table 1: Finalized Survey Attributes and Levels

Attribute	***Level***	***Level***	***Level***	***Level***
Water Quality	Wetland restoration	Reduced fish kills	Reduced phosphorous and nitrogen	
Water Supply	Diversion	Regulations		
Recreation	Additional boat access points	Enhanced fishery management	Additional bike trails	Supervised swimming areas
Institution	Local water districts	Local conservation districts	Basin-wide organization	Non-governmental organizations
Price	12 increments of \$20, \$20-240			

The experimental design is the technique of listing all attributes for each choice set, and assigning particular levels to each attribute (Alpizar, et al 2001). The starting point of experimental design is the full factorial design, where every attribute level is combined with every other possible attribute level. A fractional factorial is a subset of all possible combinations and is usually used for convenience.

Zwerina, et al (1996) identify four principles to efficiently design a choice experiment: 1) orthogonality; 2) level balance; 3) minimal overlap; and 4) utility balance. Orthogonality is satisfied when the levels of each attribute vary independently of one another. Level balance is achieved when the levels of each attribute occur with equal frequency in the design. Minimal overlap occurs when an attribute level does not repeat itself in a choice set. Utility balance means that the utilities of the options within a choice set are equal. Efficient designs are considered to be those that minimize D-error, even when they are not completely orthogonal. According to Alpizar, et al (2001), D-optimality refers to the covariance matrix of the *K*-parameters, and occurs when D-error is minimized.

$$D - efficiency = \quad [|\Omega|^{1/K}]^{-1}. \tag{6}$$

Computer software is used to directly minimize D-error, and as a result all these principles are approximately satisfied in the design. D-optimality is the most common criterion for computer-generated optimal designs, and SAS has a general model statement that builds choice designs (Zwerina, et al 1996).

The full factorial design for the attributes and levels presented in Table 1 would be $3^1*2^1*4^2*12^1$ = 1,152 possible combinations. It would be unrealistic to expect respondents to answer this many combinations, so a fractional factorial design was applied to come up with 48 combinations of surveys, each with 4 choice sets of 3 options. A representative choice set is presented in Figure 3.

	Option A	**Option B**	**Option C**
Water Quality	Reduce Fish Kills	Wetland Restoration	No Change
Recreation	Supervised Swimming Areas	Additional Boat Access Points	
Water Supply	Diversion	Regulations	
Institution	Basin-Wide Organization	Local Water Districts	
Price per Year	$240	$80	$0

My Choice: ☐**A** ☐**B** ☐**C**

Figure 3: A Representative Choice Set.

The survey was divided into four sections. A copy of the survey instrument is attached in the Appendix. First, the IRB approved cover letter mentioned the purpose and scope of the project, and requested voluntary completion of the survey. Next, a Likert scale section was used to gauge attitudes of the respondents. This Likert scale assessment followed Purdy and Decker (1989) and McGonagle and Swallow (2005), and presented a basin attitudes and values scale (BAVS) for agree-disagree responses. These questions elicited attitudes towards access to and conservation of basin water resources, similar to the traditional-conservation attitudes, societal-benefits attitudes, and problem-acceptance attitudes of Purdy and Decker (1989). The third section contained the choice sets. This section explained each attribute and level. Four choice questions, selected through the experimental design, were given in each survey. The final section of the survey asked socio-economic questions to check that a representative sample of the Red River basin was achieved.

A number of potential survey populations were identified in preliminary discussions with focus groups and interviews. Criteria developed by Leach (2002) were followed when choosing stakeholder groups. A number of potential stakeholder groups was identified (Figure 4).

Responses were desired from resident taxpayers as well as additional groups of more informed stakeholders. Local political officeholders, Red River Basin meeting attendants (RRMA) and residents were identified as appropriate stakeholder groups to survey. The RRMA population County commissioners and mayors of towns with at least 500 residents were chosen as appropriate informed stakeholders. Table 2 lists the counties with some land in the basin.

Officeholder names and addresses were found via city websites or by calling local government offices for contact information. These were obtained for all counties that contained territory within the Red River basin. A list of water-related meeting attendees was obtained courtesy of the Red River Basin Commission. A number of ways to get a random stakeholder list were considered. After investigating alternatives, InfoUSA was selected as the data source. InfoUSA is a private company that sells addresses for survey research. They gather their data from sources such as phone books, utility bills, and cable bills. They update their listings on a monthly basis with the United States Postal Service in order to maintain current records. This source eliminated the bias of not surveying people without phones or surveying a biased amount of people who recently moved.

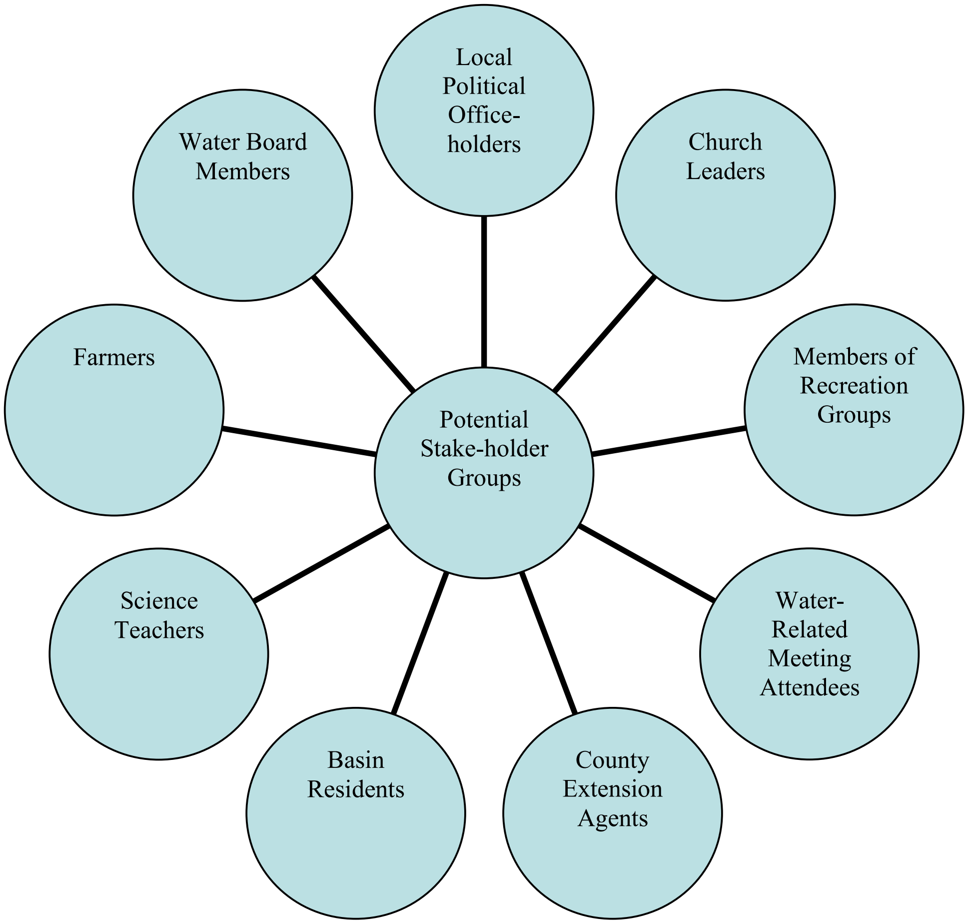

Figure 4: Possible Stakeholder Groups to Survey.

Table 2: Counties With Land in the Red River Basin

Minnesota: 21	***North Dakota: 24***	***South Dakota: 2***
Becker	Barnes	Marshall
Beltrami	Benson	Roberts
Big Stone	Cass	
Clay	Cavalier	
Clearwater	Dickey	
Grant	Eddy	
Itasca	Foster	
Kittson	Grand Forks	
Koochiching	Griggs	
Lake of the Woods	McHenry	
Mahnomen	Nelson	
Marshall	Pembina	
Norman	Pierce	
Otter Tail	Ramsey	
Pennington	Ransom	
Polk	Richland	
Red Lake	Rolette	
Roseau	Sargent	
Stevens	Sheridan	
Traverse	Steele	
Wilkin	Towner	
	Traill	
	Walsh	
	Wells	

Survey application followed procedures outlined in Dillman (2007). Initially a pre-letter was sent to inform each identified stakeholder that they would soon be receiving the survey in the mail. The final survey instrument was mailed three days later. Included in the survey was the IRB approved cover letter, the survey in booklet format, a business-reply return envelope with the researcher's address printed on it, and a pen to help the respondent fill out the survey. After the surveys were mailed, a postcard was sent to thank those that had already responded, and remind those who had not yet completed the survey to please do so.

In total, 1,062 survey instruments were sent. The full census of local political office holders and RRMAs were sent questionnaires. And a random sample of 501 residents of counties with land in the Red River basin was provided by InfoUSA. Table 3 presents the number of surveys.

Table 3: Survey Application

Stakeholder Group	***Number of Surveys Mailed***
Officeholders	316
Red River Meeting Attendants	245
Random List of Residents	501

Of all the survey instruments sent, 30 were returned due to an insufficient address. Another ten were sent back with no responses, either because the respondent was deceased, or because the person refused to answer any of the choice questions. Four people received two surveys since the Red River Basin Commission meeting attendants list contained multiple signups. In all, 350 out of 1,018 surveys were returned that had at least one response to a choice set question, representing a 34% response rate. Results of the final survey were analyzed using the econometric software Limdep NLOGIT 3.0.

RESULTS

Empirical results obtained from the logit models are discussed below. This section begins with a description of general statistics related to general socio-demographic results. After this, results of the model tests and models will be presented. A discussion follows describing implications of the results.

A total of 350 survey instruments were returned that had at least 1 response to a choice set question. Each group returned at least a 25% response rate (Table 4). Overall a 34% response rate was achieved.

Table 4: Stakeholder Response Rates

Stakeholder Group	***Number Sent***	***Number Received***	***Percentage***
Officeholders	305	111	36%
RRMA	239	118	49%
Random	474	121	25%

Following studies by McGonagle and Swallow (2005) and Purdy and Decker (1989), Likert scale questions were used to identify respondents that can be characterized as in favor of conservation and those in favor of access. These basin attitudes and values scale (BAVS) questions closely resembled those in published research (Table 5).

Pro-access and pro-conservation attitudes were determined by taking the average of the related Likert scale questions, and then adding one standard deviation from the mean.

The Likert scale questions ranged from 1 to 5, 1 being "strongly disagree", 3 was "neutral", 5 was "strongly agree". If the sum related to pro-access questions was greater than the average plus one standard deviation, then the person was identified as pro-access. If the sum related to pro-conservation questions was greater than the average plus one standard deviation, then the person was identified as pro-conservation.

Table 5: BAVS 5-Point Likert-Scale Questions

It is important to me personally that…

1†	…I fish in lakes and rivers for recreation.
2†	…I use lakes and rivers for non-fishing recreation.
3†	…I use floodplains and wetlands for hunting.
4‡	…lakes and river are managed to protect fish and wildlife habitats.
5†	…I observe or photograph wildlife along lakes and rivers.
6†	…river-shore and lakeshore land owners are able to develop their property.
7‡	…development of river-shore and lakeshore land is regulated to protect nature.
8†	…development of river-shore and lakeshore land is regulated so that everyone may use it.
9‡	…lakes and rivers maintain high water quality.
10†	…local economies benefit from the sale of equipment, supplies, or services related to water recreation.
11†	…public shoreline access is not blocked by wildlife or nature protection programs.
12‡	…rules and regulations are strictly enforced at river-shore and lakeshore access sites.
13‡	…I express my opinions about lake and river management to public officials or to officers of private conservation organizations.

†Pro-Access Questions	Eight Questions	Max = 40, Min = 8
‡Pro-Conservation Questions	Five Questions	Max = 25, Min = 5

Pro-Access Response Mean: 28.4	Pro-Access Standard Deviation: 5.6
Pro-Conservation Response Mean: 19.1	Pro-Conservation Standard Deviation: 4.3

Results showed that 17% preferred actions that would allow for greater access to basin water resources, while 13% preferred actions that would allow for greater preservation of basin water resources (Table 6). These were not completely mutually exclusive, as a few respondents favored both actions that allowed for greater access and for greater preservation.

The third and last section of the survey instrument identified socio-economic characteristics of the respondents. Of the respondents, 83% lived within the Red River basin. This was expected since a number of survey respondents lived within counties of the Red River basin, but not in the basin itself. Thus for someone who lives in Bemidji, Minnesota, he or she would be in Beltrami county, which has territory in the basin, but would not be in the basin itself. Approximately 32% of responders lived in cities larger than 5,000 residents. This was less than expected, since Fargo-Moorhead and Grand Forks-East Grand Forks lie in the basin. However, this can be explained since the politicians and meeting attendees' populations are skewed toward rural areas (approximately 16% and 24%, respectively).

Roughly 53% of the random stakeholders lived in cities larger than 5,000 (Table 7). While 94% of respondents owned the property where they lived, only 6% rented (Table 8).

Table 6: Participants' Attitudes Toward Basin Water Resources

Pro Access	***Pro Conservation***
17 %	13 %

Table 7: Breakdown of Percent Living in Population Greater Than 5,000

Stakeholder Group	***Percent in Population > 5,000***
Local Officeholders	16 %
Meeting Attendees	24%
Random	53%

Table 8: Stakeholder Demographics

	Demographic	***Percent***
	Live within the Red River Basin	83 %
All Stakeholders	Own their Property	94 %
	Male	78 %
	Majority of Income from Commercial Farming	22 %

Table 8 also shows that about 22% of responders earned the majority of their income from commercial farming. Approximately 78% were male. One reason for this is that males dominated the political office holder population and most the Red River Basin Commission meeting attendants were male. Of officeholders, only 10% were female while 20% of meeting attendees were female. Finally, 32% of the random stakeholders were female.

An ambitious, and perhaps cognitively difficult, solicitation was used to identify the location of the respondent. This question asked the responder to place an 'X' on a map of the basin to mark where he or she lived. 136/350 answered the question: approximately only 39% answered the question. The rest were determined from people that did mark their location on the map combined with the return envelopes that were stamped with the location from which it was sent. These results show that 50% of responders were from Minnesota, 36% from North Dakota, and 14% from South Dakota (Figure 5).

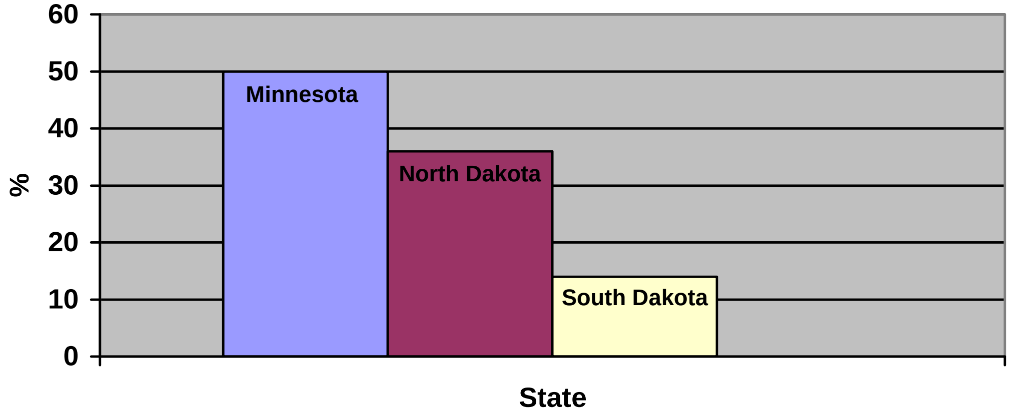

Figure 5: Percentage of Respondents from each State.

The frequency of change choice A or B was compared to the frequency of choosing a status quo option, choice C. Results show that responses were almost equally distributed among the three possibilities (Table 9).

Table 9: Frequency of Respondent Choosing Change

Choice	***Percentage***
Option A (Change Bundle)	34.0%
Option B (Change Bundle)	34.8%
Option C (Status Quo)	31.2%

Model Specification Tests

Likelihood ratio tests were run to examine each sub-population against the rest of the population (Louviere et al, 2000; Hearne and Salinas 2002). Given the particular interests of office holders and RRMAs and the fact that random residents were postulated to be less informed then the other stakeholder groups, it was not unextepcted to have different preference orderings from the three populations. However, given that the critical value with the Chi-squared distribution with 11 degrees of freedom at the 95% confidence level is 19.68, results showed that the equality of coefficients from each group was not rejected (Table 10). This means that local political officeholders, informed stakeholders, and the random list do not elicit completely different preference orderings and may be combined into one population.

Table 10: Likelihood-Ratio Tests

-2[LogL (pooled) – LogL (Office Holders) – LogL (Non-Office Holders) = 6.427 $\sim X^2_{11}$

-2[LogL (pooled) – LogL (Attendants) – LogL (Non-Attendents) = 10.041 $\sim X^2_{11}$

-2[LogL (pooled) – LogL (Residents) – LogL (Non-Residents) = 7.002 $\sim X^2_{11}$

The IIA property states that the probability of one option being selected from a choice set is not affected by adding or removing other options (McFadden, 1973; Hanley, Wright, and Alvarez-Farizo, 2006). In order to test the validity of this assumption, a Hausman test was conducted (Blamey, et al., 2000). Specifically, 'Option A' was left out to complete the test. The Chi-squared (10) value of the Hausman test was 18.71. This is greater than the critical value of 18.31 at a 95% confidence level, and indicates that the IIA assumption is rejected at a 95% significance level. An alternative model to use in the case where the IIA assumption is violated is the nested logit (Hanley, Wright and Koop 2002).

Nested Logit Models

Due to the results of the Hausman test, a nested logit model was run. The pooled population results are shown in Table 11. Results for the inclusive value parameter show that there is a significant desire for change versus status quo. For the model with choices among alternatives, option A was not significantly preferred to option B, which is expected because these options were not correlated with any attribute.

Coefficients for the first level choice presented in Table 11 show the sociodemographic variables that had a significant impact upon the choice of *change* or *status quo*. Neither income, education, state of residence, nor living in a city had significant impact on choosing an 'A' or 'B' *change* option as opposed to the *status quo*. However, females and older respondents elicited less willingness to choose a change option. Respondents with higher levels of education were less likely to choose the status quo. Non-farmers and pro-conservationists preferred *change* to *status quo*. This is expected given the expected interest of farmers toward more traditional water management concerns such as drainage, and the interest of pro-conservationists in water quality control and recreation.

The coefficients for the second level decision demonstrate the preference for or against an alternative to the base alternative that is also listed in Table 11. The different levels for the *Assessment to Annual Property Taxes* attribute were coded to be continuous and ordinal. Thus, the coefficient for this attribute shows the increased negative utility for each $20.00 increment in annual special assessments. For the other attributes, ordinal ranking is not feasible, so that the coefficient for each attribute level present the added utility of that alternative in respect to the base alternative which is not included in the nested logit model. Table 11 presents the base alternative as well as the subsequent choice alternatives. The coefficient for *Assessment to Annual Property Taxes* is negative and highly significant revealing the expected preference against increasing property taxes and special assessments. Among the water quality attributes, preferences for *reduced phosphorous and nitrogen* and *wetland restoration* were positive and significant suggesting that these goals were preferred to *reduced fish kills*. Among the recreation alternatives, *enhanced fishery management* was significantly preferred to new supervised swimming areas. However there were no significant preferences toward *additional bike trails* or new *boat access* points. Not surprisingly there were no significant preferences for institutional arrangements, except management by a *basin-wide organization* was significantly preferred to that of a *non-governmental organization*.

Preference orderings for the discrete attribute levels as presented in Table 11, should not be used to make comparisons outside of the direct analysis. Thus as presented in Table 11, both *phosphorous and nitrogen* and *wetland restoration* were preferred to *reduced fish kills*. But no conclusions can be made, based upon this observation, about preferences between *phosphorous and nitrogen* and *wetland restoration*. However different iterations of the model with alternative base levels can be used to make these comparisons. Table 12 presents the preference orderings that result from the different iterations of this model with alternative base options. Some of these orderings result from very significant preferences, such as those against a *Non-Governmental Organization* and *Supervised Swimming Areas.*

This analysis was designed to present results for the different sampled populations. Table 13 presents results for the sample of local office holders, which includes mayors and county commissioners. Once again, results demonstrate a significant preference for *change* as opposed to the *status quo*. Only two sociodemographic variables are statistically significant. Respondents who are not farmers and those with higher education levels were more likely to choose a *change* alternative. Very few of the attribute levels within the second- level decision are significant. Once again there is a strong preference toward lower special assessment levels. Also, decision makers preferred other institutional arrangements to a non-governmental organization.

The population of Red River Conference attendees was chosen in order to present input from informed and interested stakeholders. This sample did not have a significant preference toward change. Results from this nested logit model are presented in Table 14. Women and higher income RRMA respondents were less likely to choose a *change* alternative. This is somewhat unexpected given that environmental quality and recreation are considered to be superior goods which receive higher proportion of household expenditures as income rises. However higher income individuals may be more concerned with special assessments to property taxes than their less affluent counterparts. And some of the recreation alternatives within these choice sets may appeal more to men than women.

This sample demonstrated a preference against higher special assessment and against water management by a non-governmental organization. Neither *pro-access* nor *pro-conservation* were significant variables in the first-order decision. This indicates that this sample is not heavily skewed toward any particular interest group ideology. These respondents demonstrated stated preferences towards a number of water quality and recreation attributes including *Enhanced Fish Management*, *More Boat Access Points*, *Reduce Phosphorus and Nitrogen*, and *Wetland Restoration*.

The final population sampled was residents of counties within the Red River Basin. As a random sample of resident taxpayers, this is the only stakeholder group that can present a valid representation of society's willingness to pay for any of these water management programs and options. Results of the nested logit model are presented in Table 15. This sample has no significant preference for the change option. For this reason any estimate of willingness to pay would be misleading, since the sample does not present any significant preference the change options that include the attributes and the payment options.

In this sample, younger, non-farm, and pro-conservation respondents were more likely to choose a *change* option. Pro-access respondents were more likely to choose *status quo*. As expected, there is a strong preference against higher special assessments and once again this sample displays a preference against *non-governmental organizations* and for *enhanced fish management*. This sample demonstrates a weakly significant preference toward *increased bike trails* and *wetland restoration*.

Table 11: Results of Nested Logit Models Pooled Data (N=1,358)

	Coefficient	Standard Error	
IV Parameters			
Status Quo	Fixed Parameter		
Change	0.568	0.201	***
First Level Decision Change or No Change, Socio-Demographic Variables			
Female	-0.338	0.086	**
Age	-0.179	0.059	***
Education	0.105	0.059	*
Non-Farm	0.984	0.143	***
Pro-Conservation	0.575	0.208	***
Second Level Decision Attributes of Program			
Alternative Specific Constant 'A'	-0.028	0.070	
Assessment to Annual Property Taxes	-0.006	0.000	***
Reduce Fish Kills	Base		
Reduce Phosphorus and Nitrogen	0.308	0.110	***
Wetland Restoration	0.192	0.115	*
Supervised Swimming Areas	Base	Base	
Additional Bike Trails	0.136	0.118	
More Boat Access Points	0.100	0.120	
Enhanced Fish Management	0.443	0.125	***
Increased Dry Period Regulations	Base		
Interbasin Diversion	-0.148	0.086	*
Basin Organization	Base		
Conservation Districts	0.033	0.113	
Watershed Districts	-0.076	0.115	
Non-Governmental Organization	-0.595	0.132	***
$\chi^2_{(17)} = 412$	Restricted log likelihood	-1571	

12: Preference Orderings for Pooled Sample

Reduced Phosphorous and Nitrogen	$\sim$	Increased Wetlands	$\succ$	Reduced Fish Kills		
Enhanced Fish Management	$\succ$	Additional Bike Trails	$\sim$	Additional Boat Access Points	$\succ$	Supervised Swimming Areas
Conservation Districts	$\sim$	Watershed Districts	$\sim$	Basin Organization	$\succ$	Non-Governmental Organization
Increased Dry Period Regulations	$\sim$	Interbasin Diversion				

Table 13: Results of Nested Logit Models Local Office Holders (N=426)

	Coefficient	Standard Error	
IV Parameters			
Status Quo	Fixed Parameter		
Change	1.334	0.501	***
First Level Decision Change or No Change, Socio-Demographic Variables			
Education	0.235	0.106	**
Non-Farm	0.905	0.253	***
Second-Level Decision Attributes of Program			
Alternative Specific Constant 'A'	-0.073	0.121	
Assessment to Annual Property Taxes	-0.006	0.001	***
Reduce Fish Kills	Base		
Reduce Phosphorus and Nitrogen	0.309	0.170	*
Wetland Restoration	-0.025	0.166	
Supervised Swimming Areas Base	Base		
Additional Bike Trails	0.181	0.175	
More Boat Access Points	-0.065	0.174	
Enhanced Fish Management	0.093	0.181	
Increased Dry Period Regulations	Base		
Interbasin Diversion	-0.144	0.134	
Basin Organization	Base		
Conservation Districts	-0.082	0.173	
Watershed Districts	-0.116	0.179	
Non-Governmental Organization	-0.520	0.205	**
$\chi^2_{(14)} = 147$	Restricted log likelihood	-501	

Table 14: Results of Nested Logit Model Red River Meeting Attendant (N=451)

	Coefficient	Standard Error	
IV Parameters			
Status Quo	Fixed Parameter		
Change	0.399	0.255	
First Level Decision Change or No Change, Socio-Demographic Variables			
Female	-0.970	0.269	***
Income	-0.405	0.269	***
Non-Farm	1.125	0.239	***
Second-Level Decision Attributes of Program			
Alternative Specific Constant 'A'	0.122	0.128	
Assessment to Annual Property Taxes	-0.006	0.001	***
Reduce Fish Kills	Base		
Reduce Phosphorus and Nitrogen	0.386	0.199	*
Wetland Restoration	0.393	0.207	*
Supervised Swimming Areas	Base	Base	
Additional Bike Trails	-0.037	0.210	
More Boat Access Points	0.476	0.214	*
Enhanced Fish Management	0.765	0.229	***
Increased Dry Period Regulations	Base		
Interbasin Diversion	-0.232	0.158	
Basin Organization	Base		
Conservation Districts	0.098	0.210	
Watershed Districts	0.042	0.210	
Non-Governmental Organization	-0.747	0.249	***
$\chi^2_{(15)} = 156$	Restricted log likelihood	-491	

Table 15: Results of Nested Logit Model Residents (N=481)

	Coefficient	**Standard Error**	
IV Parameters			
Status Quo	Fixed Parameter		
Change	-0.065	0.422	
First Level Decision Change or No Change, Socio-Demographic Variables			
Age	-0.381	0.090	***
Pro-Access	-1.122	0.324	***
Non-Farm	1.391	0.297	***
Pro-Conservation	1.119	0.419	***
Second Level Decision Attributes of Program			
Alternative Specific Constant 'A'	-0.133	0.124	
Assessment to Annual Property Taxes	-0.005	0.001	***
Reduce Fish Kills	Base		
Reduce Phosphorus and Nitrogen	0.224	0.196	
Wetland Restoration	0.443	0.224	**
Supervised Swimming Areas	Base	Base	
Additional Bike Trails	0.383	0.219	*
More Boat Access Points	0.050	0.218	
Enhanced Fish Management	0.596	0.219	***
Increased Dry Period Regulations	Base		
Interbasin Diversion	0.073	0.178	
Basin Organization	Base		
Conservation Districts	-0.160	0.202	
Watershed Districts	-0.090	0.210	
Non-Governmental Organization	-0.550	0.230	**
$\chi^2_{(16)} = 162$	Restricted log likelihood	-553	

CONCLUSIONS AND RECOMMENDATIONS

This research sought to estimate stakeholder preferences for Red River Basin management alternatives. Specifically, it identified issues that basin residents and experts considered relevant and estimated their relative preference for implementing changes. The choice experiments method was used for eliciting stated preferences, and a nested model was applied to assess the probability of a respondent choosing change or no change based on his or her socio-demographics, then choosing which change option based upon the presented attribute levels.

An analysis of different stakeholder groups was employed because of an expectation that informed stakeholders and decision makers would be more engaged with basin management issues particularly water quality goals and institutional arrangements. However, this analysis demonstrates that the three different samples did not have significantly different preference orderings. An interesting conclusion from this result is that the local political decision makers, county commissioners and mayors, had similar preferences as did the combination of a sample of informed and active constituents and another sample of random constituents. This presents a favorable demonstration of these decision-makers' capabilities towards representing their constituents. It also suggests that the random residents were not completely uninformed and disinterested, since their preference orderings were not different from those of the other more involved stakeholders.

Some socioeconomic characteristics of the individual respondent impacted the choice of *change* versus *status quo*. Specifically, someone who was pro-conservation was more likely to vote for a *change* option. Farmers were significantly likely to prefer the *status quo*. An interesting result is that neither income nor state of residence significantly impacted the first level decision. As age increases, respondents were generally less likely to choose a *change* option. Also, females were less likely to opt for *change* options.

Efforts to reduce fish kills were the least preferred water quality option. However, *enhanced fishery management* was the most preferred recreation alternative. The least preferred recreation alternative was *supervised swimming areas*. Although there are groups, such as the Fargo-Moorhead River Keepers, that are trying to attract people to use the Red River for recreation, most residents seem reluctant to consider the river as a place for swimming. The sample of random residents preferred bike trails to swimming areas. This population and sample is much more urban than the other stakeholders, given the number of office holders from smaller communities. Bike trails along the Red River are feasible and popular in the basin's larger urban areas. Fishing remains popular across all stakeholder groups.

There was a small preference, significant at the 90% confidence interval, for increased drought-period water use regulations over an interbasin diversion to increase water supply security. This is an interesting result in the Red River basin, given the current efforts to lobby for a diversion of Missouri River water to support water supply for basin residents. This result, from the pooled sample, was not robust across the stakeholder group samples, which demonstrated no significant stated preference for any water supply alternative.

There was a significant preference against water management by a non-governmental organization. Preferences for the other three alternative institutional arrangements were mixed. Significantly, the preferences among the more informed stakeholders, meeting attendants and office holders, were consistent with those of the supposedly less informed random residents.

Stakeholder analysis can produce some interesting results, including insights into the how a level of awareness would impact upon the preferences for alternative management options. However, stakeholder analysis is less valuable for assessing economic measures such as willingness to pay, because different stakeholder groups are expected to represent special interests. An original objective of this research was to assess willingness to pay. The sample of random residents ideally suited this estimation, because they can represent taxpayers' interests, and their individual willingness to pay can be aggregated to represent societal willingness to pay. However, the random residents did not present a stated preference toward a change from the status quo and the acceptance of special assessment to pay for that change. This implies that willingness to pay estimation is not possible. It also suggests that the population of local decision-makers as well as other water managers and interest groups might be doing an acceptable job at currently providing the water management services that residents are willing to pay for.

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Appendix

Dear Red River Basin Resident:

My name is David Torpen and I am a graduate student in the department of Agribusiness and Applied Economics at North Dakota State University. I am conducting a research project to help water institutions understand resident preferences for issues related to the Red River.

You are invited to complete this survey to help the research study. Your participation is entirely voluntary, and you may withdraw from participation at any time. However, your assistance is greatly appreciated in making this a meaningful study. If you decide to complete this survey, you may tear off this sheet and keep it for your information.

It should take about 15 minutes to complete and enclose the attached questionnaire in the envelope to send back to me.

Your identity will not be revealed in the experiment results, and your responses will remain confidential. Only group comparisons will be made and reported in summary form.

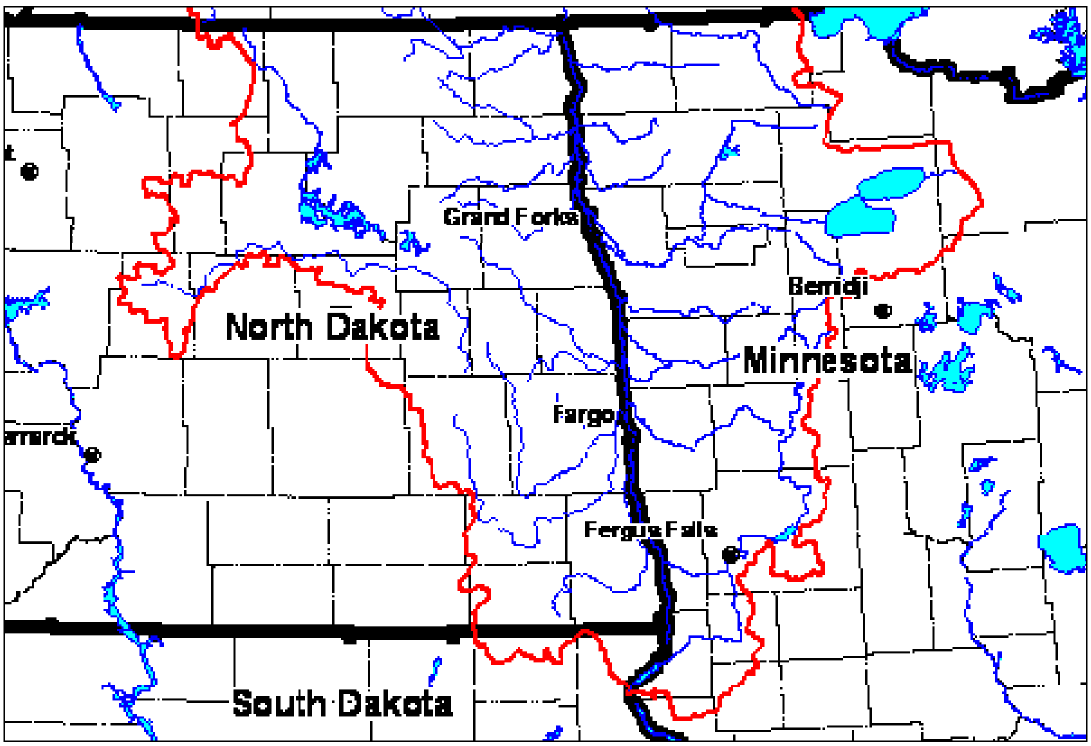
If you have any questions about this project, please call me at 701-373-5992, or call my advisor Dr. Robert Hearne at 701-231-6494. You can also email either of us at Robert.Hearne@ndsu.edu, or David.Torpen@ndsu.edu. If you have questions about the rights of human participants in research, or to report a problem, contact the NDSU IRB Office, (701) 231-8908, or ndsu.irb@ndsu.edu.

Thank you for your participation in this study. If you wish to receive a copy of the research results, please email either one of us.

NDSU

DEPARTMENT OF AGRIBUSINESS AND APPLIED ECONOMICS

The United States' Portion of the Red River of the North Basin:



Map shows the Red River basin outlined in red.
The basin contains about 39,200 square miles of land
in North Dakota, Minnesota, and South Dakota.
Roughly 350,000 people live in the basin.

<u>Section 1.</u>

We would like to find out your attitude about Red River watershed usage. Please circle the degree of importance that you consider the following statements according to the following scale.

1 – Strongly Disagree
2 – Somewhat Disagree
3 – Neither Disagree nor Agree
4 – Somewhat Agree
5 – Strongly Agree

← *Disagree … Neutral … Agree* →

It is important to me personally that…

…I fish in lakes and rivers for recreation.
1 2 3 4 5

…I use lakes and rivers for non-fishing recreation.
1 2 3 4 5

…I use floodplains and wetlands for hunting.
1 2 3 4 5

…lakes and river are managed to protect fish and wildlife habitats.
1 2 3 4 5

…I observe or photograph wildlife along lakes and rivers.
1 2 3 4 5

…river-shore and lakeshore land owners are able to develop their property.
1 2 3 4 5

…development of river-shore and lakeshore land is regulated to protect nature.
1 2 3 4 5

…development of river-shore and lakeshore land is regulated so that everyone may use it.
1 2 3 4 5

…lakes and rivers maintain high water quality.
1 2 3 4 5

…local economies benefit from the sale of equipment, supplies, or services related to water recreation.
1 2 3 4 5

…public shoreline access is not blocked by wildlife or nature protection programs.
1 2 3 4 5

…rules and regulations are strictly enforced at river-shore and lakeshore access sites.
1 2 3 4 5

…I express my opinions about lake and river management to public officials or to officers of private conservation organizations.
1 2 3 4 5

Section 2.

The following information about water-related issues is provided to help you answer the four choice question sets. Potential initiatives within the basin are discussed below in four broad categories: water quality, recreation, water supply, and governing institution.

1. Water quality:
    a. *Wetland Restoration:* Wetlands provide habitat and breeding grounds for waterfowl and other wildlife. They also filter and absorb polluted water before it enters lakes and rivers. Legislation in the early years of statehood led to many wetlands being drained in Minnesota, North Dakota and South Dakota. It is possible to restore some of these to their proper and natural use.

    b. *Reduced fish kills:* Fish kills occur in some lakes and rivers each year. Often these are caused by low oxygen levels for fish. Installing aerators and managing urban storm water runoff can help reduce fish kills.

    c. *Reduced phosphorous and nitrogen:* These nutrients in excess may cause algae growth, which can harm fish habitat, water-based recreation, and diminish aesthetic values. Reducing the nutrient levels in surface water would improve habitat, water quality and decrease algae growth. This would be achieved through best management practices by farmers and cities, and by constructing natural buffer zones along river banks and lakeshores.

2. Water Supply:
    a. *Diversion:* This buried pipeline would provide communities that use the Red River as their main source of water with a backup source of water from the Missouri River in case of a severe drought.

    b. *Regulations:* Regulations would be set in place during low-flow conditions. Potential regulations include limiting water for lawns, car washes, cooking and cleaning, and regulating water storage to prepare for future droughts.

3. Recreation:
   a. *Additional boat access points:* These would provide more public access points for boats into lakes and rivers within the Red River basin.

   b. *Enhanced fishery management:* This would include activities such as additional fish stocking, trapping undesirable species, and relaxed limits when fish kills are expected.

   c. *Additional bike trails:* These would allow for walking, running and biking.

   d. *Supervised swimming areas:* These would provide sandy beach areas and lifeguards for some lakes and rivers.

4. Governing Institution:
   a. *Local water districts:* Local water districts would receive the responsibility and additional resources to coordinate the proposed changes within the Red River basin. These districts currently implement water conservation practices for flood control and lake management. They also operate water infrastructure.

   b. *Local conservation districts:* Local conservation districts would receive the responsibility and additional resources to coordinate the proposed changes within the Red River basin. Conservation districts currently are responsible for developing local water management plans. They plan water activities and support best management practices for agriculture and other land uses, drainage, and solid waste disposal.

   c. *Basin-wide organization:* A single basin-wide organization would receive the responsibility and additional resources to coordinate the proposed changes within the Red River basin. This may make it easier to coordinate and implement projects, and improve allocation of resources.

   d. *Non-governmental organizations:* Non-government organizations would receive the responsibility and additional resources to coordinate the proposed changes within the Red River basin.

5. Price per Year:

   This represents an additional property tax that would be assessed yearly. In the Minnesota portion of the Red River Basin households currently pay, on average, about $65 per year to Watershed Districts, through organization taxes and special assessments. Minnesota households also pay, on average, about $7 per year to Soil and Water Conservation Districts through county taxes. In North Dakota, Red River Basin residents currently pay, on average, about $28 per year to Water Resource Districts and about $25 per year to Soil Conservation Districts, both of which are primarily funded through county taxes.

Please choose among the following sets of possible changes. Your responses to these questions will help water management organizations understand and prioritize the changes that residents want the most within the Red River basin. Answer as best you can, referring to the explanation section on the previous two pages as necessary.

Choice #1. Please consider the different options and place a checkmark in the box of the choice you most prefer.

	Option A	**Option B**	**Option C**
Water Quality	Reduce Nitrogen and Phosphorous	Reduce Nitrogen and Phosphorous	No Change
Recreation	Additional Bike Trails	Additional Bike Trails	
Water Supply	Diversion	Diversion	
Institution	Non-Government Organizations	Local Conservation Districts	
Price per Year	$100	$160	$0

My Choice: ☐ **A** ☐ **B** ☐ **C**

Choice #2. Please consider the different options and place a checkmark in the box of the choice you most prefer.

	Option A	**Option B**	**Option C**
Water Quality	Reduce Fish Kills	Wetland Restoration	No Change
Recreation	Supervised Swimming Areas	Additional Boat Access Points	
Water Supply	Diversion	Regulations	
Institution	Basin-Wide Organization	Local Water Districts	
Price per Year	$240	$80	$0

My Choice: ☐ **A** ☐ **B** ☐ **C**

Choice #3. Please consider the different options and place a checkmark in the box of the choice you most prefer.

	Option A	Option B	Option C
Water Quality	Wetland Restoration	Reduce Fish Kills	No Change
Recreation	Additional Boat Access Points	Enhanced Fishery Management	
Water Supply	Regulations	Regulations	
Institution	Local Water Districts	Local Conservation Districts	
Price per Year	$20	$140	$0

My Choice: ☐ **A** ☐ **B** ☐ **C**

Choice #4. Please consider the different options and place a checkmark in the box of the choice you most prefer.

	Option A	Option B	Option C
Water Quality	Reduce Fish Kills	Wetland Restoration	No Change
Recreation	Supervised Swimming Areas	Enhanced Fishery Management	
Water Supply	Diversion	Regulations	
Institution	Non-Government Organizations	Basin-Wide Organization	
Price per Year	$120	$60	$0

My Choice: ☐ **A** ☐ **B** ☐ **C**

<u>Section 3.</u>

In order to help us represent the population, we would like to know some general information about you.

1. Are you male or female?
   ___Male
   ___Female

2. What is your age?
   ___18-29
   ___30-39
   ___40-49
   ___50-59
   ___over 60

3. What is your highest education degree completed?
   ___Less than High School
   ___High School
   ___Some College
   ___College Degree
   ___Graduate or Professional Degree

4. Some people who received this questionnaire do not live in the Red River basin. Please mark your approximate location on the front page map with an 'X' and determine if you live within the basin.
   ___Yes, I live in the basin.
   ___No, I do not live in the basin

5. Do you live in a city that has 5,000 or more people?
   ___Yes
   ___No

6. Do you own or rent the property where you live?
   ___Own/Pay mortgage
   ___Rent

7. What was your before-tax household income last year?
   ___less than $39,999
   ___$40,000 to $79,999
   ___$80,000 to $150,000
   ___More than $150,000

8. Last year did the majority of your household income come from commercial agriculture?
   ___Yes ___No