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Change and Conflict in Land and Water Use: Resource Valuation in Conflict Resolution among Competing Users

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Conflicts among competing resource users have become more frequent in the Southeast. Political and legal processes and economic values will play major roles in negotiations to resolve competing resource uses. Resource economists can contribute to resource conflict resolution in several ways, such as facilitating negotiation, asserting importance of institutional mechanisms, analyzing incentives, and evaluating resources.

Contentious issues related to water and land quality and quantity appear to be at least in part a result of increased population, incomes, and industrial activity in the region. Several recent examples illustrate the important professional capability and responsibility of agricultural and natural resource economists. The Chesapeake Bay Agreement among the several relevant states, the EPA, and the Chesapeake Bay Commission limits agricultural practices in the watershed to control nutrients and erosion. In Florida the recent initiation of projects to "re-engineer" the Everglades plans to return it to a more sustainable natural state.

The Alabama-Coosa-Tallapoosa (ACT) and Apalachicola-Flint-Chattahoochee (ACF) River basins conflict among Georgia, Florida, and Alabama and the US Army Corps of Engineers over allocation of water among competing users in these watersheds serves as a notice to the citizens and policy makers of any watershed that coordination among users of a shared resource can spin out of control if not actively managed. Previous to this conflict the connection between environmental quality in the Apalachicola and Mobile Bays and the recreational use of major reservoirs such as Lanier (GA) and Martin (AL) would not have been obvious to most observers. Agricultural and resource economists can provide useful information to facilitate resolution of resource conflicts.

This paper will focus on the economic methods and values that can be used in resolving water allocation conflicts, using the ACT/ACF as an example. The latter study addressed the effects of limiting water supply entering the ACT watershed and how different water management scenarios would economically affect recreation and lakefront property values for six Alabama reservoirs. Hanson (1998) originally evaluated three water-management scenarios, but only one will be used as an example for this paper. The scenario evaluated here will look at the impact of hypothetical but permanent lowering of summer full-pool reservoir water levels. Impacted components valued in this study were lakefront property, recreational use, and potential use of these water resources.

Wise interbasin management of southeast U.S. water resources is important for future

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development. ACT and ACF water use has evolved from power generation to diverse multiple uses. Recreation and housing have become increasingly valuable components. Changing use patterns imply changing resource values. Resource management based on historic use patterns may be inappropriate. Economic valuation methodologies could be useful for timely re-evaluation of reservoir resources.

ACT-ACF Water Conflict

The ACT and ACF River basins have recently been the focus of a confrontation over water rights between Alabama, Florida, and Georgia. In the early 1990s, the State of Georgia and the US Corps of Engineers announced plans to build a reservoir in Georgia on the Tallapoosa River (ACT watershed) just upstream from the Alabama border. It was projected that the stored water would be pumped to and used in Atlanta and thereafter discharged into a different water basin (ACF watershed). This interbasin water transfer would result in a loss of water to Alabama in the ACT watershed and an increase of water to Alabama, Georgia, and Florida in the ACF watershed.

The Coosa and Tallapoosa Rivers originate in north Georgia and flow southwest into Alabama, join near Montgomery (AL) to form the Alabama River that eventually flows into the Gulf of Mexico at Mobile, AL. The Chattahoochee River originates in north Georgia, flows through Atlanta (GA), becomes the border between Alabama and Georgia, is joined by the Flint River in South Georgia, and then becomes the Apalachicola River before entering the Gulf of Mexico at Apalachicola, FL. The Flint basin is the most highly irrigated area (GA) in these river systems. Lake Lanier (GA) is the most high-valued recreational property and Lake Martin (AL) appears to be the most rapidly growing recreational property. Lake Seminole is an important navigation point at the confluence of the Chattahoochee and Flint rivers at the GA-FL border.

Control of river water for present and future growth is the crux of these interstate conflicts. The State of Alabama was concerned about the reduced future water supply to the ACT and negative impact on future development. The State of Florida was concerned about the impact of additional water. Increased river flow would affect the oyster fishery and recreation in Apalachicola Bay. Highly variable water flows and treated sewage from Atlanta could upset the intricate biology of the oyster habitat in estuarine bay waters and adversely affect the food safety aspect of the harvested oysters. In the early 1990s, a federal court ruled that no new dam construction would be allowed until studies among the three states investigated past, present, and future water use and the effects of the proposed dam and water basin transfers on the three states.

Many reservoirs built in the 1920s and 1980s were intended for power generation, flood control, and municipal water supply. The Federal Energy Regulatory Commission (FERC) is involved in decisions related to water levels. They provide a 'rule curve' for power companies to follow on each reservoir. The reservoir 'rule curve' is a guide telling reservoir managers what water level the reservoir should be at any given time during the year. Curves are developed based on energy needs, seasonal rains, and repair/maintenance requirements.

A 'rule curve' would have a winter drawdown period providing a safety margin where winter rain can be collected, its flow regulated, and surprise flooding prevented. 'Run-of-the-river' reservoirs may have no seasonal change in water management while 'Lake-type' reservoirs may have winter drawdown of 18 feet or more. In the spring, rainfall runoff collects, raising the reservoir water level. In early summer, reservoir water levels reach their highest extent during what is called the *summer full-pool* period. Each reservoir's 'rule curve' states a specific number of days at the full-pool level. Full-pool levels may vary from no drawdown for 'run-of-the-river' type reservoirs to 120 days for lake-type reservoirs. In the early fall, water levels are gradually lowered to winter levels.

A permanent reduction to a reservoir's full-pool water level implies the existing summer full-pool water level would not be met. For example, if the present summer full-pool water level were 487 feet above sea level, a one-foot decrease would result in a new 'permanent' summer full-pool of 486 feet above sea level. In reality, this could increase time at the new full-pool level, as it would not take as long to fill the reservoir to this reduced 'full-pool' level.

Water Resource Valuation—Literature Review

Some basic tenets concerning water resources are at the heart of competing uses. First and foremost, water is a resource often treated as "free," especially in humid regions around the world. The distinction between water quantity and water quality has become an increasingly important issue. In humid regions such as the Southeast U.S., the high average annual rainfall makes variability in supply and demand the crucial component of water management. Seasonality of water, both temporally and spatially, is very critical to some uses and not for others, for example timing of water for agriculture is very critical while timing for municipal water systems with large storage capacity is not so critical. Surface water supplies some of society's needs while groundwater supplies other needs and often the groundwater is of a finite nature, not quickly recharged. There are consumptive and non-consumptive uses of water, which affect its valuation. Supply development compared to demand management is another aspect requiring negotiations in water resource conflict resolutions. Supply development was the dominant water management strategy until recently and was based on projecting increases in future demand and constructing sufficient storage to meet the anticipated growth. As the number of sites for large reservoirs has diminished, water management has focused on development of small reservoirs on tributaries for demand management. The potential contribution of resource economists has increased with the growing importance of the latter strategy.

More specifically, a reduction in water quantity is the value being measured in Hanson's study. As reservoirs are a public good surrounded by private housing, many conflicting uses are placed upon the resource and assessing values to these diverse uses requires knowledge of many natural resource economic topics and a variety of tools to assess their values. Contingent valuation (CV) is a methodology that was used in the study's mail and interview surveys to measure respondents' valuation of changes in water quantity. Market segmentation concepts were critical in aggregating individual recreational user visitation values to reservoir-level values. Preservation values for non-users required delving into valuation of non-market goods with option, bequest, and existence values. And in each study component, many additional concepts and principals were drawn upon to conquer additional challenges not fully covered in this brief literature review. A more comprehensive literature review is available from Hanson (1998).

Because the reservoir water resource is a public good, valuation of its many uses is a difficult undertaking. There are no clearly defined property rights, no exclusivity of access, no single market-based price, and no consumption divisibility. Individuals may know whether the reservoir "good" is desired, but placing a monetary value on it is difficult and more a perception of magnitude than actual knowledge of future value. Measuring society's value for a public resource has proven to be a controversial process laden with potential biases. Biases can be introduced through the valuation question format, content and context, as well as target population definition and sampling design (Mitchell and Carson, 1989; Diamond and Hausman, 1994; Bishop, Champ and Mullarkey, 1995; Messonier et al., 1995; Bergstrom et al., 1996).

Contingent valuation questions measuring non-market environmental and natural resource values have been the subject of much research and many issues have been summarized by Freeman (1993), Johnson and Johnson (1990), and Mitchell and Carson (1989). Contingent valuation methodologies have been criticized for a number of reasons, such as estimation bias resulting from embedded effects, number of questions, and question order with each potentially affecting the respondent's valuation. Harrison and Lesley (1996) have noted the cost of data collection for valuing non-market goods is high as well. Even with such problems, a well-designed CV question format has been shown by Portney (1994), Lazo et al., (1992) and Bishop and Heberlein (1990) to be a good alternative for estimating values for changes in resource attributes of public and non-public goods.

Market segmentation of a resource is useful because it characterizes information for groups of similar users. Distance is one of the primary decisions users take into account when deciding to visit a recreational area and is central to trip-cost estimation. Clawson and Knetsch (1966) developed a method for estimating the recreational demand for a site when market prices were not available. This method has been the basis for the widely used travel-cost method. Basically, this approach divides the surrounding site area into concentric circles for the purpose of measuring travel cost from each zone to the site for the population within the zone.

However, this process neglects political boundaries, urban/metropolitan areas, and road systems that are practical in linking survey data to other available databases, such as the U.S. Census. Since these attributes surrounding a reservoir resource do not follow concentric circles, a revised method of determining reservoir market segments was developed. How the population distribution around a recreational site is accounted for plays an important role in determining total travel costs (Stynes, 1990). Sutherland (1982) has reported considerable variation in results depending upon how travel cost data is aggregated. Smith and Koop (1980) have shown that definition is important in determining consumer surplus values which can be very sensitive to the zone boundaries chosen and zones of unequal population (Bowes and Loomis, 1980).

Preservation values include option, bequest, and existence values (Loomis, 1990; Krutilla, 1967; Krutilla and Fisher, 1975) and are usually obtained through WTP questions presented to users of the resource. However, non-users of the resource also have preservation values. Therefore, full accounting of the value of non-market resources should include both user and non-user values (Cameron, 1992; Hanneman, 1994). Improvements in the precision of estimates of the non-user preservation value for an individual are particularly important because estimating total preservation values may include large populations of non-users.

Cordell and Bergstrom (1993) used CV and willingness-to-pay questions to value alternative water level scenarios on recreational use values for four North Carolina reservoirs. The value recreational users placed on higher water levels held longer into the summer and fall seasons—i.e., an additional one, two, or three months—was compared to the value of current reservoir management. It was found that maintaining higher water levels for longer periods during the summer and fall resulted in considerable gains in estimated recreational benefits. Aggregate values for changes in recreation were \$3.7 million, \$7.6 million and \$13.6 million for one, two, or three additional months of full-pool water levels, respectively.

Allen, Jackson, and Perr (1996) evaluated potential water management alternatives on water-based recreation at 25 reservoir and river reaches of the ACT and ACF watersheds. They used a combination telephone survey to determine use and expenses and mail survey employing CV questions to determine recreational boat owners change in trips for two lowered water conditions. They estimated recreational boaters spent \$1.27 billion in 1995. Recreational trips were significantly reduced at lowered water levels. For the 'first impact level' total boat trips were decreased by 35 percent to 63 percent depending on location. At more severe water level reductions, trips were decreased by 65 percent to 82 percent.

Lansford and Jones (1995) used the hedonic method to isolate recreational and aesthetic components of residential property around two Texas reservoir lakes. They noted that reservoirs were not typically built to maximize recreational use, and thus demands for stability in reservoir levels by landowners presented a conflict between consumptive and non-consumptive users. Because this conflict was complex, it was difficult to accommodate the needs of all parties, especially for the summer season,which is the peak demand period for recreation, irrigation, watering of lawns, and other consumptive uses. As the State owned the water, recreation was non-exclusive, and recreational users had no legal rights to any quantity of water. Ironically, once water was pumped from the river or lake it became private property.

Residential sales, date of sale, and water level deviation from average lake level at the time of sale were key variables in their model. Other amenity variables were included, such as house location relative to lakefront, urban areas, schools, housing characteristics, sales price, and aesthetic views. Sites located on bluffs and having difficult access to water were valued at 90 percent of the lot having easier access to water. Marginal house sale prices for lake level deviations from historical levels were estimated to be $717 and $650 per foot above long-term lake levels for the two study lakes. For a six-foot negative deviation from long-term water levels, an estimated loss of $6,800 in the sale amount was attributable to water level. Maintenance of higher water levels added value to homes surrounding the lake and increased the recreational and aesthetic values of the residential lot.

Methodological Challenges

Resource economists can assist in the overall planning of water resource use by providing estimation tools developed through research. A continuum of valuation precision for public-private water resources may be grouped according to use. Generally, those uses with market transactions can be valued more precisely than those resources having no direct market. For instance, a higher precision of value estimation can be derived for power generation using reservoir water and a lower degree of precision would be expected in estimating potential users preservation value for a reservoir environment they have not yet used. And then there are cases such as lakefront property having a market value under a given set of conditions, in this case water level and scenic view, but a less precise value for permanent changes to that water level condition.

The following will use the ACT-ACF study as an example of methodologies that were developed to overcome estimation challenges presented by the interaction of uses placed upon public and private resources under alternative water conditions. Some brief results will follow, but more detailed results can be found in Hanson (1998) and FIMS (1997). Lakefront property owners and recreational users were surveyed to find out how changes in water level would affect landowners' property values and recreational visitation and expenses. Potential reservoir users, termed as *non-users*, were surveyed to determine their willingness to pay for preservation of the current reservoir resources.

Three surveys were required to develop empirical relationships between potential water level conditions and lakefront property values. First, a reservoir perimeter count of all lots was conducted resulting in each lakefront lot being placed into one of four categories. A 'Developed Lot' category included having a house on the lot, utilities, and road access. Another percentage of the lakefront property was defined as an 'Undeveloped Lot' where no house existed, but utilities and road access were present and a house could be built without any additional infrastructure. There was a lakefront property category for 'Undeveloped Land' including land that had no present road access or access to electricity and would need additional infrastructure development. There will always be a portion of the lakeshore line that cannot be developed for one reason or another and this category was subtracted from the total shoreline perimeter.

Second, aggregation of land category value to estimate a reservoir's total lakefront property value required additional information from realtors. This informal survey of realtors familiar with each reservoir was used in determining the ratio of developed lots to undeveloped lots, total shoreline miles, and the amount of land that would not likely ever be developed. Values for each land type were then multiplied by the quantity of each land type and summed to obtain aggregate reservoir lakefront property value.

Third, a direct mail survey was sent to lakefront property owners at each of the studied reservoirs. Dillman's (1978) survey methodology was followed. Lists of lakefront landowners were obtained from homeowner associations, utility companies, and from referencing county plat maps. Addresses were selected randomly from the master list. If after three weeks no response was obtained, a reminder card was sent and if there was no response an alternate was chosen and sent a survey. The sampling continued until a minimum of 200 completed surveys were obtained for each reservoir.

The economic impact of changes in water conditions hinged upon a CV question asking respondents to estimate the percent change in property value resulting from hypothetical, but permanent changes to summer full-pool water levels. Specifically, lakefront homeowners were asked to give a percentage change in property values for reservoir water level reductions of 1, 2, 3, 4, or 5 feet. Increases in reservoir water levels were not considered, as they would represent flood stage. Analysis of permanent lowering of summer full-pool water levels used linear regressions (Freund and Littell, 1991) to determine the change in property value.

The recreational user expenditure portion of the study investigated integration of telephone survey of the general population living within the watershed area of the studied area and on-site recreational user surveys. Each survey had its strength and weakness. In general the telephone survey gave better indications of public visitation to the reservoirs, while on-site interviews gave better estimates of recreational expenditures. Only on-site surveys were used in evaluating trip frequency changes at different water levels. The two surveys were used in developing market segments for each reservoir and aggregation to total reservoir level recreational expenditures.

A set of questions for the on-site survey was developed to determine visitation frequency by activity, associated expenditures, and how visitation would be affected by lowered water levels. Once visitation frequency was determined, follow-up questions established a reduced water level at which no trip would have occurred. The interviewer then halved this reduction in water level and the recreational user was asked how often he/she would recreate if the water level were reduced to this mid-water mark. (Reservoir managers later provided the exact water level for the interview date and it was used to determine the "no-go" threshold as well as the halfway water level.) This process established three water levels and three visitation frequencies for each on-site interviewee and many recreational activities. This information was applied to trip expenditures for a particular recreational activity and used to determine overall economic impact of reduced visitation occurring from changes in lake water levels.

Travel-cost market segmentation methods were the basis for development of reservoir-specific market segments. Segments were largely based upon information gathered from the on-site and telephone surveys and used in conjunction with 1990 U.S. Census data. A market segment was defined by user characteristics (proximity to reservoir, visitation frequency), location characteristics (highway accessibility, urban population centers), and homogeneity of county characteristics. Market segmentation allowed use of different user characteristics (their primary activity, trip expense, and visitation frequency) to estimate total reservoir recreational expenditures. Changes to aggregate user expenditures due to decreases in summer full-pool water levels were evaluated using linear regression techniques.

Lake-specific market segments included up to five general market segments based on characteristics stated above. The primary market counties were defined as those counties contributing 4 percent or more of the overall visitation to the reservoir as determined from the telephone survey. The Jefferson County market segment included the city of Birmingham, AL with its large population far exceeding any other county or metro area counties within the telephone survey area. The 'Other Urban

Counties' category consisted of counties with highly populated standard metropolitan areas within the telephone survey area. The 'Secondary Counties' category included those counties not in the other categories but contributing more than 1 percent of the total visitation. 'Tertiary counties' category included the remaining counties within the watershed basin sample area. Specific numbers of households in a county that visited each reservoir were estimated by multiplying the percent of users obtained from telephone survey by the U.S. Census number of households within the county. On-site surveys revealed recreational users also came from areas outside the telephone survey area. This information was used to weight the total visitation estimation in the combined survey estimation approach.

To determine non-user preservation values toward the reservoir resources, a telephone survey for non-users was developed. The sampling frame for the telephone survey was population proportional for 25 Alabama and 12 Georgia counties within the Coosa and Tallapoosa River watersheds. This area contained 959,114 households.

Dichotomous choice CV questions were asked to collect data on preservation values and determine barriers to use. The two-part CV question resembled a double-bounded referendum question format and was devised for its potential to obtain additional information to better estimate the true WTP preservation values (Jordan and Elnagheeb, 1994a, 1994b; Cameron and Huppert, 1991). In the first part of this two-step question, respondents were asked their willingness to pay some amount (yes/no) for the assurance of the optional use of the reservoir resource in the future. The second part of the question was asked only to those who responded "yes" to the first part of the question and asked a specific (random) bid amount to the respondent. This two-part question format was a desirable scenario because consumers likely follow this process in day-to-day market transaction decision-making. That is, the first decision a consumer makes is whether he or she wants a "good" or not. Those not wanting the "good" can be seen as willing to pay zero dollars. But if the respondent is willing to pay some amount, then it is a decision of buying at the offered price and this is the conventional single-bounded dichotomous choice model.

An ordered probit model was developed that would directly estimate respondents' WTP as a function of socioeconomic variables and the offered bid amount. The corresponding log-likelihood function identifies the variance and the maximum likelihood method was used to estimate the unknown parameters. With the variance term separated from the $X\beta$ terms, the resulting equation had coefficients that directly indicated the change in willingness to pay in dollar terms. Summing the coefficients multiplied by variable means can directly solved the empirical WTP measure for the average respondent. Independent variables used in the final model were respondents' age, age squared, income, income squared, and gender.

Results

Permanent reductions in summer full-pool water level resulted in a 4-percent to 15-percent decrease in lakefront property values for each one-foot reduction for all studied reservoirs. An example change in property value for water level changes for Lake Martin, one of the six studied reservoirs, is given in Table 1. As the lowering of summer full-pool water level continued, two reservoirs were estimated to lose more than 50 percent of the aggregate lakefront property value at five feet below current summer full-pool water levels.

On-site recreational user survey interviews obtained accurate trip expenses without being hindered by memory recall problems. On-site surveys enabled accurate visitation enumeration from beyond the telephone survey boundary, enabling a correction factor development that added outside recreational visitation into the total reservoir user expenditures. As two of the study reservoirs were well known for their sport fishery this "outside" visitation was large and would have been completely missed if the phone survey alone had been used.

Avidity of visitation by local users can actually overstate visitation at low trip expenditures if not weighted properly. The avidity

Table 1. Change in Lakefront Property Value and Recreational User Expenditures Associated with Reductions in Summer Full-pool Water Level, Lake Martin, Alabama

Feet Below Summer Full Pool	Aggregate Lakefront Property Value		Aggregate Total Value of Recreational Use	
	$ million	% change	$ million	% change
0	1,005	(NA)	130.37	(NA)
1	925	−8%	118.14	−9%
2	824	−18%	105.91	−19%
3	724	−28%	93.68	−28%
4	633	−37%	81.45	−38%
5	533	−47%	69.22	−47%

Source: Hanson, 1998.

bias associated with on-site interviews was overcome by using visitation frequency from the telephone survey, i.e. a potentially much broader segment of society than avid visitors to a specific reservoir.

Total annual recreational user expenditures ranged from $21.1 million for one reservoir to $130.4 million for Lake Martin (Table 1). Aggregate recreational value for the six reservoirs was $442.5 million annually. Changes to aggregate user expenditures from a one-foot lowering of reservoir water levels ranged from a 4-percent to 30-percent decrease in recreation user expenditures. For the Lake Martin example, a one-foot permanent drop in water levels would result in reduced recreational visitation value of $12.23 million annually (see Table 1).

Of the 959,114 households within the telephone survey area, 63 percent were non-users of the study reservoirs. Non-user respondents showed strong preferences for protecting study reservoirs. Estimated households' willingness to pay to preserve the six reservoirs under present management conditions was $47.21 per household or approximately $29 million for the entire watershed basin area (Table 2).

Concluding Comments

Agricultural and resource economists can play an important role in facilitating less contention among users and more efficient use of the resource by providing more information on the economic value of water in various uses. In addition, the importance of time and place in the value of water resources can be documented and clarified. A truly integrated water basin model determining the economic effects of alternative water management decisions on multiple-user groups is needed for the ACT and ACF watershed basins.

Integration of reservoir resource valuation requires in-depth knowledge of diverse stakeholders. For a reservoir these groups may in-

Table 2. Non-user Individual and Aggregate Willingness-To-Pay Preservation Values (Option, Bequest, and Existence) for the Six Study Reservoirs

Preservation Value Type	Per-Person Willingness-to-Pay Amount Per Year ($)	Annual Aggregated Non-User Willingness to Pay ($ million)
Option Value-Personal use	12.53	7.57
Bequest Value-Intergenerational use	17.07	10.31
Existence Value-fish and wildlife habitats	17.61	10.64
Total Willingness to Pay on an Annual Basis	47.21	28.52

Source: Hanson, 1998.

clude recreational users, lakefront property owners, business operators, power generators, municipalities, agriculturists, and potential users. It is a large undertaking to determine the effect of a resource change on all of these groups in an integrated manner.

Contingent valuation questions posed in on-site, mail, and telephone surveys allowed alternative water level impacts to be estimated for some of these stakeholder groups. Results for a sub-region of the ACT-ACF river basin regions produced a large economic impact from potential reservoir water level changes. Alabama, Florida, and Georgia have much to gain or lose depending on how much water each state will eventually control.

Summer control of water in these basins is key to maintaining the highest value. Full-pool water level is the most valued water level for recreation and lakefront property owners. Agriculture, municipalities, industry, and navigation uses of water resources have not been included in this study, but the economic impact on them would be great also for reduced water levels. Recent legislation passed by the Georgia legislature provides for an auction to buy farmers' irrigation water rights in the Flint River Basin.

The implications of the study detailed in this paper for resource management planning are many. As the reservoir resource has evolved from being primarily a power generation resource to a multi-use resource, the increasingly important recreation and housing sectors need to be considered when water management issues arise. Changing resource use patterns imply changing resource values. While regulatory agencies may lag behind the new realities of reservoir use, it is apparent that resource management based on historic use patterns may be inappropriate. Consistent and continued reevaluation of resource values needs to be a part of the resource planning process.The possibility that more watersheds in the Southeast US will be managed through mechanisms such as water districts (e.g. Florida), water compacts (e.g. ACT/ACF), or comprehensive watershed agreements (e.g. Chesapeake Bay) should be both an opportunity and a responsibility for agricultural and resource economists to provide objective, science-based estimates of economic implication of resource-management decisions. Economists should not be naïve in thinking that such estimates will necessarily change resource-management decisions, because the latter are typically based on a host of political, legal, and environmental considerations. However, better economic information may result in improved understanding of the tradeoffs resulting from resource-management alternatives.

Economic valuation tools developed during this study would be helpful to policy makers needing economic information on the effects of changing water management parameters. Furthermore, these methodologies are transferable to other reservoir systems, to river systems, or to other public resources such as parks, wildlife preserves, and national forests. Projecting valuation changes from alternative management scenarios are critical in assisting stakeholders, resource use planners, and governmental policymakers in making informed resource use decisions.

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