

US EPA ARCHIVE DOCUMENT

**PRELIMINARY IDENTIFICATION OF APPROACHES
USED IN VALUATING NATURAL RESOURCES**

November, 1990

U.S. Environmental Protection Agency
Office of Solid Waste
401 M Street, S.W. Washington, DC 20460

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1. OVERVIEW

EPA's Office of Solid Waste (OSW) is considering various approaches for assessing the impacts of mining waste and materials. Among the approaches being considered are various methodologies used to determine the economic value of natural resources. In particular, OSW is interested in the techniques used to determine the value of water resources for alternative uses. Of secondary interest are methodologies that are used to determine the value of natural resources for tourism and various recreational activities.

This document presents the results of a preliminary identification of the resource valuation methodologies that are currently in use or under development within the United States, with an emphasis on the following 21 States:

Alaska	New Mexico
Arizona	North Carolina
California	Oregon
Colorado	South Carolina
Florida	South Dakota
Idaho	Texas
Michigan	Utah
Minnesota	Washington
Missouri	Wisconsin
Montana	Wyoming
Nevada	

The remainder of this report section describes our approach in carrying out this task and presents our major findings. Two following report sections provide background information that supports these findings. These supporting report sections are:

Personal Contacts Summary - A catalog of summaries of conversations held primarily with State agency staff and secondary discussions with universities and other private groups with expertise in natural resource valuation. The catalog is organized by State and lists addresses, telephone numbers, conversation summaries, and any documents that the contact referenced or agreed to provide to the investigators.

Preliminary Bibliography - A list of selected references on natural resources valuation, with an emphasis on approaches used in valuing water resources for alternative uses.

Approach

This preliminary identification of resource valuation efforts was accomplished through a literature review and an informal survey of State agency staff.

EPA's contractor, SAIC informally surveyed government agency personnel and representatives of selected nongovernment institutions in the 21 targeted States. EPA focused on the following State departments/divisions: Parks and Recreation, Fish and Wildlife, Water Resources, Water Quality, and Tourism. EPA asked about cases of water resource valuation within the State and methods used in determining resource values. Where literature or reference materials were available, EPA asked that these be sent to us.

EPA also conducted a literature search using a large commercial electronic library, which contains abstracts for articles and documents on topics relating to science, business, technology, law, economics, environment, social sciences, and engineering. Keywords used in this automated search included: economics, natural resources, valuation, evaluation, water, pricing, and costs. Seven relevant data bases were searched within the electronic library. References considered particularly relevant to EPA's interests were culled from the results of the literature search and were grouped in categories.

In addition to the computerized literature search, EPA undertook a preliminary scan of current journals that tend to include articles on natural resource valuation. Results of this search are included in the preliminary bibliography presented later in this report.

General Findings

In general, the States are increasing and broadening their efforts in determining the economic value of natural resources for alternative uses, which is evidenced by a growing list of anecdotal or site-specific cases. Although the concept of valuating non-market goods and methods for determining values remain controversial, there are clear indications that this is an emerging tool in resource management and environmental protection. Among these indications are: (1) a growing list of suits under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), which require defensible valuations of damaged natural resources; (2) an increasing number of water marketing proposals and cases in Western water courts, which involve water quality issues; and (3) the current efforts by several States to develop systematic approaches for geographic classification of resource benefits and habitat quality.

Well Established Areas of Resource Valuation

There are some well established areas of resource valuation, which were strongly revealed by our survey of State agency staff. As shown in Table 1, virtually all of the Western States we surveyed have an extensive history in water pricing and valuating water supplies. Under the doctrine of "prior appropriation," individuals hold legal title to the use of some portion of a given water supply to be used for a beneficial purpose. The prior appropriation doctrine of "first in time is first in right," which has been adopted by most Western States, has given rise to a complex legal system, where disputes over rights are settled by water courts and administrative action. This complex system has established a vast case history of valuation of water supplies.

The surveyed States also have well established methodologies for valuating losses of fish and wildlife from pollution incidents or other environmental perturbations. These valuations are

well accepted as a basis for setting penalties under the Clean Water Act or various State statutes. Because of the wide use of fish and wildlife valuations in determining penalties for pollution incidents, the few cases where our preliminary survey showed no "hit" for this area probably reflect our failure to make contact with State staff who are familiar with State damage assessments for these resources.

Similarly, there is a strong base of experience and relative comfort among State agencies in valuating the recreational benefits of water and other natural resources. Much of this experience stems from traditional cost-benefit studies for proposed dams and other major water projects. In addition, a long tradition of Federally-supported studies of the economic benefits of recreational fishing and hunting have helped build State expertise as well as substantial list of documents on the recreational value of specific waterbodies.

In addition to this base of experience in valuating recreational benefits, most, if not all States, have undertaken extensive studies of the economic value of tourism within their jurisdiction. Generally, these studies are broad Statewide assessments, although some targeted studies of the economic benefits of natural resource-related tourism have been undertaken. Some organizations, such as the Center for the New West in Denver, Colorado, have seized upon survey data indicating the growing importance of tourism, as a basis for promoting environmentally-sound economic development.

Emerging Areas of Resource Valuation

In the Western States, a complex water rights doctrine, a tradition of cost-benefit analyses for Federal water projects, and an increasing demand for water by a wide range of prospective users, are leading to important and relevant changes in water supply pricing. As signaled by a 1987 resolution by the Western Governors' Association to facilitate voluntary water transfers, the Western States are moving to adopt policies that would allow water prices to vary according to specific resource use. Thus, water used for irrigation might have one price, while water used for municipal supplies or snowmaking at ski resorts would be priced differently. Specific efforts to

develop water markets, particularly in Colorado and California, provide another line of evidence for the valuation of natural resources according to quality and intended use.

Efforts to clean up designated Superfund sites are attended by a growing list of CERCLA suits, where the government must value natural resource damage caused by a polluter. Within the West, a number of these cases involve mining wastes. For example, the Eagle Mine case in Colorado provides a forum for developing and testing valuation methodologies. In this particular case, cleanup actions are also alleged to have adversely affected the suitability of water for snowmaking by a nearby ski resort and have increased wastewater treatment costs at a downstream facility.

In addition to CERCLA suits, Western water courts are handling an increasing number of cases of "material injury to water rights," where impacts on water quality are alleged to have impaired the suitability of water for a designated beneficial use. These cases, some of which are likely to involve mining wastes, would have required the calculation of damage assessments and may indicate differences in the value of water according to use.

Another emerging area is the development of broad classification schemes for resource quality that can be used in assessing damages from a wide range of environmental insults. For example, the Washington Department of Ecology is developing a methodology for quantifying damage to water resources that considers damages to water resources within a multi-dimensional framework. Environmental data are being used to define geographic zones within the marine environment, based on ecological sensitivity. This classification scheme is used in a matrix format, showing the relationship between resource benefits and severity of pollution.

In another case, the Missouri Departments of Conservation and Natural Resources are developing an approach for comprehensive valuation of resource damage resulting from a major oil spill in Missouri's Gasconade River. The State is assessing adverse effects on aquatic organisms and wildlife, private water supplies, and recreational uses. Losses in recreational

revenues are being quantified by measuring the differences in public use between pre-spill and post-spill surveys.

Valuation Methodologies

There are several methodologies that are commonly used in resource valuation. These include: (1) "willingness to pay," or contingent cost valuation methodologies; (2) "travel cost" methodologies; and (3) economic valuation, which reflects costs and benefits accrued by individuals and local economies.

Valuation methodologies tend to be similar across resource sectors. For example, in most cases, States that have conducted valuations of park and recreational resources have used the travel cost method. Similarly, most States have adopted specific resource valuation procedures developed by the American Fisheries Society (AFS) in determining damage assessments for fish kills in fresh water environments.

Specific Findings

In addition to the general findings presented above, some specific findings from our informal survey and preliminary literature review are listed below:

Water Resource Valuation

- Most of the States we surveyed valued water quality as part of regulatory actions. Maximum penalties and the activities that trigger penalties are specified either in State statutes or State regulatory codes. In many States, the assessment of water quality damages from a pollution event is equated to the number of fish and wildlife lost, without regard for other resource issues.
- Where unpermitted discharges harm water quality, Idaho levies fines that are equal to the value of certain lost resources. Fines take into consideration both short-term and long-term costs. Short-term costs include stopping and containing unpermitted discharges. Long-term costs include correcting the problem and restoring the resource to its previous water quality classification. If this is impossible, the cost of finding and supplying an alternative water source is

included as a long-term cost. In setting fines, enforcement offices rely on resource management agencies, such as the Fish and Game Department, which assesses economic losses of any fish kills, the Parks and Recreation Department, in cases where recreational areas are damaged.

- Oregon does not have a fixed policy for penalty assessments. The Division of Water Quality makes a case-by-case judgment of environmental damage as a factor in determining penalties.
- Wyoming assesses penalties based on the estimated value of lost resources according to replacement cost. Penalty assessments consider both the illegality of the action causing damage and the value of aquatic life killed. Losses of recreational benefits are not considered in calculating penalties.
- Montana has surveyed park visitors on how much they would be willing to add to their monthly utility bills in order to maintain desired water flows.
- Texas legislation requires cost-benefit analysis for water quality standards. Costs are represented as the incremental cost of additional treatment necessary because of resource degradation.

Valuations of Fish and Wildlife Resources

- Nearly all of the States we surveyed have used the AFS publication Fish Kill Investigation Procedures to determine the number of fish killed in given pollution incidents in fresh water environments. Most States also have used the publication Monetary Values of Freshwater Fish and Fish-Kill Counting Guidelines to determine the value of the lost fish. The most recent AFS guidelines were published in 1982. To compensate for inflation, AFS suggests that 1990 valuations increase suggested values by 37.1 percent.
- An increasing number of States are abandoning or modifying the AFS methodology. We noted that some States treat the AFS guidelines as replacement values and other States consider the guidelines as use-values. Some States, including Idaho and California increasing rely on local production costs as a basis for determining replacement costs.
- Few States have gone the next step of calculating losses to the local economy resulting from resource losses. Exceptions include major oil spill events, such as the EXXON Valdez incident. As part of such resource damage assessments, Alaska determines changes in fish populations from pollution events by comparing commercial fish catches before and after pollution events. Damage assessments are then calculated based on per pound value and measured change in the weight and sale of the commercial catch.

- Michigan uses AFS costs for replacement costs only. In considering damages against a polluter the State considers reasonable costs and replacement costs for all species or fish stocks killed or damaged. Estimating the functional cost is broken into four categories; threatened and endangered species, commercial fisheries, forage fishes, and game fishes. All fish losses are approached on a case-by-case basis. The State first assesses the damage using the AFS methodology and values and if they feel the costs/values are inappropriate the State will then use the functional value approach.
- Oregon has attempted to calculate the net economic value of fisheries activities by estimating the number of fresh water and ocean anglers, estimating their expenditures, and determining the anglers' willingness to pay for fish stocking.
- The South Dakota Department of Game, Fish and Parks uses the AFS guidelines but also considers the potential recreational losses, derived from a decrease in fishing trips.

Parks and Recreation

- States that have valued park resources have used variations of the travel-cost method. In each case, the results are used as proxies for market prices.
- Missouri has been particularly active in recreational use valuation. The Department of Conservation has performed numerous studies on the economic benefit and value for various parks, fisheries, or distinct recreational activities in the past several years. Most of the States assessments involve use of the travel cost method.
- Arizona has assessed the value of its State parks. The State used the travel cost method in determining the value of the parks to the economy. Using this method, the State determined that every 3 visitors spend between \$203 and \$208 within a 50 mile radius of a State park. Based on average number of the park visitors and average expenditures, it was estimated that State parks contribute \$7 million annually to a local economy. In determining the number of visitors in State parks the State relies on actual visits versus estimated visits (the common measure).
- Idaho has not placed an economic value on lost recreational resources. However, the State has conducted studies/surveys of perceptions of park amenities. Visitors have been surveyed on their willingness to pay for key attributes.

Tourism

- None of the States we surveyed have conducted comprehensive studies that solely address the tourism value of water resources. State studies generally address

number of visitors, modes of transportation, visitor origin, expenditures while in the State, and the effects of tourism on local and State economies.

Table 1. Summary of the Results of Interviews on Types of Resource Valuation Undertaken by State Agencies

2. PERSONAL CONTACTS SUMMARY

ALASKA

Herman Savacoe
Alaska Game and Fish Department -- Commercial Fisheries Division
P.O. Box 3-2000
Juneau, AK 99802-2000
(907) 465-4210

The Commercial Fisheries Division of the Game and Fish Department assists the State's legal authorities and the Habitat Division in placing values on damaged fisheries. The division determines changes in fish populations from pollution events by comparing commercial fish catches before and after the event. A dollar per pound value on fishes lost is calculated from a change in the commercial catch.

The department does not use the American Fisheries Society's values because the State's fisheries are primarily marine in nature, and the AFS methodology does not apply to marine resources.

Pete Carlson
Alaska Department of Commerce and Economic Development -- Tourism Division
P.O. Box E
Juneau, AK 99503
(907) 465-2010

Mr. Carlson noted that in Alaska tourism is a \$1 billion a year industry. Approximately \$500 million is spent on transportation to the State and another \$400 million once the visitor arrives. The State received 561,000 visitors during the summer months of June to September 1989. The number visitors during the same period in 1990 is expected to be approximately 582,000.

The State has issued a new contract that will determine the effect of the tourism on the local economies. The final report is in April 1991. The State currently has a document available called 1989 -- Summer Expenditure Study which describes where visitors spend their money once they arrive in Alaska. The cost is \$15 and is approximately 150 pages. The document was not ordered.

Pete Panarese
Alaska Department of Natural Resources -- Division of Parks and Outdoor Recreation
225-A Cordova Street
Anchorage, AK 99501
(917) 762-2603

Mr. Panarese was not aware of any resource valuation studies. He referred me to Dave Stevens, the economic program officer for State parks.

Dave Stevens
Alaska Department of Natural Resources -- Division of Parks and Outdoor Recreation
225-A Cordova Street
Anchorage, AK 99501
(917) 762-2600

The Division of Parks has not conducted studies placing values on natural resources. The State has attempted some "minor" studies using travel cost methodology to determine the amount of money people spend visiting some State parks. The studies were conducted by biologist and ecologists. Because of the lack of input from economists, Mr. Stevens believes the studies are inadequate. He is sending some of the studies conducted by the Division of Parks and Outdoor Recreation.

Doug Redburn
Alaska Department of the Environmental Conservation -- Division of the Environmental Quality -- Water Quality Management Office
P.O. Box O
Juneau, AK 99811-1800
(907) 465-2653

Alaska has not evaluated water resources according to alternative uses. The values that have been placed are related to enforcement activities. Penalties are the same no matter the classification of the water resource, although triggers for water quality standard violations vary according to water quality classifications.

The State is considering initiating studies on the economic value or functional benefits of wetlands.

ARIZONA

Joe Janish
Arizona Game & Fish Department -- Fisheries Division
P.O. Box 9099
Phoenix, AZ 85068-9099
(602) 942-3000

The State of Arizona uses the American Fisheries Society's publication Fish Kill Investigation Procedures to determine the number of the fish killed and Monetary Values of Freshwater Fish and Fish-Kill Counting Guidelines to determine their value.

Robert Yount
Arizona Land Department -- Natural Resources Division
1616 West Adams Street
Phoenix, AZ 85007
(602) 542-4625

In leasing State lands, Arizona determines economic value based on an appraisal. Appraisers follow standard methodologies in determining the value of the land, which consider current land use, features on the land, and availability of water. Appraisals are done on a case-by-case basis.

The Land Department also sells water located on State lands. Sale prices vary across the uses with domestic users paying the greatest price for water.

Mr. Yount stated that he did not have any literature indicating the price structure for water sales or indicating the procedures for conducting land appraisals.

Steve Jenkins
Arizona Department of Water Resources
15 South 15th Avenue
Phoenix, AZ 85007
(602) 542-1546

Arizona's Department of Water Resources has not conducted any studies to determine the value of water resources for various uses. Benefit-cost studies conducted by the Department are primarily for flood control projects.

Paul Malmberg
Arizona State Parks
800 W. Washington, Ste. 415
Phoenix, AZ 85007
(602) 542-4174

Arizona has assessed the value of State parks. The travel cost method was used in determining the value of the parks to the economy. Using this method it has been determined that every 3 visitors spend between \$203 and \$208 within a 50 mile radius of a State park. The State has found these dollar estimates to be very similar to ones developed for New Mexico. Based on average number of the park visitors and the amount of money spent by every 3 visitors, State parks contribute \$7 million annually to a local economy. Multipliers or estimates were not used in determining the annual contribution of State parks to the economy.

Received a copy of 1987-1988 Use Study of Arizona State Parks Visitors: All Park Summary. This document describes the methodology used and includes a copy of the survey used for collecting information.

Greg Wallace
Arizona Department of Water Resources -- Hydrology Division
15 S. 15th Avenue
Phoenix, AZ 85007
(602) 542-1586

In responding to resource damage due to pollution events, Arizona assesses penalties and enforces remedial actions. Penalties are assessed on a case-by-case basis. Costs are passed on to the responsible party. The Department has not done any studies placing a value on water for different uses.

Eileen Mahoney
Arizona Office of Tourism
11 W. Washington
Phoenix, AZ 85007
(602) 542-8687

Ms. Mahoney sent a copy of The Arizona Travel and Tourism Industry 1988 Update by Ronald J. Gunderson and James V. Pinto. The document describes tourist expenditures, tax revenues from tourism by County, and tourism employment by industry.

CALIFORNIA

Diane Donian
(916) 322-2881
California Department of Commerce -- Tourism Division
1121 L Street, Ste. 600
Sacramento, CA 95814

California has conducted studies looking at visitor expenditures and the regional impact tourism has on the State. Received the document Regional Economic Impacts of California Travel 1986-1988 that describes travel impacts for the State in 1988 and on each of the State's 12 regions. The document also reviews the methodology used and data sources.

John Hillerman
California Department of Parks and Recreation
P.O. Box 942896
Sacramento, CA 94296-0001
(916) 445-9060

Mr. Hillerman did not know of any studies assessing the value of State parks in California, since they value State parks according to their acquisition cost. The only studies that he is aware of compare operating costs and revenues within an individual park.

Larry Thomas
California General Services Department
925 Capitol Mall, Ste. 590
Sacramento, CA 95814
(916) 323-4363

The acquisition cost or the value placed on land for State parks is determined according to the principle of highest and best use. For example, the value of land proposed for use as a coastal park would be appraised as residential land, if the area would be suitable for housing development.

Other lands are valued at their speculative value, with the intent of future development increasing the current price of the land. Appraisals consider current zoning, the possibility of future zoning changes, surrounding community growth potential, and nearby zoning patterns. Projecting changes in current zoning patterns is done in cooperation with the local planning departments. The local planning departments recommend the zoning level to be used in the assessment.

Jim Rich
California Department of Water Resources
P.O. Box 942836
Sacramento, CA 95236-0001
(916) 445-7239

California does not conduct studies on the value of the water resources, and lacks statutory authority to conduct such analyses. The State used to document record water supply costs, but this effort ceased in 1986. Cost tracking will be restarted in the near future. The Department of Water Resources sets rates only for water from the "State Water Project" that transports water from northern California to southern California.

The State has conducted studies that involve the cost of acquiring water. There is little market activity because of pre-existing water rights. The price of water varies greatly within the State from irrigation costs of \$10.50 per acre foot in the largest irrigation district (2.6 million acres) to approximately \$3,890 per acre foot in Santa Barbara.

We received a letter from Mr. Rich and Mr. Hoagland (Chief of the Economic Analysis Section) with tables showing urban and agricultural water costs.

California State Bulletin #160-87 describes past prices for acquiring water in the State. This publication will be updated in 1992. The document can be ordered for \$5 from (916) 445-9371. This document was not ordered.

COLORADO

Brad Brockbank
Governor's Office of Policy and Research
Governor's Office
State Capitol
Denver, CO 80203

Several CERCLA suits with Colorado involve damage from mining wastes. The State Attorney General has the lead in developing damage estimates. Mr. Brockbank noted that cleanup of Eagle Mine Co. wastes created affected snowmaking by Vail Associates' ski resort at Beaver Creek—although he is unaware of any resulting litigation. Suggests we contact Ms. Jackie Beridini in the State Attorney General's Office for more details.

Janice Romero
Center for the New West
1625 Broadway
600 World Trade Center
Denver, CO 80202
(303) 592-5310

The Center for the New West is actively publicizing/promoting trends in Colorado and other western States toward environmentally-sound economic development. The Center has taken a particular interest in the growth of tourism. The Director, Phil Burgess, does have interest in resource valuation and will return our call after his return from a month-long trip (due back around 11/19/90). Background materials on the Center are being sent.

Julie Kraus
Water Resources Division
Natural Resources Department
1313 Sherman Street
Room 718
Denver, CO 80203
303-866-3581

Within Colorado most state policies focus on water quantity or supply issues. Colorado is being sued by Kansas over water rights, but no dollar amount is being assigned to any water involved in the conflict.

Tom Easley
Parks and Outdoor Recreation Division
Natural Resources Department

1313 Sherman Street
Room 718
Denver, CO 80203
303-866-3067

The Parks and Outdoor Recreation Division of Colorado does not undertake resource valuations. Mr. Easley referred us to the Water Quality Control Division.

Daniel L. Law
Water Resources & Power Development Authority
1580 Logan Street
Suite 620
Denver, CO 80203
303-830-1550

Denver's primary water and electricity generation utility also has not undertaken economic valuations relating to water quality.

Richard Meredith
Local Affairs Department
Tourism Bureau
1313 Sherman Street
Denver, CO 80203
303-592-5410

Mr. Meredith did not know of information or tourism studies that involve water resources valuation.

Bruce McCloskey
Wildlife Division
Natural Resources Department
1313 Sherman Street
Denver, CO 80203
303-291-7208

Mr. McCloskey referred me to Julie Kraus in the Water Resources Division.

Seth Goldstein
Water Quality Control Bureau
Colorado Health Department
4210 East 11th Ave.
Denver, CO 80220

Mr. Goldstein did not know of any studies done at the state level. He suggested that we concentrate on local entities.

FLORIDA

Tim Glover
Florida Department of the Environmental Regulation--Ground Water Bureau
2600 Blairstone Road
Tallahassee, FL 32399-2400
(904) 488-0130

Florida's Department of Environmental Regulation is concerned with permitting and enforcement of water quality regulations. The State does not have a set penalty structure for assessing a water resource once it has been damaged. Mr. Glover suggested we contact the legal department of the Department of Environmental Regulation. If any studies had been done concerning the value of the water resources, they would most likely have been done by the Water Districts (i.e., South Florida Water Management District), Regional Planning Councils or by the Department of Community Affairs.

Robert Wattendorf
Florida Game and Fresh Water Fish Commission -- Fisheries Division
620 South Meridian Street
Tallahassee, FL 32399-1600
(904) 488-4066

In determining the economic value from fish kills, the State of Florida uses the American Fisheries Society's publications Fish Kill Investigation Procedures and Monetary Values of Freshwater Fish and Fish-Kill Counting Guidelines to determine the number and dollar value of the fish killed. Fisheries investigators in the Districts perform the estimation on the size, type, age, and area affected by the pollution and follow the AFS publications to place a value on the loss.

George Apthorp
Florida Department of Natural Resources -- Recreation and Parks Division
3900 Commonwealth Blvd.
Tallahassee, FL 32399
(904) 488-5968

Florida does not calculate the economic value of the recreational resources. Instead, they undertake studies based on carrying capacity of their parks. For example, if a park is forced to close then an economic value could be placed on the lost recreational opportunities. Estimates would consider the carrying capacity of the park and the average expenditure values. No studies have been conducted using willingness-to-pay or travel-cost methodologies.

Joyce Brides

Florida Department of Commerce -- Tourism Division
Collins Bldg. 510C
Tallahassee, FL 32399-2000
(904) 488-9447

Florida's Department of Commerce has undertaken studies of the number of visitors to Florida and types of visitor activities, both at the County and State level. The Commerce Department has done studies on the amount of dollars spent by tourists. Received a report called Florida Visitor Study 1989.

Raephel Marcucui
Florida Department of Commerce -- Tourism Division
Collins Bldg. 510C
Tallahassee, FL 32399-2000
(904) 487-2373

Visitors to Florida spent \$26 billion dollars in the State during 1989. Visitors include both tourists and business travellers. Fifty-five percent of the visitors arrived by automobile and one of their top activities was visiting "beaches".

IDAHO

Gwen Burr
Idaho Department of Health and Welfare -- Water Quality Bureau
450 W. State Street
Boise, ID 83720
(208) 334-5860

Idaho approaches the evaluation of a damaged natural resource whether a loss of a drinking water supply, fish habitat or recreational activity on a case-by-case basis. The State levies fines against polluters equal to the value of the lost resource. The fine takes into consideration both short and long-term costs. Short-term costs include stopping and containing the unpermitted discharge. Long-term costs include correcting the problem and returning the resource to its previous classification. If this is impossible, the cost of finding and supplying an alternative water source is included as a long term cost. Calculation of fines includes input from agencies such as the Fish and Game Department, which assesses the economic losses of fish kills (if fish populations are destroyed), and from the Department of Parks and Recreation (if a recreational area is damaged).

Pete Hassamer
Idaho Department of Health and Welfare -- Fish Management Bureau
450 W. State Street
Boise, ID 83720

(208) 334-3791

Idaho uses the American Fisheries Society's publications Fish Kill Investigation Procedures and Monetary Values of Freshwater Fish and Fish-Kill Counting Guidelines to determine the number of fish killed and the economic loss associated with those losses. Currently before the State court is a case in which a semi-truck trailer loaded with liquid fertilizer crashed into a river killing all fishes 20 miles downstream of the crash site.

The State has assigned a staff person to work on the effects of water degradation from both forestry and mining activities.

Al Van Voorn
Idaho Department of Fish and Game
P.O. Box 25
600 South Walnut
Boise, ID 83707
(208) 334-3791

Idaho uses the AFS guidelines in setting replacement costs for fish kills but relies on local production costs if they are available.

The Department of Fish and Game has no legal authority to assess penalties on polluters. The Department of Health and Welfare assesses penalties for violations in water quality standards but does not include losses resulting from fish kills. The Department of Fish and Game then takes the polluter to court to recover damages.

Studies by Dennis Donnelly et al. have attempted to place an economic value of recreational fishing on the State economy. The studies use both contingent value (CV) and the travel cost methods to determine the economic value of a fishing trip. The two studies are available from the U.S. Forest Service in Fort Collins Colorado. Both documents, Net Economic Benefits of Recreational Steel Head Trout Fishing (RM-9) and Net Economic Benefits of Cold & Warm Water Fishing (RM-11), have been ordered but have not been received.

The State calculates the economic loss resulting from a spill by using the AFS guidelines for replacement costs plus the losses that result from a decrease in the number of fishing trips. For example, if 50 steelhead trout were accidentally killed and the average number of the steelhead trout caught per fishing trip was 1, then the economic benefit derived from 50 fishing trips would be lost. If one fishing trip resulted in \$100 of expenditures, then the economic loss of this incident would include the replacement cost of the fish plus \$5000 from a reduction in 50 fishing trips. The State uses the Donnelly et al. publications to determine the effect of recreational fishing on the State economy.

Mr. Van Voorn wishes the State or the Federal government would address the following situation that occurred in Idaho. An illegal mine tailing pond ruptured and released suspended sediments into a stream. Sediment deposits up to 6 inches deep were found 6

miles away from the accident site. No fish or other aquatic life were killed from the sudden increase of sediment. Because no fishes were killed the Department of Game and Fish could not take legal action against the owners of the illegal tailings pond. The Department of Health & Welfare was able to fine the mine operator for operating an illegal tailings pond and subsequent pollutant release, but the fine does not take into consideration the impact on future beneficial uses of the stream. The sedimentation destroyed all spawning sites in the affected area, which will effect fish populations for several generations. As a result, a decreased fish population will reduce the number of fishing trips to that stretch of the river and the local economy will be affected. The department has no recourse or methodology to assess the long term damages from this illegal tailings pond.

Bill Dokken

Idaho Department of Health and Welfare -- Parks and Recreation Bureau
450 W. State Street
Boise, ID 83720
(208) 334-2154

Idaho also does not place an economic value on lost recreational activities. However, the State has conducted studies/surveys of perceptions of park resource values. The methodology has been to stop tourists/vacationers in various parks and ask them questions including one concerning willingness-to-pay for the resource being used. The data were collected and extrapolated for a Statewide analysis with no values placed on individual parks. A copy of the survey was requested and will be sent if the State has some available.

Frank Sherman

Idaho Department of Water Resources
Statehouse
Boise, ID 83720
(208) 327-7900

Mr. Sherman, the Chief of the Water Planning Division, has not or does not know of any studies relating to placing a value of water resources. He suggested that if studies have been done they would have been done by the Water Quality Bureau in the Environment Division of the Department of Health and Welfare. Once it was mentioned that studies have not been done by the Water Quality Bureau Mr. Sherman concluded that the State has not conducted studies to determine the value of water resources.

MICHIGAN

Doug Jester

Michigan Department of Natural Resources -- Fisheries Division
P.O. Box 30028
Lansing, MI 48909
(517) 373-1280

The fisheries Division of Michigan's Department of Natural Resources calculates replacement costs for damaged fisheries resources using the American Fisheries Society's publication Monetary Values of Freshwater Fish and Fish-Kill Counting Guidelines. Estimating the functional value of fisheries involves different techniques, based on the following resource categories:

- Threatened and endangered species -- In determining damages the State looks at both the existence value and the replacement value of the lost species and then assigns the lesser of the two. It is nearly impossible to determine the existence value of a threatened or endangered species. By accepting the replacement value (which is usually the lower of the two costs) settlements are achieved quickly.
- Commercial fisheries -- When a commercial fish stock is damaged the State assesses the affects on net cash flow for the commercial fishing industry. If the effect is only short term, then changes are noted in marginal operating costs. If the damage is chronic, then the assessment is on the capital stock. Chronic damages are characterized by a 15 to 20 percent decrease in profit.
- Forage fishes -- In assessing damages to forage fishes the State determines changes on the productivity of game species. Changes in the value of game fishes are converted "by an appropriate method" to assesses damages on forage fishes. The conversions and effects on forage fish are system specific.
- Game fishes -- In assessing damages to game fishes the State uses a discrete choice model (still under development). The State determines the use value of the species for assessing damages.

All fish losses are approached on a case-by-case basis. Michigan goes beyond the AFS methodology and established values, only if they judge the costs/values are inappropriate.

If a polluter contests the State's assessment of damages, then the burden of proof is shifted to the responsible party to show that the State's assessment is inaccurate. Very few cases are actually litigated. Most of these are settled out of court and using the AFS values.

Tom Jenkins
Michigan Department of Natural Resources -- Parks Division
P.O. Box 30028
Lansing, MI 48909
(517) 373-1270

The Parks Division of Michigan's DWR has estimated recreation values for the State park system. Supporting studies were conducted by Michigan State University Department of Parks and Recreation. Mr. Jenkins recommended that we contact Neil Lacasse (same phone number), of his office for details.

Dave Morris
Michigan Department of Commerce -- Travel Bureau
333 South Capitol
Box 30226
Lansing, MI 48909
(517) 335-1865

Mr. Morris did not know of studies that detail resource values for recreation or other outdoor activities. For 1989, the direct travel expenditure in the State of Michigan was an estimated \$9.3 billion. A trip is classified as any journey more than 100 miles away from the persons principle residence, or any overnight stay in a hotel/motel. There were an estimated 56.8 million person trips in Michigan during 1989.

These figures are based on a study by the U.S. Travel Data Center in Washington, D.C. The study is called "The Impact of the Travel on State Economies." The U.S. Travel Data Center is a nonprofit organization associated with the travel industry.

Tim Breden
Michigan Department of Natural Resources -- Office of Great Lakes
P.O. Box 30028
Lansing, MI 48909
(517) 373-3588

The Office of Great Lakes has not conducted any studies evaluating water resources or other natural resources.

Ron Van Till
Michigan Department of Natural Resources -- Office of Water Resources
P.O. Box 30028
Lansing, MI 48909
(517) 373-8801

From 1985 to 1987, personnel in the Office of Water Resources conducted a search for information evaluating water resources in Michigan. Researchers did not find any studies sponsored by the State of Michigan. A few academic research studies were identified but these studies dealt with resources outside the State. This search was done for the 1987 State Water Management Plan. A copy of this report is being sent.

MINNESOTA

James Birkholtz
Executive Director
Water & Soil Resources Board
155 S. Wabasha St., Suite 104
St. Paul, MN 55107
612-296-3767

Minnesota has done two studies concerning water values. One was done by the Governor's Commission for Hunting, Fishing, and Tourism eight years ago. The study considered what level of investment was necessary in order to preserve the state's natural resources. These resources are important for tourism revenue which amounts to \$1 billion per year. The Commission concluded that the 6 percent sales tax earned on this revenue was to be applied to the resources over 10 years. Also, Minnesota has been losing wetlands which have a natural capacity to control floodwater so that the state is having to construct additional stormwater storage capacity at a cost of \$300 per acre foot. This cost should be incorporated into the overall cost of water resource management.

Tim Scherkenbach
Water Quality Division
Pollution Control Agency
520 Lafayette Rd North
St. Paul, MN 55155
612-296-7202

Mr. Scherkenbach was unaware of any water quality valuation studies within the State except those that show what tourism revenues are attributable to lake use. An analysis for water sewage treatment plant costs per user also was conducted.

Joan Hummell
Tourism Division
Trade and Economic Development Department
150 E Kellogg Blvd., Room 900
St. Paul, MN 55101
612-296-2755

The State of Minnesota has done annual studies on revenues derived from tourism, but none on the values of water resources specifically.

David Leuthe
Ecological Services Division
Natural Resources Department
500 Lafayette Road

St. Paul, MN 55155
612-297-1308

Mr. Leuthe sent a copy of the Natural Resource Department's 1987 study, The Economic Value of Water.

MISSOURI

Jim Choate
(314) 751-4115
Conservation Department
Wildlife Division
P.O. Box 180
Jefferson City, MO 65102-0180

Missouri has been aggressive in the performance of recreational cost-benefit analyses. Currently, the Conservation Department is building a data-base of economic values of certain recreational resources. These values were developed through the performance of a public use and attitude survey which utilized both travel cost models and contingent valuation. These surveys were organized into management reports. Also, the Conservation Department participated in a national fish and wildlife survey, relying upon specific State data on recreational costs. Mr. Choate suggested we contact Deirdre Hirner at the Department of Natural Resources, Outdoor Assistance Program for further information on valuation surveys.

Dr. Ed Brown
(314) 751-4115
Conservation Department
Wildlife Division
P.O. Box 180
Jefferson City, MO 65102-0180

The Conservation Department undertook a comparative study on the recreational costs of an oil spill on the Gasconade River. Conservation Department measured the recreational losses, caused by the accident, based on the differences in public use between a pre-spill survey and a post-spill survey. This comparison indicates the value of the lost resource. Dr. Brown noted that industrial uses of water are easier to value because it is possible to compute the value of money saved and earned by polluting a natural resource (costs of pollution continuation versus the costs of pollution mitigation). Dr. Brown confirmed that Missouri is among the most aggressive States in pursuing the valuation of natural resources. Still, Missouri's efforts are mainly limited to responding to violations. The State is considering the development of a long-range plan to subdivide Missouri's river basins into distinct categories in order to conduct thorough economic value assessments of each basin.

The result may provide a set of baseline data which may be relied upon for the valuation of different water uses.

We received the following documents from Ed Brown:

Economic Benefits of Waterfowl Hunting at Duck Creek Wildlife Area in 1988. Missouri Department of Conservation, Planning Section.

Recreational Use of Ted Shanks Wildlife Area, 1987-1988. Missouri Department of Conservation.

Economic Impacts of Recreation Expenditures in Missouri.

Public Use on Deer Ridge Wildlife Area - An Economic Valuation Using the Travel Cost Method. Missouri Department of Conservation, Planning Section.

What's It Worth? Dollars and Cents in Fish and Wildlife Recreation. J. Rathert. Missouri Department of Conservation.

Recreational Use of Whetstone Creek Wildlife Area, 1987-1988. Missouri Department of Conservation.

Economic Valuation of Recreational Activity on the Missouri River - Simplified Travel Cost Models. Missouri Department of Conservation, Planning Section.

Economic Benefit of Waterfowl Hunting at Ted Shanks Wildlife Area in 1987. Missouri Department of Conservation, Planning Section.

Jane Busch
(314) 751-4115
Conservation Department
Fisheries Division
P.O. Box 180
Jefferson City, MO 65102-0180

Missouri's Conservation Department uses the American Fisheries Society national guidelines for establishing monetary assessments or values for the damage to fish populations. These values are then used assess fines for fish kills. Mr. Busch suggested we contact Steve Weithman (Fisheries Division) in relation to surveys he helped conduct on the "willingness to pay" for recreational fishing.

Steve Weithman
(314) 751-4115
Conservation Department

Fisheries Division
P.O. Box 180
Jefferson City, MO 65102-0180

Mr. Weithman confirmed that Missouri's Conservation Department uses the American Fisheries Society guidelines on the value of fish species for the assessment of fish kill damage penalties. This assessment is based primarily on "replacement costs" for particular fish species. In addition, the Conservation Department uses other methods for the valuation of recreational uses of water, including the travel cost method, contingent cost valuation (willingness to pay), and economic valuation (local costs-benefits for local economies). Also, the Fisheries Division conducts surveys which establish the number of people participating and how frequently they are participating in a particular recreational activity. The Planning Section of the Conservation Department then equates travel costs with the survey information in order to calculate a monetary value on the recreational activity. The Planning Section uses the monetary values to facilitate comparisons of costs between different activities. The Conservation Department is currently working with a particular case involving an oil spill in the Gasconade River. The Division performed studies to establish the extent of damage done to the river and the economic impact of the lost use of the water resource. The purpose of the study is to develop an actual monetary value for the resource damages in order to assess an appropriate penalty.

Received following documents from Steve Weithman:

Socioeconomic Value of the Trout Fishery in Lake Taneycomo, Missouri. Weithman, A.S. and M.A. Haas. Missouri Department of Conservation, Fish and Wildlife Research Center.

Recreational Use and Economic Value of Missouri Fisheries. Missouri Department of Conservation.

Inland Fisheries Management in North America - Socioeconomic Benefit of Fisheries. S.A. Weithman. Missouri Department of Conservation

Deirdre Hirner - Director
(314) 751-2479
Natural Resources Department
Outdoor Assistance Program
P.O. Box 176
Jefferson City, MO 65102

Sending reference list of sources relating to resource valuation.

Jerry Lane - Director
(314) 751-5331
Natural Resources Department

Public Drinking Water Program
P.O. Box 176
Jefferson City, MO 65102

Missouri's Natural Resources Department's Public Drinking Water program has not established methodologies for monetary assessments for damage to drinking water supplies, although development of a valuation policy is under consideration. On a case-by-case basis, the monetary value of drinking water has been assessed according to the retail value of water per 1,000 gallons. The costs of drinking water is directly affected by the level of treatment required to satisfy drinking water standards. Pollution of a drinking water supply increases the cost of treatment, and, in turn, this cost is transferred to the consumer.

Jim Penfold
(314) 751-1300
Natural Resources Department
Water Pollution Control Program
P.O. Box 176
Jefferson City, MO 65102

Missouri's Water Pollution Control Program (WPCP) works in conjunction with the Conservation Department in enforcement actions, particularly in relation to the assessment of water resource damages. The WPCP uses the Conservation Department's established fish and wildlife values for particular species to assess damages for pollution events involving fish or wildlife kills. The Conservation Department utilizes the American Fisheries Society guidelines for species values. The WPCP is beginning to look at resource damage assessments with a broader perspective. Their assessments have historically involved a general opinion on appropriate penalty amounts, without regard to the different uses affected by environmental damage. The Natural Resources Department is currently involved in an enforcement proceeding against Shell Oil Co., which was responsible for a major oil spill on the Gasconade River. The assessment has involved a broader look at the loss of different uses as a result of the spill, the negative effects on wildlife and aquatic organisms, effects on private water supplies, and the loss of recreational revenues. Mr. Penfold suggested we contact John Young (Natural Resource Department, Water Quality Division) for further information.

John Drew
(314) 751-2867
Natural Resources Department
Water Resources Program
P.O. Box 176
Jefferson City, MO 65102

Missouri's Water Resources Program is involved in the initial stages of a State Water Plan. The plan is intended as a mechanism to examine certain State-wide water issues. Most direct water valuation work is done in relation to permit compliance.

Bob L. Hain
(314) 751-3051
Economic Development Department
Tourism Division
P.O. Box 1055
301 W. High St.
Jefferson City, MO 65102

Missouri's Tourism Division does not do any work in relation to the value of water resources. Tourism Division does not perform recreational value surveys. Mr. Hair suggested we contact the Conservation Department and the Natural Resources Department.

MONTANA

Nancy Johnson
Department of Natural Resources
1520 E 6th Avenue
Helena, MT 59620
406-444-6797

Montana's Department of Natural Resources undertook an environmental impact study that included a state-wide survey of valuation of instream flows. The report, which is in final form, is being sent. The survey collected data from 9,000 people across the State. It incorporated a contingent valuation, and bid distribution with dichotomous choice.

Dr. Steve McCool
Institute for Tourism & Recreational Research
S.C. 428
University of Montana
Missoula, MT 59812
406-243-5406

The Institute has conducted a survey using contingent valuation technique for valuing water resources. Visitors were shown pictures of waterfalls with varying amounts of water flowing over the falls. They were asked how many extra dollars they would be willing to add to their monthly utility bills in order to maintain the desired amount of water flow.

Alvin Fitzhugh
Montana Power Company
40 East Broadway
Butte, MT 59707
406-723-5421

The Montana Power Company did a study on recreational importance of the Missouri River, but did not place dollar values on resources. Mr. Fitzhugh said overall, little has been done to determine the value of natural resources.

Jim Domino
Parks Division
Fish, Wildlife and Parks Department
1420 East 6th Ave.
Helena, MT 59620
406-444-3750

Mr. Domino was not aware of any resource valuation studies. He did refer us to other State agencies.

Richard Moy
Water Management Bureau
Natural Resources & Conservation Department
1520 E. 6th Ave.
Helena, MT 59620
406-444-6633

Mr. Moy's department has not conducted any water valuation studies.

Howard Johnson
Fisheries Division
Fish, Wildlife & Parks Department
1420 E. 6th Ave.
Helena, MT 59620
406-444-2449

Mr. Johnson stated that Montana does not conduct any resource valuation studies. He suggested a number of other individuals for us to contact.

Abe Harpsted
Water Quality Bureau
Health & Environmental Services
Cogswell Building
Helena, MT 59620
406-444-2459

Many attempts were made to contact Mr. Harpsted but he was unable to return the call during an study. Since several people referred us to Mr. Harpsted, it may be worth following up on this contact.

NEVADA

Richard Moreno
Tourism Commission
Public Information Division
5151 S. Carson St.
Carson City, NV 89710

Nevada's Tourism Commission has not conducted any recreational value surveys or performed monetary assessments of recreational water use in the State. Mr. Moreno suggested we contact Conservation and Natural Resources Department, State Parks Division.

Wendell McCurry
(702) 687-4380
Conservation and Natural Resources Department
Water Quality Planning Bureau
123 W. Nye Lane
Carson City, NV 89710

Nevada's Conservation and Natural Resources Department has not performed any water resource evaluations. The only case which had any relevance to water resource valuation involved a drilling fluid pollution event, where the responsible party was assessed a fine and was required to reimburse all restoration costs. Mr. McCurry suggested we contact the Conservation and Natural Resources Department, Water Planning Division for additional information.

Everett Jesse
(702) 687-4380
Conservation and Natural Resources Department
Water Planning Division
123 W. Nye Lane
Carson City, NV 89710

Nevada's Water Planning Division is participating in the update of the State Water Plan. The plan basically projects the water demands of different categories of water uses (i.e., irrigation, stock, municipal, industrial, recreational, fish and wildlife, and availability). The Water Planning Division has not valued these separate water uses, but may be doing so sometime in 1991.

Tom Atkinson
(702) 687-0500
Wildlife Department
Law Enforcement Division
P.O. Box 10678

Reno, NV 89520

The State of Nevada does not conduct water resource valuation work. The Wildlife Department does not conduct economic assessment of aquatic organisms, or anything relating specifically to water uses. The Wildlife Department does not possess the methodology to perform water use valuation.

NEW MEXICO

Deborah Potter
Watershed & Air Management
USDA Forest Service
517 Gold Ave.,SW
Albuquerque, NM 87102

In New Mexico, groundwater quality degradation caused by irrigation, mining and oil and gas activities is drawing increasing emphasis on valuation of resources with consideration of quality and resource utility. She mentioned a new Rio Grande Consortium that is looking into these issues, but efforts are still in early stages.

Dr. Frank Ward
New Mexico State University
505-646-1220

New Mexico State University has spent \$2.5 million in 9 years constructing a computer model to simulate water resources and fisheries affected by different water management practices. Changes in water quality are related to changes in fishing levels and the benefits produced. The methodology consists of a demand function as a function of travel time, water quality and fishing levels.

Dr. Ward is sending a copy of the model and a user handbook, as well as any journal articles he may have.

Mike Hatch
Fish Management Division
Game and Fish Department
Villagra Building
Santa Fe, NM 87503
505-827-7910

Mr. Hatch referred us to Dr. Frank Ward at New Mexico State University. He was not aware of any economic studies, only studies on the effects of water quality degradation on fish populations.

David Tague
Surface Water Quality Bureau
Environmental Improvement Division
1190 St. Francis Drive
Santa Fe, NM 87503
505-827-2800

New Mexico has not undertaken systematic resource valuations, including cost/benefit analyses. Mr. Tague referred us to Deborah Potter of the Forest Service.

Walter Hisenberg
State Soil and Conservation Bureau
Energy, Minerals and Natural Resources Department
2040 S. Pacheo St.
Santa Fe, NM 87505
505-827-3987

Mr. Hisenberg directed us to the Environmental Improvement Division.

NORTH CAROLINA

Steve Tedder
Environmental Management Division
Environment, Health and Natural Resources Department
P. O. Box 27687
Raleigh, NC 27611
919-733-5083

North Carolina has not attempted to determine the value of its water resources. Mr. Tedder believed North Carolina would be wary of placing a value on its water or water quality because it would lock them into a certain price that would be difficult to deviate from once its published or known. Mr. Tedder will check his library and send anything he finds.

William Davis
Parks & Recreation Division
Environment, Health and Natural Resources Department
P.O. Box 27687
Raleigh, NC 27611
919-733-4181

Mr. Davis referred us to the Water Resources Division.

John Morris

Water Resources Division
Environment, Health and Natural Resources Department
P.O. Box 27687
Raleigh, NC 27611
919-733-4064

Mr. Morris referred us to the Environmental Management Division.

David Sides
Soil & Water Conservation Division
Environment, Health and Natural Resources Department
P.O. Box 27687
Raleigh, NC 27611
919-733-2302

Mr. Sides referred us to the Water Resources Division.

OREGON

Greg Robarts
(503) 220-5400 ext. 463
Fish and Wildlife Department
P.O. Box 59
Portland, OR 97207

Oregon's Fish and Wildlife Department (FWD) is involved in the investigation of incidences in which fish or wildlife have been killed by some type of environmental perturbation. FWD has methodologies in place to calculate the monetary value of organisms according to species.

Chris Carter - Staff Economist
(503) 229-5400 ext. 304
Fish and Wildlife Department
P.O. Box 59
Portland, OR 97207

Oregon's FWD has determined net economic values for water resources. These values are based on: (1) angler surveys (estimated fishing efforts statewide and expenses incurred by fishing), (2) ocean fishing estimates (used both the travel cost method and the willingness to pay for different fish stocks of Columbia River), (3) Fish Kill Damage Task Force (State statutory authority which operates under laws relating to damaged/killed fish populations from pollution sources and to illegal takings of fish). Currently, the Fish Kill Task Force gears work towards recovering the costs of individual organisms lost to pollution. In the future, the Task Force will assess damages to fisheries based on the impact to future

generations of that species (amount of generations taken to recover lost fish). The Task Force generally relies on statutory language for estimating the values of lost fish. However, the Fish Kill Task Force relies partly on the American Fisheries Society guidelines for these assessments.

Shirley Kengla/Nancy Hogan
(503) 220-5766
Department of Environmental Quality
Water Quality Division
811 S.W. Sixth Ave.
Portland, OR 97204

Ms. Kengla was aware of proposed legislation, which did not pass, which would have levied a tax on water users for the purposes of assessing appropriate fines for pollution damage. THE Only relevant work of which she was aware are the Fish and Wildlife Department's assessment of fines for fish kills.

Ms. Hogan provided an explanation of the Water Quality Division's basis for assigning civil penalty amounts to water quality violations. The Water Quality Division does not have a fixed policy for penalty assessments, but considers the relative degree of environmental damage as a factor in making penalty determinations.

[Received: Oregon Administrative Rules Chapter 340 Division 12 Enforcement Procedure and Civil Penalties Index. March 30, 1990.]

Beverly Hayes
(503) 378-3739
Water Resources Department
3850 Portland Road N.E.
Salem, OR 97310

Oregon places monetary value on water as a resource only in relation to the value of a particular water right. The State uses tax assessors to value particular properties for property transaction. Oregon's water right system is similar to that used by the other Western States.

Harold Sawyer - Assistant to the Director
(503) 229-5776
Department of Environmental Quality
811 S.W. 6th Ave.
Portland, OR 97204

Oregon's Department of Environmental Quality (DEQ) does not participate in efforts to assess the monetary value of its water resource. The only relevant work of this nature

involved damage assessments by either Fish and Wildlife Department or the Water Resources Department.

Neil Mullane
(503) 229-5284
Department of Environmental Quality
Planning Section
811 S.W. 6th Ave.
Portland, OR 97204

Mr. Mullane confirmed that water resource valuations are conducted only in response to a pollution incident, such as an oil spill.

Bruce Sutherland
(503) 229-6035
Department of Environmental Quality
811 Front Street N.E.
Ste. 240
Salem, OR 97310

Oregon's Department of Environmental Quality (DEQ) does not do much work in water supply damage assessments. DEQ performs relevant work only in relation to fish and wildlife damage. DEQ is considering revisions to its damage assessment policies to possibly incorporate broader resource impacts.

Deborah Kennedy
(503) 373-1270
Economic Development Department
Tourism Division
595 Cottage St. N.E.
Salem, OR 97310

Oregon's Tourism Division does not do relevant resource valuation work. Ms. Kennedy suggested that we contact the Natural Resources Division of the Governor's Office as a possible source of information.

Don Eixenberger
(503) 378-5000
Transportation Department
Parks and Recreation Division
525 Trade Street S.E.
Salem, OR 97310

Oregon's Parks and Recreation Division (PRD) undertook a survey which identified rivers according to their recreation value for a particular use (boating, fishing, etc.). PRD surveyed

different groups of recreational users and asked each to assign a rating to each river. There is not much happening with water resource valuation in the entire state of Oregon. PRD has expressed interest in conducting water resource valuations in the future. Mr. Eixenberger suggested we contact Rebecca Johnson, a resource economist at Oregon State University.

SOUTH CAROLINA

Ann Nolte
(803) 737-0800
Water Resources Commission
Policy Development
1201 Main Street
Suite 1100
Columbia, SC 29201

In South Carolina, the cost of municipal water depends upon the availability of the water supply (saltwater intrusion is a major problem in terms of cost in the State) and the relative abundance of the supply. Ms. Nolte referred us to the Wildlife and Marine Resources Department for information on monetary assessments for fish killed by pollution events.

Tony Bebber
(803) 734-0189
Parks Recreation and Tourism Department
1205 Pendleton St.
Ste. 248
Columbia, SC 29201

Mr. Bebber suggested we contact the Water Resources Commission and Governor's Office for information on water resource value. The Water Resources Commission participated in a South Carolina Rivers Assessment study.

Brock Conrad
(803) 734-3886
Wildlife and Marine Resources Department
Wildlife and Freshwater Fisheries Division
P.O. Box 167
Columbia, SC 29202

South Carolina's Wildlife and Freshwater Fisheries Division (WFFD) uses the American Fisheries Society guidelines for assessing the monetary value of fish kills. Other monetary assessments by WFFD for wildlife kills are done on a case-by-case basis. The values assigned to birds killed by a gold mining cyanide leaching operation were based on an estimate of the replacement costs for each bird.

Larry Beasley
Coordinator of River Conservation Programs
(803) 737-0800
Water Resources Commission
1201 Main Street\
Ste. 1100
Columbia, SC 29201

South Carolina's Water Resources Commission (WRC) has not done any direct economic benefit analyses of the water resource involving an actual monetary assessment. However, the WRC assisted in the coordination of the South Carolina Rivers Assessment. This project involved a comprehensive assessment of different aspects (non-monetary) of South Carolina's river segments for different use categories, such as industrial, fisheries, recreational boating, and timber management. Scientists developed evaluation criteria for each use category. Some examples include the following: (1) industrial - dissolved oxygen levels, temperature ranges, average stream flow; (2) fisheries - species composition and diversity; (3) recreational boating - scenic quality and degree of rapids; and, (4) timber management - relative timber values.

Received following document from Barry Beasley:

South Carolina Rivers Assessment. Beasley, B.R., Lange, D.A., and W.C. Brittain. South Carolina Water Resources Commission and National Park Service.

John McMillan
(803) 734-0445
Governor's Office
P.O. Box 11369
Columbia, SC 29211

The Governor's Office participated in the South Carolina Governor's Freshwater Wetlands Forum. The forum placed qualitative rankings on State wetlands and made recommendations to link level of protection to resource quality. The Governor's Office is sending a copy of its Freshwater Wetlands Forum.

Jim Joy
(803) 734-5235
Health and Environmental Control Department
Water Pollution Control Bureau
2600 Bull St.
Columbia, SC 29201

South Carolina's Health and Environmental Control Department's (HECD) participates in economic assessments involving environmental damage. HECD primary focus in making economic assessment is loss of fish and wildlife. The Wildlife and Marine Resources

Department assists in assessing the monetary values of fish and wildlife killed by pollution. Damage assessments are based on both American Fisheries Society guidelines for number of species, and an established penalty policy which assigns baseline fines. Some considerations for the magnitude of the fine include effects on recreational resources (e.g., swimming days lost) and the extent of environmental damage.

SOUTH DAKOTA

Chuck Backland
(605) 773-4231
Game, Fish and Parks Department
445 E. Capitol
Pierre, SD 57501

South Dakota's Game, Fish and Parks Department has participated in the performance of surveys several years ago on the monetary value of recreational user days for different water bodies within South Dakota. Valuation involved estimating the capital value of the water body based on current dollar worth. This work was performed in relation to land acquisition efforts for different water projects. Game, Fish and Parks Department is sending copies of the latest survey reports.

Steven M. Pirner
(605) 773-3351
Department of Water and Natural Resources
Environmental Quality Division
Joe Foss Building
523 E. Capitol Ave.
Pierre, SD 57501

South Dakota's Environmental Quality Division (EQD) of the Department of Water and Natural Resources (DWRN) indicated that the economic assessment work performed by the Department may be divided into two efforts: (1) calculation of water development costs and (2) assessment of damages to water supplies from pollution events. The DWRN's studies of water development costs examine the costs of water transport and development for agricultural, industrial, and municipal projects. The DWRN's damage assessments look at the cost of replacing drinking water, fish and wildlife resources lost from pollution. The penalties established conform to the DWRN's written penalty policy. The DWRN relies on information generated by the Game, Fish and Parks Department to calculate the costs of restocking certain species of fish or wildlife. Environmental Quality Division indicated that it is sending a copy of the latest penalty policy.

Joan Bortman

(605) 773-3351
Department of Water and Natural Resources
Environmental Quality Division
Joe Foss Building
523 E. Capitol Ave.
Pierre, SD 57501

Another staff member of the EQD confirmed that the division does not perform any general economic analyses of the value of water resources. The only relevant work performed by EQD is the calculation of penalty assessments for pollution damage. The penalties are all categorized according to the DWNR's penalty policy. The fines are based on actual damage done to the water resource or to the relative risk to public health.

Arlene Hammer
(605) 773-3301
Tourism Department
711 Wells Ave.
Pierre, SD 57501

South Dakota's Tourism Department performs occupancy and visitation surveys. Staff recommended that we speak with their economic researcher for further information on tourist surveys. The research contact was Michael Madden, associated with the University of South Dakota.

Michael Madden
(605) 923-1434
South Dakota Department of Tourism
711 Wells Ave.
Pierre, SD 57350

His participation in the Tourism Department's surveys includes the performance of annual evaluations of the economic impacts of tourism on the State economy. He utilizes spending models, models developed by the Department of Commerce, and sales tax rates to determine the fiscal and employment impacts of tourism. The report findings are organized by county. He is sending copies of the latest report.

Mark E. Steichen
(605) 773-4216
Department of Water and Natural Resources
Water Resources Management Division
Joe Foss Building
523 E. Capitol Ave.
Pierre, SD 57501

South Dakota's Water Resources Management Division (WRMD) has participated in the performance of studies assessing the recreational value of certain lakes. The studies examine extent and sources of pollution and the feasibility for restoration of the particular lakes (e.g., dredging of polluted sediments). One part of this effort includes the calculation of the total value of the South Dakota's lakes. The studies utilized statistics from the Game, Fish and Parks Department and the Tourism Department to calculate the money generated through State tourism. The studies then assume that half of these revenues were generated through lake recreation (waterskiing, boating, fishing, etc.). This value is used for the total value of the lakes. WRMD does not think that other similar work is being performed on freshwater stream systems. WRMD is sending a copy of the latest study.

Bob Hanton
(605) 773-4508
Game, Fish and Parks Department
445 E. Capitol
Pierre, SD 57501

South Dakota's Game, Fish and Parks Department (GFPD) utilizes the guidelines developed by the American Fisheries Society for the values of different species of fish when calculating damage penalties. GFPD also considers the potential recreational losses, derived from the average value of fisherman days, when computing damage assessments. Other recreational uses of the damaged water, apart from fishing, are not considered in the penalty assessment.

TEXAS

John Millican
Soil and Water Conservation Board
P.O. Box 658
Temple, TX 76503
817-773-2250

This agency does not undertake economic analyses.

Mike Gonzalez
San Antonio River Authority
P.O. Box 830027
San Antonio, TX 78283
512-227-1373

This river authority has not done any work on resource valuation. Mr. Gonzalez suggested that we contact specific cities or counties that are involved in resource disputes.

Dr. David Sager

Resource Protection Division
Parks and Wildlife Department
4200 Smith School Rd.
Austin, TX 78744
512-389-4864

Texas statutes authorize the Parks and Wildlife Department to sue responsible parties for loss of wildlife, fish and other resources. The Parks and Wildlife Code gives the Department the authority to set resource values. Dr. Sager is sending a copy of the Texas code and an explanation of the methodology for resource valuation.

Henry Alvarez
Water Quality Division
Texas Water Development Board
P.O. Box 13231
Austin, TX 78711
512-445-1424

The Water Quality Division of the Texas Water Quality Board does the technical analyses for water quality monitoring: sampling, testing, evaluation. They have sampled for heavy metals from mining activities, but they have not related pollution to economic costs. Mr. Alvarez directed us to the Water Commission.

Marilyn Hunt
Lower Colorado River Authority
P.O. Box 220
Austin, TX 78767
512-473-3218

The Lower Colorado River Authority has done some research on resource valuation as part of efforts to develop water pricing policy. One study by the Authority considers different uses of water, including recreation and agriculture. Costs and benefits were not quantified, however. Background materials were sent to us.

Dr. Jim Davenport
Water Quality Division
Texas Water Commission
P.O. Box 13987
Austin, TX 78711
512-463-8475

Mr. Davenport noted that there is no accepted State-endorsed method for valuing water quality, although there is pressure to develop one. Texas legislation requires cost/benefit analysis for water quality standards. Traditionally, costs are taken as the incremental costs of additional treatment as a result of resource degradation. Texas policy is that there is no

defensible method for quantifying benefits. Mr. Davenport is sending us a copy of relevant materials.

UTAH

Eugene Bigler
(801) 538-7230
Natural Resources Department
Water Resources Division
1636 W. N. Temple
Rm. 310
Salt Lake City, UT 84116

The two roles of the Water Resources Division (WRD) include: (1) performance of economic analyses for water projects (based on the amount of revenues which the project will return), and (2) the planning of water supply according to consumption needs. WRD possesses no authority to set costs beyond willingness to pay and the market values of water. The factors which have an impact on the relative market value of water include: (1) water quality (the level of treatment required for a water supply directly affects the cost of that water), (2) water location (water transport costs vary according to distance), (3) water supply (dry versus wet weather causes cost variances), and (4) water source. WRD is just beginning to value water bodies in relation to their multi-purpose values. These economic analyses examine a broad range of values, including aesthetic, recreational, municipal, wildlife mitigation, and conservation. This work is being performed by WRD on the Bear River Project. WRD indicated that a report of the findings will be generated sometime around October 1991.

Barry Saunders
(801) 538-7230
Natural Resources Department
Water Resources Division
1636 W. N. Temple
Rm. 310
Salt Lake City, UT 84116

The WRD develops water supply plans that account for different uses of water. The cost of water is based on either the amount people are willing to pay for a given water supply (or the value of development costs for a specific water use) or on the value of a unit of water in the water market. The State gets involved in the pricing of water only to the extent that they receive specific requests to do so (usually in relation to a certain water project). If an irrigation company expresses interest in developing a water project, WRD would assist by determining the cost of the water supply based on either the market value or the willingness to pay.

Office of the Director
(801) 538-7362
Natural Resources Department
Parks and Recreation Division
1636 W. North Temple
Rm. 116
Salt Lake City, UT 84116

Parks and Recreation Division (PRD) is participating in a federally-required survey called SCORP. The States are required to perform these surveys prior to receiving federal conservation funds. The required surveys include household surveys, recreational surveys, and user surveys.

Don Ostler
(801) 538-6416
Health Department
Environmental Health Division
Water Pollution Control Bureau
P.O. Box 16700
Salt Lake City, UT 84116-0700

The Water Pollution Control Bureau (WPCB) uses its penalty policy to determine the penalty amount for particular resource damage incidents. The penalty policy establishes formal regulatory procedures which divide potential penalty assessments into four categories, including: (1) high impact on public health and environment - between \$7,000 and \$10,000 per day, (2) major violations of the Clean Water Act - between \$2,000 and \$7,000 per day, (3) administrative violations - between \$2,000 and \$500 per day, and (4) minor excursions - between \$500 and \$0 per day. The specific penalty is decided upon by three qualitative categories, including: (1) history of noncompliance, (2) degree of willfulness/negligence, and (3) efforts to comply. The WPCB also considers such factors as the replacement costs of fish killed, the severity of pollution, and the degree of environmental damage.

Milo A. Barney
(801) 538-7200
Natural Resources Department
1636 W. North Temple
Salt Lake City, UT 84116-3156

Natural Resources Department (NRD) staff discussed the overarching framework for western water management as a system of water rights which are bought and sold in accordance with the current market price. Mr. Barney referred us to the Water Resources Division for relevant information on the development of a Statewide Water Plan. The plan supposedly examines Utah's water resource needs and the possible ways to address these needs, as well as the potential costs involved.

Eugene Bigler
(801) 538-7230
Water Resources Division
1636 W. N. Temple
Rm 310
Salt Lake City, UT 84116

Utah's State legislature is requiring the Water Resources Division (WRD) to lead in the development of a cross-agency State Water Plan. The report will examine Statewide policy issues on a general level. The intent of the project is to establish policy for the uses of water for specific projects.

Lou Kaposki (Atty)
Parsons, Behle & Lattimer
(801) 532-1234

Contact referral for this person received from Marilyn Hunt at the Lower Colorado River Authority. Mr. Kaposki's firm handles transactions of water rights between owners and buyers, and the determination of value for specific uses of the water right (i.e., valuating irrigational uses in relation to industrial uses). Mr. Kaposki asserted that nationally, water resource valuation remains at a rudimentary level. Water quality is becoming an increasingly more important issue as it relates to the valuation of water as a resource. Water resource valuation is occurring mostly at the local level since water value varies according to region. Discussed concept of "shadow pricing" as it relates to water use restrictions from environmental concerns and/or contamination.

Tharold Green/Steve Roberts
(801) 538- 7362
Natural Resources Department
Parks and Recreation Division
1636 W. North Temple
Rm. 116
Salt Lake City, UT 84116

Utah's Parks and Recreation Division (PRD) is in need of economic information on the various uses of parks. The only relevant work which PRD has conducted in relation to resource valuation has been visitation studies for various parks. The studies involved economic surveys of outdoor recreation in Utah and a determination of the economic benefits generated by the activities. The economic value is not broken down according to different water uses. PRD will send copy of several of these studies.

WASHINGTON

Larry Cowan
(206) 753-4626
Fisheries Department
115 General Administration Bldg.
MS AX-11
Olympia, WA 98504

Washington's Fisheries Department performs cost-benefit analyses only with respect to the value of targeted fisheries projects. The analyses consider relative production values (potential versus current). Fisheries Department will send methodology papers for the analyses.

Alan Miller
(206) 753-2550
Attorney General's Office
Highways Licenses Bldg.
7th Floor
MS PB-71
Olympia, WA 98504

Washington's Attorney General's Office has participated in some litigation work with the Ecology Department on fish and waterfowl kill assessments. The Attorney General's Office relies on guidance provided in State statutes in placing monetary values on lost fish or birds. If a commercial fishery is damaged, the current market value of the particular fish species is used in the assessment. If a recreational fishery is damaged, travel cost methodologies are used in assessing damages.

Dick Logan
(206) 457-7120
Ecology Department
Central Programs
MS PV-11
Olympia, WA 98504

Washington's Ecology Department has organized a Natural Resource Damage Assessment Team which has taken part in an effort to create a new system for damage assessments. The system establishes compensation categories for different water body zones. These zones are grouped according to their particular ecological sensitivity to presence of pollutants (petroleum products, pesticides, etc.) which have the potential for presence in marine or freshwater systems. The system does not place exact monetary values on different resources, but establishes a matrix according to the relative sensitivity of the water zone. The matrix

ranks each zone with consideration to the characteristics of the particular pollutant in water (acute or chronic toxicity, persistence) and any aspects of the aquatic resource which would be affected by the presence of the pollutant. The aquatic aspects considered include: (1) marine mammals, bottom feeders, shellfish, and anadromous fish; (2) birds (affected particularly by persistent pollutants); (3) rare/endangered species; (4) plankton species; and, (5) human recreation (amount of public use and number of public beach miles damaged). The assessment procedure looks at each zone from the perspective of an entire working ecosystem. The particular ranking assigned to a particular damage assessment may then be equated with a monetary value based on the penalty per pollutant volume. According to the Department, moneys received as a result of the assessment efforts will be allocated completely to a coastal protection fund controlled by the Natural Resource Damage Assessment Team, rather than being given to a general State fund. The Ecology Department reasons that pollution events tend to affect an entire ecological system as opposed to a distinct resource. The Ecology Department is critical of the present system of assessing pollution damages because it only looks at dead fish and waterfowl. The matrix system was developed for both freshwater and saltwater damages.

Gordan Wiggerhaus - Staff Economist
(206) 438-7038
Ecology Department
MS PV-11
Olympia, WA 98504

Washington's Ecology Department conducts damage assessments for the results of pollution events. These assessments involve mostly the valuation of fish and wildlife kills. Mr. Wiggerhaus suggested we contact Dick Logan in Central Programs.

Ken Bruya
(206) 586-1191
Fisheries Department
115 General Administration Bldg.
MS AX-11
Olympia, WA 98504

Washington's Fisheries Department is involved with some of the pollution damage assessments of fish killed by pollution of water.

Tom Newcomb - Field Representative
(206) 786-2226
Conservation Commission
MS PV-11
Olympia, WA 98504

Washington's Conservation Commission is involved primarily with nonpoint source pollution of irrigated land and the Puget Sound. The Conservation Commission conducts studies to

locate the sources of pollution and identify areas of concern. The Conservation Commission does not perform any water resource valuations.

Linda Fredericks/Jan Tveatn/Bill Bush
(206) 753-5757
State Parks and Recreation Commission
7150 Cleanwater Lane
KY 11
Olympia, WA 98504

Washington's State Parks and Recreation Commission (SPRC) performs surveys of overnight campers to identify spending patterns within a 30-mile radius of a given park. These surveys are used primarily to illustrate that campers are benefitting local economies.

Jerry Parker
(206) 438-7113
Ecology Department
Water Quality Division
MS PV-11
Olympia, WA 98504

Washington's Water Quality Division (WQD) participated in the State's "Environment 2010" project. The project involved ranking current and future environmental problems and considering options for allocating resources to address those problems. The report did not assess the monetary value of the water resource. In the future, WQD will be surveying the various uses of instream flows to assess the value of these uses. As part of this effort, WQD surveyed various States to find out what work was being performed in the area of water resource valuation. WQD is sending copy of "Environment 2010" and the findings from their survey.

John Carlton
(206) 753-5710
Wildlife Department
600 N. Capitol Way
MS GJ-11
Olympia, WA 98501-1091

Washington's Wildlife Department is participating in a economic damage assessment effort in response to a major oil spill in 1988. Because of the large number of waterfowl and migratory birds killed as a result of the spill, the Wildlife Department is assessing the value of this lost resource from a contingent valuation perspective. This method incorporates what people are willing to pay to avoid the occurrence of another spill. The damage assessment did not consider other water resource uses and values, such as recreational beach use or aesthetic values, because the visible pollution was removed almost immediately. Because visitation records showed no apparent slowdown, it would be difficult to assess the recreational or

aesthetic damages done. Other resources, such as marine plankton and juvenile fish, could not be valued due to the lack of data on the behavior of such organisms in polluted water. Because adequate data on all ecological variables did not exist at the time of the spill, certain impacts could not be valued. Wildlife Department is participating to some extent in the new damage assessment matrix being developed by the Ecology Department.

Bill Myers
(206) 538-3007
Ecology Department
Hazardous Waste Investigations and Cleanup Program
MS PV-11
Olympia, WA 98504

Washington's Hazardous Waste Investigations and Cleanup Program (HWICP) has been involved in a resource damage assessment of a case involving Time Oil's pollution of ground-water supplies. The assessment took into account the benefits lost by determining the extent to which ground-water resources had been used before the incident. Mr. Myers suggested we contact EPA Region 10 for further information.

WISCONSIN

Romy Snider
Wisconsin Development Department -- Tourism Division
P.O. Box 7970
Madison, WI 53707
(608) 266-2345

Wisconsin's Development Department has determined that tourism was worth \$5.4 billion in 1989. The report will be repeated for the 1990 calendar year with expected publication in March 1991. We received a report called The Economic Impact of Expenditures by Tourists on Wisconsin 1989.

Lee Kernan
Wisconsin Department of Natural Resources -- Division of Fish Management
P.O. Box 7921
Madison, WI 53707-7921
(608) 267-0796

Mr. Kernan is sending information on how the State places a value on the recreational fishing industry and fish kills.

Brad Nelson
Wisconsin Department of Natural Resources -- Parks and Recreation Bureau

P.O. Box 7921
Madison, WI 57707
(608) 266-2185

Wisconsin's Bureau of the Parks and Recreation conducted a study in 1983 on day users and a study in 1987 on campers. Both studies are referred to as economic studies but the methodology used was undisclosed, but likely used the travel cost method to determine park economic benefits. A copy of the results of each study has been requested.

Bruce Baker
Wisconsin Department of the Natural Resources -- Water Resources Management Division
P.O. Box 7921
Madison, WI 57707
(608) 266-8631

The Water Resources Management Division of Wisconsin's DNR has refused to place a value on water resources. The reason is that the State does not want to become involved with philosophical issues relating to pricing nonmarket goods.

WYOMING

Mike Stone
(307) 777-4601
Game and Fish Department
Fish Division
5400 Bishop Blvd.
Cheyenne, WY 82006

Wyoming's Game and Fish Department examines pollution events in relation to fish kills. Monetary assessments are made by quantifying fish losses and by using the American Fisheries Society guidelines on the cost of certain fish species. Other factors considered in the damage assessment include restoration costs for clean-up operations, overall time spent in the assessment, and any transportation costs. As an alternative to this method of calculating damage assessments, the Department has assessed reimbursement fees for recreational use losses (i.e., after an oil spill).

John Wagner
(307) 777-7082
Environmental Quality Department
Water Quality Division
Herschler Building
4th Fl W.
Cheyenne, WY 82002

Wyoming's Environmental Quality Department has done some work in relation to oil spill damage assessments. The relevant economic assessments included an estimation of the value of lost resources according to replacement costs. The penalty assessments are based on a combination of the illegality of the damage and the value of aquatic life killed (cost of restocking a specific species in a given stream locality). The Department has not assessed the recreational losses resulting from oil spills, even though damage has forced the shutdown of some recreational water uses.

Reggie Rothwell
(307) 777-4601
Game and Fish Department
Game Division
5400 Bishop Blvd.
Cheyenne, WY 82006

Wyoming's Game and Fish Department also has quantified what certain animals are worth for replacement purposes. This evaluation took place in response to an oil and gas spill assessment. The Game Division has also performed some economic analyses on various wildlife management activities.

Ari Nicholson
(307) 766-2143
Water Research Center

The Water Research Center has performed a recreational use value survey for a State reservoir. The survey examined the frequencies of use, distances traveled, and total expenditures. The travel cost method was utilized to estimate the overall value of the area.

Evan Greene
(307) 777-7626
Environmental Quality Department
Herschler Building
Cheyenne, WY 82002

Water Quality Department (WQD) performs feasibility studies for the development of water projects on various bodies of water. WQD does not perform direct economic analyses of the different uses of water. The studies really only analyze the costs and benefits from the perspective of project funding, as opposed to water use valuation. The cost-benefit analysis portion of the studies utilizes a "willingness to pay" method.

Walt Gasson
(307) 777-4601
Game and Fish Department
Office of the Director
5400 Bishop Blvd.

Cheyenne, WY 82006

Wyoming's Game and Fish Department (GFD) has not calculated the net economic worth of wildlife. However, GFD has quantified expenditures on wildlife for both consumptive uses (fishing and hunting) and non-consumptive users (photographers, birdwatchers, etc.). Based on these expenditures, an indirect value is assumed for a given species. These values are used for pollution damage assessments. Copies of two annual GFD reports will be sent.

3. PRELIMINARY BIBLIOGRAPHY

General Water Valuation

PROMOTING INCREASED EFFICIENCY OF FEDERAL WATER USE THROUGH VOLUNTARY WATER TRANSFERS

Wahl, Richard W.

Resources for the Future, Washington, D.C. Discussion Paper Series No. FAP87-02, 1987.

WATER AND THE MICHIGAN ECONOMY: ESTIMATING THE ECONOMIC VALUE OF MICHIGAN'S FRESH WATER

Libby, L.W.; Hoehn, J.P.; Caudill, J.; Walker, D.

Michigan State University, East Lansing, Department of Agricultural Economics, 1986.

Michigan's water resources are an important input into a range of residential, agricultural, recreational, and commercial activities. Because these various activities draw upon the same water resources, conflicts arise. Resolution of these conflicts require tradeoffs and compromise. One way to quantify the tradeoffs involved in water quality management is to measure the economic value of water resources to the various interests involved. The primary objective of this study was to contribute to the development of information and procedures for assessing the economic value of Michigan's water resources. Given the existing policy demands and the generic nature of economic valuation procedures, the study focused on the management tradeoffs involving groundwater resources. The study's main accomplishments include a description of methods to: 1. Improve the quality of information available for groundwater planning and management in Michigan. 2. Develop and apply procedures for estimating the economic values associated with some subset of Michigan's groundwater resources. 3. Establish a basis for continuing research on the economic value of water resources.

SOME WATER RESOURCE POLICY CONSIDERATIONS

Beard, L.R.

Water Supply & Management, Vol. 3, No. 3, p 173-177, 1979.

The author questions water resource policy changes in the United States in relation to their impact on public welfare and on the democratic nature of the U.S. system of government. Multiple objective evaluations are seen to be unscientific and socially destructive when they fail to express the relative values of various objectives in terms of the general welfare. The author states that the use of unwarrantedly high discount factors for estimating the present values of future benefits strongly supports the type of project that is of transitory value and discourages the development and preservation of resources for the benefit of future generations. To avoid the pitfalls of multiple objectives concept, all project benefits need to

be expressed in common terms in order to permit determination of an optimum management plan. Through this, multiple objective planning reverts properly to single objective planning and scientific methods can be applied to the solution of water resources management problems. Conclusions indicate that the most reasonable financial discount rate usable for planning is the difference between the interest rate in long-term government investments and the rate of inflation, which should be supplemented by discounts due to expected changes in technology and expected changes in social values. Proper implementation of a comprehensive economic system of values can expedite proper management of resources, greatly reduce costs and increase benefits and truly will build for the benefit of future generations as well as for the present.

ESTIMATING THE ECONOMIC VALUE OF NATURAL COASTAL WETLANDS: A CAUTIONARY NOTE

Shabman, L.A.; Batie, S.S.

Sea Grant Research Report A.E. 30, August, 1977.

This is a critique of the methodology used by Gosselink, Odum, and Pope (GOP) in 'The Value of the Tidal Marsh,' the most cited study which evaluates the economic values of wetlands. It identifies the major conceptual errors in methodology and demonstrates that there is reason to be skeptical of the value estimates. There are two fundamental problems with the GOP approach. GOP failed to recognize the nature of the process by which economic values are determined and incorrectly combined the principles of systems ecology with economic theory. This failure makes the values calculated for 'total life-support' meaningless for conceptually correct economic comparisons for development and preservation. Second, where GOP attempted to apply proper economic principles, they made numerous errors which resulted in estimates of economic values that are in errors. GOP's estimates of the values of marsh services are inaccurate and misleading.

OPPORTUNITY COSTS AND WATER RESOURCE USE

Street, D.R.

In: Social Accounting Approaches to Water Resource Use in Economic Development, Auburn Univ., August 1972.

There exists a counter argument to the proposition that there is no such thing as a 'free lunch,' which is useful in analyzing externality problems in water resource use. A 'free lunch' is defined as a net increase in economic welfare resulting from a pareto optimal rearrangement of resources, products or services from the status quo. The existence of a 'free lunch' is first illustrated using an Edgeworth-Bowley trading box, where each bargainer benefits as a result of the exchange. Net increases in welfare can also be derived from redirection of resources, services and products when externalities exist through reduction of damages, reduction of production costs, or transformation of negative externalities into positive factors. Net benefits are shown in three cases involving externalities. The first illustrates benefits from separation of antagonistic enterprises; the second shows benefits arising from alternative orderings of

enterprises on water bodies; and the third shows benefits arising from alternative groupings of different wastes.

THE SOCIO-ECONOMIC DIMENSION OF WATER MANAGEMENT

Sweet, D.C.

In: 'Dimensions of Water Management,' Proceedings of the 1st Annual Water Resources Conference, March 24, 1970, Columbus, Ohio, pp. 12-20.

An ideal water management methodology is described in order to provide a theoretical basis for evaluation and design of working processes. The Susquehanna River Basin model, an example of a water management process based upon the ideal, is presented. The elements which comprise the ideal system include inventory and compilation of data describing the various socio-economic, physical and ecological characteristics of the area. Thus, a notion of primary demand on existing water resources may be derived and compared with their potential for supply. The definition process of the goals for the system includes establishment of the social and economic value of various water resources. Finally, both the short- and long-run socio-economic impact of accomplishment of the goals must be employed in selection of possible alternative means of achieving the prescribed goals. The Susquehanna River Basin model developed in Battelle-Columbus is considered as one of the few models which relates socio-economic components to the physical components of a water resource planning area.

THE ECONOMIC VALUE OF WATER: CONCEPTS AND EMPIRICAL ESTIMATES

Young, R.A.; Gray, S.L.

National Water Commission Report No. SBS 72-047, March 1972.

Conceptually valid and empirically sound estimates of water values are essential for rational allocation of water among uses and users over time. The study was divided into two parts. In the first part, a number of issues are examined that must be taken into account in deriving conceptually valid estimates of the values of water. These issues include (1) defining the quantity of water used in both instream and withdrawal uses, (2) assuring comparability of use in terms of time, location and quality, (3) choice of accounting stance, national, regional or individual, and (4) maintaining a distinction between long run and short run values where water is used for production of consumer goods. The second part of the study involves analysis of water values for various uses with attention to regional differences. This analysis employs numerous previous studies from an exhaustive literature review. The water uses considered are municipal, industrial, irrigation, waste assimilation, recreation, fish and wildlife, navigation and hydroelectric production.

ECONOMIC VALUE OF WATER IN A SYSTEMS CONTEXT

Butcher, W.R.; Whittlesey, N.K.; Orsborn, J.G.

National Water Commission Report No. SBS 72-048, May 1972.

Decisions about water allocation and investment in water resource developments could be improved by knowledge of the value of water in alternative uses. The interdependent system in which water resources occur and uses take place make it important to consider these water values in a systems context. Systems models provide the most systematic approach to estimating these values but much can be learned through a careful description of effects that each use has not only on quantity of water but also on quality of time or place of availability. Application of systems analysis to the Yakima, Columbia and Susquehanna rivers illustrates the approach and provides examples of the significance of a systems approach to water valuation.

THE ROLE OF ECONOMIC EVALUATION IN PLANNING FOR WATER RESOURCE DEVELOPMENT

Kneese, Allen; Nobe, Kenneth C.

Nat. res. J. Vol 2, No. 3, December 1962.

Economic reasoning plays an important role in resolving problems of socio-economic choice encountered in planning for water resources development. The unique characteristics of water quality and the application of simple valuation models treat water as an economic commodity. Pollution abatement is used to illustrate the uses and weaknesses of a valuation model approach. A constrained objective function is suggested as a useful framework for incorporating public goals. Maximizing an objective in a practical situation makes great demands upon concepts, data and problem solving abilities. Simulation and mathematical programming are discussed as procedures for approximating optimum systems. The authors suggest a relationship between economic function and the choice of administrative forms for water management.

ESTIMATING THE VALUE OF WATER IN ALTERNATIVE USES

Colby, Bonnie G., Univ. of Arizona, Tucson.

Natural Resources J., Spring 1989

As water transfer policies are implemented there is an increasing need to assess the economic value of water resources. Estimating a market demand curve and using consumer surplus as an indicator of water value is likely used, but is not the ideal measure because it does not account for changes in real purchasing power of consumers. Non-market water valuation is important for assessing water values in alternative uses such as instream values, irrigated agriculture, municipal uses and industrial uses. A review of water value estimation studies shows that the economic value of instream flows can be measured and compared to any of the other alternative uses. Western states should selectively increase instream flow allocations to make water management more efficient.

OKOBOJI EXPERIMENT: COMPARING NON-MARKET VALUATION TECHNIQUES IN AN UNUSUALLY WELL-DEFINED MARKET FOR WATER QUALITY

D'Arge, Ralph C. and Shogren, Jason F.

Ecological Economics, Oct. 1989

Three techniques are contrasted for valuing the non-market commodity of water quality for the Okoboji Lakes region of northwest Iowa, a notably active and unusually well-defined market for water quality. The techniques entailed: a site valuation based on comparing property values between East and West Okoboji; a market valuation by soliciting realtors' and real estate agents' interpretation of observed price differentials between the lakes; and contingent valuation using a limited sample of site dwellers to examine their willingness to pay or to be compensated for a change in water quality. The results obtained for the three approaches are similar in magnitude. The value of water quality is in the 13-23% range of the total residence value/FT² of private residence.

VALUATION AND MANAGEMENT OF WETLAND ECOSYSTEMS

Costanza, R.; Farber, S.C.; Maxwell, J.

Ecological Economics, 1989 Vol. 1, No. 4 (December)

Abstract not contained in data base.

ECONOMIC VALUE OF WATER: CONCEPTS AND EMPIRICAL ESTIMATES [PREPARED FOR NATIONAL WATER COMMISSION]

Young, Robert A., Gray, S. Lee.; Held, R. Burnell; Mack, Richard S.

Colorado State University, Department of Economics, 1972

Abstract not contained in data base.

VALUE AND DEPRECIATION OF EXISTING FACILITIES: THE CASE OF RESERVOIRS

Lund, J.R.

Hydrologic Engineering Center, Davis, CA, April 89

The value of an asset is determined by the net economic value of its production over time. This value is summarized by the net present value of all present and future production. Change in asset value, either depreciation or appreciation, results from both changes in the economic value of each unit of production and the asset's physical productivity. A theory of depreciation expressing this approach is derived from first principles of engineering economics. The theory is illustrated for the case of water resource reservoirs.

ECONOMIC IMPACT OF WATER QUALITY ON RIVER BASIN MANAGEMENT

Helweg, Otto J.; Alvarez, Desi

California Univ., Davis. Water Resources Center, March 1978

Groundwater quality degradation caused by irrigation affects as much as one-third of the irrigated area of the world. This problem is particularly insidious because the process is slow and hidden. A management tool called the Accelerated Salt Transport (ASTRAN) method has recently been proposed to help control groundwater degradation. The ASTRAN method distributes the different qualities of available irrigation water over the basin in a way that controls groundwater degradation at minimum cost. This study investigated a way to price water quality and quantity by approximating its value with a derived demand surface. This value was then used to price the optimally distributed water. The data from the San Luis River Basin in Southern California were used to test the results which are presented in a series of figures along with a detailed description of the approach used.

WATER ALLOCATION: THE ROLES OF VALUE AND PRICES

Anderson, C.L.; Peterson, J.M.

J. Environ. Syst Vol. 15, No. 1, 1986

Fresh water may no longer be considered as a free resource by society. The demands for water with reasonable quality characteristics have surpassed available supplies in many regions of the United States. This will likely lead to major changes in state and national water policy as the need to more effectively allocate the available water supplies becomes necessary. This article discusses some of the basic economic principles which may serve as guidelines for this allocation. In particular, the distinction between the value of water and the appropriate price of water are discussed as well as their roles in efficient water allocation.

THE BENEFITS AND COSTS OF POLICIES RELATED TO GROUNDWATER CONTAMINATION

Raucher, Robert L.

Land Economics Vol. 62, No. 1, February 1986

In this paper, a conceptual framework to measure the benefits or groundwater "protection" policies is reviewed and expanded. This benefit-cost framework is based on the premise that the probabilistic value of protection is at least as great as the expected costs of contamination. The theoretical construct also reveals the interrelationships that exist between the three generic types of groundwater policy; containment, detection and corrective action. The theoretical framework is then applied in case studies of three waste disposal sites currently affecting vital aquifers. The empirical results are to some degree counter intuitive-indicating that preventing the contamination that has occurred is not unambiguously economically preferred to corrective action after the fact. The studies also show that remedial response may not always be warranted even when contamination is known to exist. More generally, these studies illustrate the extent to which resources may be misallocated if efficient prevention and clean-up options are not pursued.

WATER MARKETS IN THEORY AND PRACTICE: MARKET TRANSFERS, WATER VALUES, AND PUBLIC POLICY

Colby-Saliba, Bonnie and David B. Bush

Boulder, Colorado: Westview Press, 1987

The authors provide a review of the theoretical issues involved in assessing water marketing along with very useful descriptions of marketing as practiced in six southwestern States. The authors give a good idea of the complexity of the issues but few insights as to either the magnitude of the transaction costs associated with various institutional and hydrological conditions or the policies required to promote more socially efficient markets.

THE ECONOMIC VALUE OF WATER

Gibbons, Diana C.

Washington D.C.: Resources for the Future, 1986

The author provides a theoretical framework for understanding water values, discusses methodologies of estimation, and summarizes a substantial published and unpublished literature on the value of and demand for water in various sectors. No special significance should be attached to any of the individual water values reported; they are based on conditions existing at specific times and places. On the other hand, the discussions of the measurement of various values, and of the ranges of values generally associated with particular uses, are of interest to water planners, engineers, economists, and environmentalists. Data on the opportunity costs of putting water to one use at the expense of others should interest those who would increase the benefits derived from scarce water resources. Moreover, by focusing attention on relative water values and their measurement, the study offers strong evidence of the shortcomings of a tradition which assumes that offstream water uses are insensitive to price and warrant priority over all instream uses.

SUMMARY: THE ECONOMIC VALUE OF WATER

Adelsman, Hedia R. and Bloomgren, Patricia A.

Minnesota Department of Natural Resources, Division of Waters, September 1987.

This report shows the results of using an economic model to simulate the interplay among market sectors in order to determine a value of water for economic production.

THE NATIONAL WATER SUPPLY: ITS IMPACT ON AVAILABILITY AND COST OF WATER

Johnson, Steven L. and Winslow, David E., Industrial Development, May/June 1983

The authors claim that most assessments of the national water supply have been either too gloomy or too rosy. Actual per capita water use is 10 times what was once supposed, but the real shortage is one of water developments and waterworks, not water.

LEGAL CONSTRAINTS IN WATER PRICING POLICY

McDonough, Martin, 1968.

This article discusses the legal limits on setting prices or rates for water. It explores the legal difference between rate level and rate structure.

WATER SUPPLY: ECONOMICS, TECHNOLOGY, AND POLICY

Hirshleifer, Jack; De Haven, James C., Milliman, Jerome W., The RAND Corporation, 1963.

This Chapter states that marginal-cost pricing is the appropriate principle for determining the general level of rates for water. The Chapter examines existing and recommended practices of the industry in terms of marginal-cost pricing.

PRICING OF WATER SERVICES

Herrington, P., 1987.

Department of Economics, University of Leicester, United Kingdom

This study assesses the contribution of economic techniques, especially water pricing, for developing practical options for the efficient management of demand and supply of the appropriate quality of water.

DRAFT CHAPTER 307: TEXAS SURFACE WATER QUALITY STANDARDS LEGISLATION

Texas Water Commission, 1990.

This draft preamble to the proposed revisions of the Texas Surface Water Quality Standards contain a qualitative discussion of water quality benefits and costs to the regulated community.

General Natural Resource Values and Benefits

THE ECONOMICS OF NATURAL ENVIRONMENTS, STUDIES IN THE VALUATION OF COMMODITY AND AMENITY RESOURCES

Krutilla, J.V.; Fisher, A.C.

Johns Hopkins University Press, Baltimore, MD. 1975.

A book addressing valuation, allocation and management of the resources of natural environments, and in particular aims at describing the range of amenity resources that have not previously been included in economic analyses even though they have been long recognized in public policies providing for such services as national parks, wildlife refuges and wilderness areas. The two-part volume covers institutional and theoretical considerations and provides five case studies in which analyses are applied. Chapters on theory include: (1) managing natural environment; (2) externalities, property rights, and valuation of resources on the public lands; (3) irreversibility and the optimal use of natural environments; (4) further analysis of irreversibility: Discounting, intergenerational transfers and uncertainty. Case studies include: (1) the Hells Canyon dam and reservoir on the Snake River (Idaho and Oregon); (2) mining activities in the White Cloud Peaks area of the Challis National Forest

near Sun Valley, Idaho; (3) effort to incorporate Mineral King Valley in the Sierra Nevada Mountains (Calif.) into the surrounding Sequoia National Park (4) the allocation of prairie wetlands in the north-central U.S. and neighboring provinces of Canada for breeding habitats of migratory waterfowl; and (5) environmental consequences and alternatives for the trans-Alaska oil pipeline. A summary chapter includes recommendations for establishing a network of regional centers of natural resources research focusing on various aspects of public land management, with each center to be assigned a specific area of research competence.

A WETLANDS EVALUATION MODEL FOR SOUTHERN ONTARIO

Reid, R.A.; Patterson, Nancy; Armou, Liza; Champagne, Anne, Fedn of Ontario Naturalists.

Federation of Ontario Naturalists Report, Oct. 80 (160).

More than 50% of the natural wetlands in southern Ontario have been drained or destroyed. An evaluation system to rank the remaining wetlands according to their importance will help direct preservation efforts to the areas of highest priority. An evaluation model that considers biological, hydrological, and cultural values, and management requirements is described. Indicators of relative value, derived from the characteristics of each wetland and its surroundings are assessed comparatively. These include primary productivity, diversity, rarity, regional context, habitat status, flow stabilization, water quality, resource products, recreation and amenity, research and education, threats to the wetlands ecosystem due to development and existing management practices, sensitivity, and rehabilitative requirements. Field testing verified that the evaluation model distinguishes between wetlands with high, medium, and low biological, hydrological, and cultural values, and adequately reflects the need for management.

MODELS FOR ASSESSMENT OF FRESHWATER WETLANDS

Larson, Joseph S.; Foster, John H.; Motts, Ward S.; Fabos, Julius FY.; Gupta, Tirath, R.; Smardon, Richard C.; Colet, Frank C.

Univ. of Massachusetts Water Resources Research Center Report 32, Jan. 1976

An overall three-phase eliminative model for the relative and economic evaluation of freshwater wetlands is presented. The three phases identify outstanding wetlands to protect at all costs, evaluate individual characteristics of those wetlands judged not to be outstanding overall, and estimate the economic value of those wetlands not generally outstanding. Submodels evaluate the wildlife, visual-cultural, groundwater, and flood control values of wetlands individually. A ranking system for determining priority wetlands acquisitions is developed.

TOOLS AND AIDS FOR ECOLOGICAL GUIDANCE TO DEVELOPMENT PLANNING

Thoss, R.; Van De Maarel, E.; Vellema, K.; Lemeshev, M.

Presented at Un Economic Commission for Europe Seminar on Ecological Aspects of Economic Development Planning, Rotterdam, Apr. 7-11, 1975

Problems concerning the application of ecological knowledge to economic development are discussed, with emphasis on the availability of certain ecological inventory and evaluation techniques and on attempts to develop methods for providing a synthesis of socioeconomic and ecological analysis as an aid to decision-making. The application of tools such as ecological-socioeconomic models, impact and feedback matrices, environmental impact statements, and other types of systems analysis and value accounting is illustrated. The advantages and drawbacks of the three major types of models-accounting, impact, and decision models—are discussed. A general environmental theory is first necessary in development planning, and must then be further aided by the utilization of knowledge provided from various ecological-socioeconomic models.

IN DEFENSE OF ENVIRONMENTAL ECONOMICS

Edwards, Steven E.

Environmental Ethics, 1987 Vol. 9, No. 1 (Spring)

Abstract not contained in data base.

THE EVALUATION OF NATURAL RESOURCE ADEQUACY: ELUSIVE QUEST OR FRONTIER OF ECONOMIC ANALYSIS?

Smigh, V. Kerry

Land Economics, 1980 Vol. 56, No. 3 (August)

Abstract not contained in data base.

THE ECONOMIC THEORY AND MEASUREMENT OF ENVIRONMENTAL BENEFITS

Johansson, Per-Olov

Cambridge: Cambridge University Press, 1987

Johansson has three goals for the this book: to explain in what circumstances several consumer surplus measures correctly rank commodity bundles or projects; to extend such measures to include commodity types important in environmental economics (rationed goods, public goods/bads and discrete choices), and, finally, to present empirical approaches to valuing environmental policies. The public goods case brings us to the problem of discovering preferences for environmental (public) goods. Johansson presents the clever strategy proposed by Maler (1974), which exploits the complementarity between the public good, environmental quality, and private good such as recreation trips. Under certain conditions, the value of access to a site or changes in site quality can be inferred from demand data on the private good. Travel cost and hedonic methods are two applications of the indirect techniques. The other methodology frequently used is the direct survey, also known as the contingent valuation, in which interviewers ask respondents questions about their

willingness-to-pay for public goods. The travel cost discussion focuses on classic studies designed to value access to a specific site, which is either being added or eliminated from use. Missing is any discussion of how to value changes in quality at currently available sites, except for a brief mention of the hedonic travel cost method.

INFORMATION DISCLOSURE AND ENDANGERED SPECIES VALUATION

Samples, Karl C., John A. Dixon, and Marcia M. Gowen

Land Economics Vol. 62, No. 3, August 1986

It has been proposed here that an individual's willingness to pay to preserve a particular animal is tied to the individual's marginal rate of substitution between income preservation and preservation and the perceived marginal efficiency of investment in a preservation fund. If so, information provided to the individual that changes either the marginal rate of substitution or the marginal efficiency of investment will affect revealed preservation bids. Results of this experiment lead to rejection of the hypothesis that no relationship exists between a respondents' willingness to pay for preservation, and information disclosed about its physical characteristics, behavior, and endangered status. Furthermore, in the case of preservation budget allocation it is unambiguous that information disclosure can influence perceived marginal efficiency of investment in a preservation fund, and thereby result in changes in an individual's budget allocation strategy. Taken together, the empirical findings point to the importance of information disclosure when apply contingent valuation methods to estimate social values of species preservation. Of perhaps greatest concern is the fact that information, appropriately selected, can influence the outcome of valuation studies.

THE STATUS OF ENVIRONMENTAL ECONOMICS: AN UPDATE

Binieck, Joseph P.

Congressional Research Service, June 1979

This report prepared for the U.S. Senate Committee on Environment and Public Works updates an earlier report by Mr. Binieck and addresses environmental economics from various points of view: costs of control; macroeconomic assessments; international cost comparisons; microeconomic studies; benefit-cost analyses; and other impact studies.

ECONOMIC DEVELOPMENT AND ENVIRONMENTAL QUALITY IN CALIFORNIA'S WATER SYSTEM

Willey, Zack

Institute of Governmental Studies, University of California, Berkeley, 1985.

Zack Willey suggests that a greater reliance on market forces and rigorous economic analysis of costs and benefits should play a more important role in shaping California's water development.

SOUTH CAROLINA RIVERS ASSESSMENT

Beasley, B.R., Lange, D.A. and W.C. Brittain. South Carolina Water Resources Commission and National Park Service.

Report No. 164. September 1988.

The report intends to provide a systematic and comprehensive database concerning the State's rivers and to add to the continuing development of knowledge on State river resources. The Rivers Assessment presents the findings of a thorough inventory and analysis of selected river-related natural, economic, physical and cultural resources of South Carolina. The major objective of the study is to identify the significance of rivers and river segments for natural, economic, cultural and recreational resource values represented in 14 distinct resource categories.

Fish and Wildlife Values

MONETARY VALUES OF THE FRESHWATER FISH AND FISH-KILL COUNTING GUIDELINES

American Fisheries Society, Bethesda MD, 1982

This effort by the Pollution Committee of the American Fisheries Society attempts to standardize fish values. Monetary values presented in this study were derived from comprehensive surveys of fish experts. The primary data source is a nationwide survey of commercial fish producers in 1979-1980. Fishes listed represent most families of freshwater game, nongame, and commercial species. Anadromous and catadromous species are also included.

FISH KILL INVESTIGATION PROCEDURES

American Fisheries Society, Bethesda MD, 1986

This manual provides recommended guidelines for fish kill investigations. The manual is intended to serve as a training guide and an on-site procedures reference for natural resource agency personnel.

INLAND FISHERIES MANAGEMENT IN NORTH AMERICA - SOCIOECONOMIC BENEFIT OF FISHERIES

S.A. Weithman. Missouri Department of Conservation.
March 1989. Columbia, MO.

This study examines various economic benefits derived from inland fisheries. The study partakes in the identification of fishery benefits, measurement of fishery benefits (non-monetary methods, monetary methods, and total value assessment), and management implications of socioeconomic data. The study considers the importance in fishery management in the quantification of fiscal constraints and socioeconomic benefits.

Recreational Values of Natural Resources

EMPIRICAL APPLICATION OF A MODEL FOR ESTIMATING THE RECREATION VALUE OF WATER IN RESERVOIRS COMPARED TO INSTREAM FLOW

Walsh, R.G.

Colorado State University, Fort Collins, Department of Economics, 1980.

Analysis was made of water value used for coldwater fishing at high mountain reservoirs/streams located in the Colorado Rocky Mountains, which will contribute to an economic assessment of the tradeoff between providing recreational opportunities at high mountain reservoirs (HMR) and maintaining instream flow for river recreation use. Representative numbers (130) of fishermen were interviewed during the summer of 1978 at six sites (3 HMRs and 3 rivers), 6,000-10,000 feet in elevation. Willingness to pay was found to be contingent on changes in congestion and water level. Economic benefit functions were adjusted for crowding, water level, access, participants' characteristics, and management costs. Providing access to 30% or 15% more HMRs would increase existing reservoir fishing benefits by an average of \$3.27 or \$1.25 per user-day, respectively, but once optimum capacity is reached, future expansion of fishing opportunities would be valued as average benefits of \$10.26 and \$11.78 per user-day on reservoirs and rivers respectively. Maximum benefits occur with an instream flow 35% of maximum flow.

CONCEPTS OF VALUE FOR MARINE RECREATIONAL FISHING

Dwyer, J.F.; Bowes, M.D.

American Journal of Agricultural Economics, Vol. 60, No. 5, p 1008-1012, December 1978.

Cost/benefit procedures for estimating changes in marine recreational fishing benefits under various resource management options are discussed. Maximum willingness to pay is used to measure gains in benefits due to such options as an increased stock of fish, while minimum desired compensations or willingness to sell is used to measure losses. Both concepts are estimated from a demand curve for recreation at a particular area. Travel cost and survey methods are used to estimate demand for and value of marine recreational fishing. Fishing quality is affected by many resource management decisions and also must be included in the analysis. This includes fishing success rate at particular sites, number of fish caught, congestion in the fishing area, services provided by charter industries, catch composition, size of fish caught, and water or sea conditions. Major improvement being made in the travel cost method include better procedures for building in substitutes, quality, and traveltime, and applying the model to new types of situations. Survey methods have received less attention,

but recently have been used by the U.S. Fish and Wildlife Service. A component of this, the hedonic pricing approach, provides a new approach to evaluation of changes in quality.

ECONOMIC VALUE OF HUNTING, FISHING, AND GENERAL RURAL OUTDOOR RECREATION

Martin, W.E.; Gum, R.L.

Wildlife Society Bulletin, Vol. 6, No. 1, p 3-7, 1978.

The basic interpretation of monetary values of natural resource areas for outdoor recreation is summarized. Then, based on a detailed study of recreation in Arizona, estimated monetary values for resource areas in use for hunting, fishing, and general rural outdoor recreation are presented. Two measures of monetary value are used—the total benefit value and the maximum collectable revenue value. Total benefits for deer hunting, general hunting, cold water fishing, warm water fishing, and all other general rural outdoor recreation activities in Arizona in 1970 were estimated to be \$243 million. The maximum collectable revenue for these same activities would have been \$87 million. As an illustration of the usefulness of these monetary value estimates, selected estimates are converted to values per square kilometer for comparison with values of the basic land when used for cattle production. For example, one square kilometer of huntable range in Management Region 5 had an average value of \$229 in use for hunting, while the average sale value for cattle ranging was only \$137.

Outdoor Recreation in the Salt-Verde Basin of Central Arizona: Demand and Value

Sublette, W.J.; Martin, W.E.

University of Arizona, Agricultural Experiment Station, Technical Bulletin 218, June, 1975.

Demand functions and value estimates for representative sites in the Salt-Verde Basin as well as values for the entire basin are presented. A mail survey was conducted to determine gross variable household expenditures incurred while visiting selected representative sites as a measure of gross economic activity. The largest portion of expenditures was incurred for transportation, ranging from 37 percent at Luna Lake to 53 percent at Brushy Basin-Four Peaks. Higher net values and larger expenditures are associated with sites that have water-based recreation, considerable development at the sites, and fairly easy access. The nondiscriminating monopolist value estimated for the sites in the entire Salt-Verde Basin is \$36,376,487 and the consumer surplus value is estimated at \$78,438,193.

A COMPARISON OF CONSUMER'S SURPLUS AND MONOPOLY REVENUE ESTIMATES OF RECREATIONAL VALUE FOR TWO UTAH WATERFOWL MARSHES

Brink, C. Holden

Utah Center for Water Resources Research, Logan, 29 June 1973

Demand curves were estimated for waterfowl hunting and nonconsumptive recreational use from use rate and variable expenditure data collected at the Bear River Migratory Bird Refuge

and the Farmington Bay Waterfowl Management Area during FY 1969. Consumer's surplus and monopoly revenue estimates were then derived from the demand functions. Adjusted estimates of consumer's surplus for waterfowl hunting amounted to \$7,260 per year at Bear River and \$11,400 per year at Farmington Bay. For nonconsumptive recreation annual consumer's surplus was estimated to be \$18,700 at Bear River and \$3,760 at Farmington Bay. Monopoly revenue estimates were between one-half and one-fourth the corresponding consumer's surplus estimates. The capitalized value (at 8% interest) of predicted annual consumer's surplus for all recreation was \$865,000 for Bear River and \$299,000 for Farmington Bay. Capitalization of the corresponding monopoly revenue estimates gave \$276,900 for Bear River and \$92,100 for Farmington Bay. Consumer's surplus estimates are more valuable than monopoly revenue estimates for comparison with other values included in the benefit/cost analysis of water development projects because the needed values include more than a nondiscriminating monopolist can extract.

MEASURING THE SITE-SPECIFIC RECREATION BENEFITS RESULTING FROM IMPROVED WATER QUALITY: AN UPPER BOUND APPROACH

Ochs, J.; Thorn, R.S.

Water Resour. Bull Vol 20, No. 6, 1984

The estimation of the value of recreation benefits resulting from improved water quality is required for many purposes. In particular, the Water Pollution Control Act of 1980 requires the considerations of the reasonableness of cost of reducing water pollution in relation to benefits to be derived from establishing effluent standards (Clean Water Act of 1977). Recreation is often the most important benefit resulting from water improvement. Current methods used to calculate recreation benefits are either not site-specific or are expensive and controversial. This paper presents a relatively simple, inexpensive, and less controversial method of calculating site-specific recreation benefits resulting from improved water quality. It does by producing an upper bound estimate which often is adequate for the relevant decision. The upper bound estimates is based on two assumptions: 1) there are alternative substitute sites for the newly augmented water quality site, and 2) the new augmented recreation opportunities at the site will be used to their maximum supply capacity.

ACIDIFICATION IMPACT ON FISHERIES: SUBSTITUTION AND THE VALUATION OF RECREATION RESOURCES

Menz, F.C.; Mullen, J.K.; Crocker, T.D. (ed.)

Economic Perspectives on Acid Deposition Control, 1984

This paper presents an estimate of economic losses to anglers in the Adirondack, NY, USA recreational fishery resulting from acidification damage. These results should be treated as lower-bound estimates for several empirical as well as conceptual reasons. First, the estimates of the Adirondack fishery's value are based only on licensed New York resident anglers fishing in waters open to public fishing. Second, they are based on the assumption that information concerning the effect of acidification on alternative fishing sites is known

and accurately perceived by the angling population. Accordingly, anglers are assumed to alter their visitation patterns in response to diminished angling opportunities as reflected in the underlying economic model of the fishery.

RECREATION ECONOMICS: TAKING STOCK

Matulich, Scott, William G. Workman, and Alan Jubenville

Land Economics Vol. 63, No. 4, November 1987

The authors take the point of view that recreation economics is a policy oriented subdiscipline and specialists should structure analyses to fit or to be more consistent with some form of managerial model. When the aggregate of activities in outdoor recreation economics sums only to a collective body of nonmarket valuation, society is deprived and decision-makers must act in a vacuum similar to one that would occur if a consumer economist knew the income constraint but had no information on relative price. Detailed knowledge of the biophysical response to management or changes in environmental quality is underdeveloped and plaguing the resource manager, the economist, and public policy-makers.

THE NET ECONOMIC VALUE OF FISHING IN MONTANA

Duffield, John; Loomis, John; Brooks, Rob
Montana Department of Fish, Wildlife & Parks.

This study estimates the net economic value of stream and lake anglers in Montana. A regional Travel Cost Method was used to statistically derive a demand equation from survey data collected from stream and lake anglers in 1985.

MONTANA BIOECONOMICS STUDY

Allen, Ph.D., Stewart
Montana Department of Fish, Wildlife and Parks, August 1987.

This study estimates the economic value of trout fishing in Montana using travel cost and contingent valuation methods. The report summarizes the noneconomic results of the Angler Preference Survey conducted in 1986.

ECONOMIC BENEFITS OF WATERFOWL HUNTING AT DUCK CREEK WILDLIFE AREA IN 1988

Missouri Department of Conservation, Planning Section, 1989.

This study determines the net expenditure levels of waterfowl hunters on the Duck Creek Wildlife Area, and computes the indirect benefits of this activity and its impact on the local and State economy. The study also estimates direct benefits to users by using the travel cost consumer surplus model, and determines the total willingness to pay for and the net economic value of waterfowl hunting at Duck Creek.

RECREATIONAL USE OF TED SHANKS WILDLIFE AREA, 1987-1988

Missouri Department of Conservation, March 1990.

This study presents the findings from a public use survey conducted on the Ted Shanks Wildlife Area from 1987 to 1988. The objectives of the study included: (1) estimate the amount of participation and amount of time spent in specific outdoor recreational activities; (2) determine the species harvested and estimate harvest; (3) determine selected background characteristics of users; and, (4) estimate the net economic value, or recreation benefits, of Ted Shanks to area users, or “unpaid-for” value received by visiting the site.

ECONOMIC IMPACTS OF RECREATION EXPENDITURES IN MISSOURI (TABLES ONLY)

Author not indicated.

The tables summarize the findings of a 1985 national survey of fishing, hunting, and wildlife-related recreational activities. The information summarized includes the economic impacts on the State economy from fishing, hunting and nonconsumptive uses. According to the tables, in 1985 Missouri and non-Missouri outdoor recreationists spent nearly \$1.5 billion participating in fish and wildlife activities.

PUBLIC USE ON DEER RIDGE WILDLIFE AREA - AN ECONOMIC VALUATION USING THE TRAVEL COST METHOD

Missouri Department of Conservation, Planning Section, December 1987.

This study is a follow-up to an 1984 public use survey of the Deer Ridge Wildlife Area in northeastern Missouri. The study describes methodology for computing economic values of the recreation area using the public use data collected and estimates the value of each visitor trip and annual value of the area.

WHAT'S IT WORTH? DOLLARS AND CENTS IN FISH AND WILDLIFE RECREATION

Jim Rathert. Missouri Department of Conservation.

Missouri Conservationist, Volume 34.

This article considers the dollars spend for and the value of Missouri outdoor recreation trips. Some of the activities included within the scope of the study include: Ted Shanks duck hunters, Missouri River recreation, Missouri River angling, Missouri River duck hunting, Missouri River “viewing”, Deer Ride hunters, and Deer Ridge “viewing.”

RECREATIONAL USE OF WHETSTONE CREEK WILDLIFE AREA, 1987-1988

Missouri Department of Conservation, December 1989.

This study discusses the findings of a public use survey conducted on the Whetstone Creek Wildlife Area from July 1987 to June 1988. The objectives of the study included: (1) estimate the amount of participation and amount of time spent in specific outdoor recreational activities at Whetstone Creek; (2) determine the species harvested and estimate harvest; (3) determine selected background characteristics of users; and, (4) estimate the net economic value of Whetstone Creek to area users (or “unpaid-for” value of visiting the site).

ECONOMIC VALUATION OF RECREATIONAL ACTIVITY ON THE MISSOURI RIVER - SIMPLIFIED TRAVEL COST MODELS

Missouri Department of Conservation, Planning Section, January 1988.

The Missouri Department of Conservation has employed the Travel Cost Model to estimate the net economic benefit of selected recreation sites. The travel cost analysis is part of an ongoing recreational survey of the Missouri River. The stated purposes of utilizing the travel cost model included: (1) determination of net economic value of creating a new site or modifying an existing site; (2) making more efficient allocation decisions among programs; (3) predicting recreational travel behavior; and, (4) forecasting changes in the use of a recreation site resulting from charging fees for use of that site.

ECONOMIC BENEFIT OF WATERFOWL HUNTING AT TED SHANKS WILDLIFE AREA IN 1987

Missouri Department of Conservation, Planning Section, 1988.

This study determines the annual net expenditure levels of waterfowl hunters on the Ted Shanks Wildlife Area, and from this information, assesses the indirect benefit of this waterfowl hunting and its impact on the local and state economy. The study also estimates the direct benefits using the travel cost consumer surplus model, and determines total willingness to pay for and net economic value of waterfowl hunting at Ted Shanks.

SOCIOECONOMIC VALUE OF THE TROUT FISHERY IN LAKE TANEYCOMO, MISSOURI

Weithman, A.S. and M.A. Haas. Missouri Department of Conservation, Fish and Wildlife Research Center.

Transactions of the American Fisheries Society, Volume 111. 1982.

Lake Taneycomo supports an excellent put-grow-and-take fishery for rainbow trout. when the fishery became threatened by releases of deoxygenated water from an upstream reservoir, it became important to determine its value. This study employs the following methods for estimating the value of the fishery: (1) replacement cost of fish, (2) travel cost, and (3) income multiplier.

RECREATIONAL USE AND ECONOMIC VALUE OF MISSOURI FISHERIES

Missouri Department of Conservation, 1988 - 1990.

These three studies conducted complete statewide fish and economic surveys of Missouri fisheries. The objectives of each study was to develop a statewide system to determine angler effort, angler success, and economic values of Missouri's recreational fisheries.

Pollution/Damage Assessment

SPINDOR VS LO-VACA GATHERING COMPANY (FORESEEABLE FILL-IN OF LAKE RELEVANT IN DETERMINING REMAINDER DAMAGES IN EMINENT DOMAIN)

529 SW2D 63-67 (Tex. 1975).

Petitioner land buyers were awarded compensation action brought against the respondent condemnor. The petitioners contended that during construction of a pipeline across their lake property the respondent also built a road which subsequent heavy rains washed out. This washout allegedly caused dirt to be spread throughout the lake bottom. The respondent objected to the trial court's damage award, however, contending that the expert testimony given as to the cost to restore the lake after the wash out was inadmissible. The Supreme Court of Texas held that the damage to the lake was preventable and should be taken into account when determining damages for diminution in value of the petitioners' remainder (lake). Since the damages were foreseeable, evidence of the damages was relevant to the condemnation proceeding. Thus, the evidence of estimated costs to restore the lake was for the jury's consideration in fixing the amount of foreseeable damages in the condemnation proceeding.

BENEFITS FROM WATER POLLUTION ABATEMENT, PROPERTY VALUES

Dornbusch, D.M.; Falcke, C.O.; Gelb, P.M.; Kozimore, L.W.

National Commission on Water Quality, Washington, DC, December 1975.

Increases in property values resulting from water pollution abatement programs depend on how changes are perceived, the type and size of the water body, and visual and physical access to the water body. Lay persons relate to quality of water in terms of its (1) wildlife support capacity, (2) recreational opportunities, and (3) aesthetic aspects. Residents near large lakes with good or unlimited public access receive the largest benefits, while those living by small rivers with limited public access derive smaller benefits. Magnitude of benefits is also influenced by the type of community, especially its traditional relation to water. Seventeen site descriptions are presented: Lake Washington (2 sites); Green Lake, WI; Marion Millpond, WI; Mystic river, CT; Willamette, OR; Kanawha, WV; Rockaway, NJ; Navesink and Shrewsbury, NJ; Lake Charles, LA; St. John's, FL; Kalamazoo, MI; Brown's Lake, WI; Hart, MI; Minnetonka, MN; Big Sioux, SD; and San Diego Bay, CA.

NEBOSHONE ASSN, INC. VS. STATE TAX COMMISSION (RIPARIAN OWNERSHIP INCLUSIVE OF SOIL UNDER WATER BUT NOT WATER OR FISH THEREIN)

227 NW 2D., 358-69 (Michigan CT. App. 1975).

Plaintiff landowners appealed a determination of the State Tax Commission which greatly increased the assessed valuation of plaintiff's land. The land in question, which was in a wooded, unpopulated area, had a navigable river that ran through the middle of it. Because of the river, the Commission in assessing the property, placed a valuation on the river frontage. Plaintiffs objected, contending the Commission's action was unjustified since the river was owned and used by the public. The court agreed that riparian owners do not own the water or the fish in the water. The court went on to find, however, that the public's rights did not

prevent plaintiffs from having unlimited access to the water. Thus, since plaintiffs were free to fish and use the water, the tax commission was justified in placing valuation on the river frontage in assessing the land.

ECONOMICS AND POLITICS INFLUENCE POLLUTION ABATEMENT RESEARCH

Hemwall, J.B.

Water and Sewage Works, Vol. 116, No. 6, June 1969.

Meeting the research needs in pollution abatement, while necessary, is far from sufficient to get anything accomplished. The literature contains references to unmet research needs and additional information is available from the Federal Water Pollution Control Administration. This discussion, however, is addressed mainly to the influences which make pollution abatement research insufficient—namely, economics, politics and social habits. The author states that the outstanding economic characteristic of water is that it has no value. Its price is quite arbitrary and there is a great deal of federal activity that can be considered a subsidy. The economics of water is even worse after the water has been used. Initially, payment has to be made for the cost of transportation, for whatever treatment is performed, and for the operation of the system. These items establish a cost, if not a value. Used water has neither value nor cost and there is no economic incentive to clean it up. Suggestions are deferred that could improve the economics of water in this area. Other problems of water pollution abatement in the areas of politics and unmet needs are discussed.

RECOVERY OF DAMAGES BY STATES FOR FISH AND WILDLIFE LOSSES CAUSED BY POLLUTION

Halter, Faith; Thomas, Joel T.

Ecology Law Quarterly, 1982

Several legal bases for state recovery of fish and wildlife losses caused by pollution are explored. The problem of determining the value of fish and wildlife resources has discouraged state recovery of such damages. Methods such as replacement cost are well established for valuing fish and wildlife; newer methods for more difficult valuation problems are being developed. A model state statute for initiating damage suits for wildlife losses is depicted.

Valuation Methodologies

QUANTIFYING THE ECONOMIC VALUE OF PUBLIC TRUST RESOURCES USING THE CONTINGENT VALUATION METHOD: A CASE STUDY OF THE MONO LAKE DECISION

Loomis, John B.

Wildlife Mgt Inst North American Wildlife & Natural Resources 54th Conf., Washington, DC, March 17-22, 1989

Public resources are protected by federal legislation and state mandates, and, in California, can include the protection of ecological, environmental, and recreational values as well as land. The economic value of these resources is often measured in terms of the willingness to pay, or the willingness to accept compensation instead of preservation. The Mono Lake, CA, case evaluates the value placed on keeping this lake a viable ecosystem vs. the replacement cost of water for the City of Los Angeles. The contingent valuation method is used to measure this willingness to pay to preserve the region. Results show that social benefits from preservation outweigh the costs of preservation.

EFFECT OF DISTANCE ON THE PRESERVATION VALUE OF WATER QUALITY

Sutherland, Ronald J.; Walsh, Richard G.

Land Economics, Aug. 85

A procedure is illustrated for estimating the effect of distance on the preservation value of environmental quality using the contingent valuation approach. The case considered is the potential degradation of water quality due to coal mining in the flathead river drainage system of Montana. The analysis is based on data from a regional household survey of willingness to pay for water quality in the lake area. Aggregate annual preservation value is estimated as \$81.8 million. This represents a substantial increase in value compared to an approach which estimates the average preservation value for the population of a city or state.

NATIONAL ECONOMIC DEVELOPMENT PROCEDURES MANUAL – RECREATION. VOLUME 2. A GUIDE FOR USING THE CONTINGENT VALUE METHODOLOGY IN RECREATION STUDIES

Moser, D.A.; Dunning, C.M.

Army Engineer Inst. for Water Resources, Fort Belvoir, VA, March 1986

This report is designed to assist Army Corps of Engineers planners in using the contingent value method (CVM) for the economic evaluation of NED recreation benefits. CVM along with the travel cost method (TCM) are the techniques recommended in Principles and Guidelines for evaluating the economic benefits from the recreational components of Federal water resources investments. For the preparation of this manual, CVM was applied to three case studies of actual Corps District recreation projects. These case studies proved invaluable to understanding the advantages, weakness, difficulties, and potential pitfalls of the CVM. In addition, the case studies provided the basic information presented in the examples used in this report. The chapters of this report are arranged in the basic order necessary to conduct a CVM analysis. Chapter I covers the concepts and background of CVM as an economic evaluation techniques. Succeeding chapters cover the basic areas of: sampling; questionnaire design; survey design (including estimates of survey costs); data analysis procedures and techniques; and, the evaluation of NED benefits. Several examples are used to illuminate the basic process required to correctly apply CVM. Included as an appendix is the list of CVM questionnaires approved by OMB for Corps planning purposes.

**NATIONAL ECONOMIC DEVELOPMENT PROCEDURES MANUAL – RECREATION. VOLUME 1.
RECREATION USE AND BENEFIT ESTIMATION TECHNIQUES**

Vincent, M.K.; Moser, D.A.; Hansen, W.J.

Army Engineer Inst. for Water Resources, Fort Belvoir, VA, April 1986

Preauthorization planning for water resources development projects involves an assessment of the anticipated impacts of project alternatives and an information account display of beneficial and adverse effects on National Economic Development, Regional Development, Environmental Quality, and other Social Effects. National Economic Development (NED) is significant not only as an account but also as a planning objective. Under Principles and Guidelines (P&G), one of the alternative plans to address the needs and opportunities in water and land related planning must be the NED plan. The NED plan reasonably maximizes the net difference between NED benefits and NED costs. NED benefits arise when a Federal investment in water resources increases the nation's output of goods and services or reduces the cost of producing these goods and services. These benefits are measured as the dollar value of the increased output or the dollar value of the reduction in costs. The adverse economic effects are the NED costs which arise because resources are diverted for the project that would have value in alternative uses. These cost are measured as the dollar value of the resources in their next best alternative use.

**REFERENCE HANDBOOK FOR USE WITH THE PRINCIPLES, STANDARDS, AND PROCEDURES
FOR WATER RESOURCES PLANNING (LEVEL C)**

Water Resources Council, Washington, DC, September 1981

This handbook has been compiled by the Water Resources Council staff with the assistance of Member agencies to aid planners in formulating and evaluating water resources management and development plans.

**THE ECONOMIC VALUE OF IRRIGATION WATER IN WESTERN UNITED STATES: AN
APPLICATION OF RIDGE REGRESSION**

Frank, Michael D.; Beattle, Bruce R.

Office of Water Research and Technology, Washington, DC, March 1979

This study reports marginal water values and demand elasticities for eleven major irrigated regions in the West. Agricultural output in each region was hypothesized to take the form of a multiplicative function with nine domain variables--irrigation water applied, value of land and buildings, hired labor expenditures, fuel and lubricant expenditures, fertilizer and lime expenditures, feed expenditures, value of machinery inventory, value of livestock inventory and miscellaneous expenditures. Using 1969 Census of Agriculture data, each regional function was estimated using both ordinary least squares (OLS) and ridge regression. For the ridge analysis, all parameter estimates, except one, took on the expected positive sign and the standard errors were decreased in every case. Marginal irrigation water values were estimated

for 1969 at the respective regional mean values of water usage, fixed input levels and variable input prices.

EXPANDING CONTINGENT VALUE SAMPLE ESTIMATES TO AGGREGATE BENEFIT ESTIMATES: CURRENT PRACTICES AND PROPOSED SOLUTIONS

Loomis, John B.

Land Economics Vol. 63, No. 4, November 1987

The existing research in contingent valuation has generally focused on accuracy of mean values for small samples of individuals. However, the objective of contingent valuation as a tool of benefit cost analysis is to provide estimates of aggregate benefits. The purpose of this paper is to expose the broad range of current practices for expanding sample values to the respective population. Then implementation of these approaches to a contingent value survey of California households is provided to demonstrate the large differences in aggregate benefit estimates associated with these current approaches.

TEMPORAL RELIABILITY OF CONTINGENT VALUES

Reiling, Stephen D., Kevin J. Boyle, Marcia L. Phillips and Mark W. Anderson

Land Economics Vol. 66, No. 2, May 1990

As contingent value has matured as an accepted procedure for estimating nonmarket values, the burgeoning literature on this topic appears focused on identifying the limits of its application. These investigations can be grouped under two general headings: validity and reliability. Valid and reliable estimates of Hicksian surplus are essential for contingent valuation to be a useful method for estimating nonmarket values. In this paper the authors examine a specific type of reliability, temporal reliability, by asking whether estimated contingent values, for an item which has seasonal dimensions to the occurrence of benefits and costs, vary according to the time period when a study is conducted. The authors found the contingent values to be reliable and do not vary significantly with the timing of the survey. However, after season values were larger in absolute value than the in-season values for all levels of control.

DOUBLE COUNTING IN HEDONIC AND TRAVEL COST MODELS

McConnell, K.E.

Land Economics Vol. 66, No. 2, May 1990

The analysis of this paper applies generally to situations in which increasing access to one amenity directly reduces the access to another amenity. The authors found that for oceanfront recreational activities a hedonic model would incorporate all of the influences of distance from the ocean, including air pollution, scenic amenities, and access to the beach. If a hedonic model could be coaxed to into revealing a marginal benefit schedule for distance, it would stand for all the amenities which vary with distance. Doing a separate travel cost study

for access to the beach would allow the recreational part of the amenities to be subtracted from the total hedonic effect of distance.

ACCURACY IN VALUATION IS A MATTER OF DEGREE

Kealy, Mary Jo, John F. Dovidio, and Mark L. Rockel

Land Economics Vol. 64, No. 2, May 1988

To measure the value of environmental amenities, economists have asked people to state their maximum willingness to pay for a good or service under hypothetical circumstances. Because willingness to pay depends on the circumstances specified, this technique is called contingent valuation. Although contingent valuation mechanisms try to stimulate realistic conditions, exchange of commodities and payments seldom occur. The authors investigated how closely contingent values correspond to actual behavior, or maximum willingness to pay. The research indicates that it is quite plausible that contingent values may not accurately represent actual behavior for natural resource issues involving willing to pay. It may not be possible for contingent value procedures involving environmental amenities to meet all of the important criteria for intention behavior consistency. Although people may be somewhat familiar with specific natural resources, they often lack market experience with them. They also may lack experience with aspects of the contingent valuation method itself. Therefore, information concerning the sensitivity of contingent values and actual behavior to the relaxation of one or more of the criteria is critical for evaluating the construct validity of estimates of the values of natural resources.

COMMODITY SPECIFICATION AND THE FRAMING OF CONTINGENT-VALUATION QUESTIONS

Boyle, Kevin J.

Land Economics Vol. 65, No. 1, February 1989

Contingent-valuation studies comprise a process of information transfer. A researcher, through a survey instrument, conveys information about the item being valued and respondents, in turn, provide information about the value they place on this item. Considering contingent valuation from this perspective, nearly all of the research evaluating the validity of this valuation method is, in a general sense, focused on examining the effects of information structures on value estimates. The validity of the estimated contingent values relies heavily on the information conveyed to survey respondents since varying information structures can affect the magnitude of estimated values. This paper examines how the description of the item being valued affects the resulting contingent valuation estimates. Gross changes in a minimal commodity description can significantly alter value statements and small refinements in a specific commodity description do not alter estimated means. Thus, the argument that changes in accurate or true commodity descriptions in the framing of contingent-valuation questions will change value estimates is unwarranted as a blanket statement.

THE IMPORTANCE OF SAMPLE DISCRIMINATION IN USING THE TRAVEL COST METHOD TO ESTIMATE THE BENEFITS OF IMPROVED WATER QUALITY

Ribaudo, Marc O. and Donald J. Epp

Land Economics, Vol. 60, No. 4, November 1984

The travel cost method is a widely used technique for the valuation of recreation sites in the absence of organized markets. While it has been shown theoretically and empirically how travel cost can also be used to estimate the benefits from an improvement in environmental quality at a recreation site, the method is flawed if used to analyze a degraded site. Some individuals who ceased using the site because of pollution can be assumed to return once the conditions improve, but they are not included in the travel cost method. Can it be assumed that the benefits they will receive from an improvement in environmental quality are the same as those for the recreationalists who remain?

VALUING AMENITY RESOURCES UNDER UNCERTAINTY: A SKEPTICAL VIEW OF RECENT RESOLUTIONS

Smith, V. Kerry

Journal of Environmental Economics and Management Vol. 19, 1990

This paper questions Colby and Cory's recent characterizations of the appropriate benefit measures to be used to value improvements in the quantity, quality, or conditions of access to environmental resources under uncertainty. This paper uses Graham's analysis of individual and aggregate welfare measurement under uncertainty to demonstrate the problems with Colby and Cory's recommendations. It evaluates their classification of important research issues and summarizes in general terms the difficulties that arise in the practical implementation of the conceptual measures of benefits under uncertainty.

USING SURVEYS TO VALUE PUBLIC GOODS: THE CONTINGENT VALUATION METHOD

Mitchell, Robert Cameron and Richard T. Carson

Washington, D.C.: Resources for the Future, 1989

This book starts with a historical perspective including some discussion of the early contributors to contingent valuation and their relationships to one another. Then it proceeds logically through theory, scenario design, data quality issues inherent in the use of the self-reported value data, measurement bias, sampling and aggregation issues, and an evaluative conclusion. Appendix A provides a summary of more than 100 published CVM studies, and the bibliography runs 51 pages.

General Recreation and Tourism

IMPROVED PROCEDURES FOR VALUATION OF THE CONTRIBUTION OF RECREATION TO NATIONAL ECONOMIC DEVELOPMENT

Dwyer, J.F.; Kelly, J.R.; Bowes, M.D.

University of Illinois at Urbana-Champaign, Department of Forestry, September 197

Improved procedures are presented for evaluating the contribution of recreation to national economic development. These procedures are to replace those outlined in the Principles and Standards for Planning Water and Related Land Resources. (See W74-09278) Desirable criteria for valuation procedures are specified. Variation procedures currently used by federal agencies make almost exclusive use of the 'interim unit day value approach,' sometimes augmented by point systems. This approach has little theoretical or empirical justification and modification of the 'interim unit day value approach' and the use of point systems is not a useful method of developing improved procedures. Rather, it is recommended that models be developed to predict individual willingness-to-pay for many types of recreation as functions of site characteristics, the characteristics of the individual user (including the history of previous use), the availability of substitute activities and sites, and the location of the individual in relation to the resources under study. The total value of the resource would then be a function of these variables, the number of users, and the distribution of users within the market areas. These functions may be derived from regional travel cost demand functions (which would also provide estimates of use) or could be explicit willingness-to-pay functions derived from the survey method (which must be supplemented by a use estimate). Examples of the desired models are provided along with guidelines for their development and use. Needs for further research are identified.

ESTIMATING NET BENEFITS OF RECREATION UNDER CONDITIONS OF EXCESS DEMAND

McConnel, K.E.; Duff, V.A.

Journal of Environmental Economics and Management, Vol. 2, No. 3.

Examination is made of irregularities which arise in use of the travel-cost method of assessing the value of publicly operated recreation sites when excess demand for the use of facilities at a particular site leads to rationing of access. Because recreation facilities have traditionally been provided at a nominal price by the public sector, no market pricing mechanism has existed to allocate resources efficiently. As a surrogate estimation technique, price value has been commonly assessed by use of the travel-cost method, in which a demand curve for the facility is determined indirectly by assuming that travel and transfer costs measure the price of the recreational experience to the consumer. But this method underestimates a consumer surplus when there is excess demand at a facility. The underestimate arises because the demand function is more elastic with respect to travel costs than it is with respect to admission charges. Excess demand causes recreationists to have to incur travel and transfer costs to reach recreation site with uncertainty about whether they will be admitted once they arrive. As a result, under conditions of excess site demand, per capita and total benefits are underestimated. A more accurate use of the travel-cost method with excess-demand sites where there is rationing would be to correct the slope of the estimated demand curve by a factor of π to the tenth exponential power.

THE ECONOMIC IMPACT OF EXPENDITURES BY TOURISTS ON WISCONSIN -- 1989

Davidson-Peterson Associates, Inc.

P.O. Box 350/18 Brickyard Court, York, Maine 03909

The first annual report of the economic impact of tourist expenditures on Wisconsin. The study measures the economic benefits derived by Wisconsin residents and governments from dollars spent by visitors to the State. Benefits to the State economy are defined in terms of total expenditures made by visitors, full-time equivalent jobs created from tourism, wages and salaries by these workers, and tax receipts received by the State and local governments.

FLORIDA VISITOR STUDY 1989: EXECUTIVE SUMMARY

Coggins, Chip A. (editor)

Florida Division of Tourism, 107 W. Gaines Street, Tallahassee, FL 32399-2000

The Florida Visitor Study estimates the number of the visitors to the State. The study estimates the number of the visitors by transportation mode, top ten origin states, top ten destinations, and the impact of tourism on the State and local economy.

1987-1988 USE STUDY OF ARIZONA STATE PARKS VISITORS: ALL PARK SUMMARY

Arizona State Parks Board, 800 W. Washington, Phoenix, AZ 85007, August 1988

This study concludes a year-long study of visitors at each of the State parks to determine the users' recreation patterns, preferences, and expenditures. Days were randomly selected throughout the year to correspond with high and low use seasons identified with each park. On those days selected, users were surveyed at both day and overnight use areas. In total, 3950 surveys were completed from April 1987 to March 1988.

THE ARIZONA TRAVEL AND TOURISM INDUSTRY 1988 UPDATE

Gunderson, Ronald J. and James V. Pinto

Northern Arizona University, Flagstaff, Arizona, May 1989

This study uses the "The Arizona Travel and Tourism Industry: 1984" study by Heller as a starting point. Instead of using simple linear projections this study allows for differential growth rates. This study estimates tourist expenditures, tourism related employment and the effect tourism has on the State and local economies.

REGIONAL ECONOMIC IMPACTS OF CALIFORNIA TRAVEL 1986-1988

Dean Runyan Associates, 815 SW Second Avenue, Portland, OR 97204, February 1990

This report describes 1988 travel economic impacts for California and its regions. Included are breakouts by type of traveler accommodation and type of business, plus revised travel impacts for 1986 and 1987. Impacts are reported in two general categories. "Travel Impacts" include the expenditures of travelers in California, plus the associated payroll, employment, and state and local tax revenues. "Total Travel Impacts" consist of Travel Impacts plus the economic contribution of air passenger transportation and travel arrangement. Travel

expenditures during 1988 amounted to \$31.5 billion and the associated payroll within California was \$6.1 billion.