Estimating the Local Economic Impact of Lake Recreation in Northern California

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Abstract—In this study we examine the relationship between the management of water levels at Shasta Lake and the economic impact of recreation spending on the local economy. We combine a regression visitation prediction model with an input-output model and an expert panel to derive impact estimates. Our results indicate that the economy is most sensitive to management changes in drought years.

Keywords: Management, economic impact, regression, input-output, expert panel.

INTRODUCTION

Shasta, Trinity, and Whiskeytown reservoirs were constructed near Redding, California from 1930-1960. The reservoirs are managed by the Bureau of Reclamation as part of the Central Valley Project. Initially, the lakes were used primarily for irrigation and flood control, however, state population growth has contributed to increased municipal demands downstream. In addition, a significant and perhaps unexpected recreation industry has emerged around the lakes over the past thirty years. Tourism is now one of the most important industries in this mostly rural area.

The Forest Service and Park Service manage recreation on the lakes, however control of lake levels rests with the Bureau of Reclamation. The various demands on reservoir water result in conflicts within the community, the state and between Federal agencies. The intensity of conflicts resulted in recent legislation which mandates more water for endangered species, in-stream uses, and local communities. Agricultural water contracts are also to be renegotiated to bring the cost of water closer to market values.

Effective water resource management in the face of competing demands necessitates a careful accounting of the costs and benefits of alternative water uses. In many cases, the benefits associated with recreation are often overlooked. This study addresses one component of recreation benefits. Specifically, the relationship between the management of water levels at Shasta Lake and the economic impact of recreation spending on the local economy is examined. Such information is integral to a more complete assessment of water management alternatives.

The impact of recreation and water recreation in particular, can be significant to local and/or state economies. Bergstrom and others (1990) demonstrate the large impact that recreation spending at state parks has on state economies in the Southeast. Stoll and others (1988) show that recreational boating in Texas had a total output value of over $610 million and produced almost $184 million in income to households. Other studies cited by Stoll and others (1988) include estimates of recreational boating in Michigan of more than $1 billion spent annually on boating with $469 per year spent on craft related items and $39 per boating day. In Rhode Island, between $95-110 million was spent on direct sales related to the boating industry. Marine boating sales in Florida generated $845.3 million in 1981.

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The Corps of Engineers analyzed recreation expenditures on one river and four lakes in the Southeast (Fritschen 1988). The Corps used PARVS[1] data to estimate expenditures and economic impacts of campers, day users, and other overnight visitors. Fritschen reports total household expenditure per trip of $435 for campers, $36 for day users, and $195 for other overnight visitors. These values are the mean of boater and nonboaters for each activity group. They found that user expenditures have significant impacts on local economies.

DATA AND METHODS

The management of National Forest resources has a significant effect on local economies. Sullivan and Gilless (1990) describe how changes in one resource output, timber harvests, impact Northern California rural economies. They combine an input/output model, IMPLAN, and an econometric model to forecast changes in timber related industries and subsequent income and employment effects on these rural economies.

We employ a similar methodology to examine the impacts of recreation spending on the local economy under different water level management alternatives for Shasta Lake. Visitation estimates associated with different seasonal water levels are combined with visitor expenditure patterns and integrated with the IMPLAN input/output model to project total industrial output (TIO) and employment impacts on the local two county economy. The various components of our model are presented in figure 1.

Visitation Model

Visitation estimates were obtained using two different approaches. First required the development of a regression model to predict annual visitation. Historical data were provided from the Forest Service and by the Bureau of Reclamation. The estimated visitation equation is:

$$E(MRVD) = -98150 + 6.1YEAR + 9.1MAY - 6.7RECDROP \qquad (1)$$
$$(t's) \quad (-5.9) \quad (5.6) \quad (7.5) \quad (-2.4)$$

$$R^2 = .86 \quad AdjR^2 = .83 \quad DW = 2.0 \quad N = 21$$

where, MRVD is thousand recreation visitor days, YEAR is a time trend variable, MAY is water level in feet above sea level at the beginning of May, and RECDROP is the drop in feet of the water level between May and September.

[1]Public Area Recreation Visitor Survey, developed at the Outdoor Recreation and Wilderness Assessment Unit.

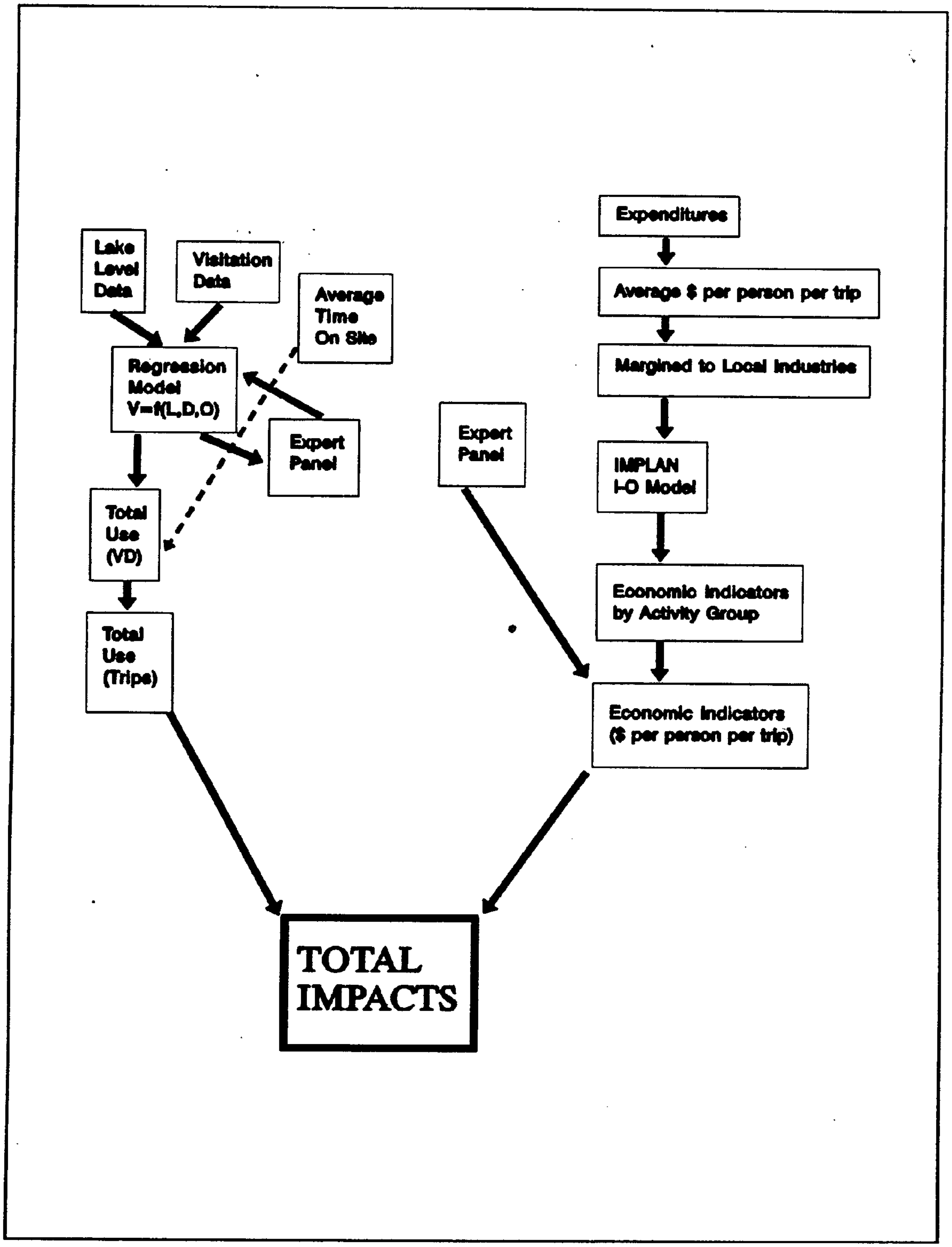

Figure 1.--Components of our model.

The regression results are then augmented by the use of the Delphi technique. Delphi methodology involves structured group input into a decision making process. This technique is often used as a proxy when historical data are not available/complete or qualitative input is needed. Delphi techniques provide valuable input into evaluating management alternatives. Singg and Webb (1979) used traditional Delphi techniques to estimate the impacts of alternative water plans in a watershed planning project. Wagner and Ortolano (1975) forecast impacts associated with alternative actions and used Policy Delphi to rank the acceptability of various alternatives.

In this case, a Delphi group or "expert panel" of local residents was chosen by the Shasta-Trinity National Forest recreation management team based on experience and familiarity with the Shasta lake area and recreation activities. The role of the panel was to (1) provide a limited set of "feasible" water level management alternatives, (2) provide activity use percentage estimates not available in the recorded visitation data and, (3) assess the validity of our regression model visitation estimates for each alternative.

Historical data were used to arrive at baseline management alternatives for the lake in both drought and nondrought conditions. Two feasible management alternatives were then chosen by the panel for comparison to each baseline. The water level management alternatives are presented in table 1.

Table 1—Lake Level Characteristics

		DROUGHT			NONDROUGHT		
		BASE	ALT 1	ALT 2	BASE	ALT 1	ALT 2
May 15	WL (ft)	-85	-85	-85	FULL	FULL	FULL
	SA (%)	-35	-35	-35	0	0	0
	BR (#)	5	5	5	6	6	6
July 15	WL (ft)	-117	-101	-85	-44	-22	-11
	SA (%)	-46	-40	-35	-19	-10	-5
	BR (#)	3	5	5	6	6	6
Sept 15	WL (ft)	-149	-117	-85	-85	-44	-22
	SA (%)	-56	-46	-35	-35	-19	-10
	BR (#)	2	3	5	5	6	6

WL is water level in feet below full.
SA is surface area reduction in percent.
BR is the number of boat ramps open at that water level.

The mix of activities to be expected at each lake level alternative is critical to estimating final total economic impacts because of differences in spending patterns associated with each activity. Panel estimates for activity use percentages for drought and nondrought years are provided in table 2. Regression visitation estimates for each scenario are combined with the activity percentage estimates and reported in table 3. It should be noted that panel members were asked to comment on the regression model estimates. With the exception of the one panelist who predicted up to 50 percent lower visitation under drought conditions than the model, panelists felt the model was not off by more than 20 percent for any one scenario and not off by more than 10 percent for most scenarios.

Table 2—Expert panel activity percentage estimates

	DROUGHT	NONDROUGHT
ACTIVITY	PERCENT*	PERCENT
Houseboating	33	35
Other Boating	27	27
Developed Camping	10	12
Dispersed Camping	10	10
Fishing	20	16

* Percent of total visitation

Economic Impacts

Total use is reported per visitor day, which is one person on site for 12 hours. Economic impacts are estimated on a per trip basis, hence a conversion factor was necessary to combine total use with economic impacts. Survey data showed that the average number of days on site for Shasta Lake visitors is six days. Therefore, Shasta Lake visitor days were divided by 12 to convert to trips.

An on-site stratified random sample of visitor expenditure information and trip profiles was conducted during the recreation season of 1992. Trip and equipment expenditures were margined to various industries of the local economy. This information was combined with the IMPLAN input/output model to estimate total industrial output (TIO), final demand (FD), total income (TI), value added (VA), and employment by activity on a dollar per person per trip basis.

All of the above measures were calculated for each activity group. Next, a total weighted average was calculated using the estimates of total use by activity group. Finally, aggregate impacts for the various water management alternatives are derived. In this study the major purpose is to identify the difference in economic activity supported by recreation spending under different management alternatives and natural conditions, hence the values and differences are reported.

The total economic effect of expenditures related to recreational visits is the sum of direct, indirect, and induced effects. Typically, the total effects are between 1/2 to 2 times more than the amount which the recreationists originally spent in the local economy. As is typical of most economic impact studies, expenditures made within an impact area only by nonresidents are used for analysis. These expenditures represent outside money flowing into the impact area. It is assumed that without the recreation area, these revenue dollars would not flow into the local economy. Thus, for this study only nonresident expenditures are considered. Sixty-five percent of those sampled on site were from outside the two-county region.

Table 3—Visitation Estimates (in million visitor days)

ACTIVITY	DROUGHT BASE	DROUGHT ALT 1	DROUGHT ALT2	NONDROUGHT BASE	NONDROUGHT ALT 1	NONDROUGHT ALT 2
Houseboat	0.66	0.73	0.87	0.96	1.01	1.08
Otherboat	.54	.59	.72	.74	.78	.83
Dev Camp	.20	.22	.27	.33	.35	.37
Disp Camp	.20	.22	.27	.28	.30	.32
Fishing	.40	.44	.53	.44	.46	.50
TOTAL	2.0	2.2	2.65	2.75	2.9	3.1

Table 4—IMPLAN IO Results

	DROUGHT BASE	DROUGHT ALT 1	DROUGHT ALT 2	NONDROUGHT BASE	NONDROUGHT ALT 1	NONDROUGHT ALT 2
FD	16.7	18.5	22.2	23.1	24.3	25.6
TIO	20.3	22.5	27.0	28	29.5	31
TI	11.8	13	15.6	16.2	17.1	18
VA	13.9	15.4	18.5	19.2	20.3	21.3
EM	465	515	618	642	677	711

FD is final demand in millions of dollars.
TIO is total industrial output in millions of dollars.
TI is total income in millions of dollars.
VA is value added in millions of dollars.
EM is employment in full-time equivalents.

RESULTS

Results for dollar output measures and employment are reported in table 4, while percentage changes from the respective Baselines are reported in table 5. In general, the results show that total economic impact is significant to Shasta and Trinity counties from nonresident visitation associated with recreation at Shasta Lake. Lake levels appear to substantially affect visitation and therefore economic impacts.

During nondrought conditions, the feasible management alternatives represented in this study indicate up to an 11 percent change in economic activity and jobs for the local economy. This is not very dramatic and in nondrought years the importance of water downstream is much less of an issue.

During drought conditions the differences in feasible management alternatives are far more pronounced. In fact there is up to a 33 percent difference in economic activity between the Baseline, which represents an average drawdown from past drought years to Alternative 2, representing essentially no drawdown during a drought year. In fact, drought Alternative 2 is only marginally different than the nondrought Baseline.

It should be noted that the expert panel felt the results were, in general, more pronounced during a drought year than our models indicate. Whether this is emotional or intuitive is a good question. It may in fact represent a valid assessment of the limitations of our linear models, both the visitation and the input-output model.

Table 5—IMPLAN IO Results

	DROUGHT			NONDROUGHT		
	BASE	ALT 1	ALT 2	BASE	ALT 1	ALT 2
FD	0	10.8	32.9	0	5.2	10.8
TIO	0	10.8	33	0	5.4	10.7
TI	0	10.2	32.2	0	5.6	11.1
VA	0	10.8	33	0	5.7	10.9
EM	0	10.7	32.9	0	5.5	10.7

FD is final demand percent change from the BASE.
TIO is total industrial output percent change from the BASE.
TI is total income percent change from the BASE.
VA is value added percent change from the BASE.
EM is employment percent change from the BASE.

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