Journal of Public Management & Social Policy

Volume 23 | Number 2 Article 4

December 2016

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Recommended Citation
Carey, Rob; Dickes, Lori A.; and Crouch, Elizabeth L. (2016) "The Economic Impact of Changing Water Levels: A Regional Economic Analysis of Lake Thurmond," *Journal of Public Management & Social Policy*: Vol. 23 : No. 2 , Article 4.
Available at: http://digitalscholarship.tsu.edu/jpmsp/vol23/iss2/4

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The Economic Impact of Changing Water Levels: A Regional Economic Analysis of Lake Thurmond

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This article examines the economic impact of declining lake levels on the local economy in six counties near the publically managed Thurmond Reservoir, located along the border of Georgia and South Carolina. A regression analysis of the relationship between lake level elevations and lake front real estate transactions is used in conjunction with an input-output model to estimate the median monthly economic impact of a one-foot increase in lake level in terms of employment, output, disposable income, and net local government revenue on the six counties bordering the lake. Thurmond Lake elevations have a statistically significant impact on regional economic impact activity but the direction and magnitude depend on a variety of factors, including the size and diversity of each county's economy and the proximity of the commercial centers within each county to the lake.

Several economic impact analyses have examined the regional economic impact of lake components. For example, Schorr, et al (1995) evaluated the regional economic effect of fishing expenditures from Lake Texoma, a lake on the Oklahoma-Texas border. Criddle, et al (2003) estimate the economic impact of sport fishing in Cook Inlet, Alaska. The environmental effects of climate change on commercial navigation in the Great Lakes have been investigated (Millerd et al, 2005). There have also been several studies on the impact of climate change on fisheries and the surrounding regional and national economies (Allison et al 2009; Hancock et al 1997; Martin et al 1987).

There have been few studies focused on the public management of lakes and their subsequent economic impact on the region surrounding the lake. While much of the literature is several decades old, these studies underscore the need to better manage public resources to maximize both the defined public use of reservoirs along with alternative uses including recreational, residential, and commercial and other lake activities not defined in public statues (Knetsch 1964; David 1968). As public reservoirs have increased in popularity for uses other than their original purpose (e.g., flood control, navigation, power generation), effective management of these resources has come under scrutiny by the public, especially in times of

drought or other highlighted scarcity of the natural resource.

Research documents (Young et al, 1984) that appropriate public policy and management of water resources will have positive effects on surrounding land values. For example, the consumer's physical view of the lake can influence land values of lake communities and subsequently impact economic activity. This highlights the public and private concern over drought and other climactic events, as this may reduce lake access and alter resident and tourist's enjoyment and view of a lake. As climactic events become more varied and frequent, consumers may have altered perceptions about the temporary nature of events like lake level changes. If consumers perceptions of current and future events related to the value of a lake are changed, it is important to further understand the relationship between lake level and measures of economic activity. Further, effective allocation of public resources to manage reservoirs during drought, for example, can improve the consumptive, as well as non-consumptive, uses of the water resource (Knetsch 1964; Lansford et al 1995). Additionally, there have not been any studies that examine the relationship between declining lake levels and local economies using input-output (IO) modeling. To that end, the purpose of this study is to estimate the overall economic impact of changing water levels in Lake Thurmond for the surrounding six county region using regression analysis in conjunction with an IO model. Previous studies have used regression analysis of taxable sales to estimate direct spending by tourists in a region. Baade et al (2008) examined the impact of attendees at professional sporting events in the state of Florida on county-level taxable sales; their study also estimated the impact of strikes and lockouts that affected the state's professional sports teams. Gabe and Lisac (2014) likewise used regression analysis to estimate direct spending by concertgoers in Bangor, Maine.

In this study, we estimate the total impact of taxable sales and real estate transactions correlated with changes in the lake elevation of Lake Thurmond using a two-stage model. First, regression analysis is used to estimate direct impact. Second, the marginal effects predicted by the regression model are input to an IO model in order to capture indirect and induced effects. This study utilizes the IO function of the Regional Dynamics (REDYN) model; REDYN is a dynamic model that integrates new economic geography (NEG) concepts ("REDYN" 2015).

Lake Thurmond, located along the border between South Carolina and Georgia, is the southernmost lake within the Savannah River Basin. Lake Thurmond is a publicly managed reservoir by the US Army Corps of Engineers, as part of the Savannah River Basin. Lake Thurmond and other reservoirs in the basin were originally created for flood control, hydropower and navigation. Today authorized uses include recreation, water quality and supply, and wildlife and fish management. However, the lake is used for a wide range of both public and private activities.

The six counties bordering Lake Thurmond—McCormick County in South Carolina and Columbia, Elbert, Lincoln, McDuffie, and Wilkes Counties in Georgia—comprised the area of study. Table 1 illustrates the 2010 populations of each of these counties. With the exception of Columbia County, which includes the city of Augusta, Georgia, all of these counties are rural. This study will examine selected lake, real estate, and economic data over a period of over 11 years from 1998 to 2009. The period of study includes two extended droughts as well as periods of ample rainfall.

Table 1: County Population

Georgia	**2010 Population**
Columbia	124,053
Elbert	20,166
Lincoln	7,996
McDuffie	21,875
Wilkes	10,593
South Carolina	
McCormick	10,233

Source: United States Census Bureau, State and County Quick Facts, http://www.census.gov.

The remainder of this paper is organized as follows. The following section presents an overview of the data sources and methodology used in the analysis. This section is followed by a discussion of the regression analysis to estimate the strength of the relationship between the water level in Lake Thurmond and real estate transactions on lake front parcels, gross sales of goods and services in two surrounding counties, and property values of lakefront parcels. The final section of the paper provides a discussion of the results from the IO model.

Data Sources and Methodology

Data

The primary independent variable used is Lake Thurmond's average monthly water level, or elevation, measured in feet above mean sea level (MSL). Full pool for Lake Thurmond is 330 feet above MSL. Two dependent variables were used in the analysis: lake-access real estate transactions and county gross retail sales. Lake Thurmond's average monthly elevation for the years 1998 through 2009 was provided by USACE. The average monthly temperature at the Greenville-Spartanburg International Airport (GSP), the closest airport for which data was accessible, is used as a seasonal indicator (lake users typically prefer warmer to colder air temperatures).

Real estate data was obtained by first identifying privately-owned parcels with direct access to Lake Thurmond within the surrounding counties (Wilkes County, Georgia was excluded from the real estate portion of this analysis, as that county has no residential properties adjacent to the lake). This data was collected from GIS (Geographical Information System) parcel maps obtained from each county's government. Once lake-adjacent parcels were identified, county real property records were searched to determine the number of real estate transactions involving these parcels that occurred between January 1998 and May 2009, or for as many years as were available from each county's dataset. Intuitively, a relationship between lake adjacent real estate transactions and average monthly water levels in Lake Thurmond is conceivable. However, seasonal, regional economic conditions, and other factors can also affect real estate activity. It was for this reason that regression analysis was also used to isolate the effect of water level on lakefront property sales from these other factors.

Economic and population data were collected from a variety of local, state, and federal government secondary source material. These variables capture both resident and nonresident economic activity as people from outside of the counties bordering Lake

Thurmond buy homes on the lake, purchase goods and services on or near the lake, and visit lake sites for recreation. Further, data was obtained on more than 25 categories of gross retail sales in each of the six counties bordering Lake Thurmond. These categories were restricted to business and industry sectors most likely to experience measurable economic impacts resulting from changing lake levels. Ultimately, our analysis focused on data from 12 SIC codes, shown in Table 2.

Table 2: Gross Retail Sales Categories

SIC Code	Category
2099	Retail Trade
5331	General Merchandise
5399	Miscellaneous General Merchandise
5411	Groceries
5511	Cars
5541	Gas Stations
5551, 5599	Boating Stores
5812	Restaurants
5813	Drinking Establishments (Bars)
5921	Liquor Stores
5941	Sporting Goods Stores

Gross retail sales data for South Carolina were obtained from the state's Department of Revenue (DOR) for five years, 2005 through 2009 (data from 1998 to 2004 was unavailable at the level of detail required). DOR provided the dollar value of total reported monthly sales of all businesses in each county, organized by SIC (Standard Industrial Classification) code. Sales tax revenue data for the Lake Thurmond counties located in Georgia were provided by Georgia DOR for the years 2001 through 2008. Gross sales were derived from these data for all sectors except groceries, which are largely tax-exempt in the state. Georgia DOR reports sales tax revenues using its own industry classification code; this was converted into SIC codes to make it comparable to the South Carolina data. Both the Georgia and South Carolina retail sales data were then converted into North American Industry Classification System (NAICS) codes for entry to the REDYN model.

Gross retail sales are a good measure of county economic activity, particularly at the consumer level. They encompass spending increases (or declines) resulting from changes in income and employment and also capture spending by visitors to the region. We hypothesized that certain gross sales categories would be more likely than others to exhibit a statistically significant relationship with Lake Thurmond water levels. We also anticipated that these relationships might vary in direction and magnitude. For example, the dollar volume of boat sales might naturally vary with lake level—up when the lake is close to full pool and down when the lake is much lower. Other categories, such as groceries and general merchandise, were more difficult to predict. While other factors influence county level economic activity, county gross retail sales provide a reasonable approximation and likely a lower bound estimate on economic activity.

Methods

A thorough regional economic impact analysis attempts to measure direct, indirect and induced economic impacts of a given economic activity. Direct economic impacts are spending by residents and visitors to the lake on lake-related activities (boat purchases, boat repairs, gasoline purchases, food purchases, etc.). Direct spending generates revenue for the recipients to pay wages, income, and taxes to individuals and government in the local economy. Indirect economic impacts are the wages paid, income received, and tax revenues paid by the recipients of direct lake-related spending that are also spent in the local and regional economy. This spending creates indirect impacts that generate additional wage, income, and tax revenue in the economy. Induced economic activity occurs as additional local and regional expenditures increase disposable income in the region that further enhances aggregate local and regional demand for goods and services.

In presenting the findings of this study, we focused on three economic metrics generated by the REDYN model: employment, output, and disposable income. In this analysis, employment is the total number of jobs (including full and part time) gained or lost in the county associated with a one-foot increase in lake level. Output is the dollar value of all goods and services produced within the county in a given year associated with a one-foot increase in lake level. Disposable income is the change in aggregated (summed across all households) household after-tax income in a given year associated with a one-foot increase in lake level.

In addition, the REDYN model estimates the fiscal impact of the predicted changes in economic activity. Net government revenue reported in this model is the change in total revenue received by local (county and municipal) governments in each county less expenses in a given year associated with a one-foot increase in lake level. These revenues are from all sources, including all taxes, licensing, and fees. Because of the daily variation in Lake Thurmond's water level, analyzing the economic impact for an entire year would obscure a great deal of detail. Therefore, we converted results from the IO model to monthly estimates based on correlation with average monthly lake levels.

No county is an island. Economic impacts from one county will naturally spill over into the surrounding counties, be they positive or negative. These cross-county effects are very important in estimating the overall impact of lake level changes on the regional economy. Therefore, effects in McCormick County, South Carolina from changing levels in Lake Thurmond impact the economy in Columbia County, Georgia, and vice versa. The REDYN model takes these factors into account when estimating the overall impact numbers using NEG modeling.

For each county, a regression model was estimated to test the relationship between lakefront real estate sales transactions in a given county and Lake Thurmond elevations. The basic structure of this model, estimated for McCormick County, is as follows:

$$y_i = \beta_o + \beta_1 X_{i1} + \beta_2 X_{i1} X_{i2} + \beta_3 X_{i3} + \varepsilon_{j,}$$

y_i = dependent variable (real estate transactions,)

x_{i1} = independent variable (average temperature)

$x_{i1} * x_{i2}$ = independent interaction variable (average temperature * lake level)

x_{i3} = independent control variables (per capita personal income, wages, employment, etc.)

β_1 = estimate of change in dependent variable per unit change in average temperature, all other variables held constant

β_2 = estimate of change in dependent variable per unit change in the interaction between lake level and average temperature, all other variables held constant
β_3 = estimate of change in dependent variable per unit change in economic and demographic control variables, all other variables held constant
i = month
ε_i = error term

Each county's regression model is a slight variation on this basic model. For example, model tests for Columbia and Elbert Counties reveal non-linearity in the lake level variable and a significant interaction between lake level and average temperature. Thus, a polynomial lake level variable was included in the traditional model. The model for each county also varies in how it controls for several economic and demographic characteristics that also influence the volume of real estate transactions in a region.

Table 3 provides a summary of the total number of real estate transactions and the number of lake access transactions in each county from 1998-2009. These were substantial datasets for each county but for Columbia, Elbert and McDuffie Counties the total number of lake access parcels were a small percentage, less than 2%, of the overall total number of transactions.

Table 3: Lake Thurmond Real Estate Transactions (1998-2009)

County	Lake Access	County Total
Columbia*	123	26,480
Elbert	23	8,205
Lincoln**	824	3,364
McCormick**	780	4,353
McDuffie	87	6,258
Wilkes***	N/A	N/A
Totals	1,837	48,660

* Data only available beginning Jan. 2003.
** Data only available beginning Jan. 2000.
*** No lake-access parcels are located in Wilkes County.

In order to estimate the impact of lake level effects on real estate transactions, the change in the number of transactions per foot increase in lake elevation predicted by the regression analysis was multiplied by the median sale price of properties sold in each given year for each county. This value was input to the IO model as demand for real estate. Indirect and induced effects were then estimated by the model through income generated by agent commissions and local government taxes and fees. Because agent commissions in particular are based upon sale price, the resulting estimated impact is largely dependent on median property values (as indicated by sale price) and the number of properties sold in a given year in each county.

Regression Results

Table 4 illustrates model results from testing the relationship between lakefront real estate sales transactions in five of the six counties located on Lake Thurmond and Lake Thurmond elevations. These statistical models yielded estimates of the marginal changes to the value of goods and services in selected industry sectors as a result of changing lake levels. When these estimates are entered into the REDYN model, it generates the predicted impact of changing water levels on the regional economy. Methodologically, this twofold approach to the analysis, along with the choice of variables used to estimate economic activity, provide for a thorough and instructive approach to estimating the impact of different lake water levels on overall economic activity.

Table 4: Model Results and Parameter Estimates

Term	Estimate	t-stat	Prob>|t|
McCormick County	**N=108**	**R^2=0.2737**	**F Ratio=9.71 Prob >F= <.0001**
Intercept	-128.189	-2.46	0.0156*
MSA GDP	.0049	2.12	0.0365*
Wages	.00285	3.27	.0015**
Average Temperature	-2.52	-4.46	.0001***
Avg. Temp * Lake Level	.0080	4.63	.0001***
Columbia County	**N=84**	**R^2=0.74**	**F Ratio=37.30 Prob >F= <.0001**
Intercept	62908.55	2.47	.0156*
MSA GDP	-.158	-2.51	.0141*
Unemployment Rate	-4.26	-.68	.501
Average Temperature	-57.482	-2.35	.0214*
Average Temp * Lake Level	.1854	2.11	.0381*
Lake Level	-369.39	-2.35	.0214*
Lake Level Squared	.5698	2.33	.0227*
Elbert County	**N=108**	**R^2=0.27**	**F Ratio=7.83 Prob >F= <.0001**
Intercept	-14568.43	-2.29	0.0239*
MSA GDP	.0253	3.88	.00025***
Employment	.0177	2.72	.0077**
Wages	.0019	3.11	.0025**
Lake Level	86.085	2.22	.0288*
Lake Level Squared	-.0133	-2.21	.0292*
Lincoln County	**N=108**	**R^2=0.4**	**F Ratio=23.14 Prob >F= <.0001**
Intercept	6.617	3.85	.0002***
Unemployment Rate	-.386	-2.37	.0195*

Average Temperature	-1.818	-6.58	.0001***
Average Temp * Lake Level	.00575	6.83	.0001***
McDuffie County	**N=108**	**R^2=0.17**	**F Ratio=3.651 Prob >F= <.0025**
Intercept	7.553	1.03	0.305
MSA GDP	-.0016	-2.09	.0392*
Employment	-.0018	-4.25	.0001***
Wages	.000079	2.80	.0061**
Establishments	.0139	1.43	.1565
Per Capita Personal Income	.00033	1.56	.1216
Lake Level	.0464	2.37	.0198**

Note: *** p< .001; ** p< .01, * p< .05

Regional Economic Impact Analysis Results

Results from the linear and nonlinear statistical models described above were used as inputs to the REDYN model to estimate the total economic impact of changing water levels on the six counties bordering Lake Thurmond. Due to variation in economic conditions in each county from one year to the next, the IO model was run so as to generate a unique impact for each year of the study period. However, we can calculate the average of these impacts across years to provide a predicted impact from a one-foot increase in lake elevation. Using this method, Table 5 illustrates the median monthly impacts from a one foot increase in lake level in each of the study area counties. For example, the model estimates that each foot increase in Lake Thurmond elevation adds about 24 jobs to the Columbia County economy in a month's time (285 over a year).

Table 5: Median Monthly Economic Impact of a One-Foot Increase in Lake Level (Gross Sales)

County	Employment (Net jobs per month)	Output ($ per month)	Disposable Inc. ($ per month)	Net Revenue ($ per month)
Columbia	+23.8	+12,307,000	+3,531,000	+438,000
Elbert	0.0	+157,000	+61,000	+6,000
Lincoln	+6.1	+3,579,000	+1,508,000	+150,000
McCormick	+8.0	+4,939,000	+1,826,000	+193,000
McDuffie	-1.6	-972,000	-169,000	-14,000
Wilkes	0.0	-1,000	+52,000	+5,000
Total	+36.3	+20,008,500	+6,809,300	+777,500

Note: Totals may not sum due to rounding.

Gross Sales Model

In terms of output, every foot increase in lake elevation is estimated to increase production of goods and services in Columbia County by $12.3 million per month. Disposable income changes are due to the aggregated impact of wages and other sources of

income. Aggregated disposable income to households in Columbia County is predicted to increase by $3.53 million per month for every one foot increase in lake level.
Local governments realize impacts on net revenue due to changes in local economic activity. The impact on revenue largely comes about through licenses and fees, local sales taxes, where applicable, and through the impact of changes in business activity on property values. The impact on expenditures is the result of changes in demand for local infrastructure, including roads and utilities, public education, and public safety, among other things. The estimated impact on local net revenue in Columbia County is an additional $438,000 per month per foot increase in lake elevation.

Real Estate Transactions Model

In the impact estimates presented in Table 6, only Columbia County indicates a significant employment impact, slightly more than 1 job per month (14 over the course of a year), averaged over the study period, from real estate transactions associated with a one-foot change in lake elevation. Likewise, output, income, and net government revenue impacts are only significant in Columbia County. This is likely due to the higher real estate values in that county relative to the remainder of the region.

Table 6: Median Monthly Economic Impact of a One-Foot Increase in Lake Level (Real Estate Transactions)

County	**Employment (Net jobs per month)**	**Output ($ per month)**	**Disposable Inc. ($ per month)**	**Net Revenue ($ per month)**
Columbia	+1.2	+1,111,000	+121,000	+15,000
Elbert	0.0	+36,000	+5,000	+1,000
Lincoln	0.0	+29,000	+8,000	+1,000
McCormick	0.0	+10,000	+9,000	+1,000
McDuffie	0.0	+1,000	+2,000	0
Wilkes	0.0	+20,000	+3,000	0
Total	**+1.2**	**+1,206,800**	**+147,200**	**+18,200**

Note: Totals may not sum due to rounding.

Observed lake access property values varied widely between the six counties adjacent to Lake Thurmond. The most populous, Columbia County, had the largest median values, $160,618, over the study period, while McCormick County had the lowest at $45,246. Also, as commissions and taxes and fees constitute only a small percentage of sale price, the impact on the regional economy estimated by the IO model will be much less than the aggregate value of the properties sold. As noted earlier, Wilkes County has no developed lake access real estate and as such, any impacts observed in that county are the result of "spillover" from the surrounding counties.

4.3 Total Estimated Impact

Due to the linear nature of IO models, the estimated impacts from gross retail sales and real estate transactions can be summed for each county to indicate a total estimated impact from changes in lake elevation. These total impacts are presented in Table 7. Because the impact predicted from real estate transactions is much smaller in five of the six counties than

those from gross retail sales, only Columbia County shows a notable difference between the impact from gross retail sales and the total combined impact.

Table 7: Median Monthly Economic Impact of a One-Foot Increase in Lake Level (Total)

County	Employment (Net jobs per month)	Output ($ per month)	Disposable Inc. ($ per month)	Net Revenue ($ per month)
Columbia	+24.9	+$13,418,000	+$3,652,000	+$454,000
Elbert	0.0	+$192,000	+$66,000	+$6,000
Lincoln	+6.1	+$3,608,000	+$1,516,000	+$150,000
McCormick	0.0	+$19,000	+$56,000	+$5,000
McDuffie	+8.0	+$4,949,000	+$1,834,000	+$194,000
Wilkes	-1.6	-$971,000	-$168,000	-$14,000
Total	+37.5	+$21,215,000	+$6,952,000	+$796,000

Note: Totals may not sum due to rounding.

Table 8 applies the findings from the IO model to illustrate the cumulative estimated impacts in each county of prolonged low lake levels occuring during the drought of record that occurred in the region between April 2007 and December 2008. As noted previously, Columbia is the most populous and has the largest base of economic activity, so it is not surprising that Columbia has the most substantial impacts across all categories. Lincoln and McDuffie both have substantial losses across all categories but with less local economic activity these impacts are relatively smaller. Elbert and McCormick have negative impacts but with substantially less lakefront development and related business activity these impacts are substantially smaller. As mentioned earlier, Wilkes County has a positive overall impact that we hypothesize is related to the substitution effect that occurs between lake related activity and local business activity and also with substitution effects between local economic activity and broader regional economic activity.

Table 8: **Net Estimated Economic Impact of Low Lake Levels (April 2007 – Dec. 2008)**

County	Employment (Net Jobs)	Output (2010 $)	Disposable Inc. (2010 $)	Net Revenue (2010 $)
Columbia	-333	-$182,921,000	-$49,849,000	-$6,220,000
Elbert	0	-$2,652,000	-$897,000	-$86,000
Lincoln	-82	-$48,953,000	-$20,635,000	-$2,082,000
McCormick	0	-$221,000	-$755,000	-$68,000
McDuffie	-106	-$67,069,000	-$24,953,000	-$2,669,000
Wilkes	+21	+$13,156,000	+$2,284,000	+$194,000
Total	-500	-$288,660,000	-$94,805,000	-$10,930,000

Finally, Table 9 puts these cumulative impacts into the broader context of overall economic activity in each of these counties. In all of the counties, except Lincoln, the

estimated impacts are less than 5 percent of the total annual 2010 county output. Moreover, Elbert and McCormick's losses are less than 1 percent of the 2010 total. Lincoln, however, realizes substantial impact as a percentage of annual output. This points to the reliance on lake related economic activity on Lincoln County as well as a possible lack of broader economic diversity in the immediate region.

Table 9: Economic Impacts in Context (April 2007 – Dec. 2008)

County	Est. Output Impact (2010 $)	Est. Total County Output (2010 $)	Output Impact as % of County Output
Columbia	-$182,921,000	$5,071,239,000	-3.6%
Elbert	-$2,652,000	$1,713,819,000	-0.2%
Lincoln	-$48,953,000	$267,852,000	-18.3%
McCormick	-$221,000	$302,175,000	-0.1%
McDuffie	-$67,069,000	$1,436,830,000	-4.7%
Wilkes	+$13,156,000	$670,985,000	+2.0%
Total	-$288,660,000	$9,462,899,000	-3.1%

Conclusions

Some caveats should be considered with regards to this analysis. Because the Department of Revenue only reports sales and sales tax data at the county level, it is not possible with these data to isolate effects from lake level changes on businesses within a certain distance from the lake; as such, some of these effects could be obscured by non-lake related economic activity in more distant portions of each county. In addition, longer time series data from the region and finer census block characteristics could improve our understanding of these relationships.

In order for this research to be more generalizable, our research highlights the need for economic data beyond the county level. Sales tax data at the city level were not available for this analysis, highlighting the need for additional methodologies for studies like this. In the future, primary source methods could be used in addition to county level secondary source data. Qualitative methodologies focusing on individual business and consumer behavior could provide additional insight into the relationship between lake activity and community and economic impacts. This study found that lake elevations have a statistically significant impact on regional economic impact activity but the direction and magnitude depend on a variety of factors, including the size and diversity of each county's economy and the proximity of the commercial centers within each county to the lake.

In light of these caveats, the methodology used in this report has a number of strengths. First, it has the ability to capture a broad swath of activity by businesses of all sizes affected by changes in lake elevation. It also allows us to take offsetting effects into account; for example, if fewer area residents are spending time at the lake, they may substitute shopping or dining out for that activity. Additionally, the use of Input-Output modeling captures "spillovers" that result from economic activity spurred (or suppressed) by the direct impact of lake level changes.

In summary, these results highlight several key conclusions. These models confirm statistically significant correlations between Lake Thurmond lake levels and economic activity. The direction and magnitude of these relationships depend on a variety of economic,

environmental and other regional characteristics. The counties with the most population and diverse economic activity experienced more substantial losses/gains from declining/increasing lake levels. This research also confirms that while the lake is an important contributor to economic activity, in relation to the overall economy, lake level and lake related activity makes only a small to moderate impact.

This research also points to the importance of substitution effects within a region for economic and leisure activity. These results further emphasize that for most of the counties the lake is an important driver of economic activity but not one that will cripple the counties if the value of the lake is reduced because of lower lake levels. Overall this is good news for communities bordering lakes, as well as public managers of reservoirs. As more individuals seek out these communities for retirement, second homes, or a different way of life, public managers may feel pressure to manage these reservoirs for recreation and economic value reasons. Thus, these results confirm the diversity and potential resilience of economic activity for most communities, even rural communities, in the face of temporal stresses to natural resources. Regions strive for sustainable, long-term economic activity and this research clarifies that lake related activity can be one piece of broader economic and community development.

Acknowledgments
This material is based upon work supported by Duke Energy. Any findings, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of Duke Energy.

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