

Research & Policy

INSIGHTS

Publication 104

September 2021



Lake Freeman Economic Impact

Roberto Gallardo

Purdue Center for Regional
Development & Purdue Extension

Indraneel Kumar

Purdue Center for
Regional Development

Hari Regmi

Agricultural Economics
Department



PURDUE
UNIVERSITY®

Center for Regional Development

Lake Freeman Economic Impact

ABSTRACT

This study looks at the economic impacts in Carroll and White Counties of changes in Lake Freeman’s homeowners and visitors spending patterns in recent years. Recreational days spent at the lake as well as recreational expenditures from homeowners and visitors were collected via surveys and used in an IMPLAN input/output model. Results indicate that there was a statistically significant decrease in both recreational expenditures and days spent—for both homeowners and visitors—in 2020 compared to 2018 and 2019. These decreases resulted in a negative economic impact of close to \$600,000 and a loss of nine jobs with ripple effects spreading to more than twenty-five industries in the two-county region. These impacts are conservative estimates given that survey respondents did not include all homeowners or visitors and median values were utilized (obtained from category ranges) versus actual expenditure figures.

INTRODUCTION

Lake Freeman, part of the Tippecanoe River, lies on the boundaries of Carroll and White Counties in Indiana (see image). It is a significant natural asset that contributes to the regional economies and quality of life. Lake Freeman was formed because of Oakdale Dam and the intent was to build an electricity generation station back in the 1920s. Given its importance to the region’s economy and quality

of life, the Purdue Center for Regional Development (PCRD) was contacted by the Carroll and White Counties local economic development organizations in early 2021 to quantify the lake’s impact on the regional economy.

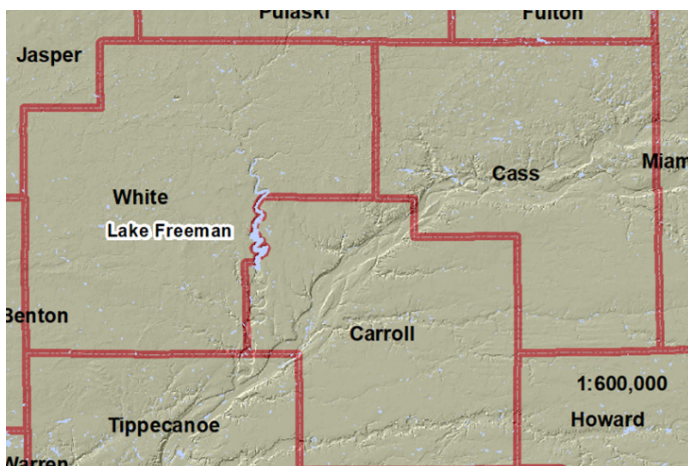
METHODOLOGY

To capture the economic impact of activities related to Lake Freeman in Carroll and White counties as well as the potential impacts of lower water levels in Lake Freeman, this study gathered data through online surveys. Once data were gathered, different data analyses were completed including descriptive, one-way ANOVA, and economic input/output (I/O) analysis.

Three different surveys were designed to capture the economic impact of activities related to Lake Freeman in Carroll and White Counties targeting lake homeowners, visitors, and local businesses. Once the survey instruments were finalized, the researchers obtained approval from Purdue University’s Institutional Review Board (IRB).

A short survey description and QR code to the online surveys were printed and distributed to the three groups (homeowners, visitors, and businesses) in both counties during May and early June 2021. In addition, local newspapers ran a story about the study including the survey links. The local economic development organizations in Carroll and White counties played a key role in distributing the survey. There were 461 valid responses from homeowners, 99 from visitors, and 19 from local businesses. Unfortunately, the data gathered from businesses was not sufficient to conduct a descriptive or statistical analysis due to lower number of responses.

Since the year 2020—when Lake Freeman’s water levels were the lowest—coincided with a pandemic year, data were also gathered for the previous two years (2018 and 2019). In addition, respondents were asked to agree or disagree on several statements applicable to 2020 that



could potentially affect lake-related economic activities in addition to lower water levels such as COVID restrictions, a decline in time spent, income, or recreational options.

For the homeowners and visitors’ surveys, a range of time spent at the lake, or its vicinity and expenditures was asked for each of the activities including recreational food and drink, gas, location maintenance (for homeowners only), and recreational activities. In addition, the homeowners survey also distinguished between the residence being primary (reside full year) or secondary (reside part-time).

Since ranges and not actual amounts were gathered (ranges tend to help with response rates versus actual amounts and minimize respondent errors), medians were utilized. The sum and average of these medians per year or expenditure activity were then used to conduct the descriptive, one-way ANOVA, and the I/O model analyses. Note that by using medians, the economic impact estimates will be conservative in nature. Table 1 outlines the categories and the values used.

Expenditure data from the surveys were used to conduct an IMPLAN input/output analysis. IMPLAN is a software that estimates direct, indirect, and induced effects on employment, labor income (including employee compensation and proprietor income), value added

Table 1 - Categories and Values Utilized

Category	Value
Less than 7 days	4
Between 7 and 13 days	10
Between 14 and 27 days	21
28 or more days	28
Less than \$100	\$50
Between \$100 and \$249	\$175
Between \$250 and \$499	\$375
Between \$500 and \$749	\$625
Between \$750 and \$999	\$875
Between \$1,000 and \$4,999	\$3,000
\$5,000 or more	\$5,000

(includes labor income plus taxes and other property income), and output (includes value added plus intermediate inputs) for a particular economic shock, either an increase or a decrease in activities.

In other words, IMPLAN models the effects of an increase or decrease in expenditures or jobs across employment, income, value added, and output. Responses from both Carroll and White Counties were combined to develop a joint regional impact. The expenditure distribution in IMPLAN was based on the proportionate distribution of industry output in seven industry sectors related to the expenditure categories outlined above for the region.

The survey was designed and data gathered to answer the study’s main research question: “Did low water lake levels have an impact on economic activity in Carroll and White counties?” To answer this question, we now turn to descriptive analyses of homeowners and visitors (including one-way ANOVAs to statistically support or rule out differences between groups) followed by an economic input/output analysis.

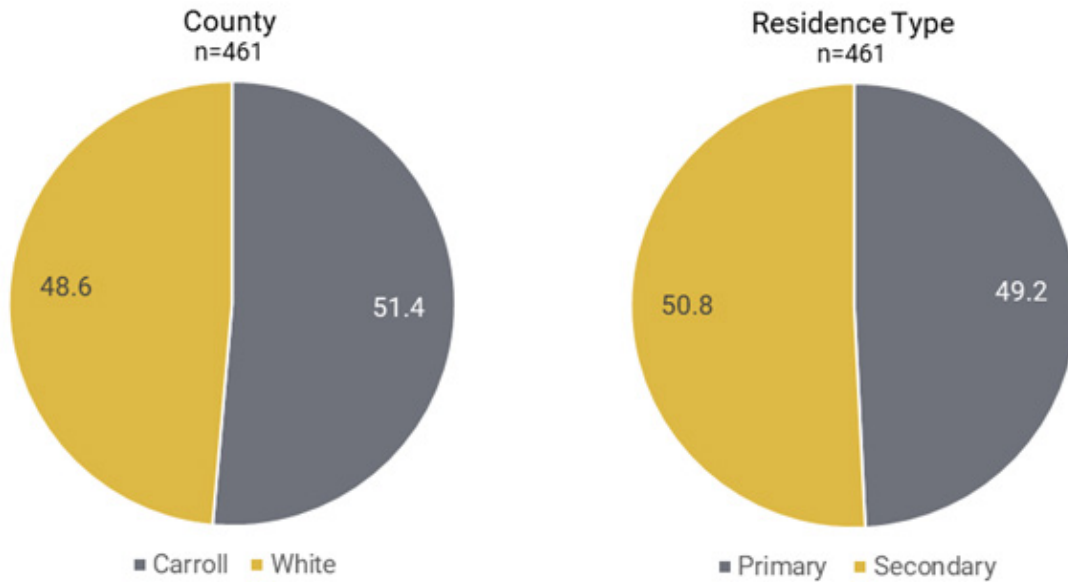
RESULTS

Descriptive Homeowner Results

Figure 1 shows the share of responses by county and residence type from the homeowner’s survey. Remember that primary residence meant residing for the full year while secondary residence meant residing part-time in the county. Responses by county were almost exactly split in half as were the residency type.

Given that the year (2020) when the lake had low water levels coincided with a pandemic year, it was important to distinguish the respondents’ perceptions affecting property-related activities and use. This in turn can help better isolate if lower lake water levels affected property use and/or expenditures independently from COVID restrictions.

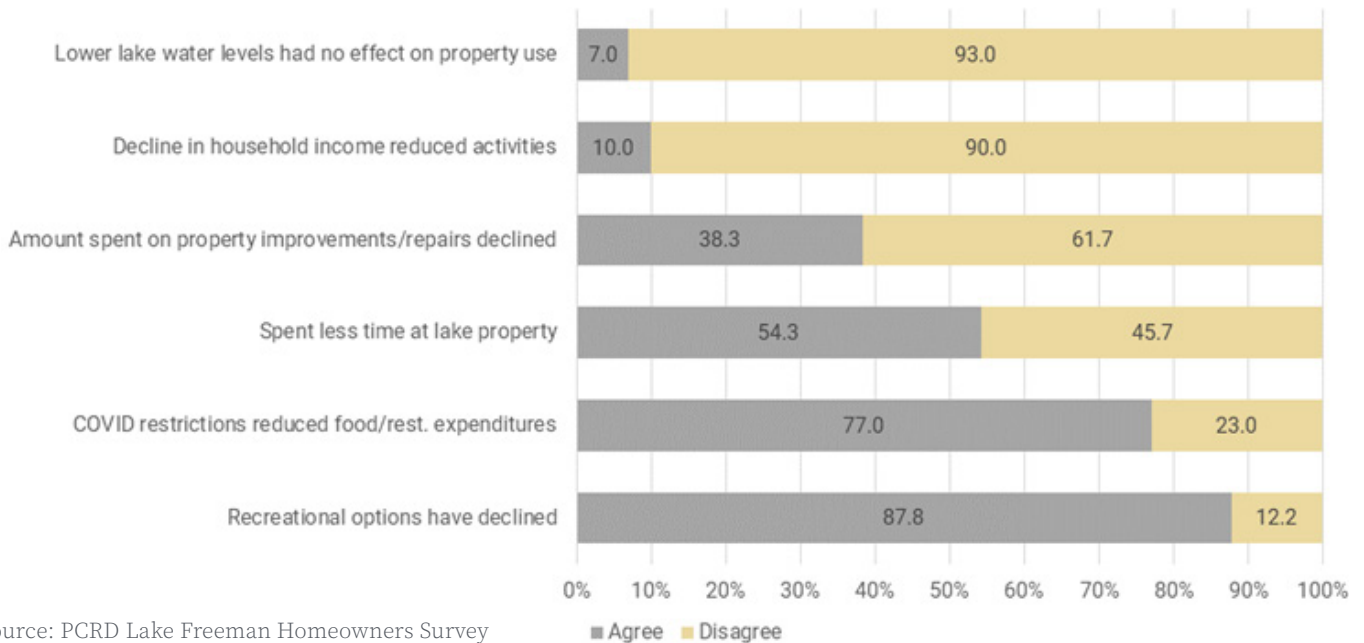
Figure 1 - Percent Responses by County and Residence Type



Source: PCRD Lake Freeman Homeowners Survey

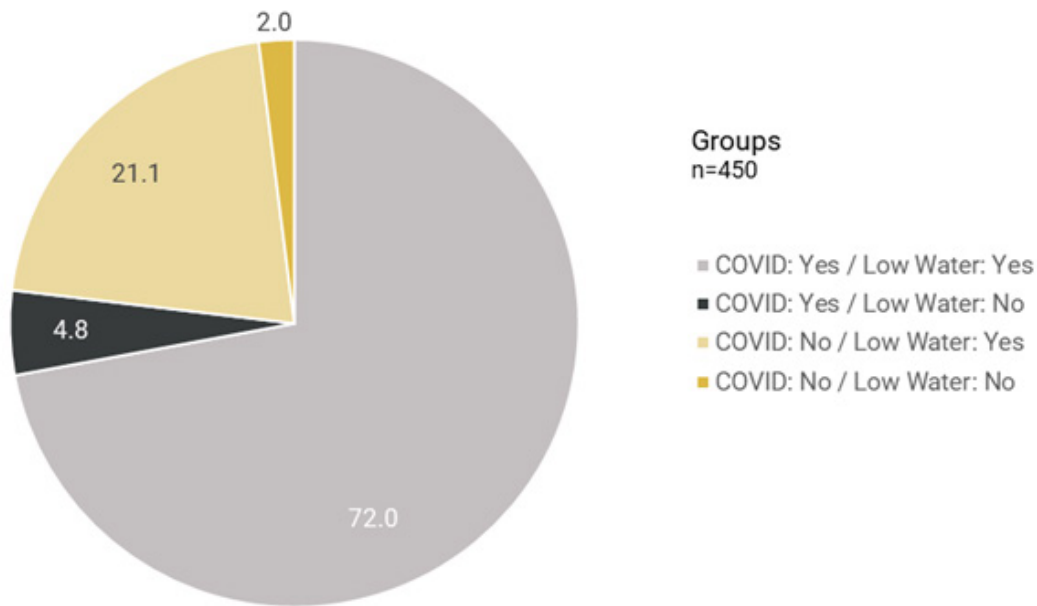
Figure 2 shows the percent responses agreeing or disagreeing on certain statements for the year 2020. Of particular interest to this study were the statements on the impact of COVID reducing expenditures as well as lower lake water levels not affecting property use. More than 90% of homeowners surveyed indicated they disagreed with the statement that lower lake water levels had no effect on property use. On the other hand, a little more than three-quarters agreed with the statement that COVID restrictions reduced food/drink expenditures. In other words, there seems to be a joint impact, by COVID and lower lake water levels.

Figure 2 - Percent Responses Regarding Property-Related Activities During 2020



Source: PCRD Lake Freeman Homeowners Survey

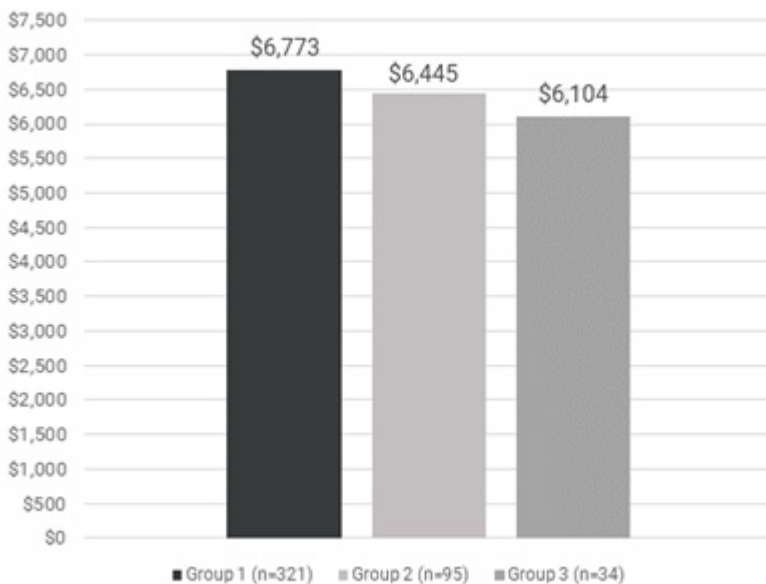
Figure 3 - Percent Responses by Property and Spending Impacts



Source: PCRD Lake Freeman Homeowners Survey

The share of responses agreeing or disagreeing with COVID's and/or low lake water across its four possible combinations are shown in Figure 3. Close to three-quarters agreed that COVID and low lake water levels affected expenditures and property use (group1). On the other hand, one-fifth agreed that low lake water levels affected expenditures and property use while COVID restrictions did not (group 2). The other two groups, labeled as group 3 (those who agreed COVID had an impact but low water lake levels did not as well as those that did not agree that either COVID and low lake water levels had an impact) accounted for 4.8 and 2.1%, respectively.

Figure 4 - Average Median Total Spent in 2020 by Selected Groups (Homeowners)



Source: PCRD Lake Freeman Homeowners Survey

Group 1 includes those who agreed COVID had an impact as well as low water levels (n=321)

Group 2 includes those who disagreed COVID had an impact but agreed low water levels had an impact (n=95)

Group 3 includes those who agreed COVID had an impact but not water levels or either COVID or water levels had an impact (n=34)

A one-way ANOVA was conducted with Tukey's-b post-hoc and results indicate the difference between groups was not statistically significant.

This means there are no differences in the group responses between COVID and low lake waters, therefore the entire sample was used for the analysis.

To distinguish COVID's versus low lake water levels impact, Figure 4 shows the average median total expenditures in 2020 between group 1 (COVID and low water levels affected), group 2 (COVID did not affect while low water levels did), and group 3 (COVID did affect while low water levels did not or either COVID or low water levels affected). The difference was not statistically significant between and within groups.¹ In other words, there are no differences in the group responses between COVID and low lake water levels affecting expenditures and property use.

Since the difference was not statistically significant between groups agreeing that COVID had an impact as did low lake water levels versus those that did not think COVID had an impact but low lake water levels did, we now look at trends over time among homeowners using the entire dataset to help answer the main research question. Please note that one-way ANOVAs were conducted to know if differences between years as well as between primary and secondary residents were significant.²

Figure 5 breaks down the percent of responses by length of stay per year for secondary residences (those that resided part-time throughout the year). Remember that

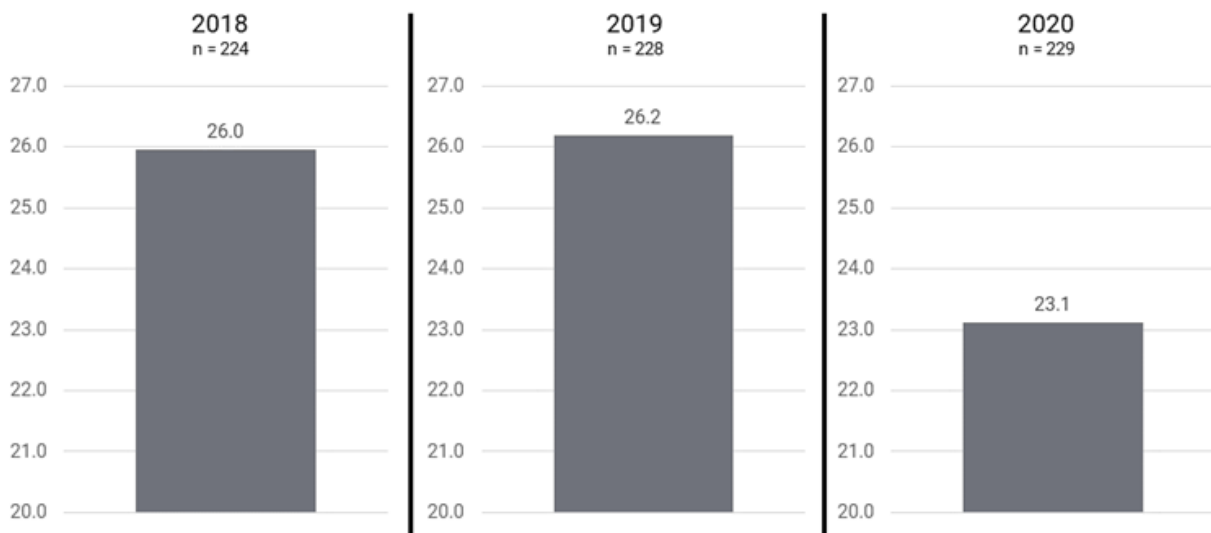
averages shown are the median of ranges previously discussed. The average median number of days was 26 in 2018, 26.2 in 2019, and 23.1 in 2020. One-way ANOVA results indicate that the average median days spent in 2020 were lower and statistically significant compared to 2018 and 2019.

Lastly, Figure 6 shows the average median total spent by year and residence type. A similar pattern is visible where expenditures in 2020 were lower compared to 2018 and 2019 across overall responses, primary, and secondary resident's responses (dollars are not adjusted for inflation; real dollars were analyzed separately and differences with nominal figures were not major). The differences based on nominal dollars were statistically significant.

Descriptive Visitor Results

In addition to homeowners, visitors were also surveyed regarding their expenditures when visiting the lake during 2018, 2019, and 2020. Figure 7 shows the percent of responses based on the county where they spent more time while visiting the lake as well as the state they came from. Close to half of visitors that responded to

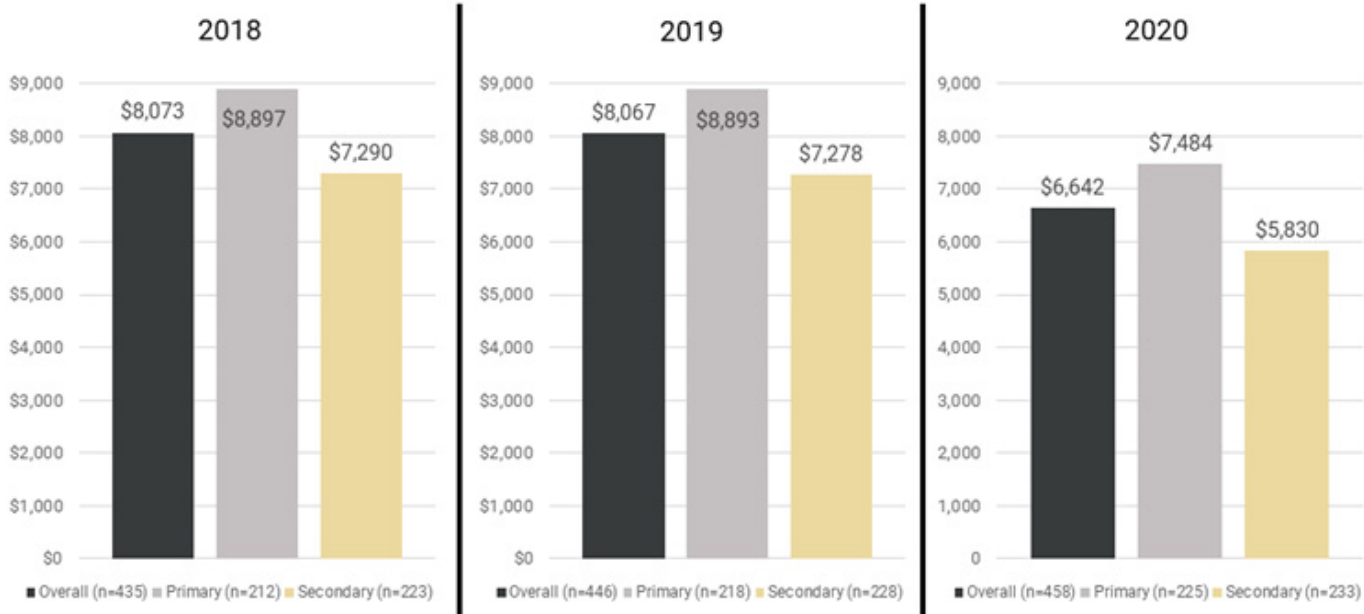
Figure 5 - Average Median Days Duration by Year for Secondary Residences



Source: PCRD Lake Freeman Homeowners Survey

1. A one-way ANOVA analysis was completed using Tukey's-b post hoc. The ANOVA was not statistically significant ($p < 0.724$).
2. ANOVA is short for "analysis of variance" – a statistical technique for testing differences among group averages. In other words, it statistically concludes if opinion or perceptions of different groups are the same based on their average responses. In this case, we looked at the average percent responses between Lake Freeman residents to better understand if the impact was due to COVID or lower lake water levels or both.

Figure 6 - Average Median Total Spent by Year and Residence Type

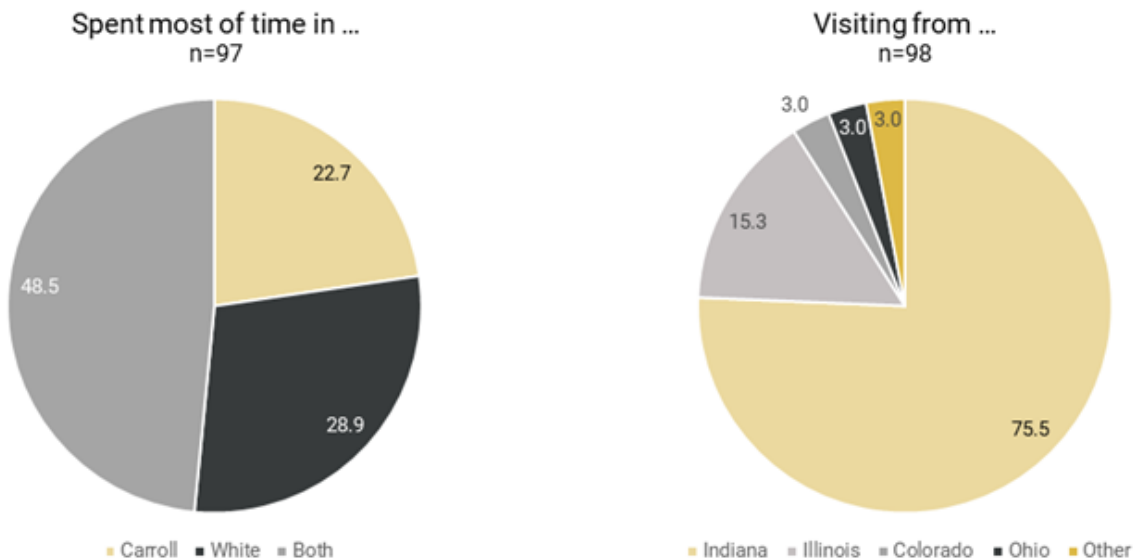


Source: PCRDL Lake Freeman Homeowners Survey

the survey spent time in both counties while three-quarters came from Indiana followed by 15.3% from Illinois (other category includes California, Florida, and Oregon).

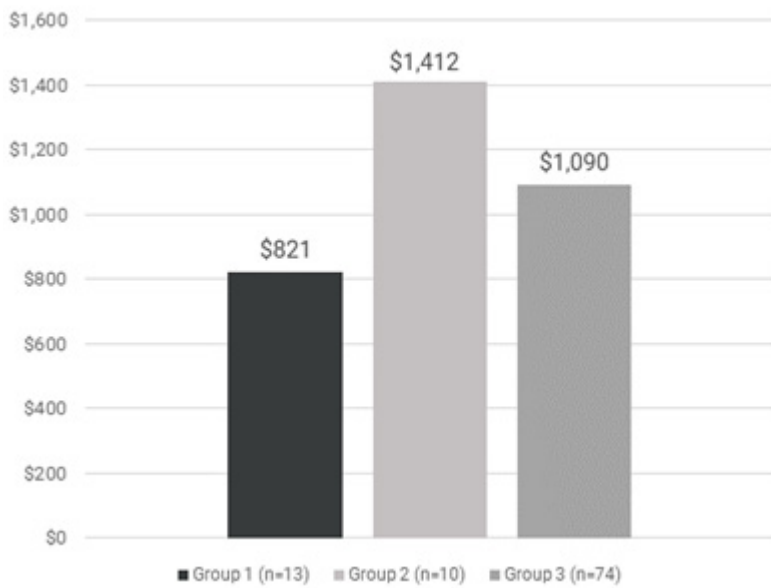
Since the year when the lake experienced low water levels coincided with a pandemic year, the survey asked visitors which or if both factors affected their expenditures while visiting. Figure 8 shows that while there were some differences between groups (like those used for the homeowner’s dataset), the differences were not statistically significant. This means there are no differences in the group responses between COVID and lower lake waters, therefore the entire sample was used for analysis.

Figure 7 - Percent Responses of Visitors by Destination and State of Origin



Source: PCRDL Lake Freeman Homeowners Survey

Figure 8 - Average Median Total Spent in 2020 by Selected Groups (Visitors)



Source: PCRD Lake Freeman Homeowners Survey

Group 1 includes those who agreed COVID had an impact as well as low water levels (n=13)

Group 2 includes those who disagreed COVID had an impact but agreed low water levels had an impact (n=10)

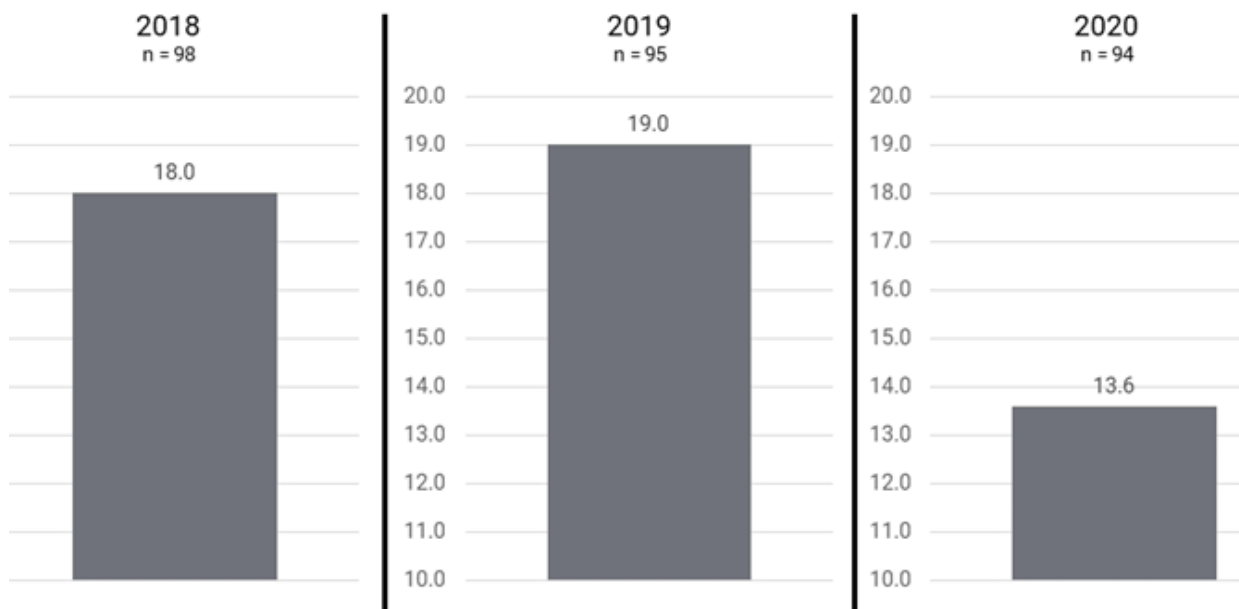
Group 3 includes those who agreed COVID had an impact but not water levels or either COVID or water levels had an impact (n=74)

A one-way ANOVA was conducted with Tukey's-b post-hoc and results indicate the difference between groups was not statistically significant.

This means there are no differences in the group responses between COVID and low lake waters, therefore the entire sample was used for the analysis.

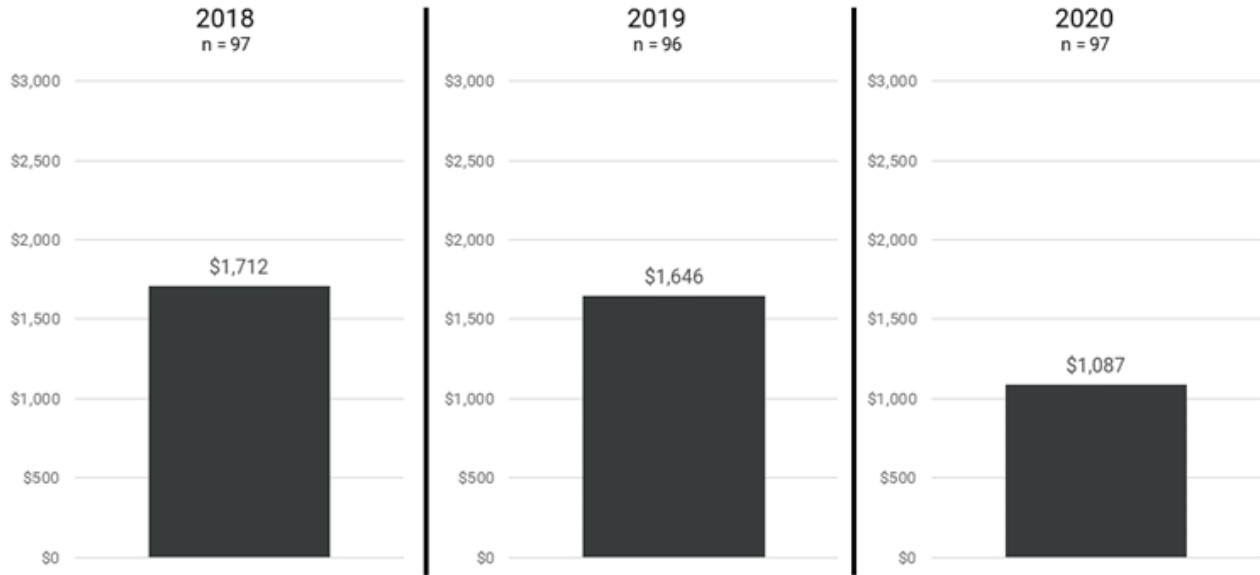
As shown in Figure 9, the average median number of days visitors spent decreased between 2019 and 2020, from 19 to 13.6, or almost one week. This difference was statistically significant. Likewise, the average median total expenditures (including food and drinks, gasoline, and recreational activities) decreased from \$1,712 in 2018 to \$1,087 in 2020 (dollars are not adjusted for inflation; real dollars were analyzed separately with no significant differences) shown in Figure 10. This difference was also statistically significant.

Figure 9 - Average Median Days Duration by Year for Visitors



Source: PCRD Lake Freeman Homeowners Survey

Figure 10 - Average Median Total Spent by Visitors per Year



Source: PCRD Lake Freeman Homeowners Survey

To conclude, both the homeowner and visitor survey data show a significant decrease in the average median days spent and expenditures between 2018-2019 and 2020. Additional statistical analyses revealed that differences between groups attributing these decreases to either COVID or low lake water levels were not significant while the difference between years was significant. In other words, the entire dataset was analyzed assuming these decreases took place due to lower lake water levels resulting in a statistically significant difference between 2018-2019 and 2020.

The next section utilizes this same dataset to conduct economic input/output analyses to quantify the economic impact due to this decrease in days spent and expenditures among both homeowners and visitors.

Input/Output Homeowner Model Results

Table 2 outlines the results of the IMPLAN model using the homeowner expenditure survey data (n=400). Keep in mind that survey respondents included a fraction of all homeowners and that median values were utilized, resulting in very conservative impact estimates. Expenditures in three out of the four categories

included in the survey declined between 2019 and 2020. Expenditures in property maintenance increased while recreational food/drinks, gasoline, and recreational activities decreased during this period.

All expenditure estimates were converted to real dollars (\$2019) to estimate the changes between 2019 and 2020. The first expenditure category is recreational food and drinks which is represented by three IMPLAN industry sectors. Similarly, expenditure category of gas for vehicles and boats and location/property maintenance is represented by an individual IMPLAN sector, respectively. The expenditure category on recreational activities such as boat and other water equipment rentals, horse riding, lunch/dinner cruises, etc., is represented by two IMPLAN sectors.

In the end, a total of seven major industries in IMPLAN were identified to be impacted directly by changes in the expenditures. They included 509- Full-Service Restaurants; 510- Limited-Service restaurants; 511- All Other Food and Drinking Places; 408- Retail Gasoline Stores; 60- Maintenance and Repair Construction of Non-Residential Structures; 504- Other Amusement and Recreation; and 420- Other Scenic and Sightseeing Activities.

The descriptions of these sectors included the key words mentioned in the questionnaire for the specific expenditure categories. Carroll and White counties were combined to develop a two-county region in IMPLAN. We utilized the 2019 output data for these IMPLAN sectors to proportionately distribute changes in the expenditures. As mentioned previously, other than location maintenance which increased between 2019 and 2020, other categories declined. All expenditure data were entered at the same time to run the impact analysis.

The net changes (reduction as well as increase) in expenditure patterns of households between 2019 and 2020 caused a decline of eight jobs in the region. In addition, there were losses in labor income of \$168,000, value added losses of \$262,000, and economic output losses of more than half-a-million (\$577,000) approximately in the combined regional economy.

Job losses were observed in limited-services and full-services restaurants, other amusement and recreation,

Table 2 - IMPLAN Model Results using Homeowners Survey Data

Impact	Employment	Labor Income	Value Added	Output
Direct	-6.9	-\$132,146	-\$196,691	-\$414,840
Indirect	-0.8	-\$26,669	-\$43,289	-\$119,980
Induced	-0.3	-\$8,955	-\$21,831	-\$42,059
Total	-8.0	-\$167,771	-\$261,811	-\$576,879

Source: PCR D Lake Freeman Homeowners Survey; Note: figures in total are rounded

scenic and other sight-seeing activities, all-other food restaurants, and retail gasoline stores. In contrast, maintenance and repair construction of non-residential structures and retail building materials stores gained jobs because of increased expenditures in maintenance by households and subsequent spillovers.

Other real estate, services to buildings, dry-cleaning and laundry services, employment services, postal services, automotive repair and maintenance, warehousing, and storage, etc., had a propensity to suffer job declines because of ripple effects and spillover of reduction in the major expenditure industry sectors.

Additionally, other real estate, electric power transmission and distribution, owner-occupied dwellings, electric power generation, monetary authorities and depository credit intermediation, wholesale-other nondurable goods merchant wholesales, and insurance agencies-brokerages-and related activities, etc. showed a decline in their economic outputs likely due to the ripple effect and spillovers from expenditure changes in the major

industry sectors. The industry sectors that were affected in addition to the seven industry sectors identified above were the result of indirect and induced effects in the regional economy. When all is said and done, the net expenditure changes in the region affected more than a dozen industries.

Input/Output Visitor Model Results

Table 3 outlines the results of the IMPLAN model using the visitor expenditure survey data (n=95). Keep in mind that median values were utilized resulting in a conservative impact. Expenditures decreased in all three categories included in the survey between 2019 and 2020. In the end, a total of six major industries were identified as impacted directly by these expenditures and included 509- Full-Service Restaurants; 510- Limited Service restaurants; 511- All Other Food and Drinking Places; 408- Retail Gasoline Stores; 504- Other Amusement and Recreation; and 420- Other Scenic and Sightseeing Activities.

Table 3 - IMPLAN Model Results using Visitors Survey Data

Impact	Employment	Labor Income	Value Added	Output
Direct	-0.66	-\$11,739	-\$19,354	-\$43,064
Indirect	-0.08	-\$2,499	-\$4,374	-\$11,555
Induced	-0.03	-\$798	-\$1,948	-\$3,748
Total	-1.00	-\$15,037	-\$25,678	-\$58,368

Source: PCRD Lake Freeman Homeowners Survey; Note: figures in total are rounded

The reduction in expenditure patterns between 2019 and 2020, based on visitors surveyed, resulted in a decline of nearly one job from the combined regional economy. In addition, there were losses in labor income of \$15,000, value added losses of \$26,000, and economic output losses of \$58,000 approximately in the regional economy (Carroll and White Counties).

The job and output losses were observed in limited-services and full-services restaurants, all-other food restaurants, retail gasoline, other amusement and recreation, scenic and other sight-seeing activities. In addition, either jobs or output impacts spilled over to other real estate, services to buildings, accounting-tax preparation-bookkeeping and payroll services, employment services, electric power transmission and distribution, etc.

Assessed Value

In addition to survey data, PCRD obtained gross assessed values (GAV) for Carroll and White Counties from 2018 through 2020 from the Indiana Gateway. Gross assessed value includes real and personal properties. Real properties refer to land and building whereas personal property includes utilities, business, and farming

depreciated equipment. GAVs were adjusted for inflation (2020 dollars).

The GAV for Carroll County was \$1.802 billion in 2018 compared to \$1.798 billion in 2020 or a decrease of 0.23%. For White County, the GAV in 2018 was \$2.967 billion compared to \$2.890 billion in 2020 or a decrease of 2.6%. Regarding GAV per capita, Carroll’s was \$89,274 in 2018 compared to \$88,547 in 2020, a decrease of 0.81%. For White County, the GAV per capita was \$122,949 in 2018 compared to \$117,065 in 2020, or a decrease of 4.79%.

CONCLUSIONS

The regional economy of Carroll and White Counties experienced a loss of nine jobs and an overall economic output decline of more than \$600,000 affecting more than twenty-five industries ranging from limited-services and full-services restaurants to sight-seeing activities to insurance agencies-brokerages-and related activities during 2020. It is important to note, however, that these impacts are conservative estimates given that survey respondents did not include all homeowners or visitors and median values were utilized (obtained from category ranges) versus actual expenditure figures.

Research & Policy

INSIGHTS

Publication 104

September 2021

Want to read more Research and Policy Insight reports?

visit www.pcrd.purdue.edu/publications