

## **A Social Impact Assessment of the Brookville Reservoir**

THOMAS J. GALLAGHER, MARGARET M. KIMMEL, and GARY W. BARRETT  
Institute of Environmental Sciences and Department of Zoology  
Miami University, Oxford, Ohio 45056

### **Introduction**

The Institute of Environmental Sciences (IES), Miami University, Oxford, Ohio, and the Whitewater Valley Jaycees, Union County, Indiana, cooperated on an investigation to evaluate the impact of the Brookville Reservoir on the residents of this area.

*The Study Site*—The Brookville Reservoir is located in Franklin and Union Counties in southeastern Indiana. A map of the study area has been previously presented (4). Authorized by the Flood Control Act of 1938, the Reservoir is to provide flood protection in the lower Whitewater and Miami River Valleys and to reduce flood stages at all points down the Ohio River Valley. Other purposes of the Reservoir are to provide a lake for general recreation, fishing, wildlife activities, and water supply storage for the state of Indiana. Construction of the dam began in November, 1965, and impoundment of the lake began in January, 1974 (7). Most lake and recreational facilities were formally open to the public in the summer of 1975.

Union County, Indiana, is a small, rural county with a population of 6582 persons in 1970. Liberty is the major population center with a population in 1970 of 1831 persons (8). Of Indiana's 92 counties, Union ranked 90th in total population in 1970 (2). Of the four Indiana counties (Fayette, Franklin, Union, and Wayne) which comprise the Brookville Reservoir area, Union has the highest percentage of its land (88.1%) devoted to agriculture (7).

Other studies have indicated that large federal projects, such as the Brookville Reservoir, have various impacts on the neighboring geographical areas (1,5). The social impact of such a project tends to be more severe in rural areas due to the stable nature of the rural social system. It is expected that Union County will experience the greatest environmental, social, and economic impact among the counties in the Reservoir area because of its rural-based economy, its small population, and the fact that three of its six townships contain the Reservoir.

### **Methodology**

This investigation was composed of three parts. First, traffic counts were conducted on three major routes within the county. Second, activities and needs of visitors to the Brookville Reservoir were assessed by means of a questionnaire. Third, a random survey of Union County residents was conducted to assess their concerns regarding the growth of the county. The investigation was conducted from 1 July to 31 December 1976.

*Traffic Counts*—Traffic was monitored on westbound US 27 at its intersection with Indiana SR 101 and both north- and southbound Indiana SR 101 at the southern boundary of the town of Liberty six times during the summer of 1976 to estimate the effect of the Brookville Reservoir on the traffic volume in Union County. No traffic counts had been conducted since the Reservoir was opened to the public. Traffic was monitored for a 24-hour period beginning at 1700 h on each of the following dates: 2, 16, and 26 July, 6 and 16 August, and 3 September. These dates were chosen to provide data on two typical holidays (2 July and 3 September),

two typical weekends (16 July and 6 August), and two typical weekdays (26 July and 16 August). US 27 and SR 101 were chosen because they would most likely be impacted by the Reservoir facility.

Totals were tabulated on an hourly basis. Vehicles were classified into the following categories: automobiles, light trucks, trucks, tractor/trailer trucks, motorcycles, and buses. Totals were also kept for motor homes, pickup campers, boat trailers, travel trailers, and campers. Finally, the states in which the vehicles were licensed were noted for each vehicle. Thus, it could be determined what percentage of the county's traffic was from out-of-state.

*Visitor Survey*—A five-page questionnaire was prepared for distribution at the Reservoir in an effort to assess visitors' activities and needs. The questionnaire was distributed on the day following each of the traffic counts (i.e., 4 July, 18 July, 28 July, 8 August, 18 August, and 5 September). Since the Brookville Reservoir has a total of nine entrances, it was decided that the questionnaire would be distributed after the visitors had entered the park. The six areas where the questionnaire was distributed were the beach area, the picnic area at the Mounds Recreation Site, the campgrounds, Quakertown Boat Ramp, the Treaty Line Museum, and the Bonwell Boat Ramp. Since the campgrounds had numbered lots, every third lot was selected for questionnaire distribution. Every effort was made to randomly select persons at each site. This method fulfilled that requirement of randomness which states that each individual should have an equal chance of selection (6). Location was considered to be a random phenomena for each individual.

The visitor questionnaire was divided into five parts. Part I was concerned with the socio-economic characteristics of the visitor group. Part II sought to establish how far the individual traveled, which routes were taken, and what vehicles were brought. Part III dealt with visitor activity at the Reservoir. Part IV sought to determine the economic activities of the visitors in the Reservoir area. Part V sought to establish what facilities the visitors would use if those facilities were present and how far the visitors would travel to make use of such facilities.

*Resident Survey*—A survey of the residents of Union County was conducted in an attempt to obtain a representative sample of opinions concerning growth of the county. On 29 November 1976, 800 questionnaires were mailed to randomly selected households in Union County. Participants were randomly selected from telephone directories which serve the county.

Questions 1 through 6 on the questionnaire dealt with some general characteristics of the household. Questions 7 and 8 asked the respondents to state the annual increase in population and housing that they felt to be the most desirable for Union County. Questions 9 and 10 asked the respondents how they felt housing and commercial development should take place. Question 11 asked the respondents to state the degree of desirability that they associated with various areas of change that would likely occur were Union County to experience growth.

### Results and Discussion

*Traffic Counts*—Traffic data are summarized in Table 1. These data were compared to previous traffic counts conducted by the Indiana State Highway Commission in 1948, 1962, and 1969 (3).

There are two major points of interest concerning these comparisons. First, the 1976 totals increased from an average of 1995 vehicles for weekdays to an average of 2743 vehicles for weekends to an average of 3066 vehicles for holiday weekends. This increase is expected on a route that carries recreationally-oriented

TABLE 1. *Summary of 24-hour totals for all vehicles*

Date	US 27 West	SR 101 North	SR 101 South
26-27 July (weekday)	2036	2101	2005
16-17 August (weekday)	2007	1872	1950
16-17 July (weekend)	2767	2662	3623
6-7 August (weekend)	2380	2184	2843
2-3 July (holiday weekend)	3492	2658	3701
3-4 September (holiday weekend)	2636	2476	3434

traffic and suggests that the Brookville Reservoir has already manifested an impact on traffic volume.

The second point of interest is the large increase in traffic between the years 1969 and 1976. In 1948, the 24-hour annual average of total traffic on SR 101 was 1100 vehicles; in 1962, it was 1725 vehicles; and in 1969, it was 2150 vehicles. Whereas the annual percentage of increase for the seven years between 1962 and 1969 was only 3.25% per year, the annual percentage of increase for the seven years between 1969 and 1976 was 12.05% per year. The three fold annual percentage increase strongly suggests that the Reservoir had a significant impact on Union County traffic volumes even prior to its official opening in 1975. This threefold increase was obtained when using only the 1976 average number of vehicles on a weekday. It is, therefore, a conservative figure.

The average 24-hour weekday total, the average weekend total, and the average holiday weekend totals for westbound traffic on US 27 in 1976 were 2021, 2573, and 3063 vehicles, respectively. Interestingly, the average weekday total for westbound traffic in 1976 represented 73% of the total traffic (east and westbound) found in 1969. Like SR 101, traffic totals increased from a low for weekdays to a high for holiday weekends, again suggesting recreationally-oriented traffic.

Since separate totals were kept for pickup campers, boat trailers, travel trailers, motor homes, and campers, it was possible to discover what percentage of the traffic was recreationally-oriented. It was determined that 3.6% the weekday, 5.8% of the weekend, and 7.7% of the holiday weekend traffic volume was composed of recreationally-oriented vehicles. These data demonstrate that increases in volumes on normal weekends and holiday weekends are, in part, a result of increases in recreationally-oriented traffic, indicating again that the Brookville Reservoir has had an impact on Union County traffic volumes.

It is difficult to determine the exact impact of the Brookville Reservoir on traffic volume in Union County since the origin and destination of each vehicle is unknown. However, an estimate can be calculated using park data which show that, in 1976, 1,202,212 persons representing 389,508 vehicles visited the Brookville Reservoir (personal communication, Michael Graham, Head Ranger, U. S. Army Corps of Engineers, Louisville Office). Results from the visitor survey show that 33.8% of the visitors who were surveyed traveled through Union County. This provides an estimate of 131,654 vehicles in the county due directly to the Reservoir. This estimate of 131,654 vehicles, however, includes only those vehicles that entered the Reservoir. Vehicles not considered include those coming to or going from the various campgrounds in close proximity to the Reservoir, vehicles carry-

ing commercial goods to commercial establishments that were attracted to the area due to the Reservoir, and vehicles carrying people searching for seasonal or permanent residences near the Reservoir.

TABLE 2. *Percentage of vehicular composition by state.*

Date	Route	Ohio (%)	Indiana (%)	Other (%)	Total Out-of-State (%)
26-27 July (weekday)	US 27 IND 101	18.0 9.3	72.2 88.8	9.8 1.9	27.8 11.2
16-17 August (weekday)	US 27 IND 101	19.0 11.5	74.4 85.9	6.6 2.6	25.6 14.1
16-17 July (weekend)	US 27 IND 101	25.4 19.2	69.0 77.8	5.6 3.0	31.0 22.2
6-7 August (weekend)	US 27 IND 101	26.3 15.3	68.3 83.2	5.4 1.5	31.7 16.8
2-3 July (holiday weekend)	US 27 IND 101	23.8 19.4	67.4 76.3	8.8 4.3	32.6 23.7
3-4 September (holiday weekend)	US 27 IND 101	26.5 22.1	64.5 76.8	9.0 1.1	35.5 23.2

Table 2 lists the percentage of vehicles registered in Ohio, Indiana, and all other states that were traveling on US 27 and SR 101 on the given dates. The percentage of out-of-state traffic on SR 101 increased from an average low of 12.6% on weekdays to an average high of 23.4% on holiday weekends. The percentage of out-of-state traffic on westbound US 27 increased from an average low of 26.7% on weekdays to an average high of 34.0% on holiday weekends. The total percentage of out-of-state recreationally-oriented vehicles traveling SR 101 and US 27 westbound increased from 38.6% on weekdays to 47.8% on holiday weekends. The typical weekend percentage was 46.1%. Vehicles from Ohio constituted the majority of these out-of-state, recreationally-oriented vehicles with values of 32.6, 43.6, and 45.2% of the total percentages for weekdays, weekends, and holiday weekends, respectively. Thus, it appears that increase in traffic in Union County on weekends and holiday weekends is related to an increase in out-of-state, recreationally-oriented vehicles.

In the questionnaire sent to the Union County residents, the respondents were asked to express any comments that they felt appropriate. Many people wrote concerning their fear that the Brookville Reservoir was going to create an increase in traffic volumes and that this increase would be composed of out-of-state vehicles, especially Ohio vehicles. Concern was expressed in regard to the use of Union County funds to repair county roads damaged by out-of-state vehicles. Table 2 appears to substantiate these fears.

*Visitor Survey*—A total of 957 completed questionnaires was received from the visitors to the Brookville Reservoir. Of these, 307 were received for weekdays, 327 for weekends, and 320 for holiday weekends.

Although Brookville Reservoir is located in Indiana, over half (53.9%) of the visitors surveyed were from Ohio. This value is extremely close to the 55% reported by Nelson and Barrett (4) during the summer months of 1975. These findings vary considerably from the 75% to 80% estimates constantly mentioned by

TABLE 3. *Frequency distribution regarding how far visitors traveled to reach the Brookville Reservoir*

Distance	Frequency	Percent
Less than 10 miles	94	9.9
10-25 miles	204	21.5
26-50 miles	380	40.1
51-100 miles	222	23.4
More than 100 miles	48	5.1
Total	948	100.0

Union County residents. It was never discovered where their estimates originated. However, based on our findings and those of Nelson and Barrett (4), it is felt that 55% is an accurate estimate.

Of those people surveyed at the Reservoir, only 1.3% were from Union County. Franklin County, which also contains a portion of the Reservoir, accounted for 10.4% of those surveyed. Although Franklin County has a larger population than Union County (16,943 compared to 6582 persons (8)), the difference is not proportional to the difference found between the two counties in their number of visitors to the Reservoir. Thus, it appears that Union County residents are experiencing the negative impacts of the Reservoir without sharing in its advantages.

Table 3 summarizes the distances traveled by visitors to reach the Reservoir. The highest percentage (40.1) of people traveled from 26-50 miles to reach this facility. Interestingly, these data represent a normal distribution curve.

Table 4 summarizes the various activities engaged in by visitors. The column entitled "Rank" is the rank that each activity held in our survey. It should be noted that the rankings were exactly the same in both surveys.

Responses to the question asking visitors where in the Reservoir area they had made purchases revealed that 107 (11.2%) of the visitors made purchases in Union County. In contrast, 433 (45.2%) made purchases in Franklin County. Of all the visitors that traveled through Union County, 82 (25.4%) made purchases in Union County. However, 140 (43.4%) of those individuals traveling through Union County made purchases in Franklin County. It appears that many individuals wish

TABLE 4. *Frequency distribution and ranking of activities engaged in by visitors to the Brookville Reservoir*

Activity	Frequency	Rank	Nelson and Barrett (4)
Swimming	807	1	1
Picnicking	505	2	2
Sight-seeing	432	3	3
Boating	345	4	4
Camping	317	5	5
Fishing	270	6	6
Water Skiing	200	7	7
Hiking	124	8	8
Sailing	40	9	9

to arrive at their destination before they stop to make purchases; since the beach and campgrounds are in Franklin County, Union County is deprived of this commerce. In addition, 50.0% of the respondents stated that they were not willing to travel more than five miles to make use of the various stores and services available in the area. Unfortunately, Liberty, the commercial center in Union County, is nine miles from any present beach or campground site. Thus, Union County must bear a large proportion of the Reservoir traffic and receive little in the form of visitors' dollars in return.

*Resident Survey*—Residents of Union County were surveyed to determine their perception of and desires for the future of both the Reservoir and the county. Of the 800 questionnaires mailed to residents, 203 (24.4%) were returned. These returned questionnaires represented 9.6% of the total number of households in Union County according to the 1970 Census (8). A comparison of returns to the actual population residing in those townships indicated that the sample was representative.

Mean responses were calculated for the questions dealing with population growth and housing development within the county. It was revealed that the majority of the people wished to see the population of Union County grow at less than 30 persons per year, i.e., less than 0.45% per year.

Table 5 lists the frequency associated with the various factors listed on the resident questionnaire. Residents indicated a preference for commercial development concentrated in towns rather than dispersed over the county. In contrast, preferences for housing were divided between those favoring dispersed versus concentrated development. We believe that this division of opinion represents the desire of current residents to maintain their present options for housing, i.e., represents a cultural aspect of this rural community. Residents were also asked to assess the desirability of change in other areas of Union County if it continues to

TABLE 5. *Response frequency for the degree of desirability associated with the various factors listed on the Resident Questionnaire*

Factor	Response				
	Very desirable	Desirable	No opinion	Undesirable	Very undesirable
Dispersed housing	22	78	19	46	37
Housing concentrated in towns	36	100	21	32	10
Dispersed commercial development	25	65	12	61	35
Commercial development concentrated in towns	37	122	13	17	8
Expansion of water facilities	41	73	22	34	29
Expansion of sewage facilities	33	70	25	36	34
Loss of natural areas	10	8	14	64	105
Loss of agricultural lands	4	7	6	41	113

grow. The majority ranked the expansion of water and sewage facilities as desirable and the loss of natural areas and agricultural lands as very undesirable.

In summary, the investigation indicates the importance of long-term planning if a local community is to benefit from large federal projects. Our results show that residents of Union County are experiencing significant social impact from the Brookville Reservoir without enjoying the recreational or economic benefits associated with this facility. Planning efforts in the future must understand better the interface between major federal projects and the local environs in order to minimize negative social impact and to provide long-term socio-economic benefits.

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#### Literature Cited

1. BARTON, T. F. 1968. Lack of planning or failures of pre-construction planning of the Monroe Reservoir. *Proc. Indiana Acad. Sci.* 77:312-320.
2. Indiana University. 1973. Population and housing profile, Union County, Indiana Census profile No. 81. Bloomington, Indiana.
3. NEIDIGH, J. H. and ASSOCIATES. 1969. Comprehensive area plan, Union County, inventory and analysis-phase I. South Bend, Indiana.
4. NELSON, L. E. and G. W. BARRETT. 1977. A socio-economic impact analysis of the Brookville Reservoir on Franklin County, Indiana. *Proc. Indiana Acad. Sci.* 86:308-316.
5. SAITTA, W. W. and R. L. BURG. 1973. Local economic stimulation from reservoir development: a case study of selected impacts. *J. Soil and Water Conservation*. March-April.
6. STEEL, R. G. and J. H. TORRIE. 1960. *Principles and Procedures of Statistics*. McGraw-Hill Book Co., New York. 481 pp.
7. U. S. Army Corps of Engineers. 1974. Final environmental impact statement for Brookville Lake project: East Fork Whitewater River, Indiana. U.S. Army Engineer District, Louisville, Kentucky.
8. U.S. Department of Commerce, Social and Economical Statistical Administration, Bureau of Census. *Census of Population: 1970, I. Characteristics of the population*. Part 16, Indiana. U. S. Government Printing Office.