An Economic Impact Study of Lower Great Miami River Segment Improvements: Executive Summary

Radha Ayalasomayajula* Fred Hitzhusen** Pierre Wilner Jeanty***

*July 2003_Research Project Sponsored by Rivers Unlimited_Authors are * Research Associate, Rivers Unlimited, ** Professor and *** Ph.D. -level Research Associate in the Dept of Agricultural, Environmental and Development Economics, The Ohio State University, respectively.*

Introduction

Traditionally, rivers have been used for water supply, hydropower, irrigation, transportation and waste assimilation. However, more recently, rivers are recognized as economic potential in creating conditions that produce favorable economic change. Individuals perceive environment as a superior good, meaning that as income increases, the demand for such goods increase. Natural assets such as rivers also provide the necessary setting for a region to develop if policies are directed towards preserving and protecting these assets. In order to do so, the unique characteristics of the resource have to be maintained and economies need to be stimulated to generate a surplus. These surpluses would not only attract investments but also accelerate the growth process.

The need for research came from a request for economic valuation of benefits derived from a natural resource, the Great Miami River. Township trustees, the Miami Conservancy District, the Hamilton County Soil and Water Conservation District and citizens' groups Friends of the Great Miami River and Rivers Unlimited wanted to explore means to enhance economic activity and recreation in the river corridor. One of the objectives of the study was to estimate the benefits and costs of a buffer strip/zone along the river. Another objective was to determine the impacts of gravel mining on residential property values. If gravel mining affected property value, regulation of mining activity along the corridor would predict a higher tax base and revenue for the region, besides enhancement of aesthetic beauty of the river corridor. Another objective of the study was to determine economic impacts of expanding boating, fishing and other in - stream recreation opportunities by constructing additional boat ramps where needed, to not only enhance the social capital of the region but also to boost the local economy, and increase recreational opportunities for river users.

The estimation of the costs and benefits of constructing a bike trail proved to be a challenge since we did not have a benchmark for estimating these figures. Besides, there was an ambiguity regarding the length and the location of the bikeway, since some properties located adjacent to the river were privately owned residential, commercial and industrial parcels. Therefore, benefit transfer values were simulated from the Heritage Trail, in Dubuque, Iowa, prepared by Siderelis and Moore 1996. The trail extends for 27 miles, and estimates that on average, per trip, a person spends approximately $11.09 on the bike trail. The aggregate benefits relevant to the local economy from the bike trail are estimated by multiplying the average amount spent by number of visitors per day. This study develops a methodology to estimate opportunity cost of acquiring land for the

bikeway and buffer strips, and also develops methodology to estimate the total Willingness to Pay, not just expenditures for construction of a bike trail.

To estimate the impact of access points, again, the BT method was adopted. A study by Kythrie Silva et al. (2000) which analyzed the behavior of Ohio boaters at newly constructed ramps using a survey-based method was used as the benchmark. The total annual visitation was estimated using benefit transfers from a study on Muskingum River. The goal was to assess the economic benefits of installing new access points to the Great Miami River. Since applying the benefit transfer method requires adjusting the benefit estimates based on the policy site characteristics, the main problem encountered in conducting the analysis was finding baseline data on the use of the Great Miami River. As a result, a preliminary survey was administered. Rather than detailed estimates on quantitative use of the river, the results of the survey give approximates of both quantitative and qualitative characteristics of the river use. For example, the type of activities for which people mostly use the river as well as some inhibiting factors to additional use contingent on more access points were identified.

Based on benefit transfers from previous studies and the results from the preliminary survey, total estimated annual economic surplus of installing new access points were a reasonable amount of $602,940. The analysis relies heavily on a number of assumptions which when relaxed will yield different results. One of such assumptions is that only three access points will be installed. Using more access points in the calculation would change the benefit/cost ratios presented in the sensitivity analysis. Further refinement of the analysis can be made through a more comprehensive survey for which some insights in terms of sample frame construction are collected from the preliminary survey.

In case of the effect of gravel mining on property values, a hedonic pricing method was used. The total decrease in property tax revenue accruing to the local government from decreased property value resulting from proximity to gravel mining is estimated at $2 million resulting in a tax revenue loss of more than $100,000 annually to the local governments.

Methodology

Methodologies to estimate the impact of property, community and environmental attributes on values of residential properties along the river, and the recreation and tourism value of the river will be the hedonic pricing (HP) method and the benefit transfer (BT) method will be used to determine the benefits and costs of buffer zones and new boating access points. Types of gravel mining regulation and reclamation from other states will be summarized, and HP and BT methods as well as information from interviewing local people and gravel mining officials will be used to get rough estimates of impacts.

Cost Effectiveness of Buffer Strips

To protect aquatic and riparian resources, buffer strips are established in the riparian zone directly beside the stream, and may extend to the adjacent upland zone. Appropriately

designed and managed buffer strips can contribute significantly to the maintenance of aquatic and riparian habitat and the control of erosion.

Consistent with cost analyses of the costs and benefits of natural resources management alternatives, the costs of buffer strips are relatively easy to quantify, but the benefits are not. Establishment of buffer strips normally results in additional costs to the landowner, public or private.

Although costs are relatively easy to determine, important non-market benefits are difficult to evaluate. Second, the value society places on non-market riparian benefits such as biological diversity is subject to not only measurement difficulties but also considerable changes in public perception and relative scarcity, all of which are likely to be substantially greater in the future.

Sohngen and Nakao (1999) tried to estimate the private benefits of filter strips for farmers. In their fact sheet, two examples of revenue producing filter strips-hay and timber were developed. The costs of installing and maintaining filter strips on cropland include: (1) land rental costs, (2) seed and fertilizer costs, and (3) equipment and labor costs. In order for the farmers to adopt these techniques, a widespread education program on the benefits of filter/vegetative strips, along with the various options available to the landowners must be launched.

The present study is confined to the two counties of Butler and Hamilton, and data were collected accordingly. The parcel information of all land adjoining the banks of the Great Miami River was collected, classified into categories of land use, such as agricultural, residential, commercial, sand and gravel mining, land used for utilities such as electric and telephone lines and railroads, government land used for state parks and recreation, and land owned/acquired by the Miami Conservancy District for various purposes such as flood damage reduction, wetland protection, construction of bike trails, etc.

It is assumed that farmers will voluntarily participate in the continuous CRP sign up program. Besides receiving the federal incentives, the farmers will also benefit from the harvesting of hay from the filter strips. It is to be noted here that only one third of the land adjoining the river is under agriculture, and the remaining land has several other uses. A total of 52 miles of the riverbank, between 33 and 70 feet wide is proposed as a vegetative buffer strip in this study, about 458 acres (if 70 feet were accepted).

In order to estimate the dimensions of the filter strip, it is imperative to perform a detailed analyses on the type of crops grown locally, collect considerable data on land ownership and estimate the opportunity cost of land for each and every parcel owner on the banks of the Great Miami River. Some of the owners of smaller parcels may have a very high willingness to accept compensation for converting their present land usage to vegetative filter strips. These analyses will take considerable time and resources which are not available to the authors at present time.

Economic Analysis of the Great Miami Bike Trail

Miami Conservancy District's Great Miami River Recreation Trail began in 1978 as an 8-mile loop in downtown Dayton. The following are the proposed/existing bike trails which will eventually all be connected to form 63.2 miles of interconnected bike trails.

The Great Miami Trail is proposed to be 28 miles long, starting at Waterworks Park in Fairfield County and extending to the Warren - Montgomery County line. It will connect the Dayton Bikeway to the north and the south roadway to the Shaker Trace in Miami Whitewater Forest.

Total cost of the construction and maintenance of the bike trail is estimated at $3 million. This does not include the cost of purchasing rights-of-way and major bridge structures. This estimate is based on current work for similar trails in other parts of Ohio, as estimated by the Miami Conservancy District (MCD). It is anticipated that about 75 percent of the cost will be paid by federal and state sources. The rest will be shared among local public entities and private donors.

Benefit Transfer Results From Moore and Siderelis

The values used in the benefit transfer that follows were obtained from a 1995 study, published by Siderelis and Moore. The authors investigated net benefits of bicycling and walking on abandoned railroad beds that have been converted to a rail-trail for recreation purposes. A sample of three diverse rail-trails from across the US, in Iowa, Florida and California were studied. In the present study, we shall use the results from the Iowa bike trail, since it is the closest match in demographic, trail landscape and income indicators to the Great Miami Trail. The study findings state that on an average, users spend $9.21 per day as a result of their trail visit to the Heritage Trail in Iowa, $11.02 in St. Marks' Trail, Florida, and 3.87 per person per day in Lafayette Trail, California. The findings of the Iowa Trail are applied in the present study, after inflating the $9.21 expenditure to current dollars for the year 2003, using a CPI inflator. For our study, we shall first apply the benefit cost method and apply the findings of expenditures from the Iowa Trail, and then apply the single point estimates of average consumer surplus or willingness to pay (WTP) per activity day per person.

Benefit Cost Ratio of Bike Trail

Benefits Benefit Cost Ratio_Interest Rate 4% 6% 8% 10%_Actual 7.21 5.90 4.92 4.19

The second set of benefit transfer values used in this study is average consumer surplus values per activity day per person from the study conducted by Siderelis and Moore. Consumer surplus is a value of a recreation activity beyond what must be paid to enjoy it. The benefit transfer estimate of a management or a policy-induced change in recreation is the average consumer surplus estimate for the average individual from the benefit transfer literature. Applying the mean of estimates to the usage, we obtain the recreational economic benefits provided by the bike trail. Taking the lower bound estimate, the net benefits are $2.8 million and taking the average for the northeastern region, the net benefits are about $5.7 million per year.

Economic Analysis of Proposed Access Points

Expanding boating opportunities by constructing new boat ramps where needed is expected to not only enhance the recreational options of a given region but also to boost the local economy. The purpose of this section is to determine the benefits and costs from the allocation of funds toward new boat ramp construction in Butler and Hamilton counties, Ohio through an ex-anti analysis of the potential behavior of Great Miami River users. An access point assumes parking and restroom facilities as well as a launching ramp, which explains the cost.

The costs to bring these benefits into existence include building the new access points, making them operational, and maintaining them. The analysis uses a study by Silva et al. (2000) for benefit transfer. The authors analyzed the behavior of Ohio boaters at newly constructed ramps on Ohio rivers and lakes using a survey-based method. As a result, their study provides a good basis for benefit transfer. From their analysis, the average number of launches per year and per boater was found to be 35.2 prior to the availability of the new boat ramps. The results of the study also indicate that approximately 26.1% of a sample of 348 boaters increased boating on an average of 4 additional times a year due to the construction of new boat ramps.

Estimated Benefits of Proposed Access Points

The purpose of conducting the survey was to adjust the estimated benefits calculated from an earlier study of the total visitation to the Muskingum River. It is evident, from the survey results that visitation to the river is related to whether the respondents live far from or close to the river. The total visitation reported averages five trips a month, implying an average use of about once a week. The relative dependence of this outcome on the location of the respondents' residence calls for a conservative but reasonable assumption that people take trips to the river two times during two weekends in a month and devote the other 2 weekends to other activities. Based on the idea that outdoor recreation is seasonal, there is a need to account for seasonality effects. Consequently, annual average visitation per user is assumed to be 18 (2x9) trips.

Relying on the Delphi survey respondents for the total visitation estimate would be inappropriate since this estimate would not result from a random sample. Alternatively, the study by Hitzhusen et al. (2000) on the Muskingum River is used for benefit transfer. Instead of using four additional visits a year as reported by Silva et al. (2000), a conservative amount of three visits is used. However, to value visitation to the river, the conservative $10 from the Delphi survey is used as average expenditure per user and per trip, which is reasonable as compared to estimates of $13.50 for the Northeast region (Region 9) provided by U.S. Forest Service. Increase in visitation is determined by drawing upon findings by Sylva et al. (2000) that 26.1% of users would increase their use by three visitation days if more access points were installed. Table 3.7 shows the estimated increase in visitation to the river and the related estimated benefits. The table indicates a total annual economic benefit of $743,850 for the entire region. Based on the Silva et al. 2000 study, $325,806 representing 43.8 percent would be spent locally. These estimates rely on a very strong assumption that the number of visits is equal to the number of visiting individuals.

Annual Estimated Benefits of New Access Points

Estimated number of visits Increase in visitation Annual increase per user Annual Expenditure for 3 visits Total annual estimated benefits Total local annual benefits_95,000 24,795 3 $30.00 $ 743,850 $ 325,806

For installing the access points, three locations were identified based on distance to major artery/road, distance to food and water facilities, proposed bike path locations, distance to current access points and distance to cluster of gravel mines.

Discounted Benefits and Costs of Three Access Points

Estimated Annual Benefits

Cost Estimates of Three Access Points DPV of Benefits at 6% DPV of Costs at 6% Initial Capital Outlay Annual Maintenance and Operation Costs
$ 743,850 $ 1,912,500 $ 13,275 $ 9,508,635 $ 2,082,194_Benefit/Cost Ratio 4.57

Assuming a linear demand curve, this results in a total annual consumer's surplus of $602,940, implying an annual per-trip consumer's surplus of $24, which is equivalent to $25.60 in 2003 dollars. This amount, which represents the annual per-trip economic benefit of installing new access points to the river, is consistent with findings by previous studies.

Discounted Benefits and Costs of Three Access Points: A Sensitivity Analysis

Estimated Annual Benefits

Costs Estimates of three Access Points DPV of Benefits DPV of Costs
Initial Capital Outlay Annual Maintenance and Operation Costs
$ 31,006,787.34 $ 1,912,500 $ 13,275 $ 281,448,608.7 $ 2,032,997
Benefit/Cost Ratio 136.44

The BC ratio presented in the table above reports the discounted present value of benefits and costs and the corresponding benefit/cost ratio, which is remarkably high, indicating that the benefits outweigh the costs, suggesting that increasing access for in river recreation in the Great Miami is a potentially high economic pay off investment. However, it is imperative to mention here that the high Benefit Cost Ratio is not a true indicator, but a possibility if the assumptions regarding the number of users and expenditures are relaxed.

Economic Impact of Gravel Mining

Gravel mining does not provide any substantial income and employment opportunities in the two counties. At the same time, gravel mines have very low assessed land value, at $12,816 per acre, compared to $30,817 for residential properties. This significantly

erodes the tax base of the counties. Besides, gravel mine operations are intensive road users for transportation of gravel, which puts an additional burden on the county and township roads. The river flows through several counties but only the lower two, Butler and Hamilton, were included in the study plan. These two are comparable since gravel mining is more intense on the riverbanks in these counties when compared with upstream counties. Data were gathered regarding property parcels located in the townships along the river.

According to the results of the hedonic price analysis of property values along the river, on an average, as distance to the gravel mine increases by one mile, the value of the property increases by $16,725. Total loss of residential property value proximity (one mile or less) due to gravel mines is $ 2.8 million. The total decrease revenue annually to the local government due to decreased property value resulting from proximity to gravel mining is estimated at $119,153 annually.

Further Research Needs

For more exact data, several areas of potential further research can be identified. However, the researchers are confident that the conclusions of this study are indeed quite conservative, are not biased towards optimism but rather if acted upon competently will exceed economic expectations.

One area is primary data collection. The data could be improved if further and more in-depth research could be carried out. Household demographics were not available from the parcel cards, and hence could not be included in the data set. Using only county auditors' parcel cards for measuring structural characteristics may have resulted in exclusion of some important characteristics such as architectural features, landscaping, elevation of the parcel, type of construction, other additions and built in structures etc. Personal interviews and individual assessments of homes would have allowed for more information regarding septic system facilities and variation between homes. This would allow for better estimates of the coefficients. With more time and financial resources, this additional data collection would be advantageous to the study.

Further research in estimating the second stage of the hedonic price function would be beneficial in estimating gains and losses in total economic welfare. The different legal, social and institutional rules that are critical in understanding the regulation of gravel mining, and ownership and stewardship of these industries could be useful. By using the marginal implicit prices and income, a demand function for these amenities could be estimated. Finally, the results from this research might be used to predict benefits accruing from such improvements in other river systems in other parts of Ohio. We look forward to discussing these results and further research implications with interested parties in the Great Miami region.