

The Contingent Valuation of Riparian Ecosystems along Recreational Trails

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Abstract

Ecosystem services are benefits humans receive from natural environments and are therefore valuable. Determining the economic value of environmental public goods can be difficult because environmental public goods are not bought or sold in a market. However, the valuation of ecosystems and ecosystem services is an important step in advocating for ecosystem restoration and conservation. One such environmental good of particular interest is the riparian ecosystem: a vegetated zone next to a waterway that reduces pollution, controls erosion, provides habitat for species, protects groundwater recharge, and manages flooding. Riparian ecosystems are particularly vulnerable to land development because of their inherent proximity to waterways; therefore, it is important to be able to communicate their value. Additionally, fishing licenses fund various efforts in the conservation of riparian ecosystems, so a potential policy implication that stems from this work will be the viability of recreationists as a source of support for riparian restoration and conservation efforts. In this study, an intercept survey was performed on four recreational trails located within riparian ecosystems in the Lehigh Valley, Pennsylvania, and the payment card method was used to estimate trail users' willingness to pay from survey results. Results show that trail recreationists are willing to pay \$25.79 annually for restoration of riparian buffers along recreation trails and \$24.94 annually for riparian conservation programs along recreation trails. Therefore, aggregate trail users at three of the trail locations are estimated to be willing to pay about \$7,574,704 for restoration and about \$7,325,053 for conservation annually. Findings suggest that recreationists can be targeted as additional sources of revenue for riparian restoration and conservation programs.

Keywords: Contingent Valuation, Riparian Ecosystem, Recreational Trail

1. Introduction:

Ecosystems provide human beings with valuable benefits known as ecosystem services. Multi-use trails put people in contact with ecosystems that allow them to experience nature, exercise, and clear their minds, improving both mental and physical health.²⁵ The trails in the Lehigh Valley are unique in that many of them border rivers and streams providing users access to waterways and also riparian ecosystems. Riparian ecosystems not only contribute a wide variety of ecosystem services that essentially protect water quality, but also are integral to the experiences recreationists have in trail environments. Therefore, the trails in the Lehigh Valley offer an ideal context to examine how recreationists experience riparian environments.

In practice, riparian ecosystems can be defined as areas of vegetation along streams that maintain healthy waterways. Areas of transition between land and water act as effective filters of harmful nutrients, sediments, organic matter, pesticides, and other pollutants before they reach the water.^{15,18,31} While riparian buffers serve as a habitat for many vulnerable species of amphibians, reptiles, mammals, and birds, they also protect habitats by stabilizing channel banks and preventing erosion.^{15,19} Furthermore, the shade provided by the ecosystems helps to keep water temperatures cool,

and the leaf litter from overhanging vegetation is a source of food for various aquatic organisms.^{15,19} The extensive ecosystem services afforded by riparian ecosystems go beyond environmental integrity, as buffers contribute numerous benefits to landowners. The protection of groundwater recharge areas allows for the replenishment of freshwater for local use, and the provisions of flood control and stormwater management protect homes and local infrastructure from extreme weather events.

The list of riparian ecosystem services attests to how important it is to conserve them both currently and for future generations. Unfortunately, the riparian ecosystem is one of the most degraded environments worldwide.^{15,21} The main contribution to the degradation of these ecosystems can be attributed to activities related to logging, agriculture, and residential development.³¹ The degradation of riparian ecosystems leaves streams vulnerable to the many chemicals, sediments, and other pollutants that are often byproducts of agricultural practices.^{15,18,31}

According to a study conducted by the Lehigh Valley Planning Commission in 2015, roughly one-third of the buffers in the Lehigh Valley are too narrow or are non-existent to be effective in protecting waterways.²⁹ This was most commonly a problem in urban and agricultural areas. While there are policies in place designed to protect water quality, and therefore stream buffers, they can fall short and are not always enforced properly. Federally, the Clean Water Act of 1972 required states to enact land use policy to control water pollution, but there is no federal policy that specifically addresses riparian buffer width.⁵

In 2010 the Commonwealth of Pennsylvania sought to strengthen riparian policy by making changes to Chapter 102 of the State Code, containing regulations surrounding erosion, sediment control, and stormwater management⁵. The changes required that there be a 150-foot wide riparian buffer within high quality and exceptional value watersheds as designated by the Pennsylvania Department of Environmental Protection⁵. In the Lehigh Valley, only 40.5 percent of the total stream length is designated as high quality or exceptional value, leaving 59.5 percent of the stream length unprotected⁵.

The gaps in state legislation show the importance of restoration and conservation programs to the maintenance of healthy waterways, riparian ecosystems, and the integrity of the environments along multi-use trails in Pennsylvania. Environmentally-focused institutions are able to successfully protect and maintain important ecosystems when legislation fails. While many organizations execute habitat restoration and conservation projects, this project takes inspiration from the Pennsylvania Fish and Boat Commission's efforts to amend Title 30 (Fish) of the Pennsylvania Consolidated Statutes which would allow them to raise the price of fishing licenses to generate enough revenue to continue to maintain Pennsylvania waterways to the best of their abilities.¹ The Pennsylvania Fish and Boat Commission has funded and carried out a variety of projects with the intention of improving habitats for aquatic wildlife to improve recreational fishing conditions. These efforts include coordinating the removal of dams and other blockages and providing technical guidance in stream bank stabilization projects to restore riparian ecosystems that will foster high quality fish habitat. By asking anglers to increase contributions to fund the commission's habitat improving initiatives, a wide range of other recreationists, such as walkers, joggers, and cyclists, are benefitting from habitat conservation programs without financial responsibility required of them.

A recreationist can be broadly defined as someone who engages in outdoor activities that occur in an urban, man-made, or natural environment.²² These activities can be either passive, such as taking a walk outdoors, or active, implying the use of nature (e.g. hunting or fishing). The intention of conservation is not necessarily to limit use, but instead to encourage sustainable use. What might compel a human being to resist the urge to exploit a natural resource and instead treat the resource with a conservation mindset?

Regular nature-based recreation activity contributes independently and significantly to pro-environmental behaviors.¹⁶ Heberlein argues that in order to effectively influence behavior, people need to have direct experiences.¹¹ His analysis suggests that the best way to increase willingness to pay for riparian restoration or conservation is to get people who already believe in sustainable land management practices interacting with them.¹¹ Because trail recreationists often interact with riparian environments it was hypothesized that they would be willing to fund restoration and conservation efforts. Accordingly, this paper assesses recreationists' willingness to pay (WTP) for riparian restoration and conservation, a way in which ecosystems are valued.

Environmental public goods are unique (because consumers do not pay for these services) so they cannot be valued using revealed preference, where value is calculated based on purchasing decisions. Therefore, the stated preference method was used to estimate non-use values of riparian restoration and conservation such as bequest value, altruism value, existence value, and option value.¹⁴ In a policy setting, public perception of monetary value has a strong voice, and that is justification enough for the use of the stated preference method.²⁷

Given that there is an abundance of multi-use trails bordering riparian ecosystems in the Lehigh Valley, trail users are experiencing and therefore perceiving benefits from the riparian ecosystem in intimate ways. Therefore, the Lehigh Valley provides an ideal context to expand on prior research by examining trail recreationists as a source of revenue.

The goal of this research was to use WTP values to answer the research question: What value do trail users assign to riparian habitats?

2. Methodology

Data collection started on October 17, 2018 and was paused on November 4th, 2018 due to weather-related complications and continued on March 30, 2019 until April 21, 2019. In total 196 surveys were collected, which allowed for robust statistical analysis.

In an effort to collect data from a range of recreationists in the Lehigh Valley, surveys were collected at four different locations. Two of the survey interception sites were located on the Delaware and Lehigh National Heritage Corridor (D&L). The closest of the D&L trail locations was the Delaware Canal State Park, in Easton, and the second location was at the D&L trailhead in Slatington, PA. The other two data collection locations were Jacobsburg State Park and the Plainfield Township Trail, both in Nazareth, PA. All four of the trail locations were chosen because they border riparian ecosystems that vary in size and accessibility. Of the three waterways bordering the trail locations examined both the Lehigh River and the Bushkill Creek have sections protected by the state code. The Little Bushkill Creek, however, is neglected because it is not considered high quality or of exceptional value. This is concerning given that robust riparian habitats along the Little Bushkill Creek could perhaps enhance the quality of the stream to be what policy makers would consider worthy of conservation status.

Data was collected in a paper-based survey format and was paired with interview questions about willingness to pay. Data was collected in three forms - hard copy survey responses, hard copy of interview responses, and refusal counts. All survey responses were kept anonymous by assigning each survey and interview response a number. The survey was printed in two font sizes to accommodate trail users who needed glasses to read. In an effort to keep the survey instrument at a reasonable length, multiple choice was used when possible.^{3,8} However, in order to avoid limiting potential responses, an “other” option was included in most closed-ended questions that allowed participants to fill in their own responses if they felt that the responses provided did not capture their true feelings.^{3,8}

An intercept survey method was used to gather responses in which trail users were asked if they would be willing to complete a survey as they were traveling on the trail. An intercept survey is a practical vehicle for gathering data and is considered a reliable survey method.^{10,13} Intercept surveys have been used as a successful data collection method in a number of outdoor recreation studies.^{9,10,23,25,33} Personal interviews have commonly been used in consumer research because they are useful for reaching a representative sample of local populations at lower costs while also avoiding selection bias.^{4,6,10}

To minimize bias and collect samples that represented the population of trail users in the area, it was imperative to attempt to collect a random sample.³ While data was collected at a number of stratified locations, dates, and times, due to adverse weather and scheduling difficulties, many additional data collection opportunities were added to the original schedule in order to collect a large enough sample to allow for robust statistical analysis. Therefore, the sample consists of a combination of convenience sampling and random probability sampling as is consistent with other similar work.¹⁰

Time of the day for surveying occurred anywhere from 10:00 am to 6:00 pm, and consisted of 1, 2, or 3 hour periods at the location depending on schedules and weather patterns. This timing optimized both daylight and warmer temperatures. In practice, interception involved a student volunteer and me going to one of the four trail locations wearing Lafayette College clothing to signal to trail users that as students our intentions were solely research-based. Surveyors positioned themselves near a well-trafficked and open trailhead because they were often stopping points, they allowed trail users a clear view of surveyors as they approached, and they were fairly easy locations to set up materials.

Solicitation of participants was limited to individuals 18 years or older to minimize the risk to human participants. If an individual appeared to be near the age of 18, they were asked to state their age when they were approached. If a participant younger than 18 accidentally took the survey, the option “17 or younger” was left on the survey as a potential response to the question regarding participants’ age. If “17 or younger” was selected the survey was discarded.

If a trail user crossed the imaginary “line of participation” they were politely approached and read, “Hello. I am doing research with Lafayette College; would you be willing to take a brief survey about the trail?” If the trail user refused, then their refusal was recorded in the form of tally marks on a refusal tracking sheet. Relevant refusal data included the type of refusal (no thanks vs. already completed), their mode of transportation (Walk/Hike, Jog/Run, Bike, Other), their gender, and their general age (<40, 40ish-60ish, and, >65). Refusal information was used to assess any potential non-response bias.²⁸ If the trail user agreed to participate then the survey was handed to them on a

clipboard and the surveyor waited until the trail users informed them that the survey had prompted them to ask for the interview portion of the survey. Upon completion of the survey, the participant was thanked and offered a granola bar. Each paper survey was marked with the date and location of data collection, as well as a number at the top that corresponded with a number recorded next to the respective interview data.

The survey consisted of important demographic and environmental attitudinal questions that allowed for comparisons across groups. The demographic characteristics section of the survey was adapted from surveys created by Beiler and by the New York State Office of Parks.^{3,20} The first section asked questions about the user's interaction with the trail, including the activities they participated in on the trail, the length of time they spent on the trail, and how often they visited the trail. All of these factors affect how the trail user interacts with the trail and the riparian ecosystem. Other demographic questions were asked later in the survey including gender, age, zip code of permanent residence, number of children, race or ethnicity, level of education, and income. All of these variables were compared with the demographic data collected by the US Census to analyze how representative the sample was in relation to the populations that live in the towns where data collection was conducted.

It was also important to examine previous perceptions of the trail, the cleanliness of the river, and environmental stewardship. Perceived cleanliness of surrounding rivers was measured using a Likert scale. Other questions attempted to value the sense of responsibility of the trail users, importance of the trail environment, perception of other trail users, and personal stewardship. Responses to these questions had the potential to influence WTP.

A particular concern with valuation methods stems from the fact that respondents are often uninformed about the ecosystem services and the general importance of the environments they are valuing.²⁶ To address this concern, the importance of riparian buffers was explained to the respondent because they should be able to determine how the scenario affects their personal welfare.¹⁴ A brief description of riparian buffers as well as a list of their ecosystem services was provided. The description read:

The Pennsylvania Fish and Boat Commission is an independent agency with the goal to protect, conserve, and enhance aquatic resources. Currently, the organization is partially funded by fishing licenses to protect and restore riparian buffers along rivers and streams.

A riparian buffer is an area with tall grasses, trees, or shrubs next to a waterway. Riparian buffers prevent pollution from entering the water, control erosion, provide wildlife habitat, improve groundwater recharge, provide flood control and storm water management by slowing the release of water into waterways.

Riparian buffers in the Lehigh Valley have been seriously impacted over the years. Residential development and farming practices have put stress on local streams through the destruction of riparian buffers.

This description does not offer a complete list of the many ecosystem services that are provided by riparian ecosystems. This was intentional, as it would take pages of complicated and scientific descriptions to communicate all of the potential benefits received from a riparian buffer. Also, one cannot standardize an ecosystem, so services can vary across ecosystems depending on composition.¹⁵ It was important to ask participants how much they knew about riparian buffers prior to reading this description to gauge if their knowledge of the environment had an influence on their valuing of it.

The method used to value riparian buffers was the contingent valuation (CV) method, a branch of the stated preference method. CV required giving a respondent a description of a scenario then following that description with a WTP question that relates to the described scenario. In order to estimate WTP, the payment card method was used because it is a well-regarded economic model that allowed maximization of precise willingness to pay estimates.³⁰

There are many components of a WTP question that should be included in a survey. It is recommended that the CV questionnaire should include: an introduction outlining the general context, a detailed description of the good, a description of the institutional setting, a clear statement about how the good will be paid for, a method to elicit respondents' preferences, debriefing questions that asked respondents to explain their responses, and finally, questions to obtain general environmental attitudes.^{4,7} All of these elements were included in the survey.

The survey instrument included a description of two separate scenarios. One involved the conservation of existing riparian buffers along the trails, and the other described a program that would restore riparian buffers along the trails' waterways. The baseline of the WTP scenarios was described as the existing conditions of the buffers bordering the trail. The current state of the riparian buffers at each survey location was used as the baseline, because it is difficult to standardize perceptions or riparian ecosystems. The baseline was also established and further clarified when a picture

of an area that existed without a riparian buffer was shown to the respondent as an example of what an area might look like before the PA Fish and Boat Commission restores the ecosystem. Questions were as follows:

“Suppose the Pennsylvania Fish and Boat Commission created a program that allowed users of the trails along waterways to contribute to their funds used to conserve existing riparian buffers along this trail. If unfunded, these riparian buffers would be unprotected from development, invasive species, and other threats. In exchange for annual membership dues, trail users would receive a stamp signifying that they had contributed to the conservation of riparian buffers along this trail. Please answer this question as if you had to actually pay for this service. If your contribution would be directed at efforts to conserve the current riparian buffers along the trail, would you be willing to pay \$ _____ for a yearlong membership stamp?”

\$0 \$1 \$2 \$3 \$5 \$10 \$15 \$20 \$25 \$50 \$75 \$100 \$150 \$200 \$300 Other \$ _____

“Suppose that the Pennsylvania Fish and Boat Commission offered you the opportunity to pay annual membership dues that would fund the purchase of land along this trail that currently exists without riparian buffers. The money would be used to plant native species to create a high-quality riparian buffer. In exchange for annual membership dues, trail users would receive a stamp signifying that they had contributed to the creation of riparian buffers along this trail. If unfunded, no new riparian buffers will be created along these waterways, and therefore areas of the river/stream without a riparian buffer will remain unprotected. Please answer this question as if you had to actually pay for this service. Would you be willing to pay \$ _____ for a yearlong membership stamp?”

\$0 \$1 \$2 \$3 \$5 \$10 \$15 \$20 \$25 \$50 \$75 \$100 \$150 \$200 \$300 Other \$ _____

As previous research suggests, the order at which WTP questions are asked can affect participant answers.¹² Therefore, the order in which these two questions were asked rotated with each respondent. To avoid starting point bias, starting bid amounts were rotated, either starting at \$1 or \$300. Then, using the payment card method, follow up questions were based on what the respondent had previously answered. For instance, if a respondent said they were willing to pay \$1, they would then be asked if they would be willing to pay \$2. Or, if a respondent said they were unwilling to pay \$300, they would be asked if they would be willing to pay \$200.

$$Midpoint = \frac{Lower\ Bound\ Bid + Upper\ Bound\ Bid}{2} \tag{1}$$

$$WTP_i = \sum Midpoint_i \tag{2}$$

To address the research question “What value do trail users assign to riparian habitats?” WTP values were found by averaging the midpoint between the recorded bid amounts (see equation (1) and equation (2)). For example, if a respondent indicated that their lower bound bid was \$3, and their upper bound bid was \$5, then that particular respondent was willing to pay at least \$3 but no more than \$5. Therefore, it could be assumed that the respondent’s true willingness to pay was between the lower bound estimate and the upper bound estimate.³⁰ So, \$3 would likely underestimate WTP and \$5 would likely overestimate WTP. Therefore, the estimate used in this paper would be \$4, or the midpoint between the estimates. The overall WTP for riparian conservation and restoration was calculated by averaging all of the midpoints between bid amounts collected. Proportion WTP was calculated by adding up the number of respondents who were willing to pay anything at all and dividing that number by the total number of respondents (see equation (3)).

$$Proportion\ WTP = \frac{\# \text{ people WTP at all}}{196} \tag{3}$$

Once the survey was developed and approved by IRB (approval number AY1718-12) on October 15, 2018, it was piloted that same day at Lafayette College.

3. Data

Out of the 284 people approached on the trail, 196 of them completed the survey for an aggregate response rate of 69.01 percent. Basic descriptive statistics are presented in Table 1. Responses were evenly distributed across male and female categories. However, males were represented in a slight majority of responses. Consistent with the demographic characteristics of respondents in surrounding areas, there was very little racial or ethnic diversity found at the trails.³² The vast majority of the sample identified as white (93.88 percent), while less than 6 percent of respondents identified as a traditionally minority races or ethnicities. While in both Slatington and Nazareth, where three of the survey locations are located, the vast majority of the population is white, there may be an overrepresentation of white respondents at the D&L Easton, given that only about 67 percent of the population identified as white.³² The average trail user was between 40 and 49 years old, and only 27.18 percent of trail users reported having children under the age of 18 in their care. Additionally, trail users were more educated when compared to regional education attainment, as the average trail users had received an Associate’s degree.³² Although the mean household income fell between two income brackets (\$50,000 and \$99,999), average respondents appeared to be wealthier than the average Nazareth, Easton, or Slatington resident.³² Only 15.9 percent of the respondents had made a previous donation to an environmental organization, and on average had previously donated about \$13.79 to those organizations. Additionally, trail users spent between 1 and 2 hours on the trail and visited about 2 to 3 times per week. Respondents perceived the cleanliness of the surrounding river or stream to be good but felt that they had very little knowledge about riparian buffers. On average, trail users reported their previous knowledge to be slightly more informed than “not at all informed.”

Table 1: Description of variables

Variable	Definition	Mean	S.D.
Female	male = 0; female = 1	0.4974	0.5012
Age	1=<17; 2=18-24; 3=25-29; 4=30-34; 5=35-39; 6=40-44; 7=45-49; 8=50-54; 9=55-59; 10 = 60-64; 11=65-69; 12=70+	6.5385	2.6089
Children	Binary variable = 1 if respondent has a child under age 18 in their care	0.2718	0.4460
Number of children	Number of children	0.4974	0.9271
White (non-Hispanic)	Binary variable = 1 if respondent identifies race/ethnicity as White	0.9388	0.2404
Black or African American	Binary variable = 1 if respondent identifies race/ethnicity as Black or African American	0.03060	0.1727
White -Hispanic/Latino	Binary variable = 1 if respondent identifies race/ethnicity as Hispanic	0.01531	0.1231
Asian	Binary variable = 1 if respondent identifies race/ethnicity as Asian	0	0
American Indian or Alaskan Native	Binary variable = 1 if respondent identifies race/ethnicity as American Indian or Alaskan Native	0.0120	0.1008
Other	Binary variable = 1 if respondent identifies race/ethnicity as “Other”	0	0
Donation	Binary variable = 1 if respondent had made any donations to environmental organizations in the past year	0.1590	0.3666
Donation amount	If donated, how much respondent donated	13.7948	76.1049
Education	1=did not complete high school; 2= High school diploma/GRE; 3=some college/technical school; 4=Associate’s degree; 5=College undergrad degree; 6=Graduate/Professional degree	4.0000	1.3698
Income	1=Less than \$25,000; 2=\$25,000 to \$34,999; 3=\$35,000 to \$49,999; 4=\$50,000 to \$74,999; 5=\$75,000 to \$99,999; 6=\$100,000 to \$149,999; 7=\$150,000 or more	4.6789	1.5282
How often visit the trail	1=almost every day; 2=3 to 5 times a week; 3=1 to 2 times a week; 4=2 to 3 times a week; 5=once a month; 6=a few times a year; 7=once a year; 8=it’s my first visit	3.9499	1.5779
How long spent on the trail	1=less than 30 minutes; 2=30 minutes to an hour; 3=1 hour to less than 2 hours; 4=2 hours or more	2.8469	0.7422
Perceived cleanliness of river along trail	Likert Scale (1=poor; 2= fair; 3=good; 4 = excellent)	3.3418	0.6247

Table 2 shows the frequency of respondents who reported a zip code for their primary residence within the respective county groups. An overwhelming number of respondents (130) indicated their primary residence was in Northampton County, followed by Lehigh County (43). It is not surprising that 89 percent of the sample falls within those two counties given that the D&L Easton, Jacobsburg State Park, and The Plainfield Township Trail are all located in Northampton County, and the D&L Slatington is located in Lehigh County. This shows that these trails were primarily visited by locals with a few exceptions. The lack of representation from counties other than Northampton and Lehigh prompted the aggregation of responses from “non-local” trail users.

Table 2: County of participants primary residence

County:	Northampton	Lehigh	Non-local
Frequency:	130	43	21

There was some variation in participants’ reasons for coming to the trail across locations. The most prominent use of both the D&L Easton Trail and Jacobsburg State Park was walking. Biking was most prominent at Slatington and respondents used The Plainfield Township Trail to enjoy nature more than the other activities. Very few trail users came to the trail to fish or specified another option. No respondents indicated that they came to the trail to swim.

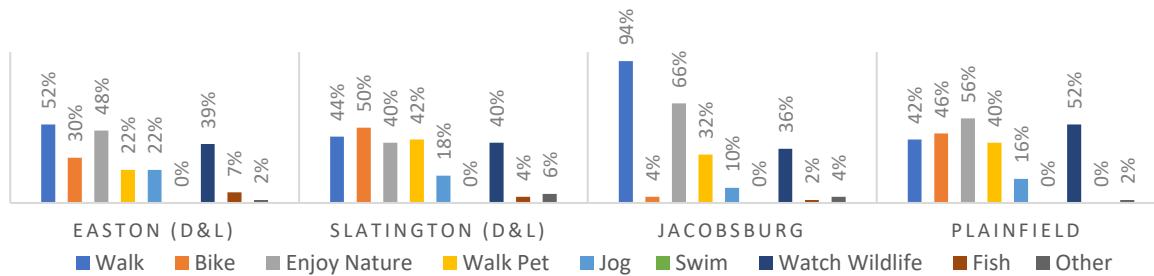


Figure 1: Trail use characteristics at the four various trail locations

When examining environmental attitudes, the average trail users agreed with pro-environmental statements and statements about trail importance (see Table 3 for results and scales). The two statements with the lowest average level of agreement from respondents were “Other trail users respect the environment around the trail,” and “I come to this trail to enjoy rivers and streams.” On the other hand, respondents were most likely to agree with the statement “conserving the environment is important to me.” Overall, respondents agreed with the environmentally-focused positive sentiments.

Table 3: Environmental attitudes and trail importance measured using Likert scale

Variable	Definition	Mean	S.D.
Sense of trail user responsibility	Trail users have a responsibility to care for the trail	4.4431	0.5972
	Trail users have a responsibility to care for the environment around the trail	4.4731	0.6191
Importance of the trail environment	This trail is important to me	4.4431	0.6908
	I come to this trail to enjoy the rivers and or streams	4.1677	0.8478
Perception of other trail users	Other trail users respect the environment around the trail	4.0240	0.7359
Personal stewardship	Conserving the environment is important to me	4.5928	0.5614

Note: All values measured on a scale 1-5 (1=strongly disagree; 2=disagree; 3=neither agree nor disagree; 4=agree; 5=strongly agree)

To find WTP for riparian restoration and conservation programs the average of the midpoint WTP values for each program was calculated (see table 4). The average lower and upper bound bid amounts are also shown. WTP did not differ much depending on the program that was described. In fact, results suggested that on average, trail users were willing to pay \$25.79 in annual membership dues to the PA Fish and Boat Commission for a restoration of riparian buffers and \$24.94 in annual membership dues to the same organization for a riparian conservation program along recreational trails.

The “Proportion WTP” results (Table 4) show the proportions of trail users who were willing to pay anything at all. While there is a slight disparity between values, if a person was willing to pay for one of the programs, they were likely willing to pay for both of them. Slightly more trail users (82.14 percent of the sample) were willing to pay for a conservation program than the restoration program (80.61 percent). Conducting an analysis of variance with a Tuckey post-hoc test showed that there were no significant differences in average WTP across study locations.

Table 4: Average willingness to pay values

Model:	Restoration				Conservation			
	Lower Bound	Midpoint	Upper Bound	Proportion WTP	Lower Bound	Midpoint	Upper Bound	Proportion WTP
Mean	\$20.641	\$25.79	\$31.16	0.8061	\$19.40	\$24.94	\$36.4847	0.8214
S.D.	(31.4663)	(37.0404)	(42.8975)	(0.3963)	(24.1847)	(30.1870)	(36.3564)	(0.3840)

In order to estimate potential revenue generation from trail users to restore or conserve riparian ecosystems, estimates for how many trail users visit the trails each year were acquired. Raw data counts were collected through trail counters by the D&L. Trail counters tend to have significant errors; therefore, an hour calibration was conducted for both the Easton and Slatington D&L locations.³ Raw data was divided by the average number of times a trail user passed the counter during their time on the trail. Table 5. Calibration is not perfect, however, and can only minimize trail counter errors.³ Counters only count number of visits, not number of visitors, so it is possible that it counted visitors more than once per year. It should be taken into consideration that it is unknown how Jacobsburg State Park calculated its trail use calculation, and therefore the number may not be accurate. Additionally, Plainfield Township Trail has not collected estimates for annual trail use. Therefore, aggregate WTP values of trail users only includes three of the four trail locations. Aggregate trail use estimates are expressed in Table 5.

Table 5: Estimated aggregate number of visits to the trail locations annually

D&L Easton	D&L Slatington	Jacobsburg State Park	Plainfield Township Trail
34,579	34,128	225,000	Unknown

Using the aggregate trail use estimates and the average WTP amounts, an estimated aggregate WTP was found. Given that the WTP value was \$25.79 for restoration and \$24.94 for conservation, aggregate trail users are willing to pay about \$7,574,704 for restoration annually and about \$7,325,053 for conservation annually.

4. Discussion

By placing a monetary value on the riparian buffer, it has been given a place in cost benefit analysis. This has the potential to justify, through valuation, decisions to degrade the riparian buffer, rather than restore or conserve it. However, valuation can be justified by the fact that valuation is taken seriously in a policy setting. One cannot defend the environment they are representing if they are unable to communicate its value in a way that everyone in the decision-making process can understand. Contingent valuation is reliable enough to be used and accepted in court and therefore is an appropriate method to communicate the value of an environmental public good without a market.^{2,17}

A potential limitation to this work is whether or not it has external validity given that the 196 responses were collected using both random and convenience sampling methods. Additionally, respondents were wealthier, disproportionately white, and more educated than the general populations of the towns where the trails were located.³² However, this was a comparison between observed trail users and the population of the trails’ locations, not a

comparison of respondents and the trail user population (this data was unavailable). A similar study found that trail users on three trails in Texas were a majority white, educated, and of higher income when compared to average local demographics.²⁵ Therefore, perhaps respondents represented the trail user population after all. Regardless, using the results of this study to justify environmentally-oriented ordinances should be approached with caution.

The finding that the valuation of restoration and conservation programs were very similar could mean that respondents actually value these programs similarly or that they do not understand the difference between them. Therefore, future studies could add more detail to their questions about the programs or add a question about how confident the respondents are in their understanding of the differences between the two programs.

Findings could be used to justify and gain support for riparian restoration or conservation campaigns and to estimate potential fundraising abilities from trail recreationists. Additionally, valuation can justify riparian restoration or conservation along the waterways that border recreational trails. The benefit trail users receive from those programs is expressed in their willingness to pay for them, and therefore, organizations can be confident that riparian restoration and conservation programs do provide benefits to trail recreationists.

This study did show that trail recreationists are in fact willing to fund riparian restoration and conservation programs, and targeting them could generate important additional revenue for organizations attempting to fund riparian programs. While the total revenue from fishing licenses for the Pennsylvania Fish and Boat Commission is about \$25 million annually, expenditures have increased by \$8.2 million since 2005.²⁴ This has required them to cut costs and they are in search of new sources of revenue.²⁴ This study has shown that more than \$7 million could be generated annually from trail users for two important riparian programs at just three trail locations in the Lehigh Valley. Therefore, it is suggested that organizations like the Pennsylvania Fish and Boat Commission who are seeking revenue for riparian programs reach out to trail recreationists in general, not just anglers. In conclusion, there is a real opportunity for organizations to successfully generate revenue from trail recreationists to fund riparian restoration and conservation programs.

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