



Calculating Cultural Ecosystem Services as part of Greenspace Management?

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	ABSTRACT
<p>2019 Research Leap/Inovatus Services Ltd. All rights reserved.</p> <p>DOI: 10.18775/jibrm.1849-8558.2015.44.3002 URL: http://dx.doi.org/10.18775/jibrm.1849-8558.2015.44.3002</p>	<p>Lake related greenspace provides many benefits to residents and visitors, which often get unnoticed. The Millennium Ecosystem Assessment Project (2005) proposed the valuation of ecosystem services, defined as regulatory, provisional, ecosystem support, providing cultural services from natural resources, free of charge. The challenge here is: How can we use cultural ecosystem services derived from scenic landscapes for greenspace management and assessment?</p> <p>Cultural ecosystem services received international recognition as part of the Millennium Ecosystem Assessment Project (2005). Also, ecosystems services encompass regulatory, provisional and ecosystem support. For this article, we are particularly concerned with cultural services, which include recreation, science and education, spiritual/historical as well as aesthetic functions. De Groot (2002) and Farber (2006) provided descriptions of cultural Ecosystem services. De Groot (2002) describes Information functions as comprising of; aesthetic information, recreation, cultural-artistic information and spiritual/historical information. Farber (2005) description of cultural services includes; aesthetic, recreation, science/education, and spiritual/historical functions.</p> <p>This article examines the existing literature with the objective of assessing ecosystem cultural services related to water-based scenic landscape resources and applies it to an Upstate New York lake landscape. Careful accounting of greenspace ecosystem services is presented as applied to lakeshore residents, village residents and town/watershed residents and other lake greenspace users utilizing the US Environmental Protection Agency’s user benefit calculations to yield over 10.6 million dollars of benefits per year (Smardon 2018).</p>

1. Introduction, Background, Literature, Study Goals & Objectives

Cazenovia Lake provides multiple economic and non-economic benefits to the greater Cazenovia community. A study conducted in 2017 was designed to quantify those benefits, to the extent possible, in monetary values. Additionally, that study sought to determine how the community currently valued the lake. Driving this study was concern about the health of the lake within the community, and a need to better understand the impact of a healthy lake on the local economy. In the context of greenspace value assessment –such studies can improve the methodology for assessing values of such resources for the population at large.

Much of the literature supporting the ecosystem service methodology is in a previously published paper by Smardon (2018). This includes background on the measurement of ecosystem services plus assessment methods for water recreation, waterfront property values, water aesthetic values, and water quality improvement. All of these methods are

important for assessing value streams of waterfront green space.

Methods

The methods utilized for the assessment of values derived from Cazenovia Lake included:

- Identification of direct and indirect benefit revenue streams;
- Identification of appropriate valuation methods for each benefit stream, or entity within a stream;
- Data gathering and analysis for all identified benefit streams;
- Data collection and analysis of businesses, clubs, events plus outreach by phone and email;
- Data collection for water-based recreational activities plus outreach and research for each activity;
- Geographic Information System (GIS) property tax assessment data collection plus real estate sales comparisons;
- Comparison of Cazenovia lakefront to non-lakefront properties to establish lake benefits from property values;

- Comparison of properties within Cazenovia Township to determine lake influence related to tax benefits; and
- Comparison of Cazenovia tax rates with other local municipalities.

A public survey was designed and conducted in order to determine community attitudes, participation and values concerning Cazenovia lake.

Identification of Direct and Indirect Benefit Revenue Streams

The first step was to identify all the direct and indirect benefit revenue streams that could be associated with the presence of the lake. A lake-related benefit matrix was created utilizing the US EPA Final Ecosystem Goods and Services Classification System (Landers and Nahilk 2013) for the general classification of activities. Next, the recreation-related activities, including the usage of settings and benefits were collected from the US Department of Interior Bureau of Reclamation Water and Land Recreation Opportunity Spectrum (WALROS) system (USDI, BR 2011). This system was used to classify all sort of activities benefiting from a lake or visual proximity to the lake. Beneficiaries may also benefit from their proximity to the lake watershed, although not from the lake itself. These lake-related benefits are meant to provide a holistic view of advantages for those adjacent to the lake, those living within the lake watershed as well as visitors and other lake watershed users have a year in and year out.

Activity category	Setting	Beneficiary experience	Benefit	Economic indicator
Resource-dependent business				
Marina	Lakeside presence	Water access	Water access	Sales +
Restaurant	Lakeside presence	Water views	View access	Expenditures
Agritourism	Lakeside presence	Water views	View access	Sales +
Recreational activities				
Motor boating	Dock/launch	Water experience	Water experience	Expenditures
Personal water craft	Launch point	Water experience	Water experience	Expenditures
Sailing	Launch point	Water experience	Multi-sensory	Rental cost
Paddleboard	Lake access	Water experience	Multi-sensory	Travel cost
Kayak/canoe	Lake access	Water experience	Multi-sensory	Travel cost
Swimming	Beach access	Water experience	Multi-sensory	Travel cost
Fishing/ice fishing	Water access	Water/ice experience	Multi-sensory	Expenditures
Wildlife viewing	Lake access	Viewing wildlife	Multi-sensory	Travel cost
Lake edge cultural activities				
Picnicking	Lake edge parks	Water views	Relaxation	Travel cost
Tennis/volleyball	Lake edge location	Water edge views	Relaxation	Rental cost
Foot races	Lake edge course	Water edge views	Relaxation	Travel cost
Bicycling/touring	Lake edge roads	Water edge views	Relaxation	Travel cost
Festivals	Lake edge location	Water edge views	Relaxation	Travel cost+
Inspirational activities				
Weddings + other events	Lake edge location	Water edge views	Presence	Event cost
Art related activity	Lake edge location	Aesthetic inspiration	Inspiration	Travel cost
Learning activities				
Historic interpretation	Lorenzo State Park	Historic understanding	Historic experience	Travel cost
Educational trips	Lake location	Educational understanding	Educational experience	Travel cost
Research	Lake location	Research opportunities	Educational experience	Travel cost
Municipal operations/revenue				
Residential owners	Lakeside	Lake environment	Lake access	Property value
Ecosystem services—regulatory				
Maintain water quality		Water related activities above		Water quality treatment
Nutrient retention		Downstream water quality		Water quality treatment
Sediment retention		Downstream water quality		Water quality treatment
Carbon storage		Reduced CO ₂		Climate change mitigation
Ecosystem services—production				
Water supply	Lakeside residences	Drinking water		Replacement cost
	Erie Canal (historic)	Water level		Replacement cost
Ecosystem services—support				
Aquatic habitat		Fish and wildlife		Enhancement
Food chain		Sustain fish and wildlife		Enhancement
Ecosystem services—cultural				
See recreational-cultural-inspirational-educational activities above plus				
Public views of the lake		aesthetic enjoyment		Viewer numbers
Existence value		Knowledge of existence		Option value

Table 1: Cazenovia Lake value stream classification. Source: Smardon 2018 p. 64

Overview of Cazenovia Lake Benefit streams

The following outlines the Lake Cazenovia benefit flows to the Greater Cazenovia township/watershed area. Some of these benefit flows, like resource-dependent businesses and recreational activities, have quantifiable economic benefits. The others, such as inspirational, learning activities, and *ecosystem services* are more difficult to quantify or translate to economic benefits. Initially, the more direct economic benefit streams were described and then the more indirect or less quantifiable ones were listed.

- *Resource dependent businesses* include services provided by such estates as lakeside marinas, restaurants and agritourism facilities located near the lake, attracting visitors due to its landscape and location. Sales and expenditures from visitors drawn to lakeside location, lakefront community identity and landscape are considered to be economic indicators.
- *Recreational activities* represent a benefit stream due to physical and sensory lake access. They usually have a seasonal aspect.
- *Lake edge cultural activities* do not require physical access to the lake, only visual proximity. Both sets of activities can be quantified by their on-site expenditures and travel cost.
- *Inspirational activities* involve special events, such as weddings or other celebratory events taking place near the edge of the lake, having visual access to the lake. On-site expenditures and travel costs can be used to quantify this benefit flow.
- *Learning or educational activities* are similar to the inspirational activities, they are considered to be ‘place - related’ to the historical heritage of Cazenovia Lake. The major draw in this regard is the **Lorenzo State Park**, but there are other cultural, historical and ecological attributes related to the lake. Visitors’ travel costs can be used to calculate benefit flows.

Lakeside Property Values: One of the major benefit flows includes the convenience of lakeside property owners. The literature (Smardon 2018) supports the increase in property values due to physical proximity and water sight. This translates to a higher value for these lakeside properties and higher real estate tax revenue for the Village and Town of Cazenovia.

Ecosystem Services: Another benefit flow array is what we call *ecosystem services*. Such can be defined as those functions of natural resources that provide an advantage but do not include an economic cost. Ecosystem services can be divided up into *regulatory* (improving water quality), *provisional* (providing drinking water), *ecosystem support* (habitat for fish and wildlife), and *cultural* (aesthetic, education and recreation).

Identifying appropriate evaluation methods for each revenue stream

The second step was to identify evaluation methods for each benefit revenue stream (see Smardon & Gavitt 2017). For each category of benefit revenue stream, and often for each subcategory or specific entity within a revenue stream, unique methods are required to determine the generated value that can be associated with the lake's health. This led to the design of a multi-prong approach to gathering data and the design of specific formulas for the application of data when determining relevant value relevant to each contributing business, event, activity, or overall revenue stream (see table 1).

Detailed quantification methods used for each revenue stream were developed for:

- Resource dependent businesses such as marinas, restaurants and agri-tourism;
- Recreational activity including; motor boating, personal watercraft, sailing, paddle boarding, kayak, canoe, swimming, fishing, ice fishing, and wildlife viewing;
- Lake edge activities such as picnicking, tennis/volleyball, bicycling/touring, festivals and day camps;
- Inspirational activities such as weddings, events and art-related activity; and
- Learning activities such as historic interpretation, educational trips, and lake-related research.

Lakeside Property Values:

A comparison of community tax assessments and real estate values to a comparable non-lakefront community was done in order to establish the presence and influence (or absence) of a lake influence factor on real estate values. We used a *hedonic method* for analysis of local properties benefiting from the proximity of the lake. The ultimate goal was to establish the relationship between lakefront properties and lake influenced properties associated with the positive valuation of the lake. GIS tax data from 2015 was utilized for this purpose and confirmed by the recent real estate sales comparisons.

Ecosystem Services such as regulatory, production, support and cultural services are accrued for an entire lake watershed system at \$85/per household, based on the meta-analysis by Campbell et al (undated), an international survey of ecosystem functions or lake benefits.

Water supply: This was a calculation of approximately 30 homes currently using lake water for household purposes, with an estimated \$10K cost of water supply replacement wells.

Data Collection and Analysis

Based on the analysis of direct and indirect benefit revenue streams, the authors made an effort to identify the businesses, parks, activities and clubs belonging to the previously identified

categories of revenue streams. A targeted survey was conducted to identify the numbers of participants, services, etc. from each entity. Detailed spreadsheets were constructed to tabulate data as it was collected. Survey methods included direct phone calls and emails. Participants from the local municipality, chamber of commerce, local restaurants, state historic sites, clubs, hotels, etc. were asked specific questions regarding the total annual number of users and, where possible, estimates were given regarding users' spending. This data collection could not have been done without the assistance of a person familiar with the functioning of the local community. It is also important to note that information privacy was guaranteed for all entities sharing information with us.

Businesses, Clubs and Organized Events

Direct and indirect revenue was calculated from lake-dependent businesses such as water recreation, lake-view restaurants, breweries, wineries, and lake-dependent tourism (historic, cultural, agri-tourism). This included revenue quantification from businesses such as boat rentals, restaurants, inns, as well as recreation-based clubs. Lake-dependent or lake influenced activities such as races, concerts, special events and weddings were itemized. Each key informed individual was contacted with specific data request that would assist us in quantifying the associated revenue streams. It was important to gain a complete understanding of each facility and to figure out all the ways in which it was contributing to the economy. Very specific information was collected regarding fees, the number of users, frequency of events, and distance patrons were traveling.

Then, based on the type of business, club, activity or event, we determined an evaluation formula. For instance, restaurants were asked how many meals they served per year, and those numbers were multiplied by the average cost per meal. Additionally, estimates were made on the proportion of out-of-town customers served, and travel costs were applied proportionately. Those expenditures were then multiplied by a *lake influence percentage factor*. For instance, a restaurant on the lake would have a greater percentage of its revenue associated with the lake than a restaurant nestled within the lakefront community, but not located directly on the lakefront. For the purposes of this data collection, privacy was ensured for fiscal data. Many contacts reported very specific data, while others chose not to disclose revenue. In cases where data was not disclosed, we made an effort to compare with like organizations that have disclosed data. We used publicly available information, such as published prices, as assistance in our quantification. While we kept very specific data in a complex matrix for calculations, we only shared cumulative benefit revenue streams with the public in our report (Smardon & Gavitt 2017).

Water-based Recreational Activities:

For estimated revenue streams for water-based recreational activities such as swimming, fishing, boating, kayaking, wildlife sighting, etc. we investigated participation numbers and applied an experiential *value* per user based on researched data and *travel cost* estimations. We were able to make use of records and general observations, with the previous and current surveys. In cases where these activities also required investment in equipment, or storage fees (such as boating), those costs were established during contacting local businesses and organizations, and then input into an extended matrix, to ensure no costs were “double-counted”.

Property Value Comparison Assessment:

For this part of the study, we wanted to determine the extent of fiscal impact Cazenovia Lake has on surrounding property values and how that translates to a community benefit in the form of property tax contributions. First, we had to establish that the lake indeed creates higher levels of value. Secondly, we had to isolate that benefit in a quantitative way. We used the *Hedonic Method* for these purposes.

Lakefront community / Non –Lakefront Community Comparison:

First we compared the Town of Cazenovia with a local non-lakefront community. For this municipal comparison, the Town of Sullivan (with the Village of Chittenango residing within) was selected to measure property value differences. This municipality was selected because it has a similar (slightly closer) commuting distance to the regional hub of the Syracuse industrial and business area. While this community possesses some lakefront properties on the far northern boundary fronting Oneida Lake, the community/village itself is not centered around or particularly close to a lake. Since it is located in a similar direction from the city of Syracuse, it can be assumed that residents from both Sullivan and Cazenovia townships have similar access to jobs, shopping, and other cultural and utilitarian services of the regional center. The fact that the town of Sullivan has only one established village also makes it comparable to the Town of Cazenovia. The overall rural character is similar as well, with the largest difference being the flatter terrain of Sullivan.

We were able to access GIS data including tax assessments for all properties in both townships for the year 2015. We also obtained available data of most recent real estate sales for comparable housing from a local real estate agent to confirm the differentials from the tax data. We were able to establish from this data the differences in values between the two communities.

Property Zone Assessments: We also extracted the local differential in real estate values associated with the proximity to the lake. To accomplish this, we assigned all properties in

the town of Cazenovia to one of four zones. The first zone (Lake Frontage) consists of all property with direct frontage on Cazenovia Lake. The second zone (Lake Influence) consists of properties in close proximity to the lake, have views to the lake, or to lakefront homes. Properties assigned to this zone had road frontage on the main roads that circle the lake or land between those roads and Lake Frontage properties. The roads include Forman St. to East Lake Road to North Lake Road to West Lake Rd. to Rt. 92 (Syracuse Rd) to Rt. 20 (Ledyard Ave.). The third zone consists of all remaining properties that fall within the village limits. The fourth zone consists of the remaining Town of Cazenovia parcels. We again employed GIS data mapping and property tax assessment information from 2015. We were able to isolate data by zone and compare zones to each other. Each zone was analyzed individually for total assessed value as well as the average assessed value.

To determine a value benefit, we calculated the difference in property tax contributions for the lakefront and lake influence zone properties, compared to an alternate scenario where those same properties were assigned the average real estate tax assessments of the remaining zone 3 and 4 properties. The collective amount the Tier 1 and 2 properties pay above the average was treated as lake benefit revenue.

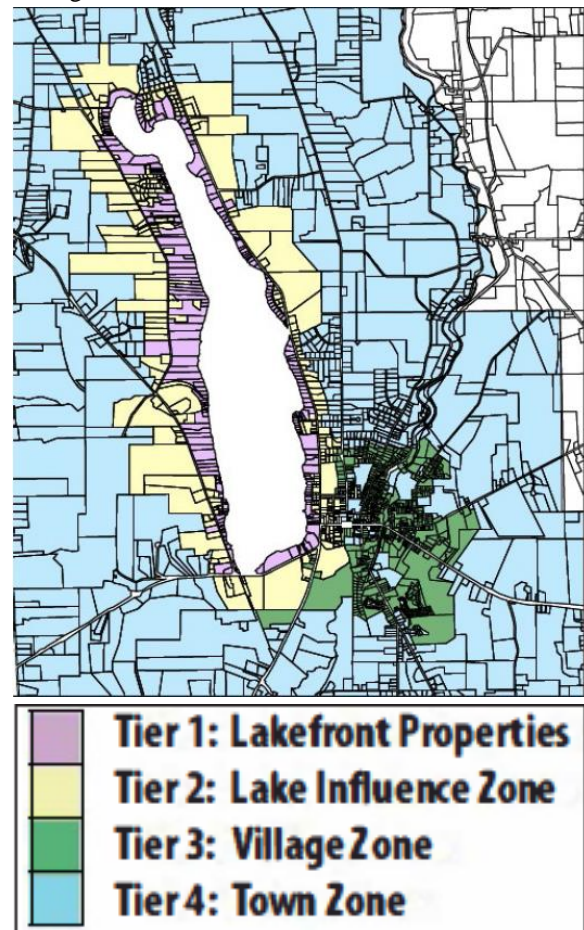


Figure 1: Area map of Cazenovia Lake showing major zones.
Source: Smardon & Gavitt 2017

Community tax rate comparison

After generating findings of the tax benefit for the community associated with higher property values near the lake, we did a comparison of local property tax rates for surrounding communities, including lakefront and non-lakefront communities. We wanted to see if there was a correlation between overall lower tax rates for lakefront communities. We were able to find data and publicly available information on several local municipalities to draw comparisons and correlations to other lakefront and non-lakefront communities.

Public Survey

A random survey (stratified for lake edge, village and town residents) was designed to determine how the community members valued the lake. The objective was to gain a better understanding of the public's use of the lake, perception of the lake, and values pertaining to lake issues. Most importantly, we hoped to gain an understanding of how much it is worth to local residents to maintain the health of the lake. For this particular question, we employed the *willingness-to-pay* method to determine how much residents were willing to tolerate in increased taxes to prevent lake quality degradation, such as a decrease in water quality, decreased ecological health and habitat, increased shoreline development, and increased water-based recreation activity.

Survey Design and Administration: The survey was created and implemented through the website service SurveyMonkey.com. Once the survey was compiled and tested, it allowed for data collection. A front-page article in the *Cazenovia Republican* as well as outreach through social media was used to publicize the survey. This method of distribution yielded 272 completed online surveys. The survey was also produced in print copy for face-to-face data collection within the Village of Cazenovia. This survey was made available at the local public library. Students also staffed tables outside the local drugstore to distribute surveys. 44 hand surveys were collected. In total, 316 surveys were completed. Local residents of the Cazenovia Township and village completed most of the surveys, with a handful from neighboring communities. Just over 20% of the respondents indicated ownership of Cazenovia lakefront property.

Results

The results of the value stream analysis for the Cazenovia Lake regarding waterfront, village and town residents amounted to more than \$10.5 million a year. Significant contributing streams include the resource-dependent category that included local businesses. Local property tax revenues associated with the increased property values were \$3.6 million a year. Expensive waterfront properties contributed to town and village services and also allowed a lower tax rate overall.

Main results from the web-based survey included:

- In respect of lake function - most respondents indicated that maintaining water quality and aquatic wildlife habitat was most important;
- In terms of frequency of lake-related activities –the highest percentages pertained to passive recreational activities, such as walking near the lake and observing the wildlife;
- In terms of lake management - the highest statement of concern involved the maintenance of water quality, the lake's contribution to the quality of life, and the lakes economic benefit contribution;
- For a hypothetical tax increase - all survey respondents were willing to pay to maintain water quality and controlling aquatic nuisance vegetation;
- In terms of survey background – a surprisingly high percentage of residents are part of an environmental or civic not-for-profit which indicates a high degree of civic involvement.

Discussion and Conclusion

This study supports the feasibility of assessing ecosystem services and multiple value streams of a freshwater lake to the immediate lakefront owners, visitors and lake users, village residents and town residents. This lake provides substantial value streams to all users and even town residents who do not use the lake directly each year. Such an approach can be used to assess other green and bluescape areas. In this case, the supporting foundation anticipated that the lake provided such benefits beyond the advantages immediate lakefront property owners harvest and, therefore provided a rationale for broad community support to maintain the ecological health of the lake.

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