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The Legacy of the Historic Canal System in Central New York: Evaluation of Cultural Ecosystem Services in the Lower Mohawk River, NY

Madison Corbeil
University at Albany, State University of New York

The Legacy of the Historic Canal System in Central New York: Evaluation of Cultural Ecosystem Services in the Lower Mohawk River, NY

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Madison Corbeil

Research Advisor: Alexander Buyantuev, PhD.

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Abstract

The canal system of New York State served as a catalyst for industry and generated a significant amount of revenue over the course of its useful life as a public work. However, with the emergence of faster, more efficient methods of transport, much of the canal was abandoned or filled during the early 1900’s.While these portions of the canal no longer offer their former economic value as a trade route, the land they once inhabited continues to serve the surrounding communities in a variety of ways. This paper in particular focuses on the Cultural Ecosystem Services provided by the land on and around the canal path as seen through a modern lens. Using the USGS generated software, Social Values for Ecosystem Services (SolVES), we evaluated the predetermined study area for both recreational and aesthetic value. The findings of the study indicate that the land areas associated with historic canal features have relatively high recreational and aesthetic values, supporting the hypothesis that sites of historic significance continue to provide social benefits long after their originally intended purpose has been fulfilled.

Acknowledgements

I would like to thank my research advisor Alexander Buyantuev for the countless hours he has spent working with me on the development and execution of this project. I have learned a great deal from him and appreciate his patience and dedication to ensuring my understanding of the concepts and software used in this project. I would also like to thank the Stormwater Coalition of Albany County for inspiring this project and for their unwavering willingness to share any data or information I required. Finally, I would like to thank my family for their constant support and encouragement to push through any challenges that I have faced.

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Background and Introduction

The construction of the Erie Canal (also known as Clinton's Ditch) has spurred massive development in the early stages of the industrial revolution in the US, which allowed for the mass transportation of goods across New York State. The canal became the largest artificial waterway of its time spanning 363 miles from Albany to Buffalo. As a public work, the canal was of great economic value both in the physical sense but also for the value that it generated through increased trade productivity. It helped to establish New York City as a center of commerce and contributed to its evolution into the booming financial center that it is today. The cost of constructing the original Erie Canal was a little over 7 million dollars with a return on investment period of about 10 years. (Fast Facts, 2018). During that period, user fees on the canal generated a sizable income and by the time the tolls were eradicated in 1883, the state had accrued over 121 million dollars in revenue. (O'Shea, 2001) Little more than a decade after its opening, the Original Erie Canal had become a booming success, with high traffic and overwhelming demand. To keep up with this increasing demand, the canal was enlarged from 40 to 70 feet wide and deepened from 4 feet to 7 feet. This enlargement included the incorporation of more durable materials and a more convenient lock system that allowed for more efficient transport.

In addition to its contribution to trade and commerce, the Erie Canal also acted as a catalyst for the academic and technological advancements of the period. It served as a blueprint for future expansions of the Canal System in New York State and was a breakthrough in technology. The Erie Canal featured an engineered lock system that was far more comprehensive than any that had come before it. This was largely due to the challenge of scaling an elevation change of 571 feet from Albany to Buffalo. The task of designing and constructing the Erie Canal provided the impetus for one of the first hands-on schools of engineering. At the time, West Point housed the only formal engineering program in North America. The development and planning of this massive public work provided the real world demand necessary to encourage the growth of a relatively young field. The growing need for engineering minds spurred by the construction of the canal helped contribute to the establishment of Rensselaer Polytechnic Institute in Troy, NY in 1825 (Engineering, 2018).

The social and cultural impacts of the Erie Canal can also be observed by looking at the increased growth and development of cities and towns along its route. The canals served as a fast-growing job market for middle to lower class Americans who could find work as canal laborers. Furthermore, increasing traffic nurtured the development of the cities and towns along its route to support the growing canal industry. Many of these communities experienced rapid population growth following the opening of the canal as immigration west became more easily achievable. The creation of an artificial waterway also added recreational value to these communities. In the warmer months, people often took canal rides for leisure while in the winter months, ice-skating on the frozen canal became a popular activity (Morganstein, 2001).

While the Erie Canal is by far the largest canal to be built in the early 1800s, it was not the only publicly funded waterway built around that time. The Champlain Canal, built during the same period, also acted as a catalyst for economic growth and development along its route. Much smaller in scale than the Erie Canal, the Champlain Canal stretches 60 miles from Whitewall to Waterford connecting the Hudson River to Lake Champlain. It was opened for use in 1823, two years before the Erie Canal, and was later enlarged several times to accommodate increasing demand. The Champlain Canal intersects the Erie Canal at the junction in Cohoes. When the Junction was later moved south during the Erie Canal enlargement a portion of the Original Erie Canal was actually absorbed by the Champlain Canal.

It is clear that the Erie and Champlain Canals served as successful innovations as public works. However, due to evolving technology, the demand for these canals was relatively short lived. The construction of the Barge Canal in 1921 rendered the Erie and Champlain Canals for the most part unnecessary and following its opening, the two were largely abandoned or filled in. This begs the question of the continued value of iconic public works such as the Erie and Champlain Canals after they have reached the end of their useful life, in terms of their originally intended purpose. While these Canals are no longer a major method of trade, some of the canal infrastructure remains intact and still exists today.

Many of the areas once traversed as canal routes have undergone significant land use changes over the past century and now serve their home communities in a way that is vastly different from their active years as a thriving canalway. This does not mean that the value of this land has been lost, but rather its function has changed. This research aims to investigate how the ways in which the neighboring communities utilize and appreciate this land have changed since it was retired as a trade route. This involves an exploration of how we as humans measure the value of land and its services. While the Canal is no longer generating financial gain through trade, the land it inhabited has inherited an intrinsic social, historical, and cultural value. The land itself may serve the community by providing recreational space, increasing green space in urban environments, or aesthetic beauty. These so-called "Ecosystem Services" services are often intangible or difficult to quantify but recent progress in methodologies and software makes it possible to conduct detailed assessments of these services.

The topic of Ecosystem Services is a wide reaching field of study targeted at measuring and quantifying the value that ecological systems provide to their surrounding communities and how that value contributes to the human experience. In 2001, the United Nations Secretary-General

Kofi Annan launched the Millennium Ecosystem Assessment (2005) in an effort to provide a framework for evaluating the influence of ecosystem changes on human life. The assessment also helps to provide a guide for effective ecosystem management, taking into consideration the importance of Ecosystem Services. The report defines Ecosystem Services as, "benefits people obtain from ecosystems" (Millennium Ecosystem Assessment, 2005). This umbrella term is then further broken down into 4 subcategories including Provisioning, Regulating, Cultural, and Supporting services. For the purpose of this project, the focus is mainly on Cultural Ecosystem Services (CES) defined as "the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences" (Millennium Ecosystem Assessment, 2005).

The term Cultural Ecosystem Services (CES) include scenic views, public parks, sites of historical significance, etc. While these features are generally regarded as assets within communities, often they are not included in formal assessments on the value of the land, as the services they provide can be difficult to quantify. One of the main challenges in evaluating Ecosystem Services is the variability of attitudes and preferences among populations when it comes to what they hold dear. The social and cultural capital that a land area offers is directly correlated with how strongly the surrounding community desires and values these services. This notion that increasing demand leads to an increase in value is a universal rule that can be observed frequently in a capitalist society. Therefore, it is important that human preferences be included when attempting to quantify the value of ecosystem services.

Another important aspect to consider is how accessible the area providing the service is to a given population. Even if one can establish that there is existing demand for a certain service, the service becomes much less valuable if it is difficult to access and take advantage of. One way to measure the accessibility of an ecosystem service is to use physical factors such as its distance from the population of interest and the effectiveness of transportation to and from the area. This could also be accomplished through surveying the population to gain insights on the subjects' perceptions of the area's accessibility. Furthermore, incorporating both methods could identify any incongruence between perception and reality and in turn reveal untapped Ecosystem Service opportunities.

A 2017 study by Hegetschweiler et al investigated the relationship between supply and demand factors when evaluating Cultural Ecosystem Services. The paper considered a culmination of studies utilizing a combination of environmental and survey data to assign Ecosystem Service values with a focus on recreation and aesthetic values. The study found that "In general, social and environmental values and visitor perception or evaluation of a site with its features and infrastructure are linked to size and shape of green space, recreational infrastructure, diversity measures, measures of amount of vegetation and accessibility." (Hegetschweiler et al, 2017) The process of accounting for both ease of access (supply) as well as attitudes and preferences of the population of interest (demand) can be observed in the Confluence model (Fig. 1).

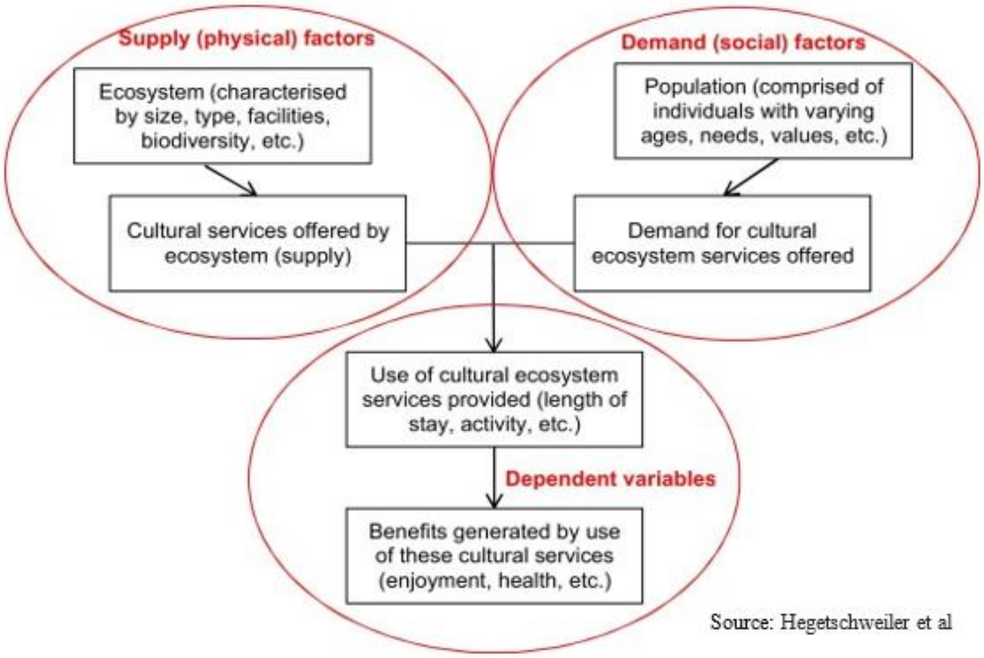


Figure 1. Conceptual diagram of the Confluence Model used in the 2017 Hegetschweiler et al study

Over the past 30 years, the interest in evaluating Ecosystem Services has grown significantly. As a result, there have been several techniques developed to accomplish this task. While some studies have focused solely on surveying populations on their attitudes and preferences, others have attempted to use more physically measurable variables to derive Ecosystem Service values. The most comprehensive approaches consider both factors when assessing Ecosystem Services values such as in the Hegetschweiler et al study. The software employed for the purpose of this research also takes both of these factors into account.

For the purpose of this research, I have chosen to focus on tracts of land on or around the path followed by the Erie and Champlain Canals as they represents massive public works that generated significant economic gain as well as being a pronounced cultural artifact. To my knowledge, there has been no recent evaluation of this area in respect to its value in terms of Cultural Ecosystem Services. This speaks to a larger calling for research in the area of Ecosystem

Services and their valuation as they are often left out of traditional quality of land assessments. This becomes important in terms of planning since these important factors may be overlooked when deciding where and how land should be developed. Given that we live in a primarily financially motivated society, these non-material services are often considered less important and are not factored into how land is valued and preserved. Finally, it is beneficial to assess the continued cultural and social values that these lands provide and how those values have transcended through time.

The areas of interest evaluated in this study include land tracts in Albany and Saratoga Counties as both are home to significant portions of the Erie and Champlain Canals. More specifically, the study area spans the cities of Cohoes and Waterford and the town of Colonie. All three municipalities have benefited greatly from their positions along the canal path. In evaluating the present day social value of these historically significant land areas, special attention is given to the concepts of Cultural Ecosystem Services with a focus on aesthetic and recreational benefits and the value they add to their home communities. The main research questions are:

1. What are the relative values of Cultural Ecosystem Services provided by the land historically occupied by the canal system?
2. How do these values relate to the environmental characteristics of the land?

Methodology

As mentioned in the introduction, there have been a variety of approaches employed in the pursuit of accurately evaluating Ecosystem Services. For this assessment, I chose to use an ArcGIS add-in tool called Social Values for Ecosystem services or “SolVES”. The SolVES software was developed based on the 2006 study which examined Ecosystem Services for the Pike and San Isabel (PSI) National Forests in Colorado (Sherrouse, 2015). The study utilized a combination of survey data and environmental data to assess the relative Cultural Ecosystem Services across the study area (PSI National Forests). The surveys gathered information on the degree to which the inhabitants valued different locations in the study area and what cultural or social benefit the location provides. Essentially, the software was developed by correlating the perceived social value of the land based on the survey data with the environmental features of the land such as elevation, distance to water, etc.

Study Area

For this application, I used the Value Transfer feature which allowed me to apply the findings of the PSI study to the study area selected for this evaluation. Study areas included the City of Cohoes, a portion of Watervliet, and a stretch of land that roughly follows the path of the Erie Canal westward through Colonie. The city of Cohoes was heavily influenced by the Erie and Champlain Canals and much of its industry was developed as a result of its position on the canal path. There are several Historic parks throughout Cohoes and multiple locations in which canal lock infrastructure remains mostly intact. The area in Waterford is centered on Peebles Island State Park. This area was included because of its interactions with both the Champlain Canal, which runs alongside it, and the Barge Canal which intersects the Mohawk River just north of the island. Peebles Island is also a good choice as its status as a state park makes it most similar to the PSI Study Area. It would be reasonable to expect higher recreational and aesthetic values in this area as there are several look out points and recreational opportunities such as hiking, fishing, snowshoeing, etc. Finally, the tract through Colonie roughly follows the Canalway Trail, a popular recreational bike route that follows the path of the historic Erie Canal, and more recently the Barge canal, westward along the Mohawk River.

The map below depicts the study area and a portion of the historic canal path through Cohoes. The digitization of the Canal path through Albany County was completed as part of a grant funded project with the Stormwater Coalition of Albany County. Unfortunately, this project did not include areas outside of Albany County and that path has yet to be accurately mapped.

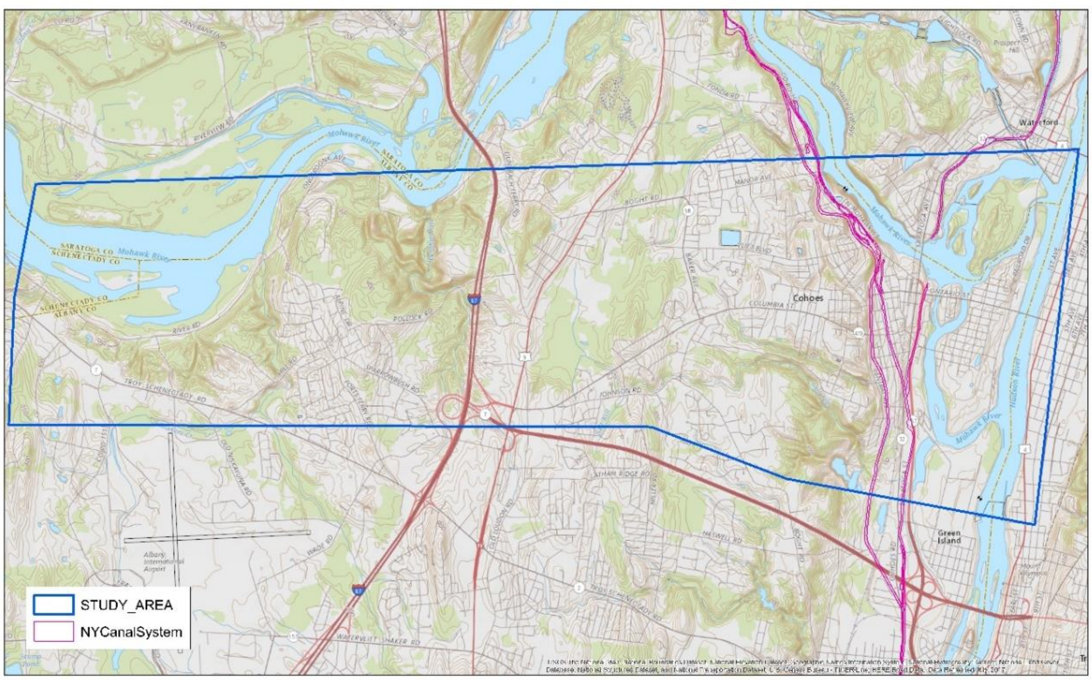


Figure 2. Map of study area following canal path and Canalway Trail from Cohoes to Colonie

Data Requirements

The model requires several environmental and descriptive layers for the area being assessed including:

- A polygon denoting the study area of interest
- Environmental Layers:
  - DTR: Euclidian distance to nearest road in meters
  - DTW: Euclidian distance to nearest water in meters
  - ELEV: Elevation in meters
  - SLOPE: Percent slope
  - LANDFORM: Land surface forms data (Values described in Global Ecosystems)
  - LULC: Land Cover data (values based on thr NLCD 2006)

The hillshade layer was also included for use as the background for the output maps generated after running the model successfully. Environmental layers were prepared by converting variables to the same raster format and creating spatial subsets with matching extents. The spatial resolution for all input data was 1 meter, which was chosen based on the land cover data availability of the digital elevation model derived from the 2008 LiDAR survey. All layers were projected onto the NAD 1983 UTM Zone 18 coordinate system. The layers were acquired from various sources and slight adjustments were necessary to ensure that they were in the correct format. This process is detailed in the following table:

Table 1. Model input spatial layers

Environmental Layer	Source	Adjustments made
DEM	The 2-meter digital elevation model was obtained from the NYS GIS Clearinghouse website. Individual tiles were mosaicked using ENVI/IDL software.	The original cell size was 2 meters. The layer was resampled to 1-meter cell size using the ArcMap Resample tool.
SLOPE	The percent slope raster was calculated from the DEM using the Slope calculator (3D Analyst) tool in ArcMap.	N/A
DTW	The Distance to Water raster was generated using the downloaded NYS Hydrography - shapefile (1:24,000) available on the NYS GIS Clearinghouse.	Vector lines were rasterized to 1-m grid in ArcMap and a DTW layer was created using the Euclidean Distance tool
DTR	The Distance to Roads raster was generated using the NYS Streets shapefile from the NYS GIS Clearinghouse	The vector shapefile was rasterized and the DTR layer was created using the Euclidean Distance tool.
LANDFORM	The landform layer was created using the USGS downloadable landform shapefile (the same one used in the original PSI study).	The original cell size was 30 meters. It was resample to 1-meter raster using the Arcmap Resample tool.
LULC	Land Cover shapefiles were prepared by Aneisha Samuels and Huiyan Wang for the Stormwater Coalition of Albany County. The maximum likelihood supervised classification was applied to the 1m resolution 4-band Digital Orthophoto Quarter Quads (USGS Quadrangles) available for 1994, implemented in the ENVI/IDL software. Accuracy assessments reports show the overall accuracy 85% or higher for all data. The classification scheme was adopted from the 1971 Anderson system.	These shapefiles were organized by class names with numeric values 1 through 12 corresponding to a given land cover type. These were changed to match the values used in the NLCD 2006 classification.

Table 2. Codes corresponding to the landform as described in the USGS downloadable landform shapefile

Value	Description
1	Flat Plains
2	Smooth Plains
3	Irregular Plains
4	Escarpments
6	Hills
7	Breaks/Foothills
8	Low Mountains
9	High Mountains/Deep Canyons
10	Drainage Channels

Table 3. Codes for the LULC types as described in the NLCD 2006 classification

Value	Descriptions
11	Open water
21	Developed Open
22	Low Density developed
23	Medium Density Developed
23	High Density Developed
31	Barren
41	Deciduous forest
42	Evergreen forest
43	Mixed forest
71	Grass and shrub
11	Open water
21	Developed Open

When all necessary layers were prepared, they were clipped to matching extents and added to the Geodatabase, the format required by SolVES software. The Geodatabase file was copied into the corresponding folder under “Data”. The first step in executing the model was the project setup. As part of this, the Home directory in the main Solves folder should contain data with all environmental layers (Fig. 3). As mentioned previously, the hillshade layer was used as the background of the results map. It was prepared by using the ArcMap’s hillshade tool by placing the illumination source (the sun) due west at an elevation of 45 degrees.

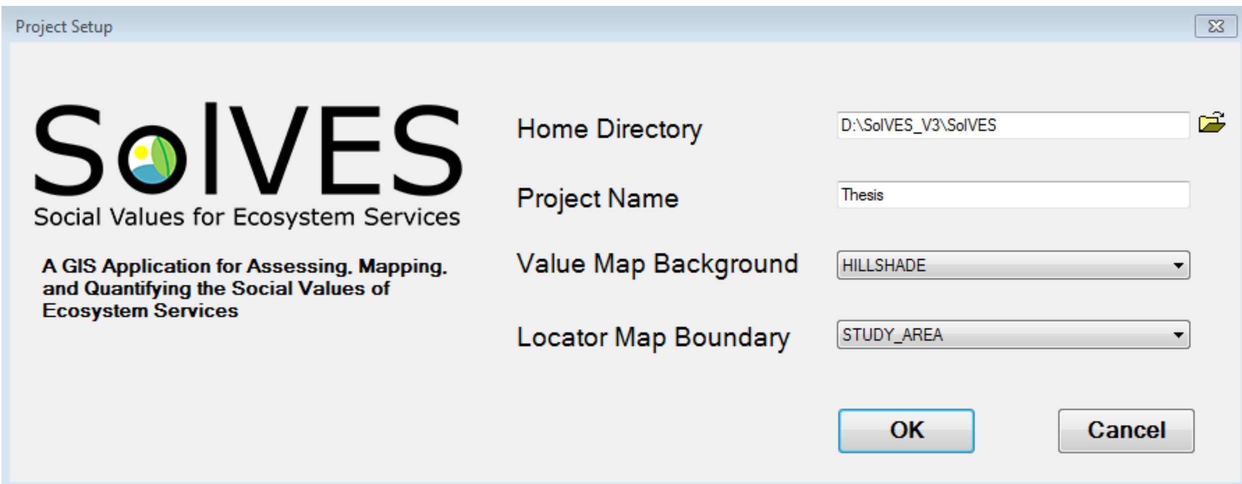


Figure 3. SolVES Project Setup window

The next step was to Transfer Values by running the project. First, set the source project as “Pike and San Isobel National Forests”. The software provides the option to generate transfer values based on either Aesthetic or Recreational values. For the Recreational value index, the maximum value that can be achieved is 8 while for Aesthetic, the maximum value is 10. The output cell size for the results was set to 1 meter.

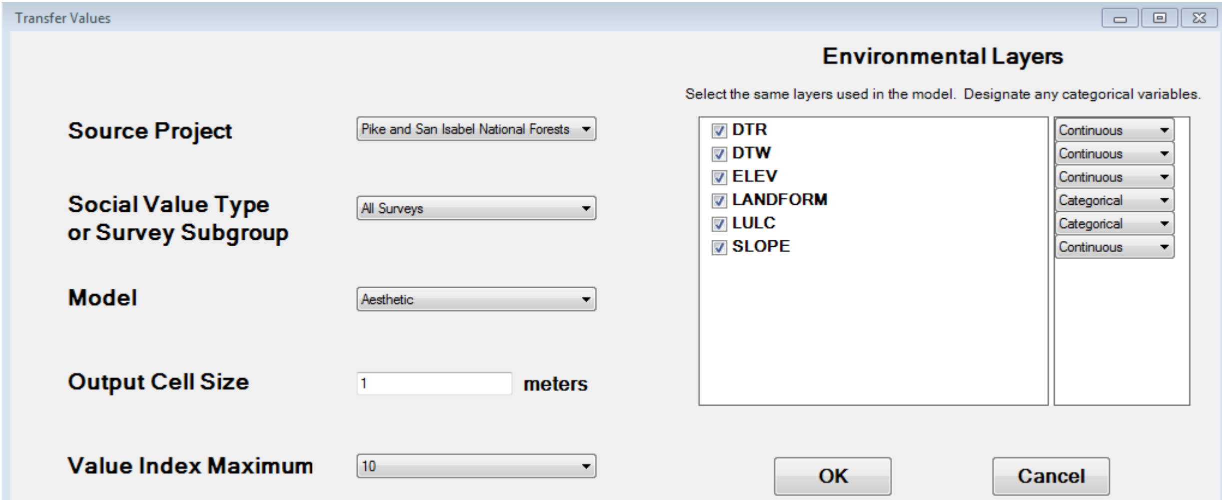


Figure 4. **Solves Transfer Values window**

The SOLVES Transfer Values software works by taking the observed statistical relationships between environmental variables and perceived social values recorded in the original PSI study and applying them to the new area of interest. The Value Mapping Model employs Maxent maximum entropy modeling software to generate models describing relationship between points and environmental variables. (Phillips)

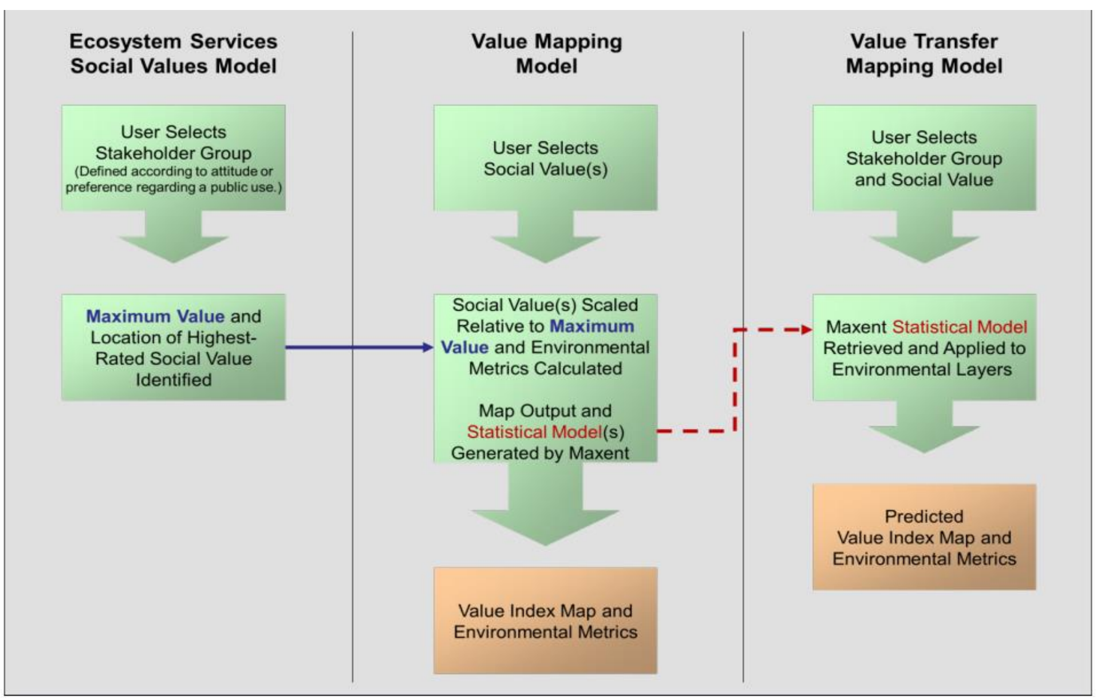


Figure 5. **The generalized model workflow**

Results

The results were generated separately for each Cultural Ecosystem Service being assessed. Outputs include a Value Index map and several graphs describing the relationship between the environmental data and the values assigned.

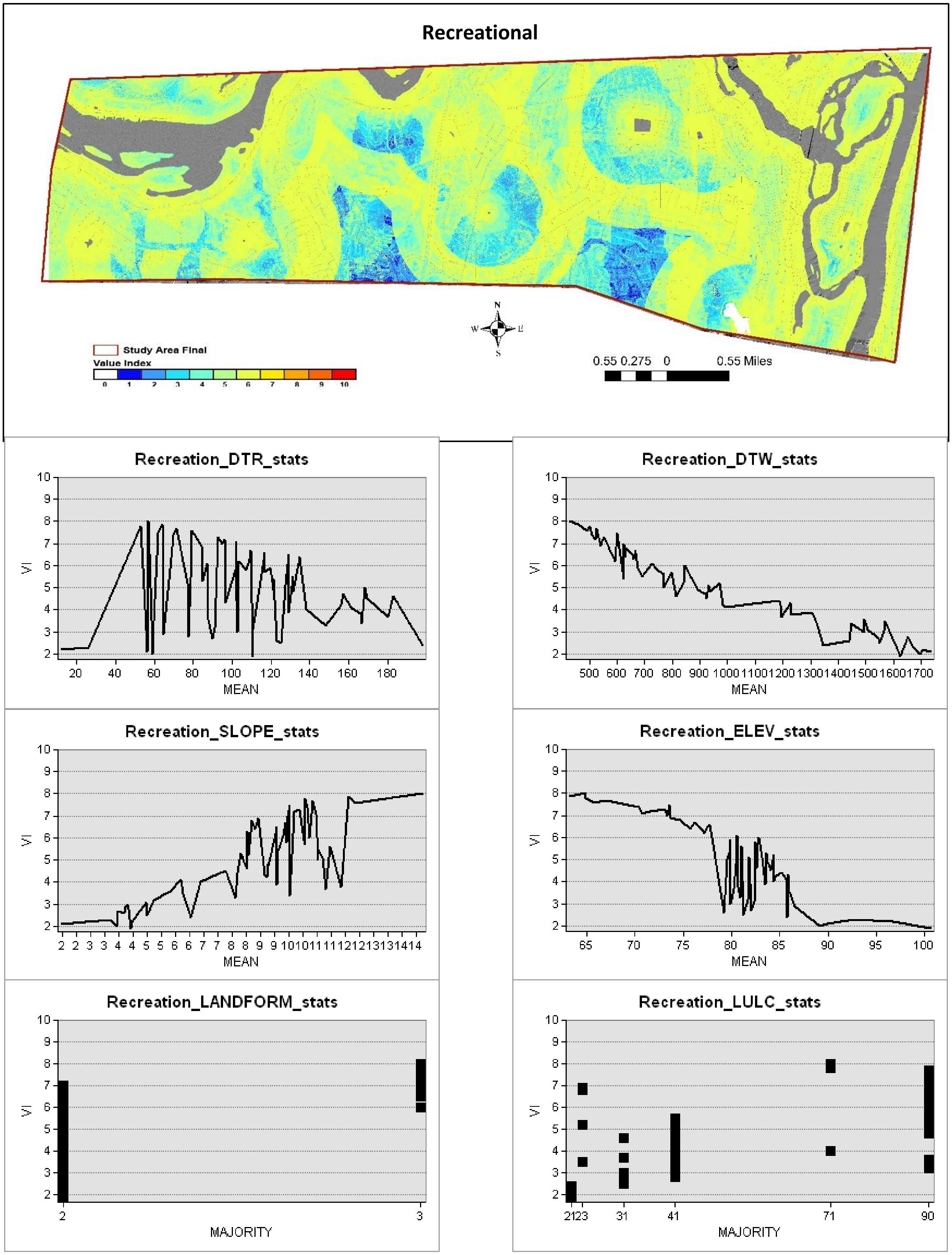


Figure 6. SolVES Recreational Value output for the study area

The recreational values for the study area ranged from 1 to 8 with 8 being highly valued and 1 being least valuable for recreational use. As shown on the map (Fig. 6), the highest value achieved in this study areas was 7 points. The following is a detailed breakdown and analysis of how the software assigned values based on the environmental input layers.

Distance to Water: According to the graphs, recreational value generally increases as the distance to water decreases. Intuitively, this seems logical given the many recreational opportunities that access to a water body can provide such as swimming, fishing, canoeing, etc.

Distance to Roads: While the distance to roads results fluctuate on the small scale, it does show several overall trends. Within the first 30 meters, the value stays very low at around 2. This can be explained by the notion that being too close to a road could impede a recreational experience. For example, an insatiable hiker wouldn't want to go on a nature hike with a highway100 feet (~30 m) away because noise and pollution would likely produce unpleasant experience. From there, the value increases to the maximum value of 8 at around 55 meters. The value bounces from high to low every few meters with the maximum value decreases as distance increases from there. The maximum value goes from 8 to 6 at 140 meters but once the DTR exceeds 140 meters the value does not exceed 5.

Elevation: Overall, lower elevations yield higher recreational values with elevations of less than 75 meters generating values between 7 and 8. From there, values generally drop as elevation increases with some variation in values between 80 and 85 meters. Elevations above 90 meters yield values of less than 3.

Slope: The slope results show a trend that is opposite of elevation. As slope increases so does the recreational value. A possible explanation for this could be that mountainous terrain tends to attract more hikers.

Landform: The landform types with statistically significant results in terms of recreational values are smooth plains and irregular plains. Of the two, irregular plains generally yield a higher value of between 6 and 8 points. Smooth plains yield values anywhere from 0 to 7 points. This is consistent with the slope findings as areas that are smoother will have less of a slope than those that are irregular.

Land Cover: The land cover types that yielded the highest values were grasslands and woody wetlands. All of the land cover types showed a wide range of 5 points or greater except for developed open space which consistently yielded values of below 3 points. Developed medium density land cover types had values ranging from 3 to 7 points. Deciduous forest ranged from 2 to 6 points. Finally, barren land was valued at less than 5 points.

In conclusion, land yielding the highest recreational values would be those that are close to water, located around 60 meters from a road, and at a low elevation. These high value lands would likely be irregular plains described as grasslands, woody wetlands, or medium density developed land. Around 52 percent of the study area achieved a recreational value of at least 7 points. This is likely in part, a result of the abundance of water features in the study area. In addition, much of the land along the canal path also falls under one of the higher ranking land cover types.

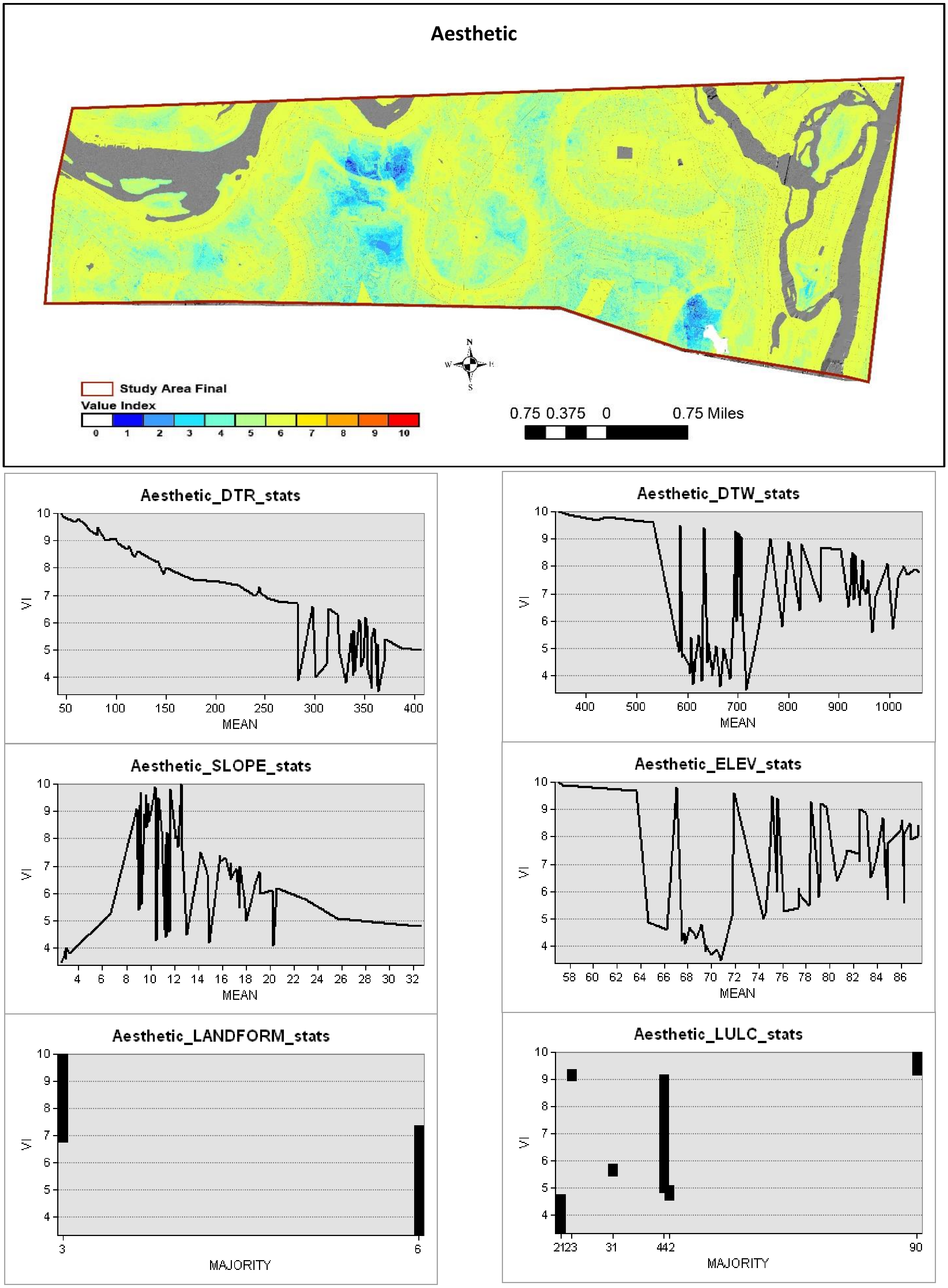


Figure 7. **SolVES aesthetic value output for the study area**

Aesthetic Value

The possible Aesthetic values ranged from 1 to 10 points with 10 being highly valued and 1 exhibiting the lowest aesthetic value. The highest aesthetic value achieved in this study area was 7 points (Fig. 7). The following is a detailed breakdown and analysis of how the software assigned values based on the environmental input layers.

<u>Distance to Water</u>: According to the graphs, aesthetic value generally increases as the distance to water decreases. Areas that are located within 600 meters of a water body yield values between 9 and 10 points. As distance to water increases past 600 meters, the corresponding values fluctuate from a maximum of 9 points to a minimum value of 4 points with a slight downward trend.

<u>Distance to Roads</u>: The distance to roads graph shows a clear trend indicating that the closer that an area is to a road, the higher its aesthetic value is. There is some variation between 270 and 370 meters where the values drop and rebound every few meters. This trend is opposite to that found for the recreational values. While outdoor recreation often requires an immersion in nature, perhaps those interested in aesthetic views do not feel the need to be completely removed from a developed area in order to appreciate the aesthetic value of the overall landscape. For example, Cohoes Falls Park serves as a tourist attraction and historical landmark with breathtaking views that does not requiring visitors to leave the city.

<u>Elevation</u>: Overall, lower elevations yield higher aesthetic values with elevations of less than 64 meters generating values just under 10 points. At elevations higher than 64 meters values vary from low and high every few meters with no distinct trend.

Slope: The slope results also vary on the small scale but overall the highest values are between 8 and 13 percent slope. Once the slope exceeds 26 percent the value does not exceed 5 points.

Landform: The two landform types with statistically significant results in terms of aesthetic values are irregular plains and hills. Of the two, irregular plains generally produce a higher value of between 7 and 10 points. Hills yield values anywhere from 0 to 7 points.

Land Cover: The land cover type that yielded the highest values was woody wetlands generating values of over 9 points. The medium density developed class also had high values of between 8 and 9 points. Deciduous forests had values ranging from 5 to 9 points. Barren land, developed open space, and evergreen forests all yielded values of under 6 points.

All in all, areas yielding the highest aesthetic values would be those that are in close proximity to both water and roads, and exist at a low elevation. These high value lands would likely be irregular plains described as woody wetlands or medium density developed. Around 56 percent of the study area achieved an aesthetic value of at least 7 points. Again, this is likely due to its proximity to water and prevalence of high ranking land cover types.

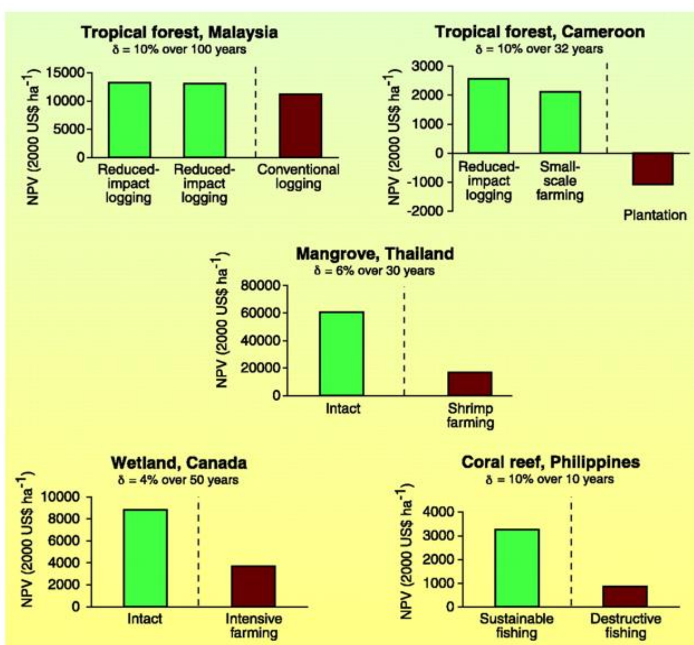
These results are similar to those generated for recreational value, indicating that many locations within the study area could provide benefits attributed to more than one ecosystem service. This makes sense given that recreational experiences are often closely tied with aesthetic views. Some examples of this include activities such as hiking, skiing, or biking.

Discussion

There are numerous reasons why this research is important in terms of future environmental planning. One growing concern for urban planners is the lack of green space in developing cities and the potential consequences that inhabiting a primarily engineered environment may have in terms of human health. Increased green space in cities has been linked to lower mortality, higher rates of physical activity, lower stress levels, decreased rates of behavioral problems in children, and a better connection with nature. Urban green space becomes especially important in terms of environmental justice, as low income or minority populations often have disproportionately less access to green space in and around their home communities. By recognizing the cultural and social value provided by green spaces such as public parks, recreational fields, or urban forests, planners are encouraged to engineer healthier, more equitable cities.

In addition to creating healthier, happier communities, Cultural Ecosystem Services can also, in some cases, translate to economic gain. Many locations that provide Cultural Ecosystem Services also act as tourist attractions that can bring cash flow back to the local community. For example, the Erie Canalway Trail is a recreational trail following the path of the historic Erie Canal that offers a myriad of outdoor activities and attracts around 1.6 million visitors per year. It is reported that "Overall (including direct and secondary effects), ECT visitor spending generates approximately $253 million in sales, 3,440 jobs, $78 million in labor income, and $28.5 million in taxes in the upstate economy each year." (Scipione, 2014). Furthermore, 79% of visitors report that they are interested in canal history. This is an example of a Cultural Ecosystem Service that provides both historical and recreational benefits while simultaneously bringing in significant economic revenue and increasing visitor traffic to its surrounding communities.

Finally, while Ecosystem Services are often defined as being non-material or non-monetary, when preserved, they do have an inherent economic value. Ecosystems Services can be evaluated in terms of their role in carbon cycling, waste treatment, or erosion control. While in most cases we do not pay for these services outright, we do reap the benefits that they yield including clean water, mudslide prevention, and the power to maintain a relatively stable climate. Some scientists advocate that these services should be valued based on the financial burden they would create if humans had to engineer these processes themselves. An earlier study estimated the dollar value generated by Ecosystem Services worldwide, which produced a figure of, at minimum, 33 trillion dollars each year (Costanza et al, 1997). Another study investigated the relative value of naturally preserved ecosystems compared to those converted to common human uses. The findings reflected that, developing the land for activities like logging or shrimp fishing yields higher revenue in the short term. Yet, it is more economically rational to incorporate sustainable practices or maintain the ecosystems natural state in the long term. (Balmford et al, 2002)



Source: Balmford et al

Figure 8. **Findings of Balmford et al study on the economic rationality of wild nature**

There are clear economic advantages to maintaining some percentage of natural land. However, this is often a hard sell for zoning boards facing calls for rapid development, particularly in urban areas. This could be partially combatted by evaluating these regions based not only on their economic value but also on their social and cultural ecosystem values. Examples of this process can already be observed but often without the vocabulary to describe. For instance, when historical landmarks are highly valued by their local community, there is significant effort made to preserve and protect the land from being developed. Evidence of this can be seen in Cohoes where several of the Historic Canal parks that remain undeveloped supply some of the only green spaces in the city.

Conclusion

Study findings support the hypothesis that areas along the path of the historic canal system offer present day communities and outside visitors significant benefits through the Cultural Ecosystem Services they provide. This is in large part a result of their location along the Mohawk and Hudson Rivers as proximity to water plays a large role in determining the aesthetic and recreational value of the land. It is also due to the urban/sub-urban setting in and around these areas that provide ample opportunities for citizens to access these services. The results generated here acts as a starting point for evaluating the value of ecosystem services provided by historically significant land areas.

The values generated in this study are estimates based on the attitudes and preferences recorded in the PSI study in Colorado and do not necessarily reflect the attitudes and preferences of populations of the study area used here of Upstate New York. Additionally, it is important to note the variation between the study area used to generate the software (PSI) and the study area used in this evaluation. SOLVES was created using survey data for national forest land while this study focused on a variety of rural and urban landscapes surrounding the historic Erie Canal path. As a recommendation for future research, it would be interesting to gather survey data for the Erie Canal Study Area and run the Value Mapping Model. This would be helpful in assessing the accuracy of the Value Transfer model and testing its performance across varying geographic land types as well as providing insights into the attitude and preferences of this particular study area vs. those of the PSI study.

Furthermore, the Value Mapping Model allows for the evaluation of 12 different ecosystem services while the Transfer Mapping Model is only currently available for Recreational and Aesthetic valuation. It would be beneficial to see how much variation there is between each service and how they may overlap or counteract each other. Perhaps as more research is done on the topic of ecosystem services and the desire for their effective evaluation grows, these tools will emerge.

The ability of this software to effectively assign ecosystem service values in areas with varying degrees of development could prove to be extremely beneficial for city planning. Urban environments are often already lacking in green space, making it even more vital that their value be effectively communicated and considered when it comes to development decisions. The ability to demonstrate the cultural value of these spaces could influence city planners in their decisions to either expand these areas or protect those that already exist. Additionally, many historic landmarks and parks are located in urban or suburban settings. The ability to demonstrate that these locations provide benefits in the form of cultural ecosystem services reinforces the notion that these historic areas, when preserved, can continue to serve the community even after their useful life has long past.

Cultural ecosystems services have an important, yet often grossly underappreciated role in our home communities. Too often decisions on whether to develop or preserve land are made solely based on monetary value. While the economics must be considered carefully, it is vital that there also be a consideration for those less obvious, social benefits, as well. When it comes to the preservation of historically significant land, Cultural Ecosystem Services become especially important. They provide the platform to demonstrate that these lands not only provide benefits as cultural artifacts but also that their presence has a positive impact on the community from a variety of standpoints, such as through their aesthetic or recreational value.

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