Wetlands as Buffer Zone Nutrient Sinks and the Implications for the Seneca Lake Watershed

Ellie Milano

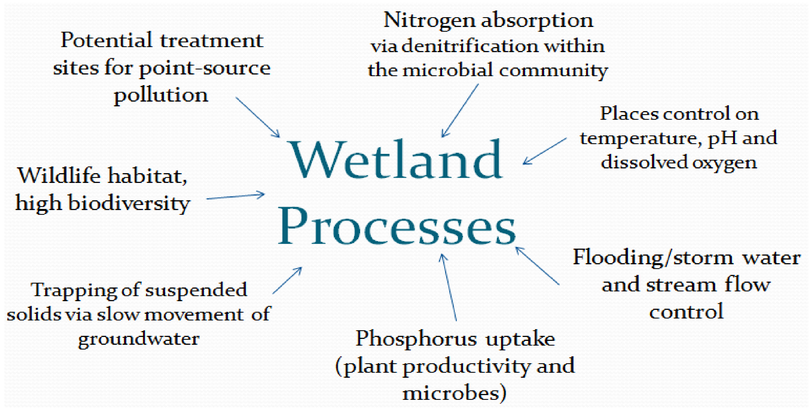
Eleanor.milano@hws.edu

Department of Biology, Environmental Studies Program
Hobart and William Smith Colleges
Geneva, New York. 14456

Introduction

Over the past couple of decades, Seneca Lake has begun to experience heightened nutrient loading, or increasing levels of phosphorus, leading to increased productivity and phytoplankton biomass. The objective of this report is to:

1) Provide a detailed discussion of the role in which natural and constructed wetlands can play in controlling nutrient flow and water quality in a lake system.
2) Identify wetlands within the Seneca Lake Watershed, plans for wetland construction in the Seneca Lake State Park, and the potentiality for future wetland construction surrounding the lake.
3) Provide a brief evaluation of the costs and benefits associated with such a construction project by examining the potential inputs/outputs for a wetland at Catharine Creek as well as by assessing the processes of constructing a wetland.



Wetlands in the Watershed

Woody and emergent wetlands cover approximately 4.2% of total land within the Seneca Lake Watershed
The most notable wetlands include:

- -Seneca Meadows Wildlife Preserve on the eastern side of the lake (owned by Seneca Meadows Landfill, operated by Applied Ecological Services) Created in 2007, 350 acre preserve, cost of the project $800,000.
- -Ontario County Waste Management-owned wetlands located on the western side of the lake.
- -Seneca Lake State Park (owned by NYS Parks, in early stages of conversion to a large, ecologically functional wetland).

Case Study for Wetland Construction: Catharine Creek

The NYS Department of Ecological Conservation has recently identified Catharine Creek Wildlife Management Area as a potential site to be restored to its historic wetland condition, especially considering the site has already begun a natural conversion process back to into marsh-land. The project would significantly increase total wetland cover within the watershed, and its location is ideal for creating a natural nutrient buffer zone.

Size of the area: 1,000 acres

Estimated Cost**: $3.5 Million (low end)**

Capacity for Phosphorus Removal: **57 to 372 metric tons** in total

Current Phosphorus Budget in Seneca: **155 metric tons; With a net 37 mtpy entering the lake.**

Proposed Future Directions?

-Assess potential funding sources

-Attempt to acquire both financial and public support for the idea

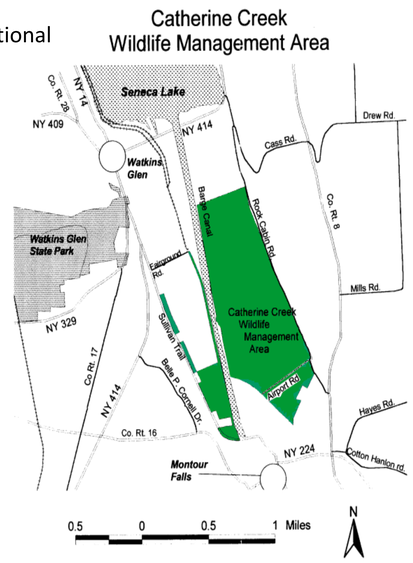


Figure 2: A sketch of the Catharine Creek Wildlife Area, showing its proximity to canals and major inlets just to the south of Seneca Lake.

Abstract

The ecological services rendered by wetlands have been shown to significantly improve local water quality within a watershed, due to their ability to absorb and retain nutrients (nitrogen and phosphorus), particulate matter, and suspended solids. Wetlands also largely control groundwater flow, and can thereby effectively mitigate the movement of water between agricultural land and stream inlets. Wetlands in the Seneca Lake Watershed cover approximately 4.2% of the land. Major wetlands in the watershed include wildlife preserves constructed by landfill associations, as well as the State Park on the northern side of the lake, which is currently undergoing restoration into a functional wetland. The wildlife preserve at Catharine Creek has also been studied for the possibility of converting the land into a fully-functioning wetland. This area is already essentially a marsh-land, and so a complete return to a wetland system would potentially have the capacity to remove a significant amount of phosphorus from the Lake system.

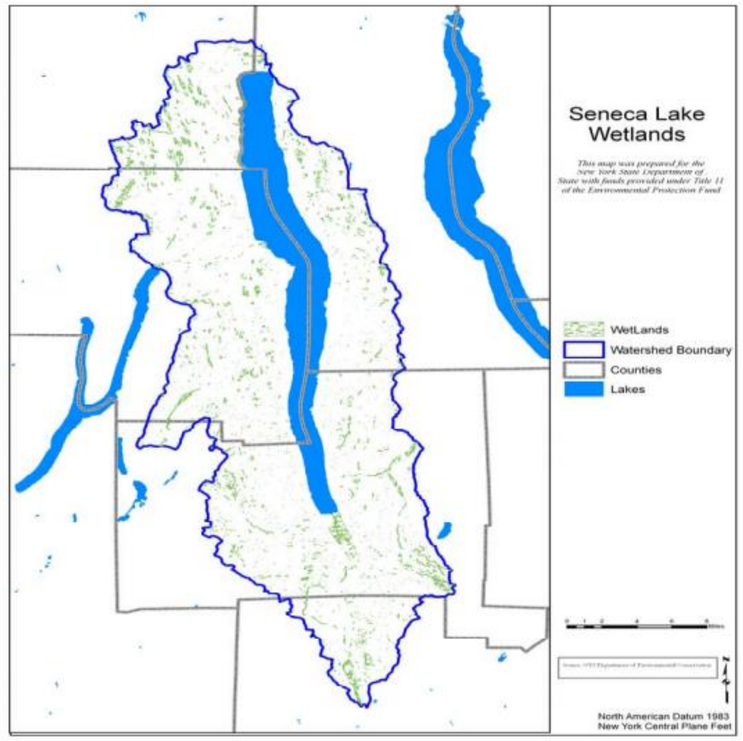


Figure 1: A depiction of the wetlands (shaded green areas) within the Seneca Lake Watershed. Wetland inventories include standing water, thus actual wetland representation here may be misconstrued.

Conclusions

1) Wetlands are important ecological entities that possess the capacity to slow groundwater flow, allowing for filtration and the retention of particulate matter, nutrients, and suspended solids, enhancing water quality for local streams and water bodies.
2) These areas can mitigate the interplay between agricultural land and stream inlets via these processes. However, the breakdown of wetlands can release these pockets of nutrients back into the lake. This may have implications for future management and the long-term costs of constructing artificial wetlands to ensure that they do not clog and break down.
3) Most wetland construction in the Seneca Lake Watershed has been and will be restorative or compensatory by landfill companies, effecting the extent to which wetlands are constructed in the area. Expansion of the Seneca Meadows Landfill, the NYS Parks Service restoration initiative, and the projected plans for the Catharine Creek Wildlife Management Area provide ecologically sound and valuable opportunities to decrease the lake's phosphorus input.
4) The investigation of wetlands and the consideration to construct additional, larger patches of wetland appears to be a healthy choice for the water quality of the lake, provided that both financial backing and public opinion would support it.

Acknowledgements

I would like to thank Professor John Halfman for his guidance and support, as well as the students of ENV 301 Senior Integrative Experience for their input and assistance. Also, many thanks to Hobart and William Smith Colleges and the Environmental Dept. for the creation of this poster.

References

"Applied Ecological Services, Inc. (AES)." *Applied Ecological Services (AES), Inc.* Computer Knowhow, 2012. Web. 7 Apr. 2012. <http://www.appliedeco.com/>.
"Catharine Creek Fish and Wildlife Management Area." dec.ny.gov. NYS Department of Environmental Conservation, 2012. Web. 13 February 2012. <http://www.dec.ny.gov/outdoor/24429.html>.
"Clean Water Act of 1977 Title 40: Protection of Environment; Part 230- Section 404(b) and 501 (a), 33 U.S.C. 1344(b) and 1361(a). Subpart A 230.3 Definitions." epa.gov. US Environmental Protection Agency. Web. 2012. <http://www.epa.gov/owow/wetlands/pdf/40cfrPart230.pdf >.
"Constructed Wetlands." *Natural Systems International*. Mindshare Studios, 2012. Web. 8 Apr. 2012. <http://www.natsys-inc.com/resources/about-constructed-wetlands/>
Gelso, B. R., J. A. Fox, et al. (2008). "Farmers' Perceived Costs of Wetlands: Effects on Wetland Size, Hydration and Dispersion." American Journal of Agricultural Economics **90**(1): 172-185.
Hobart and William Smith Colleges (2012). "Seneca Lake Watershed Management Plan: Characterization and Subwatershed Evaluation". Draft.
Hobart and William Smith Colleges (2012). "Seneca Lake Watershed Management Plan: Land Use and Land Cover". Draft.
Johnston, C. A., N. E. Detenbeck, et al. (1990). "The Cumulative Effect of Wetlands on Stream Water Quality and Quantity. A Landscape Approach." Biogeochemistry **10**(2): 105-141.
Kadlec, Robert H., and Robert L. Knight. *Treatment Wetlands*. Boca Raton, FL: CRC Lewis, 1996. Print.
Whigham, D. F., C. Chitterling, et al. (1988). "Impacts of Freshwater Wetlands on Water Quality: A Landscape Perspective." Environmental Management **12**(5): 663-671.
Moshiri, Gerald A. *Constructed Wetlands for Water Quality Improvement*. Boca Raton: Lewis, 1993. Print.
Osborne, L. L. and D. A. Kovacic (1993). "Riparian vegetated buffer strips in water-quality restoration and stream management." Freshwater Biology **29**(2): 243-258.
Sano, Daisuke, Alan Hodges, and Robert Degner. "Economic Analysis of Water Treatments for Phosphorus Removal in Florida." *EDIS*. The University of Florida, 2012. Web. 8 Apr. 2012. <http://edis.ifas.ufl.edu/fe576>.
"Seneca Meadows, Inc." *Seneca Meadows, Inc.* 2012. Web. 7 Apr. 2012. <http://www.senecameadows.com/>.
White, Ken. "Wetland Restoration/ Constructed Wetlands." *Brookhaven National Laboratory*. The University of Chicago. Web. 8 Apr. 2012. <http://www.bnl.gov/erd/peconic/factsheet/wetlands.pdf>.