

A Sustainable Chesapeake

BETTER MODELS FOR CONSERVATION

Edited by David G. Burke and Joel E. Dunn

THE CONSERVATION FUND



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Earning Multiple Credits for a Forested Riparian Buffer

A Methodology for Reducing Pollution in Pennsylvania's Susquehanna Watershed

The Pennsylvania Environmental Council's process for capturing multiple credits for the reduction of nutrients, sediment, and carbon can be followed by private landowners and corporations to further conservation efforts and receive compensation through ecosystem services markets.

CASE STUDY SUMMARY

The Pennsylvania Environmental Council conducted this project to demonstrate the ways in which a landowner can receive credits and financial compensation for the multiple environmental services that can result from a single conservation practice. Environmental services are functions of the natural landscape that deliver benefits to humans and/or wildlife. They include ecosystem functions that clean the air and the water, reduce greenhouse gases, and provide wildlife habitat. Emerging markets allow landowners to receive credit for environmental services performed by their land; those credits can then be exchanged in the markets for financial compensation.

In this case, the Pennsylvania Environmental Council entered into a layered partnership to reforest a riparian buffer on agricultural land in the lower Susquehanna watershed. The planting, sponsored by Exelon Corporation, created a 1,100-foot forested buffer on farmland owned

by Lancaster General Health along an unnamed tributary to Little Conestoga Creek. The buffer is now under a 25-year conservation easement, and a series of private contracts ensures that any nutrient reduction or carbon sequestration credit resulting from the buffer is conveyed from Lancaster General Health to the Pennsylvania Environmental Council and in turn to the project's sponsor, Exelon Corporation, for the term of the easement. By quantifying the pollution reduction services provided by this new buffer, the landowner already qualifies for carbon sequestration credits with the U.S. Department of Energy; it was also designed to qualify for Pennsylvania's nutrient trading program in the future.

RESOURCE MANAGEMENT CHALLENGE

The lower Susquehanna sub-basin of the Chesapeake Bay watershed is one of the most intensively farmed regions of the United States. It is home to millions of livestock, hogs, chickens, and dairy cattle that gener-

ate a major portion of the nutrient load that flows from Pennsylvania into the Chesapeake Bay. This sub-basin contributes approximately 25% of all the nitrogen, phosphorous, and sediment delivered to the Bay, but only represents approximately 10% of the entire Bay watershed in Pennsylvania.

According to Pennsylvania's Chesapeake Bay Tributary Strategy, the eastern portion of the lower Susquehanna sub-basin delivered 19,260,000 pounds of nitrogen, 711,000 pounds of phosphorus, and 278,000 tons of sediment to the Bay watershed in 2002.¹ In order to meet the Chesapeake 2000 agreement goals by 2010, the area needs to reduce its total load of nitrogen, phosphorus, and sediment delivered to the Bay by approximately half of its 2002 load levels. This represents an enormous challenge that requires multiple actions to address point and nonpoint sources of nutrients and sediment.

The Pennsylvania Department of Environmental Protection developed





Tree and shrub plantings along the stream and in the outer buffer area.

its nutrient trading program as one of the key elements in the Tributary Strategy to help meet Bay Program goals. Since its inception in 2006, the program has resulted in five executed trades; trading may increase in the next few years as more municipalities become subject to strict nitrogen and phosphorus discharge limits and seek nutrient reduction credits to satisfy their permit requirements for the National Pollutant Discharge Elimination System.

Even with a robust nutrient trading program and significant expansion of cost-share programs for agricultural best management practices, regional leaders have publicly stated that Pennsylvania and other state partners in the Chesapeake Bay Program will not reach the goals of the Chesapeake 2000 agreement by 2010.² One way to further progress toward nitrogen-reduction goals is to encourage conservation practices on farms by helping landowners to take advantage of other environmental credits, such as those for carbon sequestration, that are generated coincidentally with standard agricultural conservation

practices like no-till farming and forested riparian buffers.

CONSERVATION VISION

For many years, conservation groups and economists have been exploring ways to develop markets for environmental services. The markets provide a framework for placing financial value on the environmental services provided by a given conservation practice; the landowner can then receive credits for the environmental services provided by his or her land, and trade those credits for financial compensation. The credits or payment might be offered as incentive for participating in a government conservation program, or they might be part of a trading program through which a business entity offsets the impact of its pollution with financial support for conservation practices at another location.

Several successful and liquid individual credit markets have developed over the last twenty years. The Acid Rain Program, administered by the U.S. Environmental Protection

Agency, uses a cap-and-trade system to reduce emissions of nitrogen and sulfur oxides from coal-fired power plants in the eastern United States. Across the nation, nutrient trading programs like the one in Pennsylvania encourage practices that reduce nutrient runoff from farms and other nonpoint sources.

Should the nutrient reduction and carbon sequestration credit markets evolve into lucrative and liquid markets, the conservation implications for agriculture in Pennsylvania's portion of the Bay watershed may be profound. The additional income that can be generated by implementing conservation practices on farms may significantly add to the landowner's bottom line while also improving air and water quality and promoting the continued viability of agriculture.

The aim of this particular project was to model the process in which landowners can capture multiple credits from these emerging markets by implementing a single conservation practice—the planting of a forested riparian buffer in an



agricultural setting. The Conestoga River Nutrient Trading Pilot Project and the Conestoga Multi-Credit Trading Framework Project helped inform the project design. While the planting of forested riparian buffers is an approved best management practice under the Pennsylvania nutrient trading program that can also generate carbon sequestration credits, there are unique challenges in the certification, verification, registration, and contractual transfer of those credits.

IMPLEMENTATION RESOURCES

The Pennsylvania Environmental Council received a \$61,800 grant from Exelon Corporation in 2006 to develop the methodology and implement a demonstration project in Lancaster County, Pennsylvania. Exelon Corporation sponsored the project because they were interested in learning how to participate in emerging nutrient and carbon credit markets within the Bay watershed. Representatives of the Little Conestoga Watershed Alliance helped find a suitable site for the demonstration project in the East Hempfield Township. The buffer was initially planted on September 22, 2007, with the support of more than 70 volunteers organized by the Little Conestoga Watershed Alliance. The volunteer planting crew included representatives of the following organizations: Exelon Corporation; Lancaster Country Day School; Lancaster General Health; Little Conestoga Watershed Alliance; local Cub Scout and Boy Scout troops; and Millersville University.

CONSERVATION STRATEGY

Site Search: In 2006, the Pennsylvania Environmental Council began working with Exelon Corporation to find a suitable project site in East Hempfield Township. They needed an on-the-ground project to formally develop and test a replicable methodology

CONESTOGA RIVER NUTRIENT TRADING PILOT PROJECT

The Pennsylvania Environmental Council launched the Conestoga River Nutrient Trading Pilot Project in 2000, with support from The Conservation Fund, the Chesapeake Bay Foundation CH2M HILL, Environmental Defense Fund, Lancaster County Conservation District, and Pennsylvania Department of Environmental Protection. The project proceeded on three fronts:

1. Statewide nutrient trading policy development;
2. Nutrient trading education and outreach in the Conestoga watershed; and
3. Execution of a demonstration nutrient trade resulting from a natural stream and floodplain restoration project.

This pilot project played a central role in the development of Pennsylvania's nutrient trading program. Project partners envisioned nutrient trading as a significant tool for reducing Pennsylvania's net loading of nutrients to impaired waters like the Conestoga River and the Chesapeake Bay.

The project also highlighted the additional conservation benefits that could arise from rewarding participants for practices that generate multiple environmental services, including improved water quality, groundwater recharge, flood control, carbon sequestration, wetland creation, and endangered species habitat restoration.

In 2003, Enterprising Environmental Solutions, Inc., a supporting organization of the Pennsylvania Environmental Council, worked with CH2M HILL to complete a multi-credit trading evaluation of the Conestoga River watershed in conjunction with the ongoing Conestoga River Nutrient Trading Pilot Project. Multi-credit trading involves trading pollution reduction credits across multiple environmental media, using watersheds as a basis for trade. This approach recognizes the ecosystem values of the watershed and provides multiple incentives for restoration and improvement of ecosystem functions.

for planting trees in a riparian area, calculating carbon and nutrient benefits, and transferring the credits between entities.

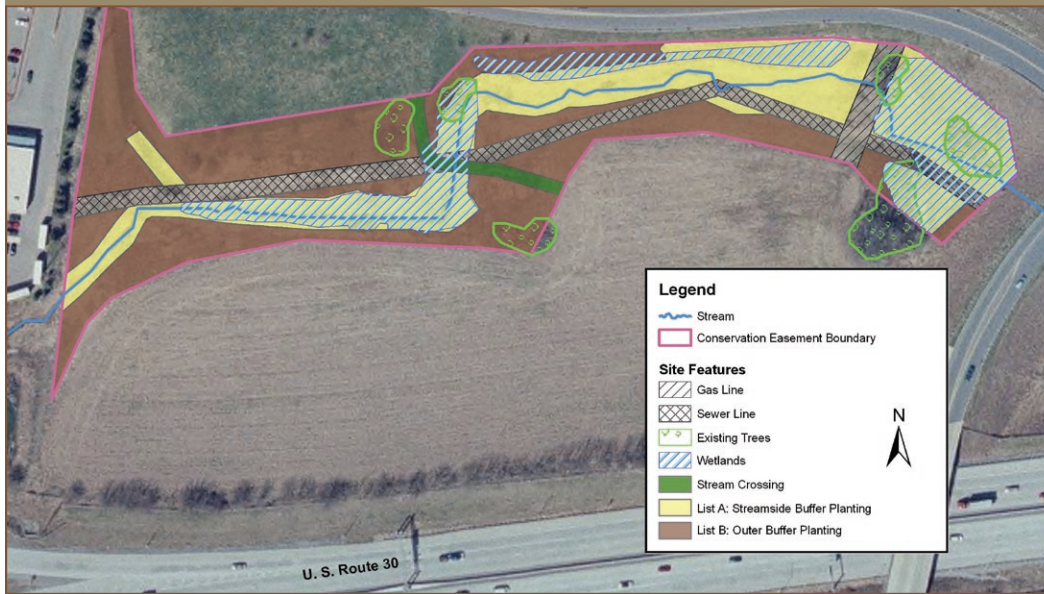
The partners began the search by contacting the Lancaster County Conservation District and local watershed groups. They were specifically looking for a site located directly adjacent to a stream and an agricultural field that had been deforested many years ago, so the buffer would filter nutrients running off the farm and sequester new carbon in the trees at the same time.

In the spring of 2007, representatives of the Little Conestoga Watershed

Alliance recommended a segment of an unnamed tributary of the Little Conestoga Creek, owned by Lancaster General Health, as the project site for the buffer installation and multi-credit trade. The southern border of the stream and the buffer site itself is adjacent to a six-acre field that is currently leased to a farmer and cultivated for soybeans during the crop year October 2007 to September 2008. The northern side of the stream consists of mixed shrubs, herbs, and grasses. The site also builds upon a forested buffer installed just upstream of the site in 2007.

Site Planting: In the fall of 2009, a team of 70 volunteers led by the

Lancaster General Health Campus Conservation and Nutrient Credit Easement



Pennsylvania Environmental Council, Exelon Corporation, Lancaster General Health, Little Conestoga Watershed Alliance, and Rettew Associates installed a forested riparian buffer at the Lancaster General site. Rettew Associates provided buffer design and surveying services for the project. The volunteers planted a diverse mix of 517 native trees and shrubs in a buffer measuring 1,100 feet long and 120 feet wide. Plants suitable for drier soils were selected for the outer buffer planting area. The Pennsylvania Environmental Council and Lancaster General Health reached a “Water Quality Trading and Carbon Sequestration Agreement,” which details watering and maintenance requirements to be followed by Lancaster General Health.

Project partners and a team of volunteers conducted a re-planting effort at the site in October 2008. Reforestation projects often require a re-planting effort due to natural environmental factors that kill plants, such as drought or disease. A subsequent inventory of the surviving trees and shrubs was conducted by Rettew Associates. The inventory data

was used for the carbon sequestration evaluation completed in December 2008.

The Pennsylvania Environmental Council hired expert consultants to help with the carbon and nutrient credit calculations and worked with the staff of the various partners involved to craft the credit agreement and easement language.

RESULTS

Multi-Credit Partner Agreements:

A private contract was developed in which the Pennsylvania Environmental Council receives credits for the annual nutrient and sediment reduction and carbon sequestration from the property owner, Lancaster General Health, for a duration of 25 years. A separate private contract was developed and signed, in which the Pennsylvania Environmental Council transferred title to those same credits to the project sponsor, Exelon Corporation. The buffer was also placed under a protection easement, in order to ensure its long-term survival and maintenance. Title to the buffer will be held for the 25-year term by the Lancaster County Conservancy, which

will also provide annual monitoring and enforcement services for the easement.

Carbon Sequestration Credits:

Environmental Resources Trust, a program of Winrock International (ERT-Winrock), estimated that the buffer will sequester approximately 8.84 metric tons of carbon per acre per year, or a total of 221 metric tons, for the first 25 years

after its installation—if growth occurs as expected. These estimates were based on the October 24, 2008, survey of surviving trees and shrubs and in accordance with the forest ecosystem carbon tables published by the U.S. Department of Energy’s 1605(b) program.³

The restored buffer area totaled 3.22 acres, with trees planted at approximately 15-foot intervals. The plantings were classified into three species groups: shrub, maple-beech-birch, and oak-hickory. Based on the species survey, an estimated 52.8% of the project area is expected to be occupied by trees in 2032, and the remainder is expected to be occupied by shrubs. Approximately 77.8% of the tree cover is expected to be maple-beech-birch, and 22.2% of the tree cover is expected to be oak-hickory. The Pennsylvania Environmental Council and ERT-Winrock used Department of Energy guidelines and field surveys to determine the carbon stock gain in metric tons of carbon dioxide equivalent per acre for each tree class. As a part of its “2020 Low Carbon Roadmap,”⁴ Exelon Corporation will register the



Expected Biomass Carbon Gain by Age 25

Class	Species	Metric Tons CO ₂ e/Acre	Source
Shrubs	Anything less than 20' tall at maturity	31.5	1605 (b) Forestry Table B2
Oak-hickory	Oak and ash trees	34.2	1605 (b) Forestry Table B3
Maple-beech-birch	Maple, shadbush, birch, hackberry, sweetgum, tulip poplar, sycamore, arrowwood, white pine, and blackhaw.	13.6	G. Smith field survey and calculation

*There is no reference carbon table for white pine for the northeast states; thus it is included in the maple class because it has low density wood similar to some of the species in that classification. **Calculations assume that shrubs achieve 1" diameter at 4.5' above the ground and a density of one stem per 2.25 square feet and a height of 10'.

carbon sequestration credits resulting from the buffer project on the Department of Energy's 1605(b) registry.

Nutrient and Sediment Reduction Credits:

The Pennsylvania Environmental Council and the World Resources Institute calculated nutrient and sediment reduction credits for the six-acre field after the installation of the adjoining 3.22 acre forest buffer and as a result of the no-till practices at the field. The farmer provided detailed information necessary for calculating nitrogen, phosphorus, and sediment reduction credits. Standardized Excel credit calculation spreadsheets, which are used by the Pennsylvania nutrient trading program⁵ and in accordance with the Pennsylvania State University Agronomy Guide,⁶ were used for the

calculation. Nutrient credit calculations are based on the crop in current production. The table presented here details the various factors involved in these calculations.

The Pennsylvania Environmental Council has determined that the project is not expected to generate significant nutrient or sediment credits this year because the farmer applied more nitrogen fertilizer than the Pennsylvania nutrient trading program recommends. Importantly, the field retains approximately 50 pounds of nitrogen per acre as a result of the soybean (legume) crop in the prior year, which the credit calculation spreadsheets take into account. In the spring of 2008, the farmer applied 160 pounds of nitrogen fertilizer per

acre. Exelon and the Pennsylvania Environmental Council are examining how future nutrient and sediment credits resulting from the project can be registered on the Pennsylvania nutrient trading system.

ADDENDUM: LESSONS LEARNED

In August of 2009, the authors were informed that the Lancaster County Commissioners had decided to build a new 10,000 square foot county morgue and crime laboratory on two acres of the six acre field owned by Lancaster General Health.⁷ The site was determined to be centrally located, easily accessible and is not near any residential areas. This information came as a surprise to the Pennsylvania Environmental Council. In their efforts to create a multi-credit forest riparian buffer methodology, the Pennsylvania Environmental Council was unable to secure an easement on the agricultural field that is designated for nutrient and sediment credits. The crime lab and morgue is expected to be developed by 2011 or 2012.

Pennsylvania Environmental Council, Lancaster County Conservancy, Little Conestoga Watershed Alliance and the Lancaster County Conservation District are working with the County and Lancaster General Health to encourage good watershed stewardship moving forward. They have asked Lancaster General Health to abide

Nutrient Credit Calculation Factors for the Six-Acre Farm

Credit Calculation Factor	Data Input
Primary crop/crop rotation used	Soybeans
Yield for soybeans crop	40-50 bu/ac
Total acreage of cropping field	6+ ac
Average Mehlich-3 P test results for cropping field	45 ppm
RUSLE 2 soil loss value for soybean field	1 ton/ac/yr
Current tillage method	No-Till
Planned N applied from commercial fertilizer	160 lbs/ac/yr
PSU Agronomy Guide recommended rate	150 lbs/acre/yr
Residual nitrogen from soybean crop harvested in 2007	50 lbs/acre
Frequency of previous manure application	Assumed none in last decade
Planned P applied from commercial fertilizer	20 lbs/ac/yr

by the easement provisions for the planted buffer and replace any trees lost due to the development of the right-of-way to the property. They are also encouraging the County and Lancaster General Health to use Low Impact Development techniques to ensure a zero net discharge of storm-water runoff from the development.

KEYS TO SUCCESS

- **Leadership:** The vision and leadership of all of the project partners was vital to developing the methodology, which can now be used in future projects.
- **Funding:** The project was made possible by generous financial support of Exelon Corporation and by volunteer assistance with the planting and re-planting efforts led by the Little Conestoga Watershed Alliance.
- **Permanent Conservation Easements:** The project's major achilles heel was its failure to put a permanent conservation easement on the farm field that was supposed to generate the nutrient and sediment credits. Future projects should ensure that vital lands associated with the multi-credit framework are protected from development.
- **Partners:** The partners brought a wide spectrum of expertise essential to the success of the project. The Little Conestoga Watershed Alliance assisted with the selection of the site as well as the organizing of volunteers for two buffer plantings. ERT-Winrock and the World Resources Institute, experts in

carbon sequestration measurement and nutrient trading policy and metrics respectively, determined the value of the environmental credits. ERT-Winrock also provided design services for the riparian restoration project. The Lancaster County Conservancy played a key role by holding title to the riparian forest buffer protection easement and providing annual easement monitoring and enforcement services.

- **Communication:** Exelon and the Pennsylvania Environmental Council coordinated a communications strategy that included press releases issued by the respective organizations and outreach to local and state media outlets. The Little Conestoga Watershed Alliance contacted a broad network of watershed volunteers to staff the original planting and the secondary re-planting efforts.
- **Volunteers:** The buffer planting and re-planting efforts would not have been possible without the 70-plus volunteers organized by the Little Conestoga Watershed Alliance.

PHOTO AND FIGURE CREDITS

Page 195: Photo, David Burke

Page 196: Photo, Pennsylvania Environmental Council

Page 198: Figure, Burke Environmental Associates/The Conservation Fund, using Google Earth image

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