



Mudford Farm in the Chesapeake Bay

Financing production, biodiversity and
ecosystem services through innovative
land restoration

Ariela Summit



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FARM OF THE FUTURE PROJECT

Case Series Editors: Ariela Summit, Louise E. Buck, Sara J. Scherr



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INTRODUCTION

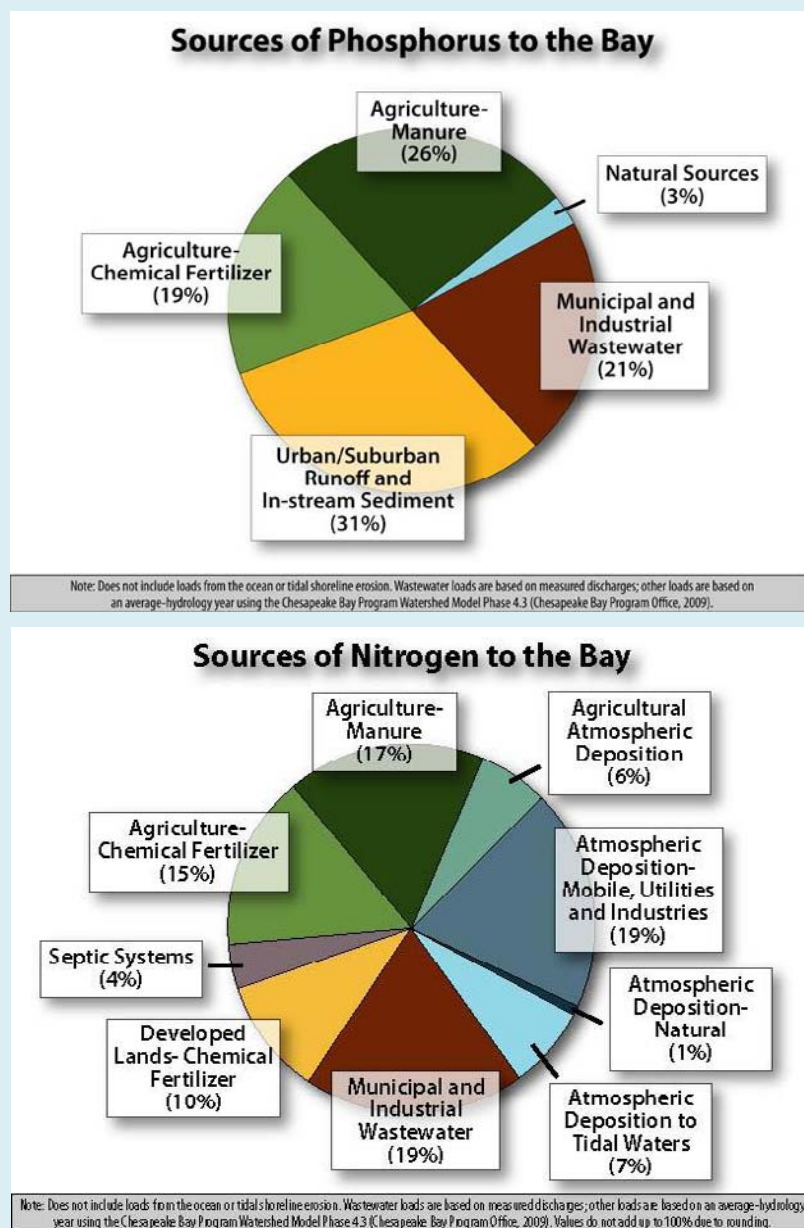
Mudford Farm provides an example of how innovative financing mechanisms can be used to jumpstart pre-compliance markets for environmental services in the Chesapeake Bay while keeping agricultural land in production. The Biophilia Foundation, a non-profit organization, bought the Mudford Farm property in 2005, and with the help of conservation funding through the Farm Bill and Maryland Department of the Environment, restored wetlands and created buffers and upland habitat on degraded land. A local partner and non-profit, Chesapeake Wildlife Heritage, designed and implemented the restoration plans. Another non-profit, Water Stewardship Inc., measured the reduction in nutrient runoff from the property, and translated this information to nutrient reduction credits that would be available for sale to investors. The Biophilia Foundation and partners anticipate that these credits will appreciate in value as a legislative framework for nutrient trading is established in the Chesapeake Bay. In the meantime, they plan to re-sell the Mudford property to a buyer who may be interested in the conservation value of the land, as well as its continued capacity for production.

AGRICULTURAL, ECOLOGICAL AND REGULATORY CONTEXT

Agriculture presents a critical opportunity for restoring water quality and biodiversity through market-based mechanisms for environmental services in the Chesapeake Bay region. The Bay is the largest estuary in the United States, with tributaries draining from the 64,000 square-mile watershed, and over 11,684 miles of shoreline. It is home to nearly 17 million people, and supports over 3600 species of plants, fish and other animals (Chesapeake Bay Compliance and Enforcement Strategy 2010). Including part of six states - Delaware, Maryland, New York, Pennsylvania, Virginia and West Virginia, and the entire District of Columbia – the Bay has received a huge amount of national attention over the past 30 years. An inter-state Chesapeake Bay Agreement was signed in 1983, but water quality has continued to decline, with a negative impact on fisheries and local livelihoods.

Excess nutrients from non-point sources (i.e., those discharged from a dispersed source, such as runoff from agricultural fields or feedlots) are a key cause of poor water quality in the Bay, with nitrogen and phosphorus runoff resulting in eutrophication and algal blooms. Nitrogen and phosphorus entering the Bay originate from fertilizer applications on agricultural land, wastewater treatment plants, urban and suburban runoff, and air pollution (Figure 1). Because the Federal Clean Water Act regulates only pollution emitted from single identifiable places, commonly referred to as “point sources,” concerned parties must be creative in their approach to reducing non-point source pollution. While there has been a six percent improvement in the health of the Bay since 2008, the Chesapeake Bay Program still rates the Bay’s overall health at a weak 45 percent on a score card averaged from measures of water quality, habitats and the lower food web, and fish and shellfish

Figure 1. Relative contribution of pollution sources to the Chesapeake Bay



Source: The Chesapeake Bay Program, 2009

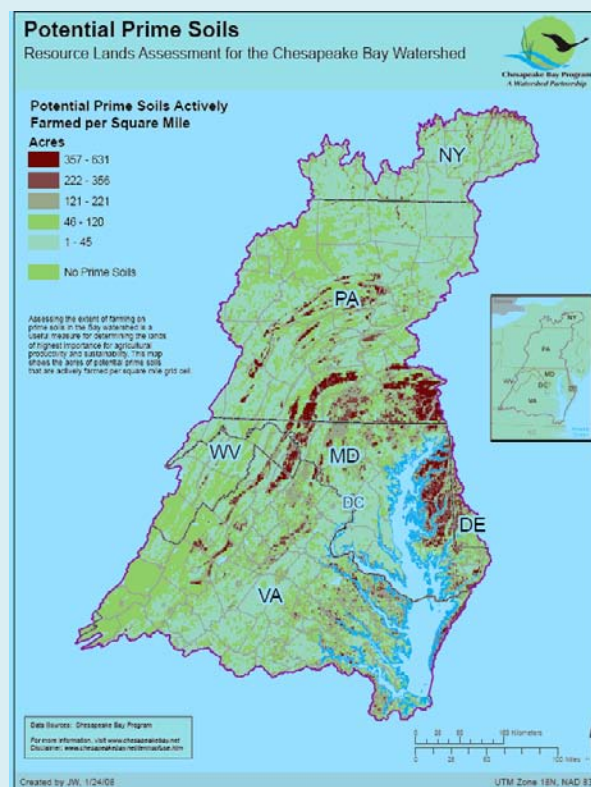
(Bay Barometer 2009). President Obama signed an Executive Order in May of 2009 calling on the federal government to lead pollution control efforts and protect wildlife habitats in the region.

Agriculture, which occupies 25 percent of the land in the Chesapeake Bay watershed, provides both an avenue to reduce nutrient pollution, and to cultivate the ecosystem services upon which the region depends. The nine million acres of land in crop (Figure 2), livestock, and poultry production

represent an important opportunity to provide ecosystem services by filtering groundwater runoff, sequestering carbon, and providing habitat for waterfowl, small mammals, and insect populations. The Chesapeake Bay Program maintains that best management practices in agriculture, such as stream buffers, restored wetlands, cover crops, and rotational grazing, are the most cost-effective way to reduce nitrogen and phosphorus pollution to the Bay. In fact, scientists estimate that best management practices could account for two-thirds of the nitrogen and phosphorus reductions necessary to restore the Chesapeake Bay, at only 13 percent of the total cost of Bay restoration (Vital Signs 2005).

Agricultural land is under severe pressure from suburban sprawl, however, with more than 90,000 acres - almost 150 square miles - lost each year in the Bay states. The number of farms has also decreased in the last 50 years, from approximately 350,000 to about 100,000 (Vital Signs 2005). Successful strategies for environmental conservation in the Chesapeake Bay must target farmers as stewards of soil health, water quality, and biodiversity and work with them to craft economically

Figure 2. Prime farmland in the Chesapeake Bay watershed



Source: Chesapeake Bay Program, 2008

viable means of continuing production and sustainable resource management.

Environmental markets can leverage public and private funds to compensate farmers for reducing nitrogen and phosphorus runoff from their fields, increase carbon sequestration, and conserve biodiversity. Markets provide an opportunity to change farmer behavior. Motivated by the success of EPA's air pollution credit auctions in the 1980s, an increasing array of environmental 'commodities' are beginning to be defined, certified, monitored and exchanged in the Bay region. Some organizations working to develop environmental markets in the Bay include the Bay Bank, the Chesapeake Fund, the World Resources Institute, and state and federal government agencies.

MUDFORD FARM PROFILE

This case study focuses on one of the pilot efforts to create markets for nutrient trading in the Chesapeake Bay. In Maryland the Biophilia Foundation is working with local partners to utilize farm bill programs to restore degraded agricultural land and market nutrient reduction credits while keeping the most productive soils in farming. A unique aspect of Biophilia's approach is that they operate using a land development and resale model, where they buy farm properties, restore them for conservation and continued production, and then resell them to a buyer with permanent restrictions on land use. The Biophilia Foundation is a non-profit organization headed

by Richard Pritzlaff, whose funding base comes from both private and grant-based sources. On Mudford Farm (see Image 1), Richard and staff worked closely with two non-profit partners: Chesapeake Wildlife Heritage, who performed the site evaluation and Water Stewardship Inc., who developed and implemented a scientific standard for tracking nutrient reduction credits.

Using their model of land purchase, restoration for ecosystem services, and resale, the Biophilia Foundation and Chesapeake Wildlife Heritage have restored and protected six farms within Maryland's mid-Eastern Shore within the past eight years (Figure 3). In total, these properties comprise 1415 acres (see Table 1), of which portions have been converted to grassland buffers, forested buffers, tidal wetlands and mature woodlands, all of which provide habitat for wildlife and filter for agricultural runoff. A total of 369 acres of the most productive farmland have stayed in

Image 1. Spring crops on Mudford Farm



Source: Wenceslao Almazan

agricultural crops, with nutrients from fertilizer applications filtered by the wetlands and grassland buffers resulting in less nutrient runoff to the Chesapeake Bay.

The Mudford Farm property is located one mile north of Sudlersville and eight miles northeast of Centerville in Queen Anne's County, Maryland. It lies at the headwaters of the Chester River which runs approximately 40 miles from its origin in Delaware to the Chesapeake Bay. Mudford Farm was purchased by the Biophilia Foundation in 2005 after being previously owned by an absentee landlord who contracted out farm management and labor. The property consists of approximately 275 acres, of which 162 acres were in row crops at the time of purchase and 113 acres were in mature forest. Row crops included wheat, corn and soybeans. During 2007-2008, the Biophilia Foundation worked with Chesapeake Wildlife Heritage to design, build and manage wetlands and warm season grass buffers on the farm utilizing landowner incentives offered through the U.S. Department of Agriculture's Conservation Reserve Program (CRP) and Conservation

Figure 3. Restored and protected farms



Farms in Maryland that the Biophilia foundation and Chesapeake Wildlife Heritage have protected or restored.

Source: The Biophilia Foundation, 2010

Reserve Enhancement Program (CREP) and the Maryland Department of the Environment. The most productive land continued to be farmed in a wheat, corn, and soybean rotation using low impact fertilizer and pest control techniques.

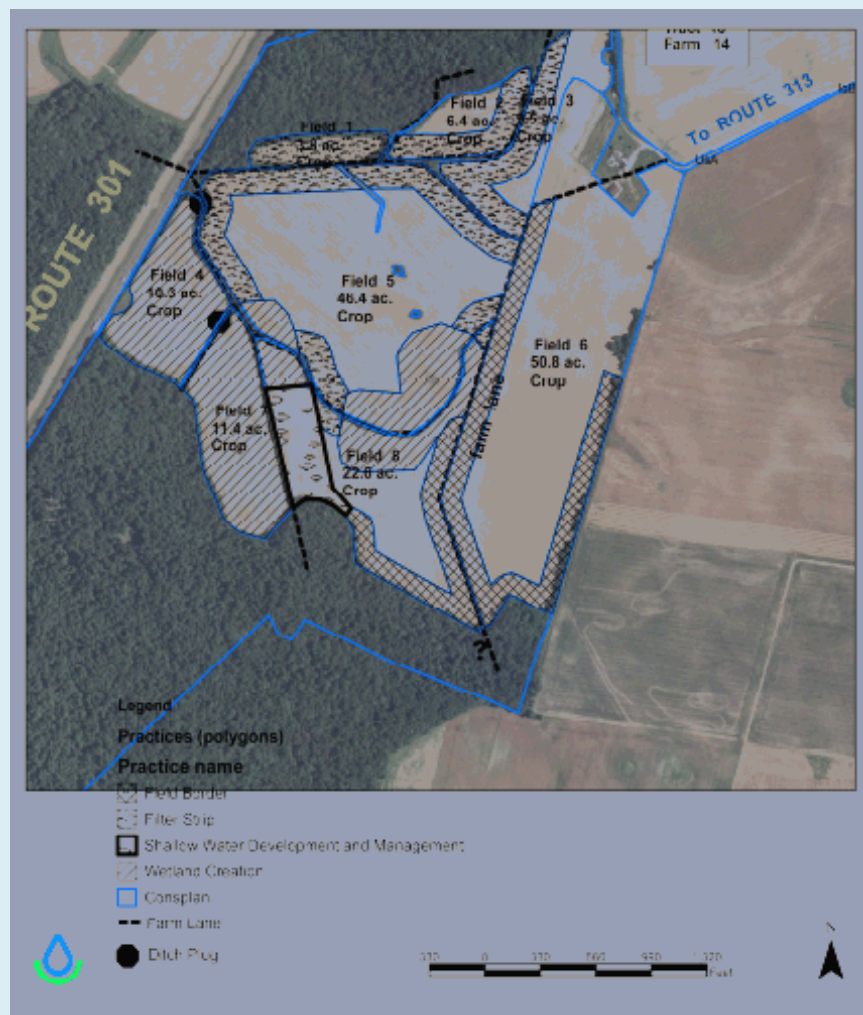
CONSERVATION MANAGEMENT STRATEGY

The Biophilia Foundation contracted Chesapeake Wildlife Heritage, a local nonprofit focusing on restoration and improved land management on Maryland’s Eastern Shore, to provide an initial environmental assessment of the Mudford Farm property. This assessment revealed significant areas of poorly drained, anaerobic soils on cropped land. Based on this criterion, the Biophilia Foundation submitted applications to CRP and CREP, eventually establishing four different classifications of conservation measures on the land including filter strips, riparian buffers, wetland restoration, and field borders on the property (Figure 4). Altogether, these federal programs helped restore 38.8 acres of wetland, and create 43.6 acres to warm season grass meadows on Mudford farm.

Table 1. Total impact (acres) on Eastern Shore properties and nutrient load reductions

Farm	Total Acres	Restored Wetlands	Warm Season Grass Buffers	Forested Buffers	BMP Farmland	% Reduction Nitrogen	% Reduction Phosphorus
Spencer	190	35	6	3	40	76.6%	75.9%
Riverbend	236	57	11	30	95	76.1%	75.4%
Chic	393	24	10	14	85	60.5%	59.3%
Mudford	274	38.8	43.6	0	80	75.9%	75.2%
Rash	151	17.7	32	0	69	80.2%	79.6%
Anchovie Hills	171	68.0	38	69	0	98.0%	95.7%
Totals	1415	240.5	140.6	116	369	75.3%	74.3%

Figure 4. Mudford management plan



Source: The Biophilia Foundation, 2010

Strategically placed buffers and wetlands filter nutrients used on crop fields, and provide habitat for waterfowl, quail, wild turkey, and other animal species. Michael Robin Haggie of Chesapeake Wildlife Heritage has collected over four years of raw field data (2005-2010) tracking bird sightings at Mudford farm, and verifies that all puddle ducks and shorebirds are there due to restoration efforts. He is also working on a peer reviewed publication focused on the effects of native versus non-native warm season and cold season grass on wildlife populations within the CREP program. The additional waterfowl increase the value of hunting leases on the land and the landowner (currently the Biophilia Foundation) is paid a yearly rental payment through CREP of about \$12,000 for a period of 15 years.

In addition to utilizing federal conservation programs, the Biophilia Foundation took advantage of wetland banking opportunities through the state of Maryland (Image 2). Last year, they sold a ten-acre wetland bank established through CREP to Maryland at \$8,000 an acre, for a total of \$80,000. The wetland is protected in permanent easement through an agreement between the Biophilia Foundation (grantor) and Chesapeake Wildlife Heritage (grantee). The remainder of the farm is not yet under easement, and Maryland no longer allows a parcel of land enrolled in CREP to also participate in its wetland banking program.

While this type of doubling up on federal and state programs for wetland restoration and protection was legal at the time of the transaction, it is now prohibited for landowners to profit from two conservation programs on the same piece of land. In this case, CREP facilitated the transition of degraded cropland to wetland by providing transition cost-share and rental payments on the land for 15 years. The easement that created the wetland bank provided the opportunity to keep the land in permanent easement, and for the landowners to earn additional income, in the form of a lump payment for development rights. The Biophilia Foundation foresees future opportunities for protecting the ecosystem service value of Mudford Farm in perpetuity, aside from the 10 acres that are already protected in permanent easement through Maryland Department of the Environment. It expects to put another 160 acres into a permanent easement with the Maryland Department of Natural Resources through CREP and hopes to sell an agricultural land easement on the 80 acres of productive cropland through the Maryland Agricultural Land Preservation Foundation. Conservation easements contain detailed provisions to provide for adaptive management of restored habitat areas and will be updated every 15 years by ecologists from Chesapeake Wildlife Heritage. An agricultural easement would require the use of farming techniques that reduce nutrient runoff, including crop rotations, precision nutrient management and no insecticides on the 80 acres that are currently being farmed in a corn, wheat, and soy rotation. Depending on the terms that are negotiated, Chesapeake Wildlife Heritage would work with the farmer on a mandatory or voluntary basis to continue a similar land management regime.

Image 2. Restored wetland on Mudford Farm



Source: Wenceslao Almazan 2010

Table 2. Main actors in the redevelopment of Mudford Farm

Actor	Role
The Biophilia Foundation http://www.biophiliafoundation.org/	Non-profit working to advance biodiversity conservation on private lands
Chesapeake Wildlife Heritage http://www.cheswildlife.org	Non-profit which designs, builds, and manages habitat to increase native biodiversity and links landowners to Farm Bill conservation programs
Water Stewardship Inc. http://corporatewaterstewardship.org/	Non-profit that evaluated the nitrogen and phosphorus reduction credits potentially available for sale as a result of implementation of conservation measures on the farm.
Mission Markets www.missionmarkets.com	Private investment exchange facilitating transactions within the social and environmental capital markets.
Markit http://www.markit.com/en/	A global online registry of carbon, water and other biodiversity credits available for sale including indicative quantities and price

Biophilia anticipates breaking even on the property, which it would consider selling to the right type of buyer at or below market cost. Ideally, Richard Pritzlaff and the Biophilia team would like to sell Mudford Farm to a “conservation buyer” – either an individual or group of farmers who value the conservation measures that have been put onto place on the land and wish to diversify agricultural production to support a regional food economy. Revenue from the sale of nutrient reduction credits would make the land more affordable. On the other four properties that the Biophilia Foundation bought and resold on the Eastern Shore, the “conservation buyer” generally fit the profile of a gentleman farmer: interested in the land primarily for conservation and quality of life values and not aiming to run it as a profitable operation (the Biophilia Foundation and Chesapeake Wildlife Heritage consulted on the two remaining Eastern Shore properties). By making the farming option financially viable through participation in Farm Bill programs and environmental service markets, however, the Biophilia Foundation and Chesapeake Wildlife Heritage hope to foster a new agricultural business model. Table 2 identifies the main actors involved in bringing about the perpetual protection of ecosystem services on the farm.

NUTRIENT REDUCTION CREDITS

Rather than waiting for a fully formed nutrient trading market to emerge in the Bay area, the Biophilia Foundation pursued a proactive strategy by contracting Water Stewardship Inc. to evaluate the nitrogen (N) and phosphorus (P) reduction credits that could be available for sale as a result of implementation of conservation measures on the farm. Water Stewardship Inc. is a non-profit based in Annapolis, MD and headed by Tom Simpson. As part of the credit evaluation process, the Biophilia Foundation provided them with maps of the parcel, showing location and approximate acreage of the practices implemented and the remaining cropland. This information was subsequently updated with the farm's nutrient management plan and the US Department of Agriculture's Natural Resource Conservation Service (NRCS) map showing location and acreage of the implemented practices. Water Stewardship Inc. evaluated the information provided and then conducted a detailed site evaluation including soil borings and intermittent measurement of buffer width to verify or modify the information on the Biophilia Foundation and NRCS maps.

Based on an evaluation of information provided by the Biophilia Foundation about the suite of practices implemented on the farm, Water Stewardship Inc. determined the nitrogen and phosphorus reductions that could be verified for use in the voluntary ecosystem market. They used standard procedures, nutrient loads and best management practice efficiencies and application protocols adapted from the Chesapeake Bay Program and the Water Stewardship Inc. Nutrient Load Estimator software. Cost estimates for these credits were based on best currently available information but may not represent actual market value. Tables 3 and 4 summarize the changes in total nitrogen and total phosphorous loads from the respective management practices, and estimate the financial value of the net reductions in loads. In this study, a nitrogen credit is equal to one pound of nitrogen reduction per year. Valuation is based on a 50 year timeframe by the Chesapeake Ecofinance Company, although 15 to 30 years is more typically employed.

The credits generated from this evaluation were registered with the firm Markit and offered for sale through the Bay Bank and Mission Markets. Revenue from credits will accrue to the Biophilia Foundation and be reinvested in the property to pay for the permanent stewardship of conservation practices through an easement requiring management by a land trust. Any additional income from the credits will be reinvested in similar enterprises. The Biophilia Foundation hopes that the scientific standard used by Water Stewardship Inc. in evaluating nutrient reduction credits will provide an important precedent for eventual standards established by federal and state agencies for a robust water quality trading market in the Chesapeake Bay Watershed.

Table 4. Summary of total annual nitrogen (N) load delivered to tidal waters

Land Use	Pre-BMP Total N Delivered Load (lbs/yr)	Post-BMP Total N Delivered Load (lbs/yr)	Total N Change (lbs/yr)
Conservation Tillage Cropland	3052.9	734.2	-2318
Warm Season Grass Buffers	0.0	225.8	+226
Warm Season Grass Wildlife Habitat	0.0	235.9	+236
Wetlands	0.0	51.8	+52
TOTAL	3,052	1,247	1,805
Annual Total N Credit Value \$18,050 (N credit value \$10/lb/yr)			

Table 3. Summary of total annual phosphorus (P) load delivered to tidal waters

Land use	Pre-BMP Total P Delivered Load (lbs/yr)	Post-BMP Total P Delivered Load (lbs/yr)	Total P Change (lbs/yr)
Conservation Tillage Cropland	143.9	39.0	-105
Warm Season Grass Buffers	0.0	2.4	+2
Warm Season Grass Wildlife Habitat	0.0	2.5	+3
Wetlands	0.0	1.9	+2
TOTAL	144	46	98
Annual Total P Credit Value \$490 (N credit value \$5/lbs/yr)			

SCALING UP: CHALLENGES AND OPPORTUNITIES

As a non-profit with a stable funding base drawn from grants and private donations, the Biophilia Foundation was able to finance the up-front costs (eventually reimbursed through CREP) for implementing conservation measures and the independent verification of nutrient reduction credits. Based on partnerships they had cultivated within the community, they drew from a significant pool of financial, conservation, and legal expertise. The time and money that went into the redevelopment plan at Mudford Farm is likely beyond the reach of most farmers. Nonetheless, the experience provides an important vision of successful strategies for establishing a marketplace for nutrient reduction credits and related services in the Chesapeake Bay.

The land redevelopment and crediting process used at Mudford could be replicated on other properties. Indeed, the Biophilia Foundation currently has similar projects in the works. It is important to note, however, that the financial success of projects like Mudford depends on a number of factors and is not a "one size fits all" type of scenario. These variables include the quality of the soils, the irrigation potential of the farm, the proximity to markets, the proximity to populations of migratory birds, how much hunting pressure a site can take, and who farms and owns the land.

Payments for environmental services present an important opportunity to build on existing conservation programs through the Farm Bill, as demonstrated by the pilot example on Mudford Farm. Specific recommendations of affiliated partners include working with state and federal actors to provide a single easement template for Farm Bill programs and exploring opportunities to stack or bundle environmental services on agricultural land. To scale up a model similar to Mudford, a broad range of public, private, and civil sector actors would need to be mobilized. Policy reform could create a framework for nutrient trading in the Chesapeake with the potential to offer farmers financially and agriculturally viable alternatives to intensive crop and poultry farming. Landowners could benefit from technical assistance and financial incentives to change the current land management regimen. New tools for valuing environmental services would need to be integrated and utilized to reach the goal of a restored Chesapeake Bay.

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GLOSSARY

BMP(s)	Best Management Practice(s) – established land management practices that also provide water quality benefits. They include such practices as cover crops, green manure crops, and strip-cropping to control erosion. Also included in this are practices such as soil testing and targeting and timing of chemical applications (similar to Integrated Pest Management) to prevent the loss of nutrients and pesticides.
CBP	Chesapeake Bay Program – a unique regional partnership that has led and directed the restoration of the Chesapeake Bay since 1983. The Chesapeake Bay Program partners include the states of Maryland, Pennsylvania and Virginia; the District of Columbia; the Chesapeake Bay Commission, a tri-state legislative body; the Environmental Protection Agency, representing the federal government; and participating citizen advisory groups.
Chesapeake Bay Protection and Restoration Executive Order	On May 12, 2009, President Barack Obama signed an Executive Order that recognizes the Chesapeake Bay as a national treasure and calls on the federal government to lead a renewed effort to restore and protect the nation's largest estuary and its watershed. The Order established a Federal Leadership Committee that will oversee the development and coordination of reporting, data management and other activities by agencies involved in Bay restoration. The committee will be chaired by the Administrator of the Environmental Protection Agency and include senior representatives from the departments of Agriculture, Commerce, Defense, Homeland Security, Interior, Transportation and others.
Conservation Easement	A restriction placed on a piece of property to protect its associated resources. In a conservation easement, a landowner voluntarily agrees to sell or donate certain rights associated with his or her property – often the right to subdivide or develop – and a private organization or public agency agrees to hold the right to enforce the landowner's promise not to exercise those rights. Agreements limit certain types of uses or prevent development from taking place on the land for an agreed period of time, while the land remains in original ownership.
CREP	Conservation Reserve Enhancement Program – a financial incentive to landowners to implement practices that will help reduce sediment and nutrient runoff and will improve wildlife habitat. CREP is administered by the Farm Service Agency (FSA). NRCS and cooperating agencies also provide technical assistance to help landowners plan and implement CREP practices.
CRP	Conservation Reserve Program – provides technical and financial assistance to eligible landowners to address soil, water and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. CRP encourages landowners to convert highly erodible cropland and other environmentally sensitive areas to permanent

cover, such as introduced or native grasses, trees, filter strips, riparian forest buffers, wetlands and shallow water habitats. CRP is funded through the Commodity Credit Corporation (CCC). CCC makes annual rental payments based on the agriculture rental value of the land and provides cost-share assistance for up to 50 percent of the participant's eligible costs to establish approved conservation practices. Participants enroll in CRP contracts for 10 to 15 years. The program is administered by the Farm Service Agency (FSA), with technical assistance provided by NRCS and other cooperating agencies.

CWA Federal Clean Water Act - the primary federal law in the United States governing surface water pollution. Its goal is to eliminate releases into water of toxic substances, eliminating additional water pollution by 1985, and ensuring that surface waters would meet standards necessary for human recreation and fishing by 1983. The principal body of law currently in effect is based on the 1972 Federal Water Pollution Control Amendments, which significantly expanded and strengthened earlier legislation. Major amendments were enacted in the 1977 Clean Water Act and the Water Quality Act of 1987.

Eutrophication The process by which a body of water acquires a high concentration of nutrients, especially phosphates and nitrates. These typically promote excessive growth of algae. As the algae die and decompose, high levels of organic matter and the decomposing organisms deplete the water of available oxygen, causing the death of other organisms, such as fish. Eutrophication is a natural, slow-aging process for a water body, but human activity has recently greatly sped up the process.