

Conservation Benefits

Putting Value Where it Belongs



October 2010



Acknowledgements:

This report from the National Association of Conservation Districts (NADC) was made possible by funding assistance from the USDA Natural Resources Conservation Service. The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the U.S. government. Mention of trade names or commercial products does not constitute their endorsement by the U.S. government or NACD.

Numerous individuals provided insights and guidance in the preparation of this report. They include Thomas Christensen, Frank Clearfield, Dennis Fuchs, Jay Fuhrer, Jim Gulliford, Tim Gieseke, Bill Horvath, James Klang, Patricia Leavenworth, Dr. Stephen Polasky, Greg Ruark and Robert Toole.

The report was compiled and written by Bill Berry, Stevens Point, Wisconsin, with guidance and oversight provided by NACD senior advisor Rich Duesterhaus. Cover art by Scott Patton, NRCS.

Non-Discrimination:

All activities pursuant to this agreement shall be in compliance with the requirements of the Executive Order 11246; Title VI of the Civil Rights Act of 1964 (78 Stat. 252; 42 U.S.C. 200(d) et seq.); Title V, Section 504 of the Rehabilitation Act of 1973 (87 Stat. 394; 29 U.S.C. 794), as amended by the Americans With Disabilities Act; the Age Discrimination Act of 1975 (89 Stat. 728; 42 U.S.C. 6101 et seq.); and with all other federal laws and regulations prohibiting discrimination on grounds of race, color, sexual orientation, national origin, disability, religion, age or sex.

TABLE OF CONTENTS

	Page
Introduction.....	4
Executive Summary.....	4
Drawing a more complete picture of the value of conservation.	
The Current Landscape.....	6
Natural Resources Inventory findings.....	6
Conservation Effects Assessment Project findings.....	7
Getting the Full Picture: Engaging a broader cross-section of society.....	8
New Directions: Taking steps to recognize, define and explain value.....	9
Streams of Value: Making the Case for What We Do.....	11
Ecosystem Services: Source Water.....	12
Ecosystem Services: Wetlands.....	14
Ecosystem Services: Flood Mitigation/Storm Water Management.....	15
Ecosystem Services: Greenhouse Gases.....	16
Ecosystem Services: Conservation Planting Systems.....	17
Ecosystem Services: Farmland Preservation.....	18
Ecosystem Services: Forestry.....	18
Ecosystem Services: Pollination.....	19
Ecosystem Services: Recreation.....	20
Ecosystem Services: On the Way, But Not There.....	20
Local and State Impacts of Conservation Spending.....	21
Value of Conservation Spending: EQIP Example from Maine.....	21
Value of Conservation Spending: Oklahoma Study.....	22
Conservation Spending: Telling the Whole Story of What We Do.....	23
Current Challenges, Future Streams.....	24
Building the case for values using new tools and better communication.....	24
Bundling vs. Stacking an issue to be resolved.....	25
Drivers Needed to Build Markets.....	25
New Streams: Private Sector Drivers Offer Promise.....	25
Challenges and New Streams: The Upshot.....	26
The conservation community can do a better job, and can't afford to wait.	
Case Studies.....	27
Kansas: Urban and Rural Partners in Water Quality.....	28
Ohio River Basin Trading Program Will be Largest.....	28
Conservation Marketplace of Minnesota Partners with Crop Consultants.....	29
New York City Watershed Set the Standard.....	29
Ecosystem Trading Opportunities Advance in Oregon.....	30
North Dakota District Spells Out Cover Crop Values.....	30
Piloting Water Quality Trading on Greater Miami Watershed in Ohio.....	31
Oklahoma Partnership Reduces Environmental Footprint.....	31
Links to Resources for More Information.....	32

Conservation Benefits: Putting Value Where It Belongs

“We talk about protecting nature, conserving nature...That’s the wrong language; I think it should be about investing in nature. I think we should think about nature as an investment that pays off. And it’s a solid investment... I’ll put nature up as an investment against a lot of other investments out there for its durability and sustainability and its tangible reality, and I think that’s a better way to frame it than ‘protect and conserve.’ Invest, and the investment will pay off.”

–Dr. Peter Kareiva
The Nature Conservancy¹

Introduction

The National Association of Conservation Districts, in an agreement with the Natural Resources Conservation Service, has been tasked with developing a summary of the status of efforts to identify economic values associated with conservation practices and systems on private lands in America. In this report, we provide an overview on the current landscape, with attention to ecosystem services and other streams of value associated with conservation activity. It explores progress and impediments to linking ecological and economic values and provides examples of where economic values of conservation efforts have been identified. We also explore strategies that might better apply value to conservation practices and systems in the future. We also include a list of links to resources for more information.

Executive Summary

While the value of conservation to society is long-established, putting an actual dollar value on services such as clean air and water has been elusive. Describing conservation benefits as “priceless” may be true from a qualitative standpoint, but hard numbers are needed if economic values are to be recognized.

Many other economic benefits from conservation have either not been tallied or have been done so incompletely.

One clear finding of this report is that the conservation community can do a better job quantifying and communicating to as full an extent as possible the economic value of its work. It cannot be assumed that the public and decision-makers understand nuance. They need to see direct streams of value.

There is little doubt that the array of practices and systems offered through existing conservation programs offer a wide range of ecological values, referred to as ecosystem services. NRCS’ Natural Resources Inventory and the multi-agency Conservation Effects Assessment Project both provide examples, some of which will be cited in this paper.

In recent years, research on determining economic value of conservation has heightened, and the body of knowledge is building.ⁱⁱ But we remain a long way from robust systems that establish the full value of

conservation practices. To be sure, there are examples of progress, especially in areas such as source water protection and wetlands mitigation.

A simple definition of ecosystem services is “the profits and products provided by natural systems that sustain and fulfill human lives.”ⁱⁱⁱ These include two major categories of services. “Provisioning services” are the food, fiber and fuel produced by America’s croplands. “Regulating services” provide water quality, water recharge and many other ecological benefits.

Historically, we have done a better job of valuing provisioning services. They attach more readily to market systems, although a variety of such services also benefit from nonmarket government payments. Efforts to place market-type values on regulating services have heightened in recent years for a variety of reasons. Success has been spotty.

One reason for this is the “winners vs. losers” dilemma. Sometimes in the private lands conservation arena, one person’s benefit is another’s cost. A conservation practice on a farm that improves water quality for users downstream is often seen differently by the farmer trying to make a living and the city dweller who needs clean water. This issue of “winners and losers” is an ongoing impediment to achieving landscape-scale successes. Reducing the number of economic losers would seem to be a central goal of any effort to place value on conservation practices and systems.

Key points:

- ✓ **Conservation’s ecological values are clear**
- ✓ **Economic values aren’t as clear**
- ✓ **It’s time to better capture and describe economic values**

This paper cites developments that may achieve this goal. They include: Growing attention to defining and valuing ecosystem services, more emphasis on targeting conservation spending where it will achieve the greatest benefits and efforts to develop market-based solutions to conservation concerns.

In addition, the conservation community can more completely account for and communicate the full range of benefits produced by conservation work. These include but are not limited to financial benefits enjoyed by customers served by conservation workers, the economic impact of federal and state conservation funding on local communities and businesses, payrolls at local conservation districts and their conservation partners and broad range of other benefits.

Our history is informed by our past, and two examples shed light on the challenge and potential of identifying value streams.

NRCS this year celebrates its 75th anniversary, an occasion made possible because of one of our nation’s most compelling stories of conservation and economic value. The Great Dust Bowl of 1930s was brought on by the combination of drought and unenlightened farming practices. It devastated local economies and caused financial ruin to people across a wide swath of the country’s midsection.

The Dust Bowl gave birth to the Soil Conservation Service, the forerunner of NRCS. It also led to creation of the local entities charged with the task of implementing conservation practices and systems on the landscape – America’s conservation districts. The soil conservation district program recognized that new farming methods needed to be accepted and enforced by the farmers on the land – locally based conservation. The extensive work of re-plowing the land into furrows, planting trees in shelterbelts, and other conservation methods resulted in significant reductions in the amount of blowing soil. When the drought came to an end in 1939, the Great Plains once again became a fertile agricultural region.

Decades later, in the 1970s, erosion was again identified as a problem as America’s farmers were asked to produce more to meet the needs of an expanding world population. So-called “ephemeral erosion” was a major problem, and reducing erosion was targeted as a national goal in the 1979 Resource Conservation Act. NACD and the SCS undertook a major educational effort to highlight the problems caused by erosion. Thousands of meetings were held in district offices across the country to draw attention to the problem.^{iv}

These meetings and other activities led to the introduction of measures such as reduced tillage. Conservation districts and equipment companies made no-till drills available to farmers. Terraces and other practices to reduce erosion were encouraged. NACD also undertook an effort to inform Congress erosion was a serious problem on many of America’s agricultural acres.

Congress established the Conservation Reserve Program in the 1985 Farm Bill, with the intent of encouraging farmers to convert highly erodible cropland or other environmentally sensitive acreage to resource-conserving vegetative cover. The 1985 Farm Bill also included conservation compliance provisions, which served as disincentives to farmers and ranchers who produced annually tilled agricultural commodity crops on highly erodible cropland without adequate erosion protection.

Neither CRP nor conservation compliance are without controversy to this day. But the bigger story here is that concerted efforts to draw attention to problems with both ecological and economic dimensions are sometimes needed to underscore the value and importance of work accomplished by the conservation community.

That is what is needed to fully tell the story of what we refer to in this paper as “value streams,” – the economic benefits of the work of the conservation partnership. We begin with a look at the current landscape.

The current landscape

In many ways, great strides have been made in addressing America’s most pressing conservation needs.

But with these accomplishments come new challenges. Here we take time to acknowledge some key achievements and also note the need to complete the circle, tying conservation more completely to value streams.

Two recent reports underscore the progress made on several fronts and highlight the fact that America's conservation delivery system – the federal, state and local partnership that delivers Farm Bill conservation programs and conservation technical assistance – is in many ways the envy of the world. We briefly touch on findings of the Natural Resources Inventory and the Conservation Effects Assessment Project.

NRI Findings

NRCS released its 2007 [National Resources Inventory](#) in late 2009, and its findings include encouraging progress on soil erosion on U.S. cropland. NRI is a statistical survey of land use and natural resource conditions and trends on U.S. non-Federal lands.



Among its major findings, the latest report estimates soil erosion on cropland decreased 43 percent between 1982 and 2007. Water (sheet and rill) erosion declined from 1.68 billion tons per year to 960 million tons, and wind erosion decreased from 1.38 billion to 796 million tons per year.

The ecological benefits of reduced erosion are well-documented, but is there an accompanying economic value? If the cost of a ton of eroded soil is considered, the answer is a qualified yes. Estimates of the costs of eroded soil range as high as \$11, but for our purposes, we cite USDA estimates of between \$6.10 and \$6.40 per ton using 2009 values.^v Off-site costs in this equation are estimated to be about three-quarters of the total. We choose the more conservative \$6.10 figure and apply it to NRI data for sheet and rill erosion in the following chart:

Annual decline in sheet and rill erosion, 1982-2007
720 million tons
@\$6.10 per ton = \$4.4 billion in costs avoided per year
On-site: \$1.1 billion
Off-site: \$3.3 billion

These numbers might not hold up in a roomful of economists, but they do provide some insight into the economic value of regulating services. Economists warn against using costs avoided to describe economic values. In this case, the farmer who prevents erosion may benefit economically, but no one is handing him a check that represents the costs avoided. Still, the erosion figures do provide insight into the high value of conservation activities that prevent erosion.

NRI also points out another key statistic: 4,080,300 acres of active agricultural land (crop, pasture, range, and land formerly enrolled in the Conservation Reserve Program) were converted to developed uses between 2002 and 2007. This represents an area roughly the size of Massachusetts. Overall, the nation has lost 41,324,800 acres of rural land to development between 1982 and 2007—an area about the size of Illinois and New Jersey. Rural land includes active agricultural land, plus forest land and other rural land. Fifty-six percent of the rural land developed, or 23,163,500 acres, is identified as active agricultural land.

In addition, there was a nationwide 13,773,400-acre decline in prime farmland between 1982 and 2007. Prime farmland soils are best suited to produce food and other agricultural crops with the fewest inputs and the least amount of soil erosion.

Does this conversion of rural land to other uses come at a cost to society? To ecosystem services? Groups like American Farmland Trust have long sought to make that link through various studies that compare, for instance, the cost of providing local services to developed property versus working lands. More careful analysis may also identify other costs of conversion, including loss of flood control and increased infrastructure costs for storm water abatement.

Later in this paper, we present information about the opportunity to more fully engage local beneficiaries of ecosystem services in providing incentives to farmers and forest owners. This may shed further light on how to better recognize value streams and provide corresponding economic incentives. It may also open pathways for engagement by conservation districts and their partners at the local level.

CEAP Findings

The Conservation Effects Assessment Project is a multi-agency federal effort to quantify the environmental effects of conservation practices and programs and develop the science base for managing the agricultural landscape for environmental quality. CEAP's [Assessment of the Effects of Conservation Practices on Cultivated Cropland in the Upper Mississippi River Basin](#) was released in June 2010.

Its findings included the following:

- Cropland in the Upper Mississippi Basin sequesters about 7.5 million tons of carbon dioxide equivalents (CO₂e) annually
- Erosion control practices can significantly increase sequestration rates by reducing losses of organic matter due to erosion.
- Voluntary, incentive-based conservation works. Reduced tillage is used on 95 percent of cropland, and sediment losses are reduced by 69 percent.
- Nutrient management is the greatest need in order to produce significant reductions in nitrogen and phosphorous losses.
- Targeting can greatly enhance program effectiveness. Treating the most critical areas can have three to five times the benefit of treating acres with less serious problems.

Key points:

- ✓ **NRI, CEAP show resource progress**
- ✓ **New directions explored for valuing ecosystem services**
- ✓ **Public education needed**

- Suites of practices that address multiple resource concerns are more effective than single practices.

As noted, CEAP concentrates on quantifying the environmental effects of conservation practices and programs. But the findings hint at economic benefits that can accompany conservation practices. Reduced tillage leads to on-farm savings for farmers, including reduced inputs and soil erosion abated. Targeting critical areas has the potential to lead to water quality improvements for downstream users and lends itself to more effective monitoring. Suites of conservation practices could fit into future efforts to “stack” market payments. “Stacking” allows landowners to receive multiple payments for ecological services such as source-water protection and carbon sequestration **on the same acres**.

One could envision future NRI and CEAP reports accompanied by information about economic benefits of conservation practices and programs, including who benefits and in what ways.

Getting the Full Picture

Terms such as ecosystem services and market-based conservation are familiar to those in conservation, academic and research communities. But beyond those pods of interest, the terms are often no more recognizable than the names of the elements in the periodic table.

Nonetheless, some segments of society are beginning to understand the importance of more completely valuing conservation. Entities charged with protecting source water are one example. Forest certification, wetlands habitat, flood mitigation and carbon crediting are examples of payment streams for ecosystem services that have gained footholds in society, however tenuous in some cases. Some values, such as recreational benefits that stem from clean water and wildlife habitat, have been successfully calculated.

A broader cross-section of society can be engaged. The public and private sectors have been slow to embrace the concept of establishing or recognizing dollar values for conservation practices and systems. Ecological economists have made strides in developing sufficient matrices that connect the dots from the benefits of sound conservation to value streams. But these gains have yet to be sufficiently transferred to policy and market sectors. In part, this is caused by the winners vs. losers dilemma. Other forces are at work, too.

Florida State University College of Law Professor of Property J.B. Ruhl describes the historical landscape: “For decades, social, political and economic forces have driven farms to manage ecological resources toward production of food, fiber, and energy commodities. They have done so well, but at the expense of maintaining the stock of natural capital necessary to provide a sustainable flow of ecosystem services of more general benefit to society, such as groundwater recharge, water purification, and flood control.” He adds: “Natural disasters and the effects of climate change are focusing society on the value of those services.”^{vi}

At present, we are left with a gap. We may know intuitively that the regulating services referred to by Ruhl have value, but we haven’t turned the corner to establish reliable value streams.

University of Minnesota environmental/ecological economist Dr. Stephen Polasky describes the current landscape this way: “The main point here is very straightforward: There are a number of environmental benefits we get from certain actions or environmental costs we get from certain activities. We want to factor that as we do with conventional goods and services in markets. The problem is, we don’t have observed market prices for these goods. So a large body of work is now trying to fill that gap.”^{vii}

New Directions

Earlier this year, Agriculture Secretary Tom Vilsack announced new details about the functions and objectives of USDA's Office of Environmental Markets (OEM). The office, part of USDA's Natural Resources and Environment mission area, will work to carry out USDA's climate and rural revitalization goals by supporting the development of emerging markets for carbon, water quality, wetlands and biodiversity.

The 2008 Farm Bill's Conservation Title directed the secretary to facilitate the development of environmental markets and ensure the participation of America's farmers, ranchers, and forest landowners. OEM is charged with the task of working across government and in consultation with experts and stakeholders to build a market-based system for quantifying, registering and verifying environmental benefits produced by land management activities.

As the next section of this report shows, ecosystem services markets continue to provide promise for attaching economic values to conservation systems and practices, but their growth continues at a slow pace. If these markets are to flourish, more and better systems that identify buyers and sellers and establish prices are needed.

As recently as 2005, The National Research Council concluded: “In general, estimating the provision of the complete range of ecosystem services from any particular ecosystem is beyond our ability at present.”

Polasky and others see the gap getting smaller. Dr. Peter Kareiva, quoted at the start of this section, believes narrowing that gap is crucial: “Ecosystem services are the only way conservation goals will become mainstream.”

The findings of this study support that conclusion. Most of our pressing conservation challenges have solutions. We have the scientific and technical wherewithal to accomplish major gains. The challenge, it would seem, is to develop the societal will to implement the necessary steps. We will best accomplish that when we find the means to link environmental and economic values.

Streams of Value: Making the Case for What We Do

"It can be said that every country has three kinds of wealth: material, cultural, and biological. The first two, the basis of almost all of our visible economic and political life, we think about every day. The third, made up of the fauna and flora and the uses to which nature's diversity is put, we take a lot less seriously. Biological wealth, however, is much more potent for long-term human welfare than is generally appreciated..."

—E.O. Wilson^{viii}

Added to the many tasks for the conservation partnership as we edge into the second decade of the 21st century is the need to quantify, highlight and enhance the economic value streams that flow from the work we do. The need to do so is of heightened importance as we make a case for our work in a difficult economy.

Here, we provide examples of where value streams have been established in areas such as water and air quality, flood control and storm water management, wetlands mitigation, wildlife habitat enhancement and other processes that fall under the general header "ecosystem services." There are many other categories worth highlighting, too. Many are in the category of "costs avoided." As noted, economists warn against using "costs avoided" to describe values, but where real numbers exist, they can be presented. "Costs avoided" beckons memories of Will Rogers' line about making money: "The quickest way to double your money is to fold it and put it back in your pocket."

Tying economic values to ecosystem services is important, but to tell the full picture, we cannot stop there. We can also articulate the full range of values that our work produces, and use common, understandable economic terms to do so. It has the potential to be a simple but compelling message.

Examples of attempts to assess the value of conservation stretch back decades. U.S. Department of Agriculture Natural Resource Conservation Service files include publications such as "Dollars and Sense in Conservation," a thoughtful and thorough circular written by S.V. Ciriacy-Wantrup and distributed by the California Agricultural Experiment Station in 1951. The circular proclaims it shows "if needed conservation practices do not pay, the reasons are often man-made and can be changed," and it "suggests practical steps to make dollars and sense work for conservation. Some of these steps are one a farmer can take in cooperation with his neighbors, his banker, or his landlord. Others require public action."

As the understanding of how to value ecosystem system grows, conservation efforts march on. That is due in no small part to government programs that provide economic incentives for easements, conservation practices and farming systems that reduce impacts on nature. In effect, these are payments for ecosystem services. Farm Bill conservation spending has risen steadily and impressively in the past quarter-century. But generous Farm Bill conservation allocations and a host of other state and local conservation incentives often fall short of demand and need. Producer waiting lists for some

programs is as an example of demand. The Environmental Protection Agency's estimate of 39,988 impaired waters in the U.S. is an example of need.

In some cases, conservation programs don't match up with economic drivers that affect decisions made by those who are asked to implement practices. The 2008 Farm Bill seeks to address that with funding for a loan program to assist producers with the cost of installing conservation practices.

Conservation value streams flow from both the public and private sectors. We now turn our attention to some of these identified value streams. This sampling is not comprehensive, but serves as a reminder that many streams of value already exist.

Ecosystem Services: Source Water

One of the most promising areas for developing conservation value streams is source water protection. Taken a step further, the whole range of actions under the general category water quality and quantity offer some of the best opportunities to attach value to conservation.

Downstream beneficiaries of source water protection include homeowners, communities, water utilities, businesses and other entities. Value streams can be attached to water quality and other closely related benefits, such as flood mitigation, storm-water protection, wildlife habitat enhancement and biodiversity.

Examples of successful programs are becoming more common. The oft-cited New York City Watershed program is one example. There, the city avoided costly construction and maintenance of a water treatment facility by taking steps to protect source water up-state. Strategies included purchase of land and payments to farmers for conservation measures. The program has drawn international attention.

But New York has company in a growing list of success stories. In Oregon's Tualatin River basin, for instance, a water resources agency avoided investing more than \$60 million in technological upgrades by restoring 35 miles of 150-foot-wide stream buffers and paying farmers competitive rates for using their land for restoration.^{ix}

One approach to source-water protect is water quality trading. Trading is based on the fact that sources in a watershed can face different costs to control the same pollutant. Trading programs allow facilities facing higher pollution control costs to meet their regulatory obligations by purchasing environmentally equivalent (or superior) pollution reductions from another source at lower cost. Water quality improvement is achieved at a lower overall cost. Such programs usually rely on a driver, such as water quality standards.

Key points:

- ✓ **Ecosystem service markets still developing**
- ✓ **Regulation drives some markets**
- ✓ **The "business" of conservation has value**

Market-based water quality trading is gaining traction in a number of watersheds. The World Resource Institute in March 2009 identified 57 water quality trading programs worldwide. Of these, 26 are active, 21 are under consideration or development, and 10 are inactive or are completed pilots with no plans for future trades. The majority were in the United States; with only six elsewhere.

WRI assessment of these water quality trading programs identified five key factors stakeholders believed were important for the successful implementation of their trading programs:^x

- Strong regulatory and/or non-regulatory drivers, which helped create a demand for water quality credits;
- Minimal potential liability risks to the regulated community from meeting regulations through trades;
- Robust, consistent, and standardized estimation methodologies for nonpoint source actions;
- Standardized tools, transparent processes, and online registries to minimize transaction costs;
- Buy-in from local and state stakeholders.

NRCS Conservation Innovation grants have helped provide startup funds for water-quality trading programs in a number of locations, including the Greater Miami River watershed in Ohio, three watersheds in Minnesota and the Willamette Basin in Oregon. (See case studies.) EPA also offers funds for water quality trading programs.

It is safe to say that these programs are in their infant stages and that robust trading programs are still in the future. But progress is noted in several areas. Efforts to address water quality through trading systems in the landscape-scale Chesapeake Bay Water Initiative are advancing, notes WRI's Michelle Perez.^{xi} Farmers will play a key role, and economics is a clear driver: "It's cheaper than storm water and wastewater plants," she says.

Demand sources for trading include new and existing wastewater plants and storm water plants. "Storm water utilities will have high interest," she predicts. Farmers applying best management practices will have to meet baseline requirements before generating credits. Perez predicts that payments could rival those of federal programs and range from \$58 million to \$207 million per year, depending on the impact of regulatory drivers. Farmers would face some out-of-pocket costs after cost sharing is applied, but trading benefits will provide net gains that far exceed costs, she says.

There's also potential for water quality trading in the Mississippi River Basin Initiative, another landscape-scale effort, Perez says. Trading between source and nonpoint source dischargers is possible. Citing the potential for such trading, she notes that the city of Chicago waste treatment facility alone will face costs of \$1 billion to meet goals.

The Chesapeake and Mississippi initiatives both hint at the potential for generating market-based payments in associated with landscape-scale efforts to meet water quality goals.

Capturing all the values: A growing body of information links clean water to economic impacts from recreational activities. An example: The Iowa State University Iowa Learning Farm reports that for every

dollar spent on stream restoration, an additional \$24.50 is returned to the regional economy each year through recreational activities.



Ecosystem Services: Wetlands

Wetlands are recognized for a variety of ecosystem services, including flood control, water quality, wildlife habitat and other benefits. Wetlands have emerged as a form of ecosystem services with clear value streams. In part, this results from a regulatory driver: The Clean Water Act requires that anyone who destroys regulated wetlands must compensate for the destruction by restoring other areas on the same site, paying in lieu fees to a conservation organization or buying credits from third parties who have restored sites elsewhere in the same region. A regulatory preference has emerged for the latter approach, known as mitigation banking.^{xii}

Wetland and stream mitigation banking is regulated at the federal level by the Army Corps of Engineers. [Ecosystem Marketplace](#), a source of news and other information on markets and payments for ecosystem services, estimates there are more than 400 wetland and stream mitigation banks actively selling credits and nearly 200 more pending approval to do so. Another 88 wetland mitigation banks have already sold out of credits. Estimates of annual transaction value of wetland and stream mitigation credits range up to \$1.3 billion. Mitigation credits are not commodities. Rather, they represent the environmental value of restoration for a specific ecosystem in a specific watershed. Credits vary widely in price, depending on a number of factors. They can sell for \$3,000 in Arkansas and \$400,000 in California, where tidal and vernal pool impacts drive up prices. The average price per credit is estimated at \$74,500. Who buys these credits? Private residential and commercial developers, public sector transportation, water and defense agencies, extractive companies and utilities are frequent buyers.

This form of mitigation is perhaps the most successful example of an ecosystem services market operating today. As one source for this report noted, mitigation bankers are investment capitalists. They sell credits to others, such as developers. In contrast, many water quality projects spearheaded by the conservation partners seek to facilitate practices but don't have a profit motive.

Wetland and stream mitigation systems also tend to "bundle" payments. A single payment is made for replacing a wetland, incorporating a number of ecosystem services that accrue to that wetland. Another system of payment, called "stacking," is favored by some who seek to value the varied benefits of ecosystem services. Stacking allows for multiple payments for different ecosystem services, such as water quality and carbon sequestration. See the following example, using a forest system.

Not Stacked (Spatially Distinct)		Stacked (Spatially Overlapped)
1 acre forest earning carbon credits	1 acre forest earning endangered species habitat credits	1 acre forest earning both carbon credits and endangered species habitat credits
 <p>One property</p> <p>Total Credits = 2 Total Acres = 2</p>		 <p>One property</p> <p>Total Credits = 2 Total Acres = 1</p>

Fox, J. Maki, T. Vroom, K. 2010 Unpublished

It should be noted that federal agencies do not see eye-to-eye on bundling and stacking. These differences will likely need to be resolved as markets expand and advance.

Capturing all the values: A variety of methods exist for valuing wetlands, and they produce differing results. While this makes it difficult for decision-makers to apply value to wetlands, it has not inhibited the development of some wetland mitigation banks and other vehicles for achieving wetland preservation or restoration. The federal [Wetlands Reserve Program](#) pays anywhere from \$105 to \$639 per acre for easements. Money spent on restoration to improve ecosystem functioning ranged from \$89 to \$139. Similarly, responses to surveys that ask how much people are willing to pay to preserve wetlands vary widely – from \$1,911 in coastal Louisiana to \$6.31-\$12.67 in Kentucky. While these numbers seem at odds, they likely reflect values, real or perceived, in these varied wetlands.

Ecosystem Services: Flood Mitigation/Storm Water Management

Economic values for various flood mitigation strategies are emerging, often involving preserving or enhancing farm and forest systems. A number of strategies are employed to reduce the impact of flood waters, ranging from preserving open spaces and forest lands to wetlands reconstruction and conservation development.

A Southern Illinois University study focused on the economic and hydrologic impacts of conservation development strategies that promote greater on-site storage of storm water runoff. ^{xiii} Conservation development seeks to cluster conventional residential and commercial development, permitting more land to be used for functions such as storm water management. As noted in the study, storm water management produces a number of downstream benefits, including reduced frequency, area and

impact of flooding; water quality; less costly public drainage infrastructure; reduced erosion and sedimentation; and an array of other benefits.

Applied to a specific case study in a suburban Chicago watershed, simulation models were used to compare alternative development scenarios. Reduced downstream flooding by using conservation design practices generates from \$1,795 to \$21,379 per acre in downstream property value benefits over all affected areas, according to the study. Flood-damage estimates for a 100-year flood event alone produce \$4,337 to \$11,732 per acre savings. Infrastructure savings for road culverts alone are estimated at \$3.3 million to \$4.5 million in reduced costs for replacements or upgrades.

In addition to strategies such as conservation development, water utilities and municipalities across the country are purchasing or preserving farmland and open spaces to help provide natural flood control. Protecting water quality and reducing flood waters will prove costly for years to come, but watershed and/or landscape scale programs offer promise.

Examples of benefits in this area are plentiful. For instance, the Floodplain Management Association estimated that replacing the natural water quality functions of Congaree Bottomland Hardwood Swamp outside of Columbia, S.C., with manmade infrastructure would cost \$6.7 million in 2003 dollars. The Minnesota Department of Natural Resources estimates replacing 1,200 cubic meters of flood storage capacity naturally provided by a wetland with artificial controls costs \$370 in 2003 dollars.

Capturing all the values: Reducing infrastructure costs through conservation practices can save billions of dollars. Aging infrastructure is a major challenge across the country. EPA's 2002 Clean Water and Drinking Water Infrastructure Gap Analysis reported the nation's municipal sewer authorities' capital needs to meet clean water requirements from 2000 to 2019 at from \$331 billion to \$450 billion.

Ecosystem Services: Greenhouse Gases

Carbon markets to mitigate impacts on climate change are an example of systems intended to give market value to conservation practices and systems. Various regulatory schemes have been proposed to reduce the impacts of carbon and other greenhouse gases on climate change.

While our focus is primarily on the United States, it should be noted that other nations may provide replicable examples. Europe has a mature, though hardly perfect carbon trading marketplace, thanks to a cap-and-trade system that requires polluters to pay to mitigate their impacts on the environment.

The current political climate in the U.S. makes it unlikely that a regulatory driver will be in place for carbon markets any time soon. Regional markets have developed in North America. In the absence of drivers, carbon credits paid on the Chicago Climate Exchange have plunged to as low as five cents per ton in late 2010. In 2008, payments were \$5.80 per ton. In that same year, payments in the European Union were \$35 per ton.^{xiv}

One area of success is in the land preservation area, says David Miller, director of research and commodity services, Iowa Farm Bureau Federation, and chief science officer, AgraGate Climate Credits Corp.^{xv} The Conservation Reserve Program has produced 4,000 carbon contract holders in Farm Bureau's

Iowa program. That results from the certainty provided by 15-year easements. On working lands, variability inhibits applicability. Seventy-two percent of the farmland in Iowa is rented on a one-year basis, Miller notes.

In the current setting, carbon markets lack sufficient funding from the private sector, and it's not clear that the demand side has the stability to infuse more capital into the system, Miller says. "What does the market need? Stability and predictability. The challenge is the demand side. The supply side is stronger," he says.

The future of carbon and related markets hinges on political decisions. Should they be resolved and markets strengthened, U.S. farm, forest, range lands and wetlands have great potential for sequestering carbon. Estimates range up to 270 million metric tons per year for cropland, CRP land, rangeland, biofuel production offsets and reduced carbon emissions from eroded sediment.

Ecosystem Services: Conservation Planting Systems

Reduced-tillage systems were introduced to address America's soil erosion problems from agricultural lands. As noted earlier, the reduced erosion resulting from these systems and other agricultural practices has calculable dollar values in reduced soil loss. USDA estimates placed the cost of eroded soil at between \$6.10 and \$6.40 per ton, using 2009 values. Off-site costs account for about three-fourths of those values.

Reduced-tillage systems also provide quantifiable benefits expressed in terms of costs avoided, such as equipment, fuel, time and other inputs. One study identified the annual net benefit of no-till or strip-till in northwest Iowa at \$21 and \$40 per acre, respectively, compared to chisel plow.

A 2006 NRCS report on the economics of on-site conservation tillage notes both short- and long-term gains.

The report notes that in the short term:

- Operating costs go absolutely down: Fewer tillage trips mean less labor, fuel, and machinery repair costs.
- Operating costs go relatively down: Relative price and productivity changes cause some farm operations to become less costly than others. The combination of herbicide-tolerant seed, glyphosate and no-till is a more productive weed control strategy than multiple tillage, cultivation, and spray operations. In addition, fuel, labor and machinery prices have increased relative to glyphosate and herbicide-tolerant seed prices.
- Expensive resource constraints can be lifted: When conservation tillage allows a physical resource constraint, such as water availability, to be lifted, yields and revenues go up. The labor saved by conservation tillage can be in short supply during critical growing periods. Lifting the constraint allows labor to be used in higher-value alternatives.

In the long term:

- Long-term improvements in resource stocks (nutrients, soil, carbon, weeds, and water) can be captured as higher returns on investment: The returns come from higher, or similar, yields and from inputs that perform better, or complement better soil and water conditions.
- Investment in machinery goes down and machinery allocated overhead costs go down. This causes the investment cost per farm and the machinery allocated overhead cost per acre to go down. The effect is magnified for larger-sized farms because of economies of scale.

The report advises: “Farmers, farm advisors, conservation planners, and agricultural policy makers, should consider these types of economic incentives when pushing the use of conservation tillage.”

Ecosystem Services: Farmland Preservation

Farmland preservation has values that are fairly well defined. These include direct economic benefits of continued production and environmental benefits such as flood control and water quality. Some of these values can be quantified, others not so well. Some studies show that costs avoided from conversion to other uses, such as public services for rural developments, are quantifiable. Farmland preservation makes it possible to capture and quantify many of the ecosystem services and other benefits we seek to capture in describing value streams.

Ecosystem Services: Forestry

We limit our attention here primarily to private forests and those in the urban setting, although impressive ecosystem benefits are attached to public forests. Private forests constitute nearly 60 percent of the nation’s total forest land and provide the majority of ecosystem services to the public.

Forests provide a wide range of benefits, including provisioning services such as shade, timber, and wildlife habitat. The range of regulating services is broad, including stabilizing landscapes by protecting soils and retaining moisture. They are major sites for carbon storage, are important for nutrient cycling, and help moderate local and regional climate through rainfall. Forests also help regulate the water cycle when tree roots soak up rainfall; stems, trunks and roots slow runoff; and tree leaves release water back into the atmosphere. In addition, plant and animal biodiversity depends on intact, mature forests. In some cases, even human health may rely on that biodiversity. Many medicines have been isolated from plant compounds.^{xvi}

The largest federal program in the nation providing payments to landowners who plant trees or enhance forested lands is the Conservation Reserve Program. Perhaps a more telling indicator of forest values comes from the states, which have long recognized the value of private forests. According to the Forest Service, virtually every state in the union has a property tax relief program for private forest land owners. In many cases, multiple state-sponsored programs exist. An array of private programs also exists.

While many of these programs were originally conceived to help provide a reliable source of fiber for wood products, the modern-day forest owner is as likely to manage his or her woodlot for wildlife or other amenities.

The Forest Service and other entities have devoted extensive research to determining the value of ecosystem services provided by forests. Some of the most impressive research has focused on urban settings, where services such as floodwater retention, savings on heating and cooling, and reductions in air pollution have been calculated. Some of these values may be transferrable to areas where land use changes have led to partial urbanization of formerly rural settings.

The Forest Service's [Pacific Northwest Research Station](#) identified key needs for Forest Service research on making the case for ecosystem services from forested land.^{xvii}

They include:

- Developing methods to describe ecosystem services and their values to society to ensure that forest benefits are included in forest policy and management decision-making;
- Communicating the value of ecosystem services and the Forest Service's role in sustaining them is critical for justifying public expenditures on Forest Service programs;
- The Forest Service can play an important role in sustaining ecosystem services across landscapes by offering expertise, resources, information, and programs to its neighbors and partners. One area of particular interest is promoting market-based conservation of ecosystem services on private land.

Conservation districts across America are heavily engaged in forestry activities. The 2001 NACD Conservation District Forestry Activity Survey established that the majority of districts were involved in forestry activity, some as a major part of their work plans. The activities ranged from tree sales and equipment rental to education and technical assistance.

Fragmentation and development are major threats to private forests across the country. In the western states, the [Western Forestry Leadership Coalition's](#) recommendations for actions include rewarding landowners for their stewardship of ecosystem services. The group recommends that multiple partners work to "give private forest land owners the economic means to continue managing their forests over the long-term for public and private benefits."

Ecosystem Services: Pollination

Conservation values come in big and small packages. Some are easily missed. For instance, wildlife ranging from bats and bees to butterflies and birds provides an estimated value of from \$4 billion to \$6 billion in pollination services annually in the United States.

Increased emphasis on the role of native pollinators has arisen in recent years due to declines in populations of honey bees. The 2008 Farm Bill authorizes the secretary of agriculture to encourage "the development of habitat for native and managed pollinators; and the use of conservation practices that encourage native and managed pollinators" during administration of conservation programs.

Ecosystem Services: Recreation

Perhaps one of the areas most studied in relation to public benefits from ecosystem services is that of outdoor recreation such as hunting, fishing, bird watching, hiking and numerous other activities. In turn, these activities drive tourist economies in a number of states.

NRCS captures many of these values in a [Contingent Value/Recreational Value web page](#). It includes numerous national, regional and local studies and reports. As with other public values, the winners vs. losers dilemma needs to be considered. Conservation practices on private lands can result in opportunity costs to landowners. But in addition to on-site costs, landowners whose conservation activities provide ecological services can reap benefits. A Farm Service Agency survey of CRP participants, for instance, found that 5 percent of CRP enrollees indicated they received income from recreational use of their CRP acreages. Most often, this comes in the form of leasing land for hunting. Nationally, CRP resulted in landowners receiving \$21.3 million more from recreational activities on their lands than they would have without enrolling in CRP.^{xviii}

Recreational activities have major impacts on both public and private sectors. In just one example, the Georgia Department of Wildlife estimates that more than 1 million state residents spend almost \$500 million yearly on fishing, generating more than 14,000 jobs and \$900 million in overall economic impact.

States often apply proceeds from sales of hunting and fishing licenses to a broad array of natural resource protection efforts that have nothing to do with stalking deer or trophy fish.

Experts note that there are strengths and weaknesses with valuing services like these public goods, but it is hard to ignore their economic impacts.

Ecosystem Services: On the Way, But Not There

It's obvious that we're a long way from tying the knot that would fully bind ecosystem services to value streams. Government programs that pay private landowners for conservation have led us part of the way. Certain market systems, such as water quality trading, show promise. Driven by regulation, wetland mitigation banking has moved forward. Other markets, such as carbon, have failed to gain sufficient traction.

With increased emphasis across several platforms, broader recognition of the value of ecosystem services is bound to grow. We are in the earliest phases of adoption. We have yet to develop systems that fully value the public goods and services that ecosystems provide. But in the meantime, we can and should talk about the full value of the work the conservation partnership accomplishes every day. We explore that next.

Local and State Impacts of Conservation Spending

Now we turn attention to conservation economic values that result from the influx of conservation spending to states and local communities and from the range of activities associated with the “business” of conservation. These are values that aren’t always considered when the conservation partnership makes a case for itself, but they are significant and important. Many times they support local businesses, help pay local taxes and provide a wide range of other economic benefits.

Spending on conservation, including implementation of practices, direct payments to farmers and administrative costs, results in an injection of dollars into state and local economies. This infusion of dollars leads to a multiplier effect at the local and regional level as the money re-circulates in the economy.

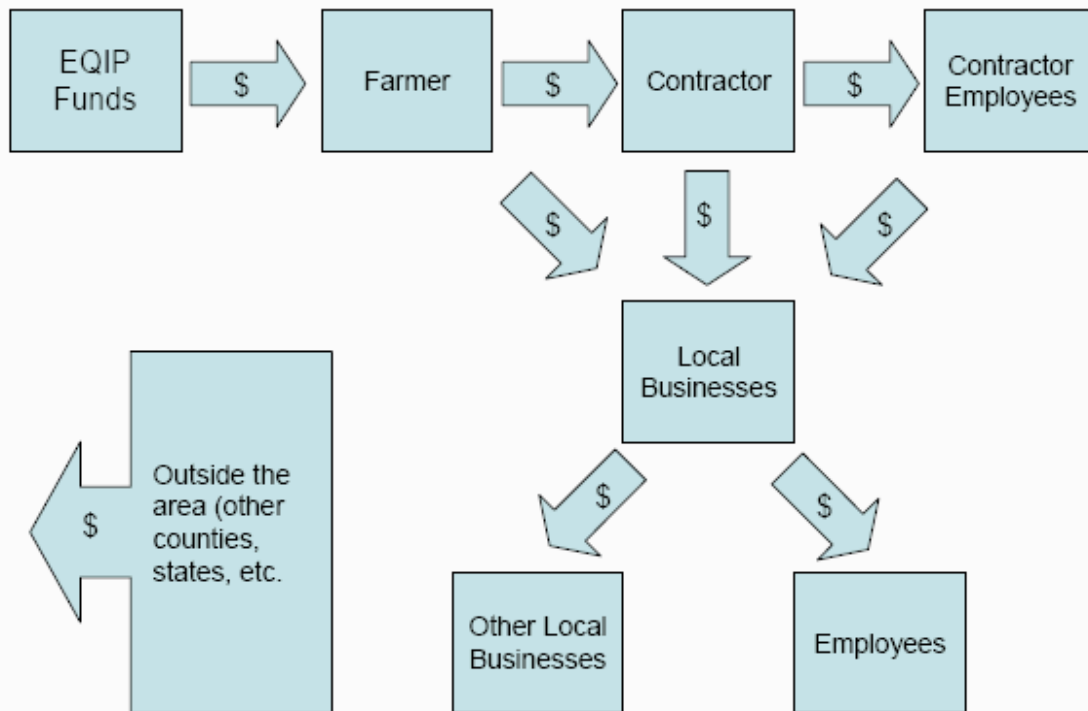
Local conservation districts and their partners provide an array of services outside the realm of federal and state program dollars. These often produce economic benefits to communities and the cooperators who are assisted. Helping a producer become more efficient can result in bottom-line gain that can be calculated. Helping a farmer convert to no-till can result in direct savings on-site and public benefits off site.

The examples provided here are meant to stimulate a broader effort to fully account for these values. Articulating these values can be an important component of the work plan for local, state and national offices.

Value of Conservation Spending: EQIP Example

The methodology now exists within NRCS to calculate the value of EQIP dollars to regional economies. As an example, NRCS Economist John Long assessed the impact of Environmental Quality Incentives Program spending from 2002-2007 in several counties in the Kennebec Region of Maine. He found that EQIP expenditures of \$2,644,900 in the seven-county region had an additional value of \$2,028,300, including wages, profits and indirect business taxes generated. The EQIP expenditures created or supported 85 jobs and produced a total output of \$4,349,800. Using the [IMPLAN economic output model](#), he calculated the total multiplier impact of the EQIP dollars at 1.65. For every \$1,000 of cost-share dollars spent on the final goods produced, \$650 of economic activity was generated in the region through repeated circulation of the money spent. “For instance, when a farm supply company is paid for supplies used in implementing a conservation practice, that company pays a percentage of the original cost-share money to its employees in the form of wages,” he says. Below is his example of how the funds circulate in a local economy.

Circulation of Dollars in a Local Economy



Citing how the multiplier effect works, he notes: “Conservation activities impact local economies with changes in production, recreation, jobs, taxes and spending. These impacts do not occur just once, but have a multiplier effect. For example, paying a contractor to install a stockwater pipeline helps pay employee salaries and other operating costs and provides a profit for the contractor. The contractor and employees will then spend their earnings at other local businesses.”

Long notes that the benefits he accounts for do not include other economic impacts, such as improved natural resources leading to increased tourism, boating, fishing, reduced water treatment and increased property values. They are significant in many cases.

Conservation districts are particularly well-suited to positively impact local economies and businesses. Often they are not bound by federal rules on how contracts are awarded, affording flexibility to choose local options.

Value of Conservation Spending: Oklahoma Study

A 2009 study conducted for the Oklahoma Conservation Commission and the Oklahoma Association of Conservation Districts found that federal and state conservation spending of \$76 million in the state had

a total impact of \$117.4 million. David Shideler, assistant professor and Extension economist for the Oklahoma Cooperative Extension Service at Oklahoma State University, conducted the research.

“Because these dollars represent injections into regional economies across the state, they will generate additional local economic activity,” he notes. Project-based grants generated an estimated \$13.5 million in additional economic activity across the state, he found. In addition, direct-payment programs generated about \$18 million and administrative expenses nearly \$10.4 million of additional economic activity locally.

“Though the results do not represent a benefit-cost analysis, they can be viewed as a first step toward understanding how conservation and the economy are connected,” Shideler notes. “Such linkages are important to understand if communities want to seriously address sustainability, of both the environment and economy in local places.”

In connection with the project, Shideler plans to develop a worksheet to aid local conservation districts to generate practice-specific impact numbers for funds expended under their jurisdiction. For more information contact Shideler at Dave.shideler@okstate.edu.

Conservation Spending: Telling the Whole Story of What We Do

The above examples are but two of many ways the “business of conservation” impacts local economies. The conservation partnership has thousands of examples of such economic impacts across the country.

One under-told story at the agency level is the Emergency Watershed Protection Program administered by NRCS. The program provides on-the-ground assistance to communities in emergency situations ranging from floods to fires. As noted in an earlier report, “NRCS frequently plays a crucial role and is the first federal agency on the scene to repair resource damage and prevent further problems but doesn’t get much credit when the cameras roll.”^{xix} In some cases, the program helps communities save millions of dollars in disaster-related expenses by protecting source water, preventing floods and mitigating the impacts of natural disasters. Capturing and sharing these stories is important, especially since key portions of the program rely on congressional appropriations on a case-by-case basis.

Similarly, local stories about the economic impacts of our work can be collected and shared. Many customers served daily by conservation districts and NRCS reap economic benefits from the assistance. The examples are as varied as the locally led conservation work accomplished daily across the country.

Conservation district funding sources are varied, depending on the state. Oftentimes, districts use that funding to leverage other income sources for their wide-ranging operations. Many districts seek and earn grants from foundations, private-sector businesses and other sources. These are new dollars introduced into local economies and have their own multiplier effects.

Conservation districts are in some ways the equivalent of small businesses, providing an array of products and services, from tree sales to equipment rentals. A better accounting of the full value of these goods and services can help districts tell their stories. The conservation partnership generates multiple streams of value. Highlighting those values to the general public and those who make decisions

about how to allocate limited government resources makes a practical, real-world case for the work we accomplish.

Current Challenges, Future Streams

Building the Case

Clearly, the task of attaching economic values to conservation is an evolving process. Some organizations are moving quickly. The Nature Conservancy, with both national and international programming, is among them. Chief Scientist Peter Kareiva predicts “Within one to two years, ecosystem services will be embedded in all of our programs.”^{xx}

[The Nature Conservancy](#) is a partner in the [Natural Capital Project](#), a joint venture with [Stanford University](#) and the [World Wildlife Fund](#).

The partners are developing tools for quantifying the values of natural capital in clear, credible, and practical ways. This is a key to moving forward with ecosystem services markets. As the partners say, “In promising a return of societal benefits on investments in nature, the scientific community needs to deliver knowledge and tools to quantify and forecast this return. “

The tools include [InVEST](#), a family of software-based tools for Integrated Valuation of Ecosystem Services and Tradeoffs. InVEST enables decision-makers to quantify the importance of natural capital, to assess the tradeoffs associated with alternative choices and to integrate conservation and human development.

Carl Lucero, deputy director of the USDA Office of Environmental Management, says USDA’s Office of Ecosystem Services is focusing on strengthening markets by improving the technical ability to measure and verify services. Work is also under way on an NRCS nutrient trading tool.

But tools take the argument only so far. A compelling case for ecosystem services must be made to get the attention of the public and policymakers. One key is communication. “We’ve done a terrible job of this. Our community has to invest in professionals to frame the message to appeal to people,” says Kareiva.

In some cases, framing the message will be telling the story of how ecosystem services affect people’s well-being.

Coastal wetlands, for instance, reduce storm surge. Kareiva cites the case of a 2008 cyclone that killed about 10,000 people in India. Without coastal mangroves to reduce the surge, the death toll would have killed 30,000 people, he says, adding that solid data shows mangroves saved lives where they had been preserved. “We’re building up this incredible set of data, not vague arguments, security and economic arguments, that link environment and environmental protection to human well-being,” he says.

Interestingly, the multi-agency CEAP report “Effects of Conservation Practices on Cultivated Cropland in the Upper Mississippi River Basin,” issued in 2010, makes links between conservation practices and human health. CEAP reports that by keeping pesticides from waterways (on average, only 1 to 2 percent of pesticides applied are leaving fields), conservation practices have reduced the pesticide threats to human health by 48 percent.

Engaging the private sector in ecosystem services markets remains a challenge. A key question, posed by David Miller, director of research and commodity services, Iowa Farm Bureau Federation, is this: “Much of the goods in ecosystem services are public goods. How do you get funding from the private sector?”

Some studies indicate that ecosystem services will accrue more value in an energy-scarce future.

Economic Challenges

Analysts note that the current economic downturn may serve to dampen interest in ecosystem services markets. Conservation organizations that might serve as aggregators and facilitators linking buyers and sellers in ecosystem service markets have staffing issues. In better economic times, buyers with corporate social responsibility standards had more funding for ecosystem services programs.

Bundling vs. Stacking

This report takes note of differences among federal agencies and other entities over valuing ecosystem services. Some agencies favor “bundling,” in which one payment is made for all services. Other entities favor “stacking,” whereby a number of payments might stream from an ecosystem service such as a wetland. Some believe that stacking is more beneficial to the seller, who might receive payments for reducing phosphorus, improving wildlife habitat and perhaps sequestering carbon. “It is a huge debate,” says one observer, adding: “The only way I can see it working is if you define the rules up front and everybody abides by the rules. For instance, in this program, you’re allowing stacking for several purposes – carbon, water quality trading on phosphorous and possibly source water protection for bacteria or wellhead protection for nitrates. The real question is, ‘Would the farmer have implemented without all three?’ “

Drivers Needed

The ultimate success of many ecosystem services markets depends on drivers – actions and policies that lend value to practices.

One form of driver is regulation. Wetlands mitigation, for instance, is driven by federal laws that require mitigation when a wetland is impacted. Total maximum daily loads for impaired waterways are seen as

Key points:

- ✓ **Progress on tools for determining values**
- ✓ **Drivers needed to create buyers**
- ✓ **Private-sector offers promise**

drivers for source water protection markets. Observers say TMDLs have been rolling out slowly, and some that have emerged don't address nonpoint pollution. But regulation isn't the only market driver. The private sector may play an important role.

New Streams: Private Sector Promise

Developments in the private sector offer promise that corporate responsibility will meld with ecosystem service markets.

Wal-Mart in 2009 announced plans to develop a worldwide sustainable product index. The index will establish a single source of data for evaluating the sustainability of products. "Customers want products that are more efficient, that last longer and perform better," said Mike Duke, Wal-Mart's president and CEO in announcing the index. "And increasingly they want information about the entire lifecycle of a product so they can feel good about buying it. They want to know that the materials in the product are safe, that it was made well and that it was produced in a responsible way. We do not see this as a trend that will fade. Higher customer expectations are a permanent part of the future. At Wal-Mart, we're working to make sustainability sustainable, so that it's a priority in good times and in the tough times. An important part of that is developing the tools to help enable sustainable consumption."

The company is surveying more than 100,000 suppliers around the world. The survey includes 15 questions that serve as a tool for Wal-Mart's suppliers to evaluate their own sustainability efforts. The questions focus on four areas: energy and climate; material efficiency; natural resources, and; people and community. U.S. suppliers were asked to complete the survey by Oct. 1, 2009.

As a second step, the company is helping create a consortium of universities that will collaborate with suppliers, retailers, NGOs and governments to develop a global database of information on the lifecycle of products – from raw materials to disposal. The company will also partner with one or more leading technology companies to create an open platform that will power the index. The final step in developing the index will be to translate the product information into a simple rating for consumers about the sustainability of products.

Private-sector initiatives such as Wal-Mart's have the potential to impact ecosystem services markets. The Coca-Cola Company has a similar sustainability program linked to water quality and quantity. [The effort](#) includes watershed protection and community watershed projects around the world. Other water-reliant companies are taking similar steps. It's smart business: A 2009 report commissioned by several companies estimates that by 2030, global demand for water will outstrip supply by 40 percent.^{xxi}

Challenges and New Streams: The Upshot

When it comes to identifying and attaching economic value to conservation practices and systems, the list of challenges is long. Some are obvious, some subtle. We conclude here with a brief review:

The conservation community has not done a sufficient job convincing the general public and policymakers that the need to protect natural resources is tightly stitched to identifiable economic rewards.

In cases where economic values have been clearly established, the rewards are often to non-local populations, such as downstream water users or downwind air breathers. Those asked to make changes that provide values to these populations are sometimes asked to forgo local rewards, such as maximum crop yields. Conservation programs that mitigate the impact of these lost opportunity costs are emerging, but speaking about Farm Bill conservation programs, one observer notes: “The conservation title of the Farm Bill is a place to steal from since its inception.”^{xxii} This instability is seen by some as an impediment to efforts to place value on conservation services.

Recent efforts to attach economic values to conservation practices and systems have led to gains in understanding, but are still evolving. Environmental economist Stephen Polasky assesses the current landscape this way: “The recent focus on ecosystem services grew out of efforts, led primarily by ecologists, to highlight the importance of ecosystems and the natural world to human welfare.”^{xxiii} Assessing progress on several fronts in these efforts, Polasky adds: “Many of these efforts are being led by natural scientists and there is a compelling need for greater economic input. Economists have much to contribute to research on ecosystem services.”^{xxiv}

As Polasky notes, while some ecosystem services result in outputs of marketable commodities, such as agricultural crops or timber, most are “public goods that are not traded in markets....For such ecosystem services, nonmarket valuation methods are needed.”^{xxv}

Even where economic values are identified, the conservation community has been unable to consistently identify and communicate these values to the public and decision-makers. It follows, then, that identifying the full range of economic values for conservation services will benefit all levels in the conservation community.

Most observers believe that developing markets for certain practices will require at least some government intervention. In the case of carbon markets, for instance, payments have lagged in the United States, where voluntary activity has not sufficiently attached value to the act of sequestering carbon.

In many other cases, numerical values for many ecosystem services are not fully developed, and monitoring costs are high. The question is whether these need to be more fully developed or whether they are sufficient today to move us forward. Kareiva the scientist and Polasky the economist both believe we possess sufficient knowledge to take the latter course.

Case Studies

Here we provide a set of case studies that illustrate some of the topics discussed in this paper. The case studies illustrate that while ecosystem services and other value streams have been identified, the work has in many cases just begun.

Urban-Rural Partners for Water Quality In Cheney Lake Watershed, Kansas

The Cheney Lake Watershed is a partnership of rural/urban stakeholders. Because the city of Wichita recognized the value of correcting pollution problems prior to water entering the reservoir, the city agreed to provide partial reimbursement to farmers for implementing structural practices and incentives for improved management. These water quality improvements are not often income generating assets for the farm. Farmers agreed to maintain the practices for the long-term. Voluntary implementation of water protection practices has been initiated successfully through one-on-one contacts with neighbors of the CLW board members administering the project. Small, informal meetings are held throughout the winter months in machine sheds, kitchens, community buildings and coffee shops. Board members personally invite and encourage other farmers to attend. An ideal meeting size is fewer than 15 people. The watershed staff works with each farmer to develop solutions to water quality concerns on their farm and to seek cost share funding to implement the practices. Most practices are eligible for existing state and federal cost-share programs at a rate of 50 to 70 percent of the county average cost of implementing that practice. The city reimburses the farmers for an additional 30 percent of the county average cost. Wichita also reimburses farmers for 50 percent of the cost of up to two miles of permanent perimeter fence for grasslands that were established under the Conservation Reserve Program. When a CRP contract expires, the fencing program provides an incentive to keep the grass for grazing instead of returning the acres to crop production.

Source: Cheney Lake Watershed Inc.: www.cheneylakewatershed.org

Ohio River Basin Trading Program Will be Largest Ever Established

The Ohio River Basin Trading Project is a first-of-a-kind interstate nutrient trading program, a comprehensive approach to designing and developing credit markets for nitrogen and phosphorus discharges. Parts of eight states make up the basin, including Illinois, Indiana, Kentucky, Maryland, Ohio, Pennsylvania, Tennessee and West Virginia. The Ohio River project will be the largest interstate trading program ever established, according to the Electric Power Research Institute. Its intent is to allow exchanges of water quality credits for nitrogen and phosphorus aimed at protecting and improving watersheds at lower overall costs in the Ohio River Basin. The program may also benefit receiving water bodies as far away as the Gulf of Mexico. The Electric Power Research Institute is coordinating the project with support from power companies; wastewater treatment facilities; federal, state, and local agencies; and other industry organizations. Impacts on water quality in the Ohio River Basin come from many sources including power plants, wastewater treatment plants, urban storm water, agriculture and from sources outside the basin. Improving water quality will require collaboration among national and state agencies, power plants, wastewater treatment plants, farmers, environmental groups, and others. In addition, coordinated efforts among state, regional and federal regulatory agencies are critical to address how interstate trading will occur. EPRI anticipates having an established program and functioning credit trading market in three to five years with early trades beginning sooner.

Source: Electric Power Research Institute: www.epri.com/ohiorivertrading

Conservation Marketplace of Minnesota

Puts Crop Consultants to Work

Certified crop consultants are helping the Stearns County Soil and Water Conservation District in Minnesota connect with farmers to protect ground water in a nearby city. The Sauk River Watershed District and Stearns County SWCD are collaborating with American Farmland Trust and Kieser & Associates and other partners to develop the Conservation Marketplace of Minnesota. The program will utilize public and private market-based incentive opportunities that provide farmers with value added payments for BMPs. Support and funding is provided by the Bush Foundation and an NRCS Conservation Innovation Grant. The project is using funds to network with existing public and private entities established with the agricultural community to leverage their networks in marketing and certifying the program. The Stearns District is working with the city of Cold Springs to reduce nitrogen leaching to ground water, the source of the city's potable water. The city has six municipal wells, three of which are close to exceeding the allowable limit for nitrates. Dennis Fuchs, district administrator, says certified crop consultants are helping identify farmers who agree to use nitrogen inhibitors paid for by the city. The inhibitors slow the release of nitrates from ammonium fertilizers until later in the growing season by delaying the conversion of ammonium nitrogen into nitrate nitrogen, which is susceptible to leaching. N-inhibitors can also be used with manure and other forms of organic nitrogen fertilizer. Fifteen priority parcels are being targeted for the venture. Fuchs says crop consultants are trusted sources of information for farmers. "If you have the right consultants, then you have an in with the farmers," he says. "One of the project's goals is to learn what adoption barriers exist for farmers and producers and work to overcome them through acceptable interactions." While the Stearns district works in the Sauk River Watershed, the Conservation Marketplace of Minnesota also works in two others. Goals also include providing efficient methods for administering environmental markets and stacking payments to farmers for multiple environmental benefits.

New York City Watershed

Set Standard for Others

Perhaps the most frequently cited model of water-quality trading is the New York City Watershed. Since the early 1990s, the city has avoided costly water filtration technologies to assure safe drinking water for 9 million people by focusing on watershed management, including BMPs on agriculture and forestry lands. The city has provided funding for these and other activities. Several conservation districts and NRCS staff have provided technical assistance and other services for an array of services, including whole-farm planning, developing comprehensive nutrient management plans and conducting annual reviews of conservation plans. Private contractors are engaged to install conservation practices. The degree of adoption by land managers has been impressive: In the Catskill/Delaware Watershed, where districts are among partners, 247 farms, or 95 percent of all farms in the watershed, participate.^{xxvi} Payments they receive for establishing BMPs are an example of green payments, which reward land managers for wise stewardship that achieves measurable conservation gains.

Ecosystem Trading Opportunities

Advance in Oregon Partnership

The Freshwater Trust and other members of [The Willamette Partnership](#) are working to activate environmental markets in Oregon, launching new and self-sustaining revenue streams for farmers and demonstrating a model for markets that can foster thriving rural communities nationwide. The focus is on water quality improvements, wetland restoration, habitat conservation and carbon sequestration. Oregon's conservation districts and the Oregon Association of Conservation Districts are among partners. Other partners include city, business, farm, and science leaders in the Willamette River basin, all working to shift the way people think about how to value, manage, and regulate the environment. The Partnership also includes representatives of Clean Water Services, the wastewater management service for the Tualatin River Basin. Their goal is ecological resiliency, and they believe naturally functioning ecosystems form the cornerstone of livable communities and a healthy, sustainable economy. Among actions the partnership is pursuing are:

- Integrated and strategic investment in ecosystems
- A fair and transparent system for people to buy and sell environmental restoration benefits
- Business models to move beyond compliance-based projects to stewardship

A 2007 NRCS Conservation Innovation Grant has allowed the partnership to build the tools land managers and regulators need to evaluate and participate in emerging markets. The fundamental rules, tools and partnerships needed to launch the first regulator-approved, multi-credit ecosystem services market in the country have been assembled. Additional work is required to attract willing buyers and spur market activity. For additional information, see <http://www.thefreshwatertrust.org/>.

In North Dakota, No-Till,

Cover Crops Spell Gains

The value of conservation can be calculated in any number of ways. Innovative crop rotations and cattle grazing practices in Burleigh County, North Dakota, are proving that. Soil health is an underpinning of programs at the [Burleigh County Soil Conservation District](#). NRCS District Conservationist Jay Fuhrer and the district board not only advocate for practices that promote soil health, but carefully calculate their economic impacts. The county's semi-arid climate is a challenge. Fuhrer and producers in the county have found success combining no-till cropping with cover crop combinations that include sudan grass, millet, sunflower, turnip, radish, soybeans and cow pea. Goals include building soil health, locking up moisture to enhance plant and animal health and keeping soil temperatures cool in the hot summers. Citing one example, a farm in the southern part of the county, the cover crop was added immediately after peas were harvested. When the cover crop was ready, 141 calves grazed there. Calves were weighed prior to being moved and again after 17 days. Average gains of 52 pounds per calf were recorded. When all costs were totaled, the farmer achieved a net gain of \$66 per acre in added poundage gains while building soil health and reducing recovery time for rangeland. The gains continued in the next year, when no-till corn was planted. In one of the driest springs on record, tests showed that the cover-crop fields had higher moisture content than control fields, and as the corn crop grew, one less herbicide application was needed because of soil health improvements. In the end, costs were reduced for the cover-crop field, even though crop yields were a bit lower. "There were fewer inputs

and less fossil fuel used,” Fuhrer said. In the fall, tests also showed the cover crops had fixed high amounts of nitrogen. A number of other applications are being used for cover crops, including water quality. The successes haven’t gone unnoticed. “Farm Credit Services is a major ag lender in North Dakota, and one of their loan people made a comment to one of our board members that they can see soil health in the bottom line of Burleigh County producers,” Fuhrer says. All five of the board members on the district board operate no-till and cover crop grazing systems.

Water Quality Trading Piloted on Greater Miami

The Greater Miami River Watershed Water Quality Credit Trading program in Ohio provides funds for reducing pollutant runoff into rivers and streams. This new program could save communities more than \$300 million over the next 20 years while significantly improving water quality. Soil and water conservation district (SWCD) staff – working with local farmers who agree to voluntarily change their farming practices – will submit projects that reduce phosphorus and nitrogen runoff. These pollutants come from fertilizer and manure and can run off the land into our rivers and streams. The projects will generate “credits” that wastewater treatment plants can use to meet regulatory requirements. Funding for the projects will come from the wastewater treatment plants combined with a grant from the USDA Natural Resources Conservation Service – providing more than \$1 million for agricultural projects during the program’s first three years. About 40 percent of Ohio’s rivers and streams do not meet state guidelines for fishing and swimming and other designated uses. As a result, new regulations will require wastewater treatment plants to reduce even more pollutants at the plant. The plants have made great strides in reducing pollutants, and even a slight percent reduction can cost millions of additional dollars. On the other hand, an agricultural project upstream of the plant can generate a far greater reduction at a significantly lower cost – saving the plant and its customers money. Projects will be reviewed and selected by an advisory committee. Project partners include the Miami Conservancy District, county soil and water conservation districts; Ohio Farm Bureau Federation Inc.; Ohio Department of Natural Resources Division of Soil and Water Conservation; Ohio Environmental Protection Agency Division of Surface Water; the cities of Dayton, Englewood, and Union; Butler County Department of Environmental Services; and Tri-Cities North Regional Wastewater Authority.

Source: Miami Conservancy District. For more information, contact [Dusty Hall](#), (937) 223-1278 ext. 3210.

Oklahoma Partnership Reduces Environmental Footprint

A new initiative from the Oklahoma Association of Conservation Districts (OACD) and the Oklahoma Tourism and Recreation Department plans to help offset the environmental footprint of visitors to Oklahoma while rewarding good stewardship undertaken by farmers, ranchers and other landowners. The initiative will help visitors offset their carbon emissions and other negative environmental impacts of travel by offering them credits generated by conservation practices that sequester carbon and protect the state’s soil, water, air and wildlife habitats. The state’s Tourism and Recreation Department will sell credits online in \$5, \$15 and \$30 intervals. Prices correspond with different conservation practices, such as no-till and strip-till farming, grass plantings, tree plantings and improved pasture management. Landowners who undertake these practices have the ability to sell these carbon credits through the OACD Oklahoma Carbon Initiative with verification provided by the [Oklahoma Conservation Commission Carbon Program](#).

Source: [Oklahoma Conservation Commission](#).

Links for More Information

The report's main body includes a number of links that on-line readers can use. Here are some key resources that will guide those seeking more information.

["Assessing the Economic Value of Ecosystem Conservation"](#) is a report of The World Bank Environment Department in collaboration with the Nature Conservancy and the World Conservation Union. The 2004 report, international in scope, provides an excellent framework for determining winners and losers in the establishment of conservation. It looks at four distinct aspects of value of ecosystems. The four approaches are linked and build on each other. They provide four ways to look at similar data: total value or contribution to society, the change in this value if a conservation action is undertaken, how this change affects different stakeholders (winners and losers) and how they could be made to pay for services they receive to ensure that the ecosystem is conserved and its services are sustained.

[Bay Bank](#) is the Chesapeake Bay's conservation marketplace, linking landowners with resources to improve and protect the region's natural resources and working lands. Bay Bank offers tools to enable easy access to local, regional, and national ecosystem markets and conservation programs. Managed by the Pinchot Institute for Conservation and Sustainable Solutions, Bay Bank is beginning landowner pilot projects in 2010 in Maryland and Delaware and will expand to the rest of the Chesapeake states and add functionality in 2011.

[Conservation Effects Assessment Project \(CEAP\)](#) is a multi-agency effort to quantify the environmental effects of conservation and develop the science base for managing the agricultural landscape for environmental quality.

["Conservation Practices in Iowa: Historical Investments, Water Quality and Gaps"](#) takes a detailed look at the cumulative costs and environmental benefits of conservation practices on Iowa farms. The 2007 report was compiled by the Center for Agriculture and Rural Development, Iowa State University.

[Conservation Value, Inc.](#) is a boutique consulting firm specializing in sustainable land use and business solutions. Its projects include global climate mitigation and adaptation, ecological restoration, ecosystem services and incentive-based conservation projects.

[Conservation Value Institute](#) is a non-profit research and communication think tank that seeks to raise public understanding of how environmental solutions benefit our economy, health, security and quality of life. Its program areas include advancing the green economy and sustainable land use.

[Ecological Society of America](#) provides materials that serve as primers on ecosystem services and possible values, now and in the future.

["Ecology in Times of Scarcity,"](#) a 2009 report in BioScience Magazine, says ecological services will increase in values as resources become scarce.

[Ecosystem Valuation](#) is a website that describes how economists value the beneficial ways ecosystems affect people. Originally funded by an NRCS grant, it is designed for non-economists who need answers to questions about the benefits of ecosystem conservation, preservation or restoration.

[Environmental Trading Network](#) began in 1998 to support the Kalamazoo River (Michigan) Water Quality Trading Demonstration Project. In the past five years, the Network has grown to include international representation. ETN is an organization dedicated to the development and implementation of successful water quality trading programs and other market-based strategies for achieving healthy, sustainable ecosystems. It is a national clearinghouse for key policy and regulatory issues, and transferable water quality trading program design elements.

[Farm Service Agency Economic and Policy Analysis](#) web pages provide a number of reports and studies relating to natural resource economic and policy issues.

[Impacts of Wetland Loss in Manitoba](#), a publication of Ducks Unlimited Canada, assesses economic losses caused by wetlands destruction in the province of Manitoba.

[“Mitigation and Conservation Banking in the United States: An emerging biodiversity-based asset class”](#) is a publication of [New Forests](#), a firm that manages private equity-style commingled funds and separate accounts for timberland and eco products investments, such as carbon credits, biodiversity credits, mitigation banks and water quality improvements. The report provides a review of existing mitigation and conservation banking systems in the U.S., with particular attention to wetland and stream mitigation.

[NACD Market Based Conservation Initiatives White Paper, 2008](#) looks at emerging market-based conservation systems across the U.S.

[Natural Capital Project](#) is a joint venture among [Stanford University](#), [The Nature Conservancy](#), and [World Wildlife Fund](#). The partners seek to meld world-class research and development with influential on-the-ground conservation programs. It has developed tools for quantifying the values of natural capital. [Click here for more on the group's toolbox.](#)

[Natural Resources Inventory](#) is a statistical survey of land use and natural resource conditions and trends on U.S. non-Federal lands compiled by NRCS.

[NRCS Technical Notes](#) web pages provide an array of reports on the value of ecosystem services and a variety of other conservation valuation topics.

[“Protecting Our Natural Heritage, The Value of Land Conservation in Georgia,”](#) published by the Environment Georgia Research and Policy Center, 2006, assesses the value of wetlands, forests and other systems in Georgia.

[USDA Forest Service Valuing Ecosystem Services](#) captures Forest Service efforts to address this topic in the forested setting. [An index](#) provides several examples.

[USDA Economic Research Service Report, “Conservation-Compatible Practices and Programs: Who Participates?”](#), notes that conservation programs appeal to different types of farmers and discusses implications. It finds that flexible incentive structures that can accommodate other farm operator goals, such as timesaving and ease of use, have their own value streams, and that policies other than direct subsidies can provide substantial environmental benefits. These could include conservation-compliance regulations, technical assistance and research to improve standard farming practices, such as crop rotations.

[Water Quality Trading Programs: An International Overview](#) is a World Resource Institute Report. [World Resource Institute](#) is an environmental think tank that seeks to go beyond research to find practical ways to protect the earth and improve people’s lives.

[Water Quality Trading Toolkit for Permit Writers](#), EPA, 2007. This is EPA’s first “how-to” manual on designing and implementing water quality trading programs. The Toolkit helps National Pollutant Discharge Elimination System (NPDES) permitting authorities incorporate trading provisions into permits. Its goal is to help improve the quality and consistency of trading programs across the nation.

Endnotes:

ⁱ From Kareiva’s address to the annual meeting of the Soil and Water Conservation Society in Saint Louis, MO., July 19, 2010. He is chief scientist with The Nature Conservancy.

ⁱⁱ Interview with Stephen Polasky, professor of ecological/environmental economics, University of Minnesota. Great strides have been made in the past half-decade, according to Polasky. Research has identified value streams in a number of areas.

ⁱⁱⁱ Dr. Peter Kareiva’s remarks to the Soil and Water Conservation Society, July 19, 2010.

^{iv} Interviews with Bill Horvath, retired NACD policy director and regional representative, and Rich Duesterhaus, NACD senior policy

^v “Water Quality and Conservation Practices,” Iowa Learning Farm, June 2009

^{vi} Ruhl, J.B, “Farms and Ecosystem Services,” Choices, the American Agricultural Economics Association, 2nd Quarter, 2008

^{vii} Polasky interview

^{viii} Wilson’s essay, “Biodiversity, Prosperity and Value,” appeared in “Ecology, Economics, Ethics: The Broken Circle,” edited by F. Herbert Bormann and Stephen R. Kellert, Yale University Press, 1991. The book provides an excellent series of essays on linking economic values to ecological services.

^{ix} Willamette Partnership, <http://willamettepartnership.org/about-markets>

^x As reported on WRI’s [Water Quality Trading web page](#)

^{xi} Remarks at the Soil and Water Conservation Society 2010 annual conference, Saint Louis, MO.

^{xii} “Market Outlook,” New Forests company, 2010 (<http://www.newforests.com.au/about/about.php>)

^{xiii} Johnson, Douglas, et al, “The Downstream Economic Benefits from Storm Water Management: A comparison of Conservation and Conventional Development,” Southern Illinois University Carbondale, 2004.

^{xiv} NACD Market-Based Conservation Initiatives White Paper, December 2008.

^{xv} Miller’s comments came at the Soil and Water Conservation Society 2010 annual meeting in Saint Louis, MO.

^{xvi} Rand Corp.

^{xvii} “Counting All That Matters: Recognizing the Value of Ecosystem Services,” Pacific Northwest Research Station Science Update Issue 16, Spring 2008.

^{xviii} “Recreational Use & Economics of Conservation Reserve Acreage: A National Survey of Landowners,” prepared for USDA Farm Service Agency by Southwick Associates Inc. and D.J. Case & Associates, January 2008.

^{xix} NACD’s [Conservation Recipes for the 21st Century, 2009](#).

^{xxi} The companies include SABMiller, Nestle and Coca-Cola.

^{xxii} Kareiva, addressing the annual meeting of the Soil and Water Conservation Society in Saint Louis, MO., July 19, 2010.

^{xxiii} “What’s Nature Done for You Lately: Measuring the Value of Ecosystem Services,” Choices magazine, 2nd Quarter, 2008.

^{xxiv} Ibid.

^{xxv} Ibid.

^{xxvi} Dewing, Dale, “Balancing Ag Viability and Water Quality in the New York City Watershed.” Dewing is nutrient management team leader for Cornell Cooperative Extension of Delaware County.