Chesapeake's Conservation Challenge

Much Has Been Accomplished, More to be Done

An analysis of lessons learned from efforts to improve the health of America's largest estuary, the Chesapeake Bay

Chesapeake Bay watershed (EPA)

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Introduction

This report draws attention to lessons learned from efforts to address water quality problems in the sprawling Chesapeake Bay basin. Achieving water quality goals for the Chesapeake Bay will require contributions from all sectors of the swelling population of the basin. This report acknowledges that, but places particular attention on agricultural landscapes.

With a land-to-water ratio of 2,800 square meters of land to every cubic meter of water, the Bay is the largest coastal body in the world. It has also absorbed dramatic land use changes, especially burgeoning urban populations. Humans have had great impacts on this huge but fragile ecosystem for centuries.

Despite many challenges, efforts to improve water quality have produced positive results. The 2011 Conservation Effects Assessment Project[1] (CEAP) has documented clear and measurable successes in reducing runoff and nutrient loading from agricultural lands. CEAP has also identified opportunities for further gains in these areas. Progress to date has largely resulted from voluntary adoption of conservation practices in efforts nurtured by a broad array of partners. Even as a presidential order has mandated a larger role for the federal government in addressing Bay issues, many Bay partners continue to believe that voluntary locally led measures can accomplish the task.

But it is daunting. Efforts to address Bay water quality have been ongoing for more than four decades. At least in part they are aimed at ameliorating negative impacts that have built up over centuries. Thus, today's conservation efforts may not be fully realized for years to come. This "lag," or the delay of ecosystem response to conservation measures, is likely at play in the Bay.

Then there is the question of whether the best management practices (BMPs) currently available are sufficient to achieve the high bar of success sought for the Bay.

In this setting, agriculture is sometimes viewed as both the problem and the solution. It is identified as the major contributor Bay water quality problems by the Environmental Protection Agency, yet it is also seen as a preferred land use by EPA and other entities addressing water quality, both governmental and non-governmental. Meanwhile, developed land increased by 67 percent between 1982 and 2007.

As federal and state agencies and traditional partners such as conservation districts set out to address 21st century conservation issues at the landscape scale, Chesapeake Bay efforts make it clear that a blend of partnerships and collaborations, together with new strategies and technologies, is needed to achieve both measurable gains and fiscal accountability. These are important lessons at a time when local, state and national financial resources are strained.

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[1] CEAP is a multi-agency effort to quantify the environmental effects of conservation practices and programs and develop the science base for managing the agricultural landscape for environmental quality. Project findings are used to guide USDA conservation policy and program development and help conservationists, farmers and ranchers make more informed conservation decisions.

A Bay-full of Challenges

Here's a sample of the challenges facing the Chesapeake Bay: Burgeoning urban populations and resulting land use changes, atmospheric deposition, agricultural runoff, overharvesting of aquatic species, loss of vital habitat and introduction of invasive species. Any one of these problems could challenge the sustainability of an ecosystem. The Chesapeake has them all and more. Traditional conservation partners such as conservation districts and the Natural Resources Conservation Service (NRCS) have learned a vital lesson from this complex set of problems: Partnerships and collaborations must be broadened, common ground must be found and cooperation for a common goal means sacrifice.

Reflected in legislation

An organized, democratic society often seeks legislative remedies to the challenges it faces. A review of legislative initiatives provides insight into the range of issues faced by local, state and federal partners addressing the health of an ecosystem such as the Chesapeake Bay.

Perhaps no other legislative act was more important to Bay partners than the 1978 charge the U.S. Senate Appropriations Committee provided the Environmental Protection Agency: "Conduct an in-depth study of the Chesapeake Bay which shall be applicable to other areas of the country."[2]

In the more than three decades that followed, hundreds of pieces of legislation were produced by local, state and federal governments in the region in an effort to address the myriad challenges facing the Bay.

Chesapeake Bay Facts, Figures

LARGEST: Covering 64,000 square miles, the Chesapeake Bay is the largest estuary in North America.

WATER FROM NEAR AND FAR: More than 150 rivers and streams from six states eventually drain into the Bay.

WILDLIFE APLENTY: More than 300 fish species, some of them critical to the Bay's health, and numerous shellfish and crab species inhabit the Bay. Critical habitat is threatened by a variety of sources.

HEALTH STATUS: While the Bay's health has steadily improved since the 1970s, pollution is still affecting water quality at the local level and contributing to hypoxic zones in the Bay.

Maryland and Virginia took the lead, creating a Chesapeake Bay Legislative Advisory Commission in 1978 to begin a two-year study.

In 1980, The Chesapeake Bay Commission (CBC) was created by the two states as a bi-state body. Pennsylvania later joined. To this day, the Commission plays a major role in pulling together partners to address Bay issues. The commission's role can't be understated. "The success of the Bay program was

[2] A Chesapeake Bay timeline of important milestones is provided as an appendix to this report.

the success of organizational structure," says Mike Permenter, an NRCS natural resource specialist. An Executive Council comprised of Bay-state governors makes key decisions, but the CBC is also a signatory to any Bay agreements. States are represented by elected officials and citizen members. They meet regularly, discuss concerns and identify issues to be brought before state legislatures.

In 1983, the governors of Maryland, Virginia and Pennsylvania; the mayor of the District of Columbia; and the administrator of the United States Environmental Protection Agency (EPA) signed *The Chesapeake Bay Agreement of 1983.* From this act, the Chesapeake Bay Program Executive Council was formed.

The Chesapeake Bay Program, a regional partnership that leads and directs Chesapeake Bay restoration and protection, was created in 1983. Its role in addressing Bay concerns has been significant. Bay Program partners include federal and state agencies, local governments, non-profit organizations and academic institutions. Staff members work at the Bay Program's Annapolis, Maryland, office and at partner organizations throughout the Bay watershed. Three states – Maryland, Pennsylvania and Virginia, along with the District of Columbia, are among the principal partners. Delaware, New York and West Virginia are Headwaters State Partners. Federal, academic and nongovernmental organizations are also partners. Scientific and technical advisory committees, citizen advisory committees and other entities allow for broad involvement, bringing to the table groups that may not agree on all aspects of how to solve a problem, but finding common ground in participation.

"If you are trying to get as broad a representation as possible, we've probably been successful," Permenter says.

That broad representation is reflected in legislative actions taken over the years. Here's a sampling:

- 1985: Maryland passes the watershed's first phosphate detergent ban. Pennsylvania follows in 1987 and Virginia in 1989.
- 1991: Pennsylvania investigates the use of Phytase as an animal food additive to reduce phosphorous loading and petitions the U.S. Department of Agriculture to register its use in the United States.
- 1993: Pennsylvania passes a nutrient management act and Virginia passes a forestry bad actor act.
- 1996: The U.S. Congress adopts a National Invasive Species Act, providing ballast water management measures to prevent introduction and spread of exotic species into the Bay.
- 2004: Maryland passes the Bay Restoration Fund, a dedicated fund for advanced wastewater treatment, generating funds to upgrade sewer treatment plants. In the same year, Pennsylvania voters approve a $250 million initiative to fund water and sewer improvements in the commonwealth.
- 2005: Pennsylvania passes the Agriculture, Communities and the Rural Environment (ACRE) Act, establishing buffer areas of 100 feet from streams, lakes and pond where no animal manure may be applied. Buffer areas may be 35 feet if they are vegetated.

- 2005: Virginia creates the Chesapeake Bay Watershed Nutrient Credit Exchange program, the first watershed-based nutrient trading program in the Bay region. Sewage treatment plants and other nutrient point and nonpoint sources are allowed to buy and sell credits from each other to meet the state's water quality goals.
- 2010: President Obama issues an executive order establishing a Chesapeake Bay Total Maximum Daily Load (TMDL) allocation plan. The TMDL establishes a pollution diet to meet states' Bay cleanup water standards. It places a cap on nitrogen, phosphorus and sediment loads for all six Bay watershed states and the District of Columbia. States are to set load caps for point and nonpoint sources.

A literal flood of legislation preceded the dramatic and controversial TMDL order of 2010. A Chesapeake Bay Commission summary of legislation from the years 2000-2010 alone, with only a brief description of the individual legislative actions, comprises 46 pages of text. The summary is an indicator of the complexity of the problems facing the Bay.

For a flavor of this complexity, here is a sample of the issues addressed by legislation in the past 10 years: The impact of pleasure craft on water quality and habitat, urban land use planning and growth management plans, the impact of gasoline additives on water quality, ship ballast water rules, efforts to protect blue crab populations and habitat, urban lawn fertilizer rules, farmland protection measures, tax credits for landowners who maintain riparian buffers, regulation of docks and wharfs that cross clam or oyster grounds, pilot projects to promote anaerobic digesters for animal wastes, efforts to control invasive mute swans, fish passages for American shad migrations, upgrading sewage systems identified as major sources of nutrient pollution, citizen water quality monitoring rules, nutrient management planning for agricultural operations, menhaden fish management efforts, power plant emissions reductions, tax credits for agricultural BMPs, and stormwater management.

The upshot for conservation districts and other partners

In recent years, NRCS and other federal agencies have moved toward a variety of efforts to address natural resource priorities on a landscape scale. The Chesapeake Bay Watershed Initiative (CBWI) is one of 11 such NRCS initiatives.

How do these initiatives impact work done by 127 conservation districts and scores of other partners in the estuary?

Under CBWI, eligible landowners can use available technical and financial assistance to address soil erosion, sedimentation, and excess nutrients in streams and waterways, as well as other related natural resource concerns such as air quality, wetlands, wildlife habitat, and forestry.

Additional federal technical assistance funding has been made available to conservation districts to assist in targeted projects. NRCS Farm Bill conservation programs, such as the Environmental Quality Incentives Program (EQIP) and Wildlife Habitat Incentive Program (WHIP), are providing financial assistance.

Districts and other partners have received competitive NRCS Conservation Innovation Grants to advance Bay cleanup efforts.

A review of state legislation over the past 10 years shows that conservation districts have been partners in a number of state-based initiatives and funding efforts related to the Chesapeake Bay cleanup. Until recently, federal expenditures amounted to less than 20 percent of the funds supporting cleanup efforts, so state and local programs have played a major role in a variety of efforts related to the Bay.

One key example is Pennsylvania's Growing Greener program, established in 2000 with initial funding of $645 million. The multi-faceted program has provided funding for a variety of projects. Staff positions such as watershed coordinators have been established in some conservation districts through Growing Greener grants. Hundreds of watershed restoration projects have been accomplished through the program.

In Virginia, districts provide technical assistance for design and implementation of agricultural conservation practices related to the state's Chesapeake Bay Preservation Act ordinances. Likewise, districts in Maryland cooperate on a number of Chesapeake-related initiatives. States in the region have periodically made special appropriations of funds to conservation districts to enhance technical assistance capability.[3]

Still, as is reflected in this report, while programmatic dollars from state and federal sources have been plentiful, funding for basic technical assistance to landowners falls short of what is needed.

[3] These appropriations are documented in the Chesapeake Bay Commission's summary of 21st Century Chesapeake Bay legislative actions.

Partners Aplenty

This is the story of Chesapeake Bay partners and collaborators, told in their words.

In the 21st century world of conservation, the need to accomplish mutual goals through partnerships and collaborations is recognized as long-established fact.

But efforts to address the health of the Chesapeake Bay began at a time when some of today's Bay partners were bitter foes. As bad, some of today's partners didn't know each other or understand the need to be at the table. Today, the Chesapeake partnerships and collaborations are many and varied. We asked them for advice to share with others, and they provided it.

Stay at the table, or...

Lynne Hoot has been dealing with Chesapeake Bay matters for a quarter-century. The executive director of the Maryland Association of Soil Conservation Districts gets to the point when she offers advice about how to work in a watershed with multiple challenges and players.

"Stay at the table, or else you'll be on the menu," she says.

Hoot, who served with the Maryland Department of Agriculture until 1989, took the part-time association job at a time when the state's 24 districts were seeing their influence grow. She has also represented other groups along the way, such as the Maryland Grain Producers, giving her several sight lines on the Chesapeake.

Her short list for groups that want to cooperate on landscape-scale projects:

- Stay engaged and current.
- Be an advocate.
- Don't give up.
- Keep the problem-solving at the local level.

And on Chesapeake progress over time: "We've made great strides, but we have a long way to go."

Hoot is a realist when she looks at the resource. "One of the problems we have is we all look around and see the water isn't

Farmer to Bay Exchange, Virginia

Now in its ninth year, the Farmer to Bay Exchange is a collaboration of the Virginia Association of Conservation Districts, Chesapeake Bay Foundation, Virginia Dairymen's Association, Virginia Poultry Federation, Virginia Farm Bureau and Virginia Young Farmers.

It is based on the simple premise that that an open dialogue and exchange amongst people from different places and backgrounds can lead to an appreciation and understanding that will motivate constructive and productive actions. The program arranges for farmers from the Shenandoah Valley to travel to the Bay to see and to appreciate where runoff from farms as far away as their valley will end up and the impact that it has on bay ecology and local water-based industries. Farmers meet fishermen and shellfishers who speak to the effects of declining water quality on their businesses, communities, families and livelihoods.

The trips provide faces and names to the Chesapeake Bay clean-up effort. Since its inception, close to 250 farmers from the Shenandoah Valley have made the all-expenses-paid trip to the Chesapeake Bay Foundation's Port Isobel Island Study Center near Tangiers Island, not far from where the Potomac River enters the Bay. One reverse trip has sent Bay watermen back to the valley to visit with farmers on their home turf.

Contact: Libby Norris, Chesapeake Bay Foundation, Virginia Office, (804) 780-1392.

clean. Well, we've doubled our population since we started working on it. Given the growth, we're lucky to have held our own. CEAP tells us that, as well as monitoring by our DNR. If we look at progress made to date – wastewater treatment plants, about 80 percent progress. Agriculture, 50 percent progress. But urban nonpoint has gone backwards."

She underscores her advice about keeping the focus on local needs this way: "Fifty percent of the water that comes to the Bay comes from Pennsylvania, and some from New York. We (states that are physically connected to the Bay) have all of the benefits. The Bay is in our backyard. For other states (such as New York, Pennsylvania and West Virginia), the selling point has to be local waters."

Federal and state cost-share dollars have helped, but an old conservation district bugaboo lingers. "Our limit of activity has not been with cost-share funds, but with technical assistance. We don't have enough TA (funding)."

Hoot remains upbeat about more progress on the Bay. "One of the things we have to get the message home on is lag time. We have a model watershed called the Corsica River, the first (state of Maryland) model watershed. In the research process of this small watershed close to the Bay, we're talking about a lag time of 20 years." In other words, it may take up to 20 years to be able to measure the impact of today's BMPs.

'Success of organizational structure'

Mike Permenter, natural resource specialist with NRCS in Washington, D.C., spent part of his career working on Bay water quality issues. Like Hoot, he says lag time applies when assessing efforts to address Bay health.

Citing the CEAP report and other indicators, Permenter says progress is being charted. He attributes much of the success to the organizational structure of the Chesapeake Bay Program, the regional partnership that's been leading and directing Bay restoration since 1983.

"We have the Executive Council comprised of governors. They're the decision-makers. But then we have the Chesapeake Bay Commission (created in 1980 to coordinate Bay-related policy across state lines and to develop shared solutions)." Representing Maryland, Pennsylvania and Virginia, the commission includes state elected officials and citizen representation. "It meets on a quarterly basis and identifies proposals they think should be submitted to state legislatures."

A scientific and technical advisory committee advises the CBP, Permenter notes. Environmental groups such as the Chesapeake Bay Foundation have citizens advisory committee roles, as do agricultural groups such as Farm Bureau and the Delmarva Poultry Industry, which represents 1,100 farm operations raising chickens in parts of Delaware and the eastern shores of Maryland and Virginia and five poultry companies producing birds on the Delmarva Peninsula, which borders the Bay.

Despite distinct differences, the groups come together under the organizational structure. "If you're trying to get as broad representation as possible, we've probably been successful," Permenter says.

Diversity is a challenge

In nature, diversity is valued. When attempting landscape-scale conservation initiatives, it can be a challenge.

Susan Marquart, acting NRCS Chesapeake Initiative coordinator, makes that point. The former executive director of the Pennsylvania Association of Conservation Districts has seen the challenges first-hand.

“One of the things that makes it difficult when you look at landscape-scale initiatives, especially over several states, is diversity,” she says. “Pennsylvania is not the same as Virginia or Maryland. Even our resources here are not the same. Politics, conservation districts, farming are different. If you’re going to do landscape initiatives, you can’t assume everything is the same.”

Time is an ally when tying diverse threads, she says. “Our partnership is strong here. It’s been operating for a long time. People can step up and bring resources to the table.”

The landscape approach “does increase the profile of the watershed we are part of.” She says. “Because of that, there is some opportunity for increased resources. Dollars, people, groups working toward a goal. From that aspect, that’s one of the successes of landscape initiatives.”

About that local thing…

The Lycoming County Conservation District in Pennsylvania is a long ways from the Chesapeake Bay, but some of its programs, including a pioneering water-quality trading program, are directly related to Bay health. Getting buy-in all comes down to local engagement, district employees say.

“Stakeholder and regional cooperation is important,” says Megan Lehman, environmental planner with the district. “I don’t know N and P from a hole in the ground, but I know long-range planning and community planning. It was very valuable to have local partners have an understanding of needs and issues.”

The trading program has an advisory committee with representation from major stakeholder groups. Point-source and nonpoint-source groups also meet regularly. All gather for occasional on-farm tours.

Selling the program comes down to convincing local folks, says District Manager Mark Davidson. “You have to talk about local benefits. It’s a program for Lycoming County citizens and their benefit,” he says. That includes farmers who sell water quality credits to water utilities as well as the utility’s ratepayers, who benefit from lower rates when costly infrastructure improvements are avoided.

Finding common ground

As government affairs director for MidAtlantic Farm Credit, Kenny Bounds sees Chesapeake Bay cleanup efforts from a pro-agriculture perspective. “I can’t recall ever talking to a farmer about installing a BMP for solely an economic benefit,” he says.

He sees plenty of bones of contention for agriculture, from the Chesapeake Bay computer model(s) to a propensity toward regulation over voluntary participation in some states.

Still, partnerships have helped states achieve gains in nutrient management, cover-crop utilization and other BMPs. He notes that groups such as the Chesapeake Bay Foundation and 1000 Friends of Maryland have helped by "figuring out it was easier and better to work with ag than fight ag."

Delmarva Poultry Industry Inc. has been aggressive in funding research and pushing for adoption of the phosphorous-inhibiting Phytase feed additive for poultry. Others in the agriculture community have stepped up, too. "Maryland Farm Bureau pushed farmers to comply when it was clear that the science was sound and the regulations were not going to change," he says. Groups interested in farmland conservation, such as American Farmland Trust, have cooperated with lawmakers seeking to enhance funding for agricultural conservation on the Delmarva Peninsula, he adds.

Dale Gardner, a former official with the Virginia Dairymen's Association, cites yet another example – traditionally hard-line environmental groups like the Environmental Defense Fund (EDF) cooperating with farmers on the ground. "Who would have ever thought that farmers and farm organizations would one day be working with Environmental Defense Fund? The incredulity went both ways – now they have a better appreciation and understanding of one another," he says.

Suzy Friedman, EDF's director of Working Lands, says successful partnering includes engagement on numerous levels. She's on the NRCS state conservationist technical committees in Maryland, Pennsylvania and Virginia. EDF partners on projects with conservation districts in several states. "They're a strong partner. They're there, on the ground and have connections and resources," she says.

Working with agricultural organizations proceeds at its own pace, she says. "You have to take time to explain we're there to work collaboratively with them. Also, we're really looking to work in collaboration with those who farmers trust, to find somebody we know who can introduce us to those who are trusted in the area and working from there."

Russ Brinsfield, director of the University of Maryland Wye Research and Education Center, sees similar promise in the evolution of Bay partnerships. A few key examples: "The Maryland Grain Producers has been willing to compromise and see both sides. The Chesapeake Bay Foundation, I give them a lot of credit for working toward common ground with farmers." Groups like the Eastern Shore Land Conservancy have worked to protect farmland and curb sprawl, he adds.

Leadership and cooperation came from the business community, too. Ann Swanson, executive director of the Chesapeake Bay Commission, notes that Wenger Feeds, a major supplier for Mid-Atlantic poultry and pork producers, embraced the sale and use of Phytase.

Chesapeake Bay Foundation staff cite other examples of maturing partnerships. Doug Siglin, CBF federal government relations director, notes that groups such as the National Association of Clean Water Agencies – representing wastewater and storm water utilities – has taken an active interest in development of the next Farm Bill. "Their involvement will drive the need for technical assistance on the ground with farmers," he says.

Virginia partnerships include the Agriculture and Conservation Partnership for Water Quality, says Libby Norris with CDF in Virginia.

In Pennsylvania, CBF's Lamonte Garber cites yet another important partner – the media. "Lancaster Farming (a weekly newspaper) isn't a partner organization per se, but they have huge outreach via their articles," he says.

What about the future?

Partnerships take nurturing and tending, but even then they're fragile and subject to fracturing. Bounds and others expressed concern about the impact of the Bay TMDL on continued Chesapeake cooperation. Other voices, especially those in the environmental community, say the TMDL threat has hastened efforts to enhance voluntary conservation activities and fully account for conservation already on the ground. The program will likely change the nature of partnerships. Just how remains to be seen. One thing is clear: The broad cooperation achieved in the cause of Chesapeake Bay health has encouraged innovation in agricultural and conservation systems and practices. We explore some of these next.

Focus: Waste Solutions Forum, Virginia

As its no-nonsense name suggests, the Waste Solutions Forum (WSF) is a roll-up-the- sleeves, get-the-job-done collaboration of the many parties in the Shenandoah Valley of Virginia with a mutual stake in the health of the Chesapeake Bay and the farms and farm communities in its watershed. Initially conceived by Virginia Tech University in 2005 as a forum to explore innovative, economically viable and long-term solutions to the nutrient challenges of livestock-based farming in the valley, two key organizational strategies paved the way for the program's outcomes to go well beyond good intentions and a final report.

The development of the original program was crafted by a steering committee made up of most of the major agricultural, environmental, industry and academic interests in the valley, ensuring a platform for an open and constructive dialogue among divergent positions and opinions. Upon completion of the forum, participants were encouraged to volunteer for a standing steering committee to see that the forum's action plans for identified priority approaches – such as advanced dairy feeding to reduce nutrients, alternative commercial uses and products for manure, enhanced composting technologies and training, and, developing compatible policies and funding sources – received serious attention and follow-up.

The membership list of the steering committee reads like a who's who of the issues and interests around agriculture in the Shenandoah Valley and the health of the Chesapeake Bay with farmers and their industry and advocacy organizations, conservation districts, academic and research departments at Virginia Tech, environmental and conservation non-profit groups, local governments, and branches of Virginia state government. The original forum priorities have since served as the basis for grant applications and funding initiatives that have led to close to $5 million dedicated to the implementation of on-the-ground pilot projects, education and outreach programs, and policy initiatives to support agriculture and improve water quality. Funded projects have included pilot projects to advance precision phosphorous feeding, and innovative and cooperative approaches to managing excess nutrients; stream bank fencing; advancement of pyrolysis technology; a Bay-friendly certification program for dairy farms; and a residual biomass inventory. In the collaborative spirit that has underscored the WSF since its creation, the partners on the steering committee work together to create projects and then decide on the best "lead" to manage a project and pursue a particular funding opportunity. Further ensuring a pathway to success for the WSF is the convention that at all times the rotating co-chairs of the forum includes a representative of the farm community in the Shenandoah Valley.

"The forum has been a tremendous coming together of a diverse group of individuals and groups to find innovative solutions," says Eric Paulson, co-chair of the forum. "It has promoted a robust dialogue and exchange of ideas in addressing agricultural nutrients in the Shenandoah Valley."

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On the way to cleaning up the Bay…

Innovation drives efforts

With four decades of efforts to address its health, the Chesapeake Bay estuary is America's de facto longest sustained landscape-scale conservation initiative.

By accident or intent, Bay efforts have introduced innovations in policy, organizational structure, conservation and agricultural practices or systems, and, as we have reviewed, partnerships and collaborations.

What have these efforts accomplished? In the words of Lynne Hoot, executive director of the Maryland Association of Land Conservation Districts: "We've made great strides, but we have a long way to go."

Perhaps no other reliable source of information underscores Hoot's comments better than the 2011 Chesapeake Bay Conservation Effects Assessment Project report. Some key points in that report:

- ***The voluntary, incentives-based conservation approach is working***. Most cropland acres have structural or management practices—or both—in place to control erosion. Nearly half the cropland acres are protected by one or more structural practices, such as buffers or terraces. Reduced tillage is used in some form on 88 percent of the cropland. Adoption of conservation practices has reduced edge-of-field sediment loss by 55 percent, losses of nitrogen with surface runoff by 42 percent, losses of nitrogen in subsurface flows by 31 percent, and losses of phosphorus (sediment attached and soluble) by 41 percent.
- ***Opportunities exist to further reduce sediment and nutrient losses from cropland***. The study found that 19 percent of cropped acres (810,000 acres) have a high level of need for additional conservation treatment. Acres with a high level of need consist of the most vulnerable acres with the least conservation treatment and the highest losses of sediment and nutrients.
- ***Targeting enhances effectiveness and efficiency***. Use of additional conservation practices on acres that have a high need for additional treatment— acres most prone to runoff or leaching and with low levels of conservation practice use— can reduce sediment and nutrient per-acre losses by over twice as much as treatment of acres with a low or moderate conservation treatment need.
- ***Comprehensive conservation planning and implementation are essential***. Suites of practices that include soil erosion control and comprehensive nutrient management—appropriate rate, form, timing, *and* method of application— are required to simultaneously address soil erosion, nutrient losses in runoff, *and* loss of nitrogen through leaching.
- Cultivated cropland represents about 10 percent of the land base in the Bay watershed but delivers 22 percent of sediment, 31 percent of nitrogen and 28 percent of phosphorous to rivers and streams in the

watershed. The table below summarizes per-acre contributions of sediment and nutrients to rivers and streams in the Bay region, by land use.

Per-acre contributions of sediment and nutrients to rivers and streams in the Chesapeake Bay region, by land use

	Pounds per acre delivered to rivers and streams annually		
Land use	Sediment	Nitrogen	Phosphorus
Cultivated cropland	897	23.1	1.5
Hayland	743	8.3	0.7
Pasture	206	7.4	0.3
Urban	2,011	34.6	3.2
Forest and other	160	1.7	0.1

As with many other watersheds, efforts to achieve water quality gains in the Bay focus on the need for enhanced nutrient management.

CEAP is a reliable measure of the status of the Bay, although it likely does not account for the full range of conservation practices on agricultural acres. A 2011 NACD project indicates that up to 30 percent of the conservation practices on agricultural lands aren't counted in the report or in the Chesapeake Bay Program Partnership models for the Bay.[4] The survey has helped EPA, State Agencies and other entities better understand the full range of contributions from the agricultural sector and offers promise for better accounting in the future. It is hoped that the work will establish a protocol for accounting for these practices going forward. Conservation districts can play an important role in surveying, categorizing and quantifying voluntary, non-programmatic conservation measures taken by farmers.

Rapid urbanization of the region has also complicated cleanup efforts. Testifying before the U.S. House Committee on Agriculture's Conservation, Energy and Forestry Subcommittee in 2011, NRCS Chief Dave White noted that developed land increased by 67 percent between 1982 and 2007. White told the committee that conservation partners have a goal of applying new conservation practices on four million acres of agricultural working lands in Bay states by 2025 in order to meet President Obama's Executive Order for the Bay.

Achieving further gains on the Bay goals will rely on tried-and-true practices and systems, including riparian buffers, conservation tillage and appropriate cover crops. It will also require a variety of innovations to improve BMPs, along with innovative methods of delivering programs and information to land managers.

Here we take a look at some of the innovations that can help achieve greater success.

[4] Under the agreement, NACD gathered data on the implementation of agriculture's conservation practices in the Chesapeake Bay region, focusing on voluntary practices that did not rely on government cost-sharing programs.

Program delivery

In addition to a sophisticated organizational structure that helps states identify and fund conservation activity, federal partners have also fashioned innovative programs and services that help put conservation on the ground.

Cost-share programs such as the Environmental Quality Incentives Program serve as the backbone of federal cost-sharing efforts. Given the need for innovation, it's no surprise that the nation's first federal-state Conservation Reserve Enhancement Program partnership in Maryland addressed Chesapeake Bay water quality issues. Pennsylvania, Virginia and West Virginia CREPs also address Bay water quality, at least in part.

Other programs reward innovation. NRCS' Conservation Innovation Grants (CIGs) Program funds development of new approaches and technologies. EPA's Nutrient and Sediment Reduction Grant Program also provides resources for on-the-ground efforts. The two agencies cooperate in awarding the grants to avoid duplication.

Conservation districts have benefited from several of the grants. The Tioga County Soil and Water Conservation District, at the upper end of the watershed in New York, received a nearly $1 million CIG grant to engage dairy producers to implement precision feeding and forage management practices, stressing the importance of precision management at every step along a farm system. In Pennsylvania, grants have funded efforts in the Mifflin County Conservation District to eliminate nutrient and sediment pollution from unpaved road corridors near agricultural operations and the Chester County Conservation District, where efforts focused on encouraging conservation tillage among Plain Sect farmers by demonstrating and evaluating a horse-drawn no-till corn planter.

Another program, the Cooperative Conservation Partnership Initiative, directs funding to producers who implement conservation practices.

NRCS in 2011 began deploying Strategic Watershed Action Teams (SWATs) to work intensively on landscape initiatives like the Chesapeake with a goal of accelerating conservation adoption within the focus area by concentrating agency expertise and resources.

Old tools made better, new tools added

Over the years, the use of cover crops and conservation tillage has reached basin-wide scale in the Bay. With the help of university researchers in the region, the use of these tools has been enhanced. Types and timing of cover crop applications have evolved. Riparian buffers feature deep-rooted plants that serve as effective nutrient barriers.

Cover crops have emerged as an especially important tool in nutrient management, keeping soil in place when wintry winds blow across the Eastern Seaboard. But the mere presence of a cover crop isn't enough.

Agricultural Research Service researchers uncovered this in Bay research. They merged remote-sensing, field-sampling and farm-program records to judge the effectiveness of winter cover crops in controlling nitrogen losses from fields.

In a 4-year study using this combination of remote-sensing tools, Greg McCarty, a soil scientist at the ARS Hydrology and Remote Sensing Laboratory (HRSL) in Beltsville, Maryland, and Dean Hively, now a visiting physical scientist from the U.S. Geological Survey Eastern Geographic Science Center, showed that, of the predominant winter cover crop species planted in Maryland — rye, barley, and wheat — wheat is by far the least efficient at taking up nitrogen because of its slow fall growth. Yet 60 percent of the land planted to cover crops is in winter wheat. The state of Maryland now pays farmers for early-planted and non-wheat crops.

McCarty and Hively also used the tools to calculate that it costs taxpayers about $9 for each pound of nitrogen sequestered by winter wheat, while it costs $2.50 per pound of nitrogen for rye and $3.50 for barley.

In a pilot project, scientists are developing GIS (geographic information system) software to automate cover crop monitoring and management reporting. Participating farmers receive field-by-field reports of cover crop performance, as well as a county summary report. Conservation district offices will then be able to evaluate underperforming fields to strategize for improved implementation in the coming year. With success, the project will be scaled up to each of Maryland's 24 soil conservation districts.

Research is showing the value of cover crops in reducing nitrogen, says Russ Brinsfield of the University of Maryland Wye Research and Education Center. Long-term data sets underscore that importance of cover crops. Maryland has heavily subsidized the practice, and 400,000 acres were signed up last year. But there are questions about farmer participation should the subsidy dry up.

Heavy emphasis on nutrient management has led to other gains. Kenny Bounds of MidAtlantic Farm Credit cites more careful P-based nutrient management plants, more careful application and calibration of animal manure, more attention to its contents and more care in application and incorporation in soils. These actions are driven by research and education, Bounds says, and, to some extent, the fear of future regulation.

Some of the innovations start at the front end of the operation. Since the Delmarva Peninsula's poultry companies began using the Phytase enzyme in chicken feed about eight years ago, there has been about a 30 percent reduction in phosphorus excreted by the chickens. Approval of Phytase for use as a food additive was at least partly driven by concerns about P loading in the Bay watershed.

Efforts toward data-driven approaches for nutrient management to address Bay health will serve other regions of the country well. Initiatives such as those for the Great Lakes and Mississippi River often focus on nutrient management as a key to water quality improvements.

Environmental markets

Bay innovations also include some of the nation's first water-quality trading programs. To some extent, these programs rely on regulatory drivers such as the proposed Bay TMDL. But viable programs are already operating in some areas.

One example is the Lycoming County Conservation District in Pennsylvania, which operates a nutrient credit trading program. Farm operations with BMPs can sell credits to county waste treatment facilities. The district serves as an aggregator of credits and works with local farmers who sign up under the county program and sell their credits at auction.

There's nothing simple about the program, says District Manager Mark Davidson. The county has seven treatment plans operated by five authorities. While the focus is local, purchasers have also included Pennsylvania Power and Light, an out-of-county private industry. "The program is definitely in its infancy, and there's a lot to hash out," says Davidson. "I think we stand to be looked upon as a model program, a template to help form other efforts for nutrient trading around the watershed." He credits county officials for supporting the program.

The program is overseen by the state's Department of Environmental Protection. The first auction produced revenues of $96,000, divided among six farmers and the county, which retained 25 percent of the funds to recover its costs and move the program forward.

While it's set up to anticipate Bay-related regulations, the benefits are local. "For every pound of nutrients that is not going to end up in the Bay, the nice thing is you might have four or five pounds that are kept out of local waters," Davidson says. That supports the local economy, too. The county has a thriving tourism industry including world-class trout fishing and kayaking that benefit from clean water.

And that's not all...

Many other innovations are worth noting, from the launching of a National Estuary Program to extensive efforts to protect and preserve farmland in the region, at least in part in response to the impact of urban sprawl on Bay health.

We've touched on these and other innovations in this report, but perhaps the most important one is cited by The Chesapeake Bay Program: "(Bay efforts) developed the science and approach for large-scale ecosystem restoration that is well-recognized as the best and most extensive in the country."

But what next?

Challenges, opportunities and more work

There is truly no end to the story of the Chesapeake Bay and the people who both love it and stress it to its limits. As Rich Duesterhaus, senior advisor for NACD indicates, the work will never be done. In a sense, that's true of any conservation activity. It's especially so for the Bay and all of its challenges.

Tracy Mehan, a principal in the Cadmus Group, environmental consultants, and a former EPA official, offers this insight: "We need to consider a watershed as a social formation."

The partners and sometime-foes in Bay cleanup efforts are on their way to accomplishing that. Four decades of work has produced unparalleled cooperation among a wide array of local, state and federal organizations and agencies.

These partnerships and the time invested in them will help Bay cleanup efforts endure.

Currently, there are questions about the Bay TMDL and its impact on cleanup efforts. Some interviewed for this report were quick to point out that the TMDL has frayed some of those partnerships. Other voices said the TMDL hastened efforts to show that voluntary conservation works.

The TMDL is only one of many challenges facing those who seek a healthy Bay. Of the states in the Bay watershed, only Delaware does not project a budget deficit for this year. By all indications, conservation programs will be cut when a new Farm Bill is passed. Local governments, too, are making tough budget decisions. And nongovernmental organizations have struggled in the current economy.

On the ground, rapid urbanization and population growth add new challenges. Worldwide demand and high prices for crops like corn and soybeans have altered the face of farming in the U.S.

And despite many advances in nutrient management, we still lack the technology to sufficiently remove nitrogen and phosphorous that moves off both farm fields and urban lawns and parking lots.

Despite these and other challenges, much has been accomplished. Recently, the 2008 Farm Bill Chesapeake allocation of $500 million has stimulated activity.

In the urban setting, sewage and water treatment plant retrofits are progressing, with more to come. Development restrictions for stormwater and environmental site design have emerged as tools in the urban setting.

NACD's effort to account for all practices on agricultural lands may help convince The Chesapeake Bay Program Partnership to provide credits for these practices, including some that don't fully line up with NRCS specifications, but still achieve gains, such as narrower grass waterways.

But one thing is clear. This story has no end. Its future chapters, like those that came before it, will tell of successes, failure and challenges. So it is with conservation, a never-ending job.