Chesapeake Quarterly

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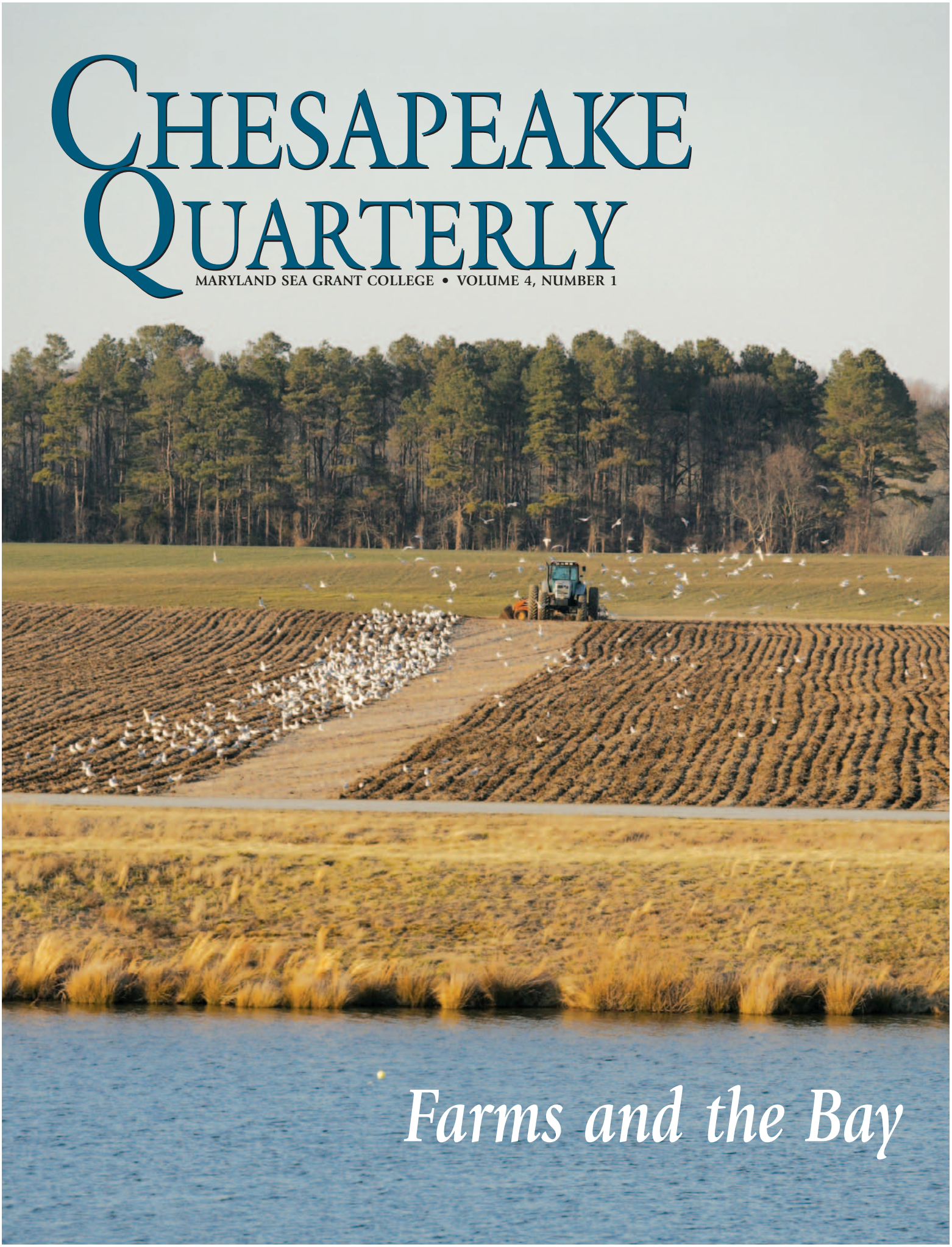

Farms and the Bay

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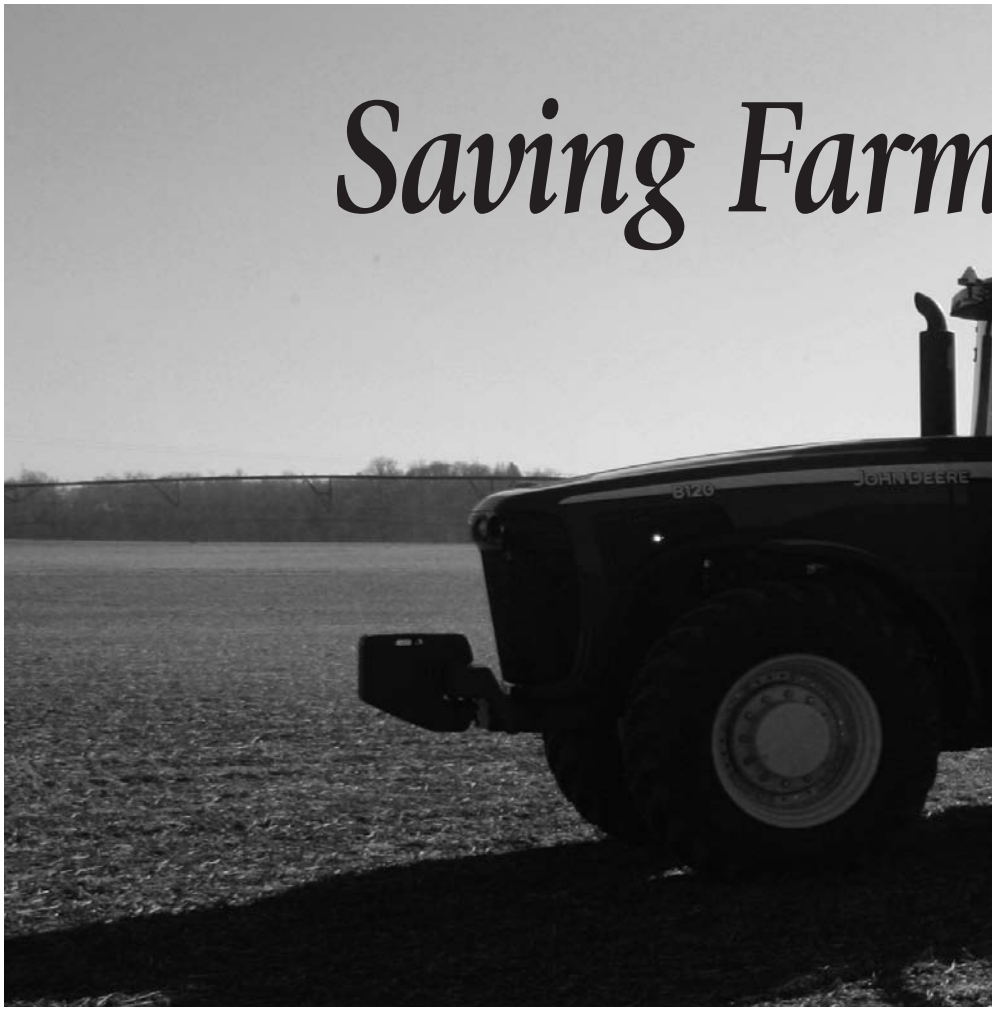
Cover photo: *Like many other Eastern Shore farmlands, this one lies next to a tributary of the Chesapeake Bay and has a buffer of grasses to slow runoff of sediment and nutrients.* ***Above:*** *Farmer Balvin Brinsfield and his son Josh work a field on their farm near the Nanticoke River in early spring.* PHOTOGRAPHS BY SKIP BROWN.

Saving Farm



A sharp west wind sings across the flat fields of Balvin Brinsfield's farm, just north of Vienna, Maryland. The wind has the bite of winter in it, but otherwise the sun is shining and the low-lying fields gleam with a thin carpet of green. Balvin has a wide smile and a welcoming handshake. Welcome to farm country, Eastern Shore style.

To get here, drive east and south from Annapolis for an hour and a half to the marshy Nanticoke River, where traffic thins out and life slows down. Turn north onto Route 331 just past a sign that says, *Scenic Byway: Chesapeake Country*. In the middle of a winter's morning you might stand on the centerline of the road and not see a car coming either way. But despite this rural quiet, there is a double message in Balvin Brinsfield's handshake and that scenic highway sign: this is both farm country and Bay country, a landscape that offers up sweet corn, peppers and soybeans, but also blue crabs, oysters and striped bass. When things are working right, it is a bountiful place to be.

The View from the Farm

Brinsfield has a round face and looks at you with clear eyes. It is a farmer's face, and you can see those same features in his ten-year-old son, Josh. Brinsfield seems a modest man, with no axes to grind. Still, working the land has its challenges, and changing weather, changing markets, and changing regulations routinely test his patience.

Cranking up the heat in one of his sheds on a cold February morning, he sits down to talk about farming. Soon his cousin John Brinsfield, who lives next-door, comes in and joins the conversation. The Brinsfields have been here since grandfather Balvin Bacchus Brinsfield settled this low-lying Eastern Shore land three quarters of a century ago.

Country in Bay Country

By Jack Greer

Both Balvin and John each farm fewer than 400 acres. In fact John shares his land with other members of his family, so they have three families supported by a little more than 100 acres each. Between Balvin and John's farms they grow sweet corn, feed corn, soybeans and assorted vegetables — string beans, peppers and onions. Depending on the year, Balvin may also grow watermelon, potatoes and pumpkins. While the vegetables are headed for market (or Balvin's roadside stand), the feed corn is usually headed for poultry houses — part of a large Eastern Shore connection between grain crops and a very big chicken business.

In addition to difficult markets and narrow profit margins, farmers must also contend with a range of programs aimed at cleaning up the Chesapeake Bay.

The Brinsfield compound represents a tiny slice of the estimated 87,000 farms in the Chesapeake Bay watershed — most of which average only about 180 acres, far smaller than the 500-acre average for the rest of the country. While large agricultural companies may get the press, the vast majority of farmland in this region is still comprised — so far — of fairly small family-owned farms.

The two Brinsfield cousins make it clear that farming is part of who they are. "We sure aren't in it because it's lucrative," John laughs, dragging out the word lu-cra-tive. John has penetrating brown eyes and a college diploma, and like Balvin, he takes his farming seriously.

Perhaps their biggest concern is what John calls "succession" — the passing on of the family farm. Fewer farm children want to stay on the farm, John says, given the demanding lifestyle and the market's economic rollercoaster, and he sees smaller farms taken over by increasingly larger ones. Grandfather Balvin Bacchus Brinsfield left his farm to his children and grandchildren, but John worries about what will happen to family farms all across the Bay region once the current generation passes away.

Ten-year-old Josh, home schooled and attentive to this conversation, says with a shy smile that he'd like to work the farm — and maybe he will.

If he does, he will inherit not only the land but the tensions of an ongoing dilemma. He will face the dual challenge of working the farm while protecting the water, of keeping this land along the Nanticoke both farm country and Bay country.

Balvin and John say that they care about the nearby Nanticoke River, where they sometimes fish and where John likes to sail and kayak. The cousins take pride in their farms, and they are often unhappy with the way farmers are portrayed in

the media. The talk about "all these subsidies" farmers are getting. Balvin tugs at the bill of his cap and says he would rather just get paid for his crops and not have to worry about subsidies at all.

This is a painful irony, that farmers, who as a group don't generally like big government, often rely on government subsidies.

And it gets more complicated than that.

The state of Maryland, the federal government and the environmental community are all calling on farmers to help clean up the Chesapeake Bay. In addition to difficult markets and narrow profit margins, farmers now contend with a range of Bay-related programs — cover crops, nutrient management plans, manure management, buffer strips and easements, among others.

This is because farming, according to the regionwide Chesapeake Bay Program, puts more pounds of nitrogen, phosphorus and sediment into creeks, rivers and the Bay than any other source — some 40 percent of the nitrogen and phosphorus and more than 60 percent of the sediment.

While about half of agriculture's flow of nitrogen and phosphorus comes from intensive animal operations, especially poultry, the other half comes from chemical fertilizer used on a variety of crops. Sediment comes from a wide range of row crops and farm activities. A recent report by the Chesapeake Bay Watershed Blue Ribbon Finance Panel (see "Desperately Seeking Dollars") has stated that in order to reach goals for restoring the Bay virtually all of the region's 87,000 farms will need to implement improved farming and conservation techniques — generally known as best management practices (BMPs) — at levels never before seen in this country.

Come spring, Balvin will walk over to the long sheds covered by corrugated roofs and start up a large machine he uses to spray herbicides and fertilizers, or he'll pull out a tractor to disk the fields and turn over the topsoil, as farmers have done for generations. If he decides on no-till farming, a widely used practice that prevents soil erosion by cultivating crops without overturning the soil, he'll have to use herbicides to burn off cover crops or weeds. If he disks his fields to turn over the soil and activate nitrogen-fixing bacteria, he'll risk more erosion. If he spreads manure but doesn't disk it in, the manure will volatilize, with ammonia evaporating into the atmosphere and then raining down to add to the region's nitrogen load.

There is a lot for a farmer to think about in Bay country.

Up Against the Nutrient Challenge

When Bay grasses began dying in the 1970s, scientists went looking for causes, and farm chemicals were high on their list.

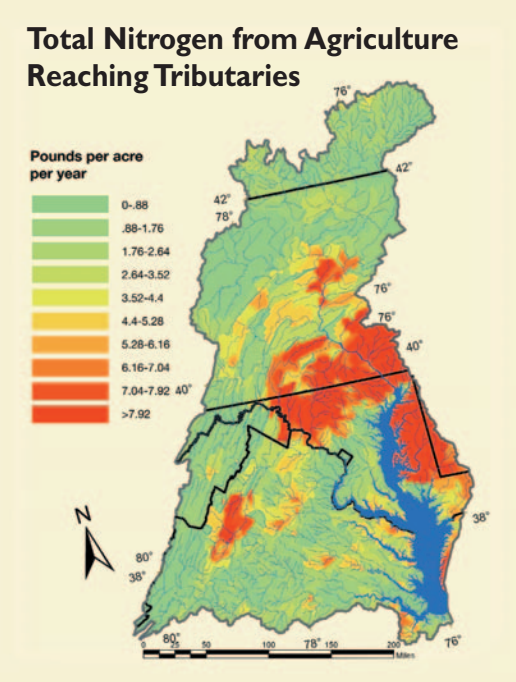
A $26 million research effort funded by the U.S. Environmental Protection Agency quickly focused on the chemical herbicides that farmers use to kill off unwanted plants and weeds. Those herbicides, the theory went, might keep killing once they entered the Bay. But five years of research concluded that except for some farm ditches polluted with herbicides, those agricultural chemicals did not reach the Bay in strong enough doses to kill Bay grasses.

Farmers, however, were not off the hook. What was smothering the grasses, the researchers found, were blankets of sediment and algae that spread across the Bay, blocking out sunlight. With fewer grasses and more algae blooms, the Bay also began to lose something else — dissolved oxygen essential for life, especially in the summer and in the deeper waters. Much of the sediment that washed into the Bay and a good deal of the nutrients came from farm fields.

When these research results hit the press, mounting public pressure — to

Skip Brown

Along the Nanticoke, *farmland blends into marshland (above). Farms have bordered the Bay since before George Washington built Mount Vernon on the Potomac, but intensive agriculture has led to a surge of nutrients that find their way into the Bay's rivers and streams (at right).*



Chesapeake Bay Program

take away this blanket of sediment and nutrients — sparked a new level of cooperation between the Bay states and the federal government and led to the signing of Bay Agreements in 1983 and 1987. While the first Agreement brought the states together in a general commitment to restore the Chesapeake, it was the 1987 Agreement that committed the jurisdictions to reduce nutrients by 40 percent by the year 2000. When the year 2000 came, and nutrient goals remained unmet, a new agreement, *Chesapeake 2000*, spelled out even more ambitious goals for improving water quality and clarity.

After two decades the clock is winding down on the court-ordered deadline of 2010, the time given the states to remove the Bay from the Clean Water Act's list of impaired waters. According to the Chesapeake Bay Program, nutrient reductions are about one third of the way toward that goal, with two-thirds of the reductions remaining to be made by the end of this decade.

The pressure to reduce nitrogen and phosphorus — as well as sediment — has intensified as success at reducing them has stalled. While new technologies can help in some cases — for example, to cut nutrient levels at waste treatment plants — it remains more difficult to control the flow of nutrients and sediment from farms, where runoff can't be put inside a pipe.

Think of farms as nutrient cycling machines. In their most basic and self-contained form farms use nutrients in the soil, combined with water and sunlight, to grow crops that in turn provide nutrients for people and animals. Waste from animals (in the form of manure) and even from people (in the form of sludge) can be returned to the soil to fuel the growth of more plants. In more intensive agriculture, however, farmers bring in specially prepared commercial fertilizers to boost yield. They may also raise animals — like chickens, turkeys or hogs — in very intensive operations that produce large amounts of waste in a very concentrated area. Since these operations often lack enough acres of farmland to use all that manure or poultry litter, what should be an asset becomes a liability — too much animal waste, with too much nitrogen and phosphorus, and no place to put it.

The result of bringing commercial fertilizers into the region and disposing of

Desperately Seeking Dollars

"They've asked us to find the money." So said former Virginia Governor Gerald L. Baliles, chair of the Blue Ribbon Finance Panel appointed by the governors of the Bay states and the other members of the Chesapeake Executive Council.

Faced with public frustration over slow progress, in December 2003 the Executive Council charged the Panel with recommending finance strategies that would take the Bay cleanup effort to the next level. Chief among their concerns was meeting the court-ordered 2010 deadline for removing the Bay from the federal list of impaired waters — the so-called "dirty waters" list.

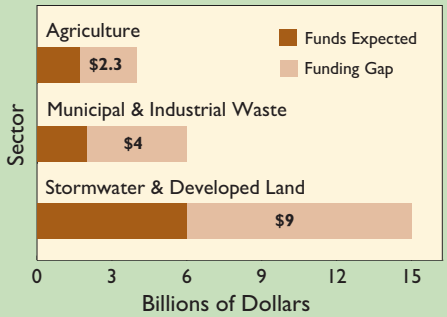
After some eight months of deliberation, Baliles, flanked by several other panelists, delivered their recommendations at a press conference on October 27, 2004 in Washington, D.C.

Their boldest idea: the creation of a watershedwide Chesapeake Bay Financing Authority, capitalized by federal and state dollars. While the media focused on the $15 billion recommended to fund the Authority ($12 billion federal and $3 billion state), the concept itself received less attention. Even if funded at a lower level, the Financing Authority would create a watershedwide revolving loan fund, able to target money to the Bay's most pressing problems, regardless of political boundaries. This would create a holistic approach to funding not yet seen in the Bay cleanup effort.

The Panel made nearly two dozen additional recommendations, among them:

- $ Establish state surcharge programs like Maryland's "flush tax" throughout the watershed.
- $ Set aside one percent of all funds for outreach and technical assistance, for example through County Soil and Water Conservation Districts and County Cooperative Extension offices.
- $ Increase Farm Bill funding for the Chesapeake Bay watershed and improve current cost-share programs.
- $ Fully implement the Conservation Security Program (CSP) under the 2002 Farm Bill and put more emphasis on CSP in the next Farm Bill.
- $ Include comprehensive Nutrient Management Plans as part of compliance for Farm Bill commodity payment programs.
- $ Invite the Secretary of Agriculture to join the Chesapeake Executive Council.
- $ Increase funding for the State Revolving Loan Fund (SRF), which currently gives loans for waste treatment and other water quality improvements, and enable the Bay watershed states to give 30 percent of their SRF funds as grants.

Cleanup Funds for Nutrients & Sediment



Dollar for dollar *agriculture remains the least expensive sector, while promising the greatest reductions. The Blue Ribbon Panel found that agriculture may also take new directions that increase profitability and decrease environmental impacts. Source: Blue Ribbon Finance Panel, 2004.*

- $ Improve coordination among federal agencies working in the watershed.

Additional information about the Blue Ribbon Finance Panel can be found on the web at www.chesapeakebay.net or www.efc.umd.edu. The Chesapeake Bay Program also offers a customized CD that contains the Panel's final report, *Saving a National Treasure: Financing the Cleanup of the Chesapeake Bay*, as well as extensive background materials prepared for the Panel.

— JG

Farm boy turned Ph.D., *Russ Brinsfield (left) now tracks nutrients as they seep through the soil toward the Bay. The most effective method he has found so far is the planting of cover crops (right), seen here on farm fields belonging to cousin Balvin Brinsfield.*

Skip Brown

Skip Brown

large amounts of animal waste on Bay area farms is a landscape that leaks nutrients from the watershed, and into the Chesapeake.

One of the scientists trying to devise ways to plug that leak grew up on a farm just across the road from Balvin and John Brinsfield. Russ B. Brinsfield (the B is for Balvin) left the family farm to get a Ph.D. in agricultural engineering, and for years he and his colleague Ken Staver have wrestled with ways to keep nutrients out of rivers like the Wye, the Choptank and the Nanticoke. How fast does nitrogen leave a farm field? What can keep it from reaching the groundwater? These are the research questions Brinsfield tackles, both as the director the University of Maryland Wye Research and Education Center and as the head of the Maryland Center for Agroecology, Inc.

To track the movement of nitrogen as it seeps into groundwater and begins its slow slide to the Bay, Brinsfield and Staver have installed wells and instruments called lysimeters on both no-till and conventionally plowed fields at the Wye's experimental farm. Using data from these devices they can watch what happens to dissolved nitrogen as it seeps through the soil after a rainstorm (see "Nitrogen's Underground Passage," page 12).

The good news is that cover crops work. The bad news is that not enough farmers are planting them.

After years of research on different fields using different farming methods, Brinsfield says that the only practice that has significantly and clearly reduced nitrogen seeping through the soil is planting cover crops.

Cover crops, planted in the fall to help hold the soil and take up unused nutrients, seem to make sense to farmers like Balvin and John Brinsfield. Balvin says that even without incentives, he'd plant some kind of cover once he'd harvested peppers or potatoes, because there is no ground cover left after the harvest — no corn stalks or other residue to help hold down the soil. He says it just makes good sense.

Balvin has nearly half his land in cover crops, and John has better than half. According to the Chesapeake Bay Commission, cover crops provide one of the most cost-effective ways to keep nutrients out of the Bay (see "Where Should We Put Our Money?").

The Brinsfield cousins are aware, though, that not everyone participates in the cover crop program, for one reason or another. For one thing, they say, farmers like to buy seed in early summer, but the cover crop sign-up is in mid-summer. So they have to buy seed before they know whether they are in that year's program, which is strictly first-come, first-served. Also, to keep excess nutrients off winter fields a farmer participating in the cover crop program can't put down any manure or fertilizer before March 1. So some farmers don't enroll, they say, in case they want to fertilize sooner.

The good news, then, is that cover crops work. The bad news is that not enough farmers are planting them. Brinsfield knows we have a long way to go, because he and Staver track monitoring stations in other areas as well — like

the U.S. Geological Survey's Greensboro station in the Choptank River watershed.

Brinsfield says that on the basis of data from such stations, he sees "little indication that we have significantly reduced the rate [of agricultural runoff] into Eastern Shore rivers."

At best, he says, inputs of nitrogen may be leveling off, but they're not going down. Even when conservation efforts begin to work, he says, the results may be years in coming, given the slow-motion nature of groundwater.

In fact, burgeoning federal deficits, proposed budget cuts, and hard-pressed state resources in many parts of the Bay watershed have led many to ask how we will ever reach levels of funding and participation needed to cut nutrient and sediment loads. With the nutrient problem spread among 87,000 farms across a 64,000-square-mile watershed, and with population growing in the Bay region at the rate of one million each decade, bringing increased sewage, urban runoff and the destruction of forests, one might well wonder, how will we ever restore the Chesapeake Bay?

At a recent rally in Virginia, the president of the Chesapeake Bay Foundation, William C. Baker, warned that if more progress is not made, the Chesapeake Bay Program, long touted as a national model for ecosystem restoration, may well become an international "model for failure."

Bringing in the Farmers

To anthropologist Michael Paolisso's way of thinking, farmers should be strong allies in protecting rural landscapes and watersheds. But Paolisso, an associate professor at the University of Maryland who has studied farming and fishing communities, argues that the Bay restoration effort has not found a way to enlist their full support. The environmental community, says Paolisso, has failed to tap the deep values of those who work the land and the water — farmers and watermen — who have, he says, their own profound attachment to nature and their own sense of environmentalism.

According to Paolisso, farmers and watermen often find themselves responding primarily to regulations — and either agreeing to cooperate, or not. There needs to be a shift, he says, toward collaboration and what he calls "collaborative learning." All these different groups — regulators, conservationists, scientists, farmers and watermen — need to learn more about each others' "environmentalism."

Russ Brinsfield agrees that we don't engage the farmers enough, and don't give them credit for their ethics.

J.D. Wilkins has experienced these divisions firsthand. When Wilkins, who is both farmer and banker, speaks to farm groups, he often encounters a deep skepticism about the Bay cleanup effort, and the science. Wilkins hails from high up in the watershed in Circleville, West Virginia, and represented the state of West Virginia on the Blue Ribbon Finance Panel appointed last year by the governors of the six watershed states.

"I have a PowerPoint presentation I've put together that shows a lot of data and information," he says, "but for farmers it's not so much about the data, as about people, and trust."

"You can see a farmer tense up when an environmentalist approaches him at one of these meetings," Wilkins says. "He expects to be blamed for something."

Wilkins says that farmers often don't accept the science that's presented to them. "They [farmers] don't believe the current model," he says.

The model Wilkins refers to is the computer model used by the Chesapeake Bay Program to estimate nutrient and sediment loads and to set allocations for the different jurisdictions — maximum limits for nitrogen, phosphorus and other contaminants in their waters. According to Wilkins, farmers often point out that the model's numbers have changed before, and so they could change again. For example, modelers have lowered their estimates of reductions resulting from best management practices on farm fields. While the rationale, according to the Bay

Continued on page 10

Where Should We Put Our Money?

While the Blue Ribbon Finance Panel explored innovative ways of finding funds for Bay restoration, the Chesapeake Bay Commission analyzed where we might get the biggest bang for each buck. They put their emphasis not so much on market-based tools but on "the most efficient use of taxpayer dollars." In December 2004 the Commission published *Cost-Effective Strategies for the Bay: Six Smart Investments for Nutrient and Sediment Reduction.*

Of six cost-effective actions only one focused on wastewater treatment plants. The other five relied on improving agricultural practices:

- $ Reduce nitrogen output to 3 milligrams per liter from all but the most costly wastewater treatment plants.
- $ Adjust diet and feed to reduce nutrients in animal waste.
- $ Implement nutrient management on farms.
- $ Enhance nutrient reduction on farms by providing yield insurance.
- $ Use conservation tillage on farm fields.
- $ Plant cover crops to take up unused nutrients.

The Commission's report notes that nutrient loads from both agricultural and point sources (such as waste treatment plants) are trending downward. Even air deposition, they note, shows some promise of dropping. On the other hand, runoff from developed land is on the rise. The report lists five ways to reduce runoff from developed land — from low-impact development practices meant to slow the flow of rainwater to homeowner actions that could reduce the use of lawn fertilizer and help keep more rainwater on site.

The full report on cost-effectiveness is available from the Chesapeake Bay Commission, 60 West Street, Annapolis, Maryland 21401, or on the web at www. chesbay.state.va.us.

— JG

Vanishing Farms?

Add to the loss of productivity in the Chesapeake Bay another loss, one tied to the character of the Bay itself — the decline in open lands, including both forests and farms.

According to an independent study by the Bay Program's Scientific and Technical Advisory Committee, if trends of the latter part of the 20th century continue into the first three decades of the 21st century, the Bay watershed will lose another 2 million acres of forestland and farmland to development. Once land converts to development, it rarely reverts. The loss of open spaces and wetlands to impervious surfaces like roads and parking lots is often devastating for water quality downstream.

While a range of improved agricultural practices — or best management practices (BMPs) — should help keep farm nutrients and soil out of the Chesapeake, sprawl development that converts farm and forest land to housing subdivisions and shopping centers remains one of the toughest challenges facing the Bay restoration effort. Though farm fields are responsible for most of the sediment entering the Bay, for example, largely because of the huge area they cover in the watershed, construction sites produce much more sediment per acre, and development often alters natural hydrology — permanently.

The encroaching suburbs that bring more and more vehicles to roads once lightly trafficked may also contribute even more nitrogen pollution to the Chesapeake Bay — much more than initially thought. At this year's annual meeting of the American Association for the Advancement of Science held in Washington, D.C., Robert Howarth, a biogeochemist at Cornell University, presented some unsettling data.

Skip Brown

Construction sites produce much more sediment per acre than farms, and development often alters natural hydrology — permanently.

Howarth found that the amount of nitrogen pollution from vehicles and electric power plants deposited into coastal rivers and bays (including the Chesapeake) could be up to twice previous estimates. The new study also shows that substantially more nitrogen — largely in gaseous form — is being deposited near highways and other urban sources, a byproduct of more population, more development, more cars.

The development issue resonates with farmers like the Brinsfield cousins Balvin and John. "We ought to keep people where people ought to be," John says. He is thinking of the nearby town of Vienna, which recently had a "visioning" exercise to consider how to rejuvenate its diminutive downtown. Land use planners often see the revitalization of small towns as the flip side of conserving open lands, since home buyers will build ever outward into rural areas, unless lured by the convenience, character and quality of life in town. If rural areas lose their character, John says, "Maryland will have more problems, not fewer."

This is another painful irony. Though agriculture is responsible for a large proportion of the nitrogen, phosphorus and sediment that enters the Bay, farms themselves are part of the Bay's threatened landscape, as more and more sprawl development consumes farmland.

The two cousins firmly believe that sprawling developments will bring more challenges, both environmental and social, than the farms they are fast replacing.

"We have gutted our open space programs," says agricultural scientist Russ Brinsfield, and many agree. Year after year funds collected from real estate sales in the form of transfer fees and targeted for the purchase and protection of open spaces, farms and forests, are diverted to the general treasury, to help balance the state budget. According to Brinsfield and others, Maryland is losing its rural landscapes and its position as a national leader in land preservation.

There needs to be a dedicated account for those transfer fees, he says, as there is for the new fee targeted to upgrade wastewater treatment plants, the so-called "flush tax," which has its own dedicated fund.

Programs like Maryland's Agricultural Land Preservation Foundation (MALPF) and Rural Legacy program can't compete dollar for dollar with what developers can offer, he says. But these policies are important for farmers who don't want to sell their land. According to Brinsfield, public programs like MALPF and Rural Legacy give farmers a chance to sell easements and development rights to their farms so they can have a 401K [a retirement fund] without the farm having to be the only retirement asset. While these public programs may not be able to offer the $10,000 an acre that a developer might offer, he feels, they can offer enough to support a farmer in retirement while keeping the farm intact.

"These programs play a very important role," Brinsfield says, but adds that agricultural preservation programs alone are not enough. He thinks that in the end there will never be enough public funding to compete with the pressures of development, and that counties will have to show more leadership in protecting rural lands.

This is precisely the conclusion of a report prepared for the Maryland Center for Agroecology by experts in the Maryland Department of Planning. According to that study, county land use plans need to be in line with broader land preservation goals for the state, especially if they expect to get state funds from MALPF and other land preservation programs.

While land use strategies such as downzoning to protect farmland are seen by some as taking value away from potential land sales (an "equity taking"), studies in Maryland have shown that downzoning can actually lead to higher land values, so that the sale of less land brings the same profit.

At the same time, according to Rob Etgen, Executive Director of the Eastern Shore Land Conservancy, once farmland begins to fall to development other farms nearby are more likely to sell out as well. Programs will have to target their efforts to the most critical areas, he says, "or we could lose everything."

The bottom line: if development trends in the watershed do not change, farming will become scarce in many parts of Bay country.

"All the benefits from nutrient management planning that we've achieved could easily be offset on the other [development] side of the equation," Brinsfield says. "All these efforts that Balvin and others are doing won't help, if we don't balance both sides."

— JG

Following in a farmer's footsteps, *ten-year old Josh has already learned a lot about big rigs and working the land from his father, Balvin Brinsfield, on their farm near the Nanticoke River.* Photo by Skip Brown.

Using Both Hands to Help the Bay

While it was John Smith who first explored the Chesapeake, it may be Adam Smith who will help us clean it up.

According to the second Smith, an influential 18th century economist and author of *The Wealth of Nations*, free markets work with an "invisible hand" to guide the economy. By acting in our own self-interest, he argued, we ultimately accomplish a common good. What many forget, however, is that Adam Smith also held that this invisible hand could only work in societies that honored the rule of law.

Suzanne du Pont, Maryland Department of Agriculture

Think globally and spend locally. *This Farmers' Market in Anne Arundel County — one of 74 throughout the state — captures the essence of local economics in action. Reaching for new ways to pay for the cleanup of the Chesapeake Bay while preserving the region's farm economy will require a two-handed approach: employing the visible hand of government regulations and funding with the invisible hand of market forces and creative economic incentives and disincentives.*

In other words, the invisible hand of market forces requires the more visible hand of government regulation to provide a level playing field and to mete out punishment for those who break the rules.

This is why Dennis King has recently focused on "enforcement economics."

King, a natural resource economist with the University of Maryland Center for Environmental Science, believes government subsidies without regulation and enforcement only lead to "gaming" the system. Market forces, he says, can help drive Bay restoration efforts, but only if they're in line with real economic benefits and real punishments for breaking the ground rules.

"The key issue is long-term monitoring and enforcement," says King of many current Bay restoration programs. He feels that if programs put in place to restore the Bay are not enforced, then they are meaningless.

The Blue Ribbon Panel appointed last year by the governors of the Bay states agreed. "Every successful environmental program in this country has depended on a combination of adequate funding and appropriate regulation," said panelist and former Arizona Governor Bruce Babbitt.

Beyond Regulation

For economist King, the funding of restoration will become more effective as it connects with economic forces. For example, those interested in planting oyster spat or seagrass

Farms and the Bay, *continued*

Program, is that some practices either were not used to the extent estimated or resulted in less of a reduction than originally thought, farmers see the changes as waffling, and question whether the "baseline" was correct to begin with, says Wilkins.

"A lot of farmers find it hard to swallow that they are responsible for all the nitrogen and phosphorus going into the Bay," says Shawn Maloney, a research associate in the University of Maryland Department of Anthropology. Maloney, who is now writing a doctoral dissertation for the University of Kansas on farmers and the environment, says farmers feel that the science presented to them is "one-sided," and they don't trust it.

Maloney points to the example of phosphorus in fertilizer, an example also raised by Balvin and John Brinsfield. For many years agricultural experts told farmers that they didn't need to worry too much about phosphorus. They were told to apply a little at the beginning of the season, and then mainly manage for nitrogen. Today that advice has shifted, and farmers hear that they must place a greater emphasis on curtailing phosphorus as well as nitrogen, since many fields in the Bay watershed now contain too much phosphorus.

Wilkins says he's come to believe that even if the science we have is imperfect, it's the best science available. "My suspicion is that the numbers put into the model are just about as good as what we've got."

The difficulty, according to Wilkins, Maloney and others, is not only getting farmers adequate money, but convincing them that they need to spend it on keeping nutrients out of the Bay.

The way Wilkins sees it, we need to de-emphasize our philosophical differences, and stop trying to change each other. "Everyone has their passion," he says. "It's like their religion. You don't have to convince the other side of your passion. When people try to 'convert' each other, the walls between them just get higher."

Herein lies the final irony. Farmers have a deep sense of doing what is right on their farm, but if pressured to "do right" for the "common good," they resist.

Wilkins thinks we should stick to specific measures that make sense for everyone — like improved feed pads. These hard-surfaced areas keep cows out of the mud and mire as they come to feed, and reduce dirt and bacteria on the cow's udders. At the same time, they reduce the runoff of mud and sediment into local streams. "We have to go to the little goals," he says.

The challenge, Paolisso says, is how to channel what has often been an antagonistic relationship — between farmers and government, between government and environmentalists of all kinds — into one focused on common interests and

seedlings could offer contingency contracts — these would guarantee a certain purchase, no matter what. This approach would offset the uncertainties of weather and other factors, King says, and make it financially worthwhile for independent contractors to ramp up production efforts.

Without that ramping up, he says, our efforts will likely remain inadequate.

King points to other creative methods to insure against uncertainty. He notes the use of weather insurance in international markets, where brokers trade against the odds that the weather will be good for crops at any given time — or not.

In the Bay, he says that this would in essence serve as "salinity insurance" or perhaps even "nutrient insurance." If, for example, rain falls in abundance one year and the salinity goes down — along with dissolved oxygen — and a grower's oyster spat die, then the grower could collect insurance. Such insurance could also cover losses to oyster growers if, during a drought, salinity climbed higher than normal and caused more oyster die-offs from disease. This kind of insurance would help mitigate the unpredictability of such risky enterprises as oyster growing and seagrass planting, and would rely on free market mechanisms — brokerage firms and insurance companies — to make it happen.

Other market-based mechanisms where Adam Smith's invisible hand might work:

- Biodiesel — adding soybean oil to diesel fuel to create a more renewable, environmentally friendly fuel.
- Bioenergy — creating energy from manure and poultry litter, as well as energy crops such as switchgrass, willow and poplar.
- Pelletized poultry litter — using waste from chicken houses to create a marketable fertilizer product, as does the Perdue AgriRecycle plant each year with 60,000 tons of poultry litter.
- Trading — using the unequal efficiencies of different entities (such as wastewater treatment plants) to set up a specific market for credits (for nutrients, for example). The Blue Ribbon Finance Panel endorsed the use of trading among point sources like wastewater treatment plants, but did not yet see a convincing model for point-to-nonpoint trading (as between a wastewater treatment plant and a farm).

New products and approaches such as these would take better advantage of the invisible hand of market mechanisms, as long as government provides the more visible hand of enforceable regulation.

It's time, King and others are telling us, to use both hands.

—JG

common values. In group meetings, Paolisso has brought regulators together with those they regulate, along with members of the scientific community, in order to explore discussions that break down walls that usually divide these groups.

He argues that if such groups can accept that there are multiple "environmentalisms," and if they can come to understand each other's core beliefs and models of what environmentalism can mean, then they will not only be able to better communicate with each other but will also be able to move together as stewards of the Bay and its watershed.

Our best hope, Wilkins, Paolisso and others seem to be telling us, is for farmers to tap their own natural ethic to do right by the land, and in this way to do right by the Bay.

"I believe in Providence, but also in sustainability," says John Brinsfield. He feels that farmers have to take the long view, to look out for their family's future. A while back, he says, the University of Maryland Cooperative Extension had farmers in his area write a mission statement. One of the goals they identified was to leave the land better than they found it. "That's important to me," John says. "These core values."

Back on the farm, as Balvin leaves the shed and heads back to work, he does not have time to think too much about all these issues. For him it is mostly about the doing. He has to get his equipment ready for spring and decide whether or not to plant potatoes this year, and how much energy to put into peppers and sweet corn.

As the day wears on an afternoon light settles over these flat fields, on this land that still belongs to the descendents of grandfather Balvin Bacchus Brinsfield. It is a low-slanting light, cold and clear, and despite the winter landscape there is color on the fields, the pale hopeful green of cover crops.

For More Information

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For a list of farmers' markets in Maryland, visit the web at: www.mda.state.md.us/md_products/farmers_market_dir.php

Tim McCabe, National Resources Conservation Service

From Farm to Bay
Nitrogen's Underground Passage

By Erica Goldman

Ever since a severe thunderstorm felled the 450-year-old Wye Oak in June 2002, residents of Maryland's Eastern Shore have missed it sorely. Ken Staver's office in the Wye Research and Education Center is only few miles down the road from where the oak, 96 feet tall with a circumference of nearly 32 feet, once stood, and he has heard a lot of "belly-aching" from people who lament the tree's fate.

"People want the tree back now but they just can't have it," he says. "But we can get on track to have another Wye Oak someday."

Skip Brown

Setting plants on a rooftop array, *Ken Staver is conducting a study on how well various grasses recommended for use in riparian buffers remove nitrate from shallow groundwater.*

Staver feels the same is true about nutrient reduction in the Chesapeake Bay. An ecohydrologist who studies the flow of nutrients through watersheds, Staver works to understand how farming affects the ecosystem and to develop strategies for change that are both ecologically and economically viable. Real reductions in nitrogen loads will not happen fast, he says. "We should be focusing on the long-term."

At the heart of the problem is that nitrogen can move slowly through groundwater, like an underground glacier. And since it can take time to wend its way down to the Bay — sometimes on the order of decades — the positive effects of nutrient reduction efforts will not be immediately obvious, explains Staver.

Nitrogen, along with phosphorus, is a prime culprit in excessive algae growth and oxygen depletion in the Chesapeake Bay. But it has only been over the past few years that scientists have understood the nuts and bolts of how nitrogen enters the watershed, what it does once it is there, and how it makes its way into the Bay.

From the Farm

The largest loads of nitrogen and phosphorus to the Bay come from agriculture, though specific inputs have changed as farming practices have evolved, says Staver. As recently as pre-World War II, farmers relied primarily on animal manures and naturally occurring microbes in the soil to make nitrogen available for growth of their crops. They also planted legumes for animal feed, like clover and alfalfa, which convert nitrogen from the atmosphere to a form that other plants, like corn and wheat, can use for growth. Their plows aerated the soil, stimulating the microbes that convert organic nitrogen to nitrate — the form useable by plants.

But nitrate can also be carried by water downward through the soil or leach. Less intensive agriculture in the pre-War era meant lower soil nitrate levels, with little excess nitrate leaching into the shallow groundwater that feeds streams.

With the advent of greater fertilizer and herbicide use on agricultural land, however, the amount of nitrate in the soil available for crops increased along with the rates of nitrate leaching. Readily available inorganic nitrogen fertilizer also helped to support feed crops for concentrated animal production, especially poultry. At the same time, farmers no longer had to depend on manure from their animals to fertilize crops.

An expanding poultry industry in the Chesapeake region also meant an increase in nutrients, since chicken manure is two to three times higher than cow manure in nitrogen and phosphorus. Since the early 1980s, the amount of nutrients from manure and poultry litter generated in the watershed has grown an estimated 17 percent. Together, fertilizer and manure make up 68 percent of the total nitrogen applied to the land in the watershed, according to data from the Chesapeake Bay Program.

Now superimpose on this increase in soil nutrient availability what Staver calls "Hydrology 101," the basics of how water moves across and through the landscape. For the Chesapeake watershed this hydrology means episodic direct runoff from the land and the chronic flow of groundwater into streams that empty

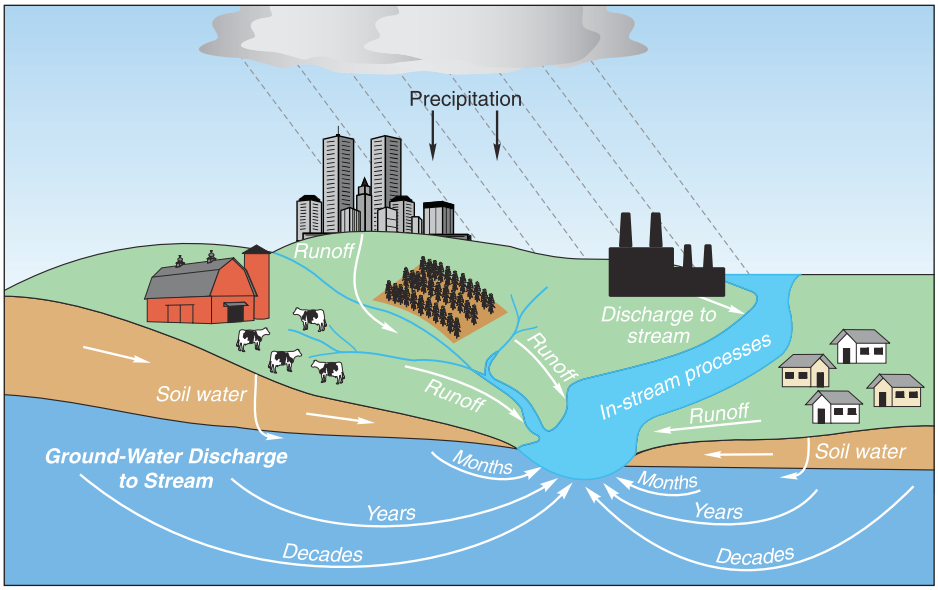
into the Bay. Both flow paths carry water-soluble nutrients from cropland into the Bay, although over much different time frames. Both routes lead to an increase in nitrogen loads.

But how does nitrogen physically move from farms into groundwater? Pure supply and demand, says Staver. If nitrate remains in the soil after summer crops die, it can leach into the groundwater during the following winter. Most inorganic fertilizers supply nitrogen as nitrate or in a form that can be rapidly converted to nitrate.

Nitrogen in manure, on the other hand, takes longer to convert to a form usable by plants. Since it is difficult to predict exactly how much nitrogen per pound of manure will be available to plants for growth, farmers cannot manage nitrogen from manure as precisely as inorganic nitrogen fertilizers, explains Staver.

Timing is also of the essence, he says. Though nitrate levels on farms are the highest in the summer because of fertilizer application and microbial activity in the soil, it is in fall and winter that nitrate is more likely to leach into groundwater. This is because in summer, the top layer of soil acts like a big sponge, says Staver. Rainfall that infiltrates the soil is continually re-evaporated, mostly by plants through their leaves (transpiration). As a result, even though summer nitrate levels are often high, water levels are not generally high enough to cause a significant amount of leaching.

But when summer ends, annual crops like corn and soybeans die. Nitrate and water uptake cease, though soil processes that release nitrate continue as long as soil temperatures are warm. Gradually as temperatures cool, soil moisture levels increase, eventually saturating the soil "sponge." Winter rain and snowmelt seep downward through surface soils towards the water table — carrying with them any nitrate that was left in the root zone. Since nitrate is a negatively charged molecule (called an anion), it is not attracted to soil particles, so it moves freely with water through subsurface layers.



Scott Phillips et al., U.S. Geological Survey

Nitrogen from point and nonpoint sources *is transported to streams through runoff, soil water, and groundwater. Once in the groundwater system, nitrogen may take anywhere from less than a year to decades to be transported to a stream.*

Cover crops — small grains such as rye or barley or winter wheat that are planted without fertilizers immediately after harvesting corn or other row crops — can keep nutrients from leaving the farm. If planted early enough, cover crops help take up nitrate in the root zone before it leaches into groundwater.

Like cover crops, forested areas at the edges of streams — so-called riparian buffers — can help keep nutrients from reaching streams and the Bay and remove them from groundwater. Buffers slow surface runoff, allowing the roots of plants to intercept sediment and water heading toward streams. In doing so, they help restore many of the benefits of stream ecosystems, including improved habitat for terrestrial wildlife and native spawning and fish passage, says Russell Mader, the Nonpoint Source Coordinator for the Chesapeake Bay Program.

"I promote buffers, but only as part of a multi-dimensional approach to restoration," Mader says.

According to Mader and others, buffers are often a "hard sell" to farmers because they take land out of production and may require ongoing maintenance. The federal government, realizing that farmers are an essential dimension of the buffer equation, assists them through the Conservation Reserve Enhancement Program (CREP). Authorized by the U.S. Farm Bill, CREP compensates land owners for setting aside sensitive lands — such as buffer strips along streams, rivers and creeks — and planting them with perennial vegetation.

To the Bay

If excess nitrogen from farms is not reclaimed by cover crops or riparian buffers it can reach the Bay via two distinct pathways: direct runoff from the land into surface waters and leaching into the groundwater that feeds streams. The groundwater pathway has only recently been studied on a watershedwide basis.

The United States Geological Survey (USGS) in 2003 published the results of a multi-year study of nitrogen in groundwater in an attempt to untangle its role in maintaining a "lag time" between the implementation of a management action and a positive response of the Bay to these actions.

Groundwater is a very significant component of the water supplied to streams, explains USGS hydrologist Scott Phillips. On average, just over 50 percent of the total volume of water in streams throughout the watershed is from groundwater, although this varies between wet and dry years and between streams

(from 16 to 92 percent). In dry years, a much larger percentage of the water in the streams comes from groundwater, while in wet years a larger fraction comes from direct discharge, he says.

How much of the nitrogen that winds up in the Bay actually comes from these groundwater sources? Quite a bit, says Phillips. The USGS study finds that an average of 48 percent of nitrogen loads in streams in the watershed are contributed in the form of nitrate from groundwater (17 to 80 percent in different streams).

But the problem in keeping track of nitrogen that arrives in the Bay from groundwater sources is that there can be a large time delay, explains Phillips. The USGS sampled 46 different springs and found that the age of groundwater in the watershed ranges from modern (less than one year) to more than 50 years, with a median age for all samples of 10 years. This means that nitrogen that enters the groundwater from cropland this year could take a decade or more to arrive in the Bay.

Another variable that affects both the timing and amount of nitrogen that arrives in the Bay is the carbon content of the streams, says Phillips. High carbon levels will enhance the natural processing of nitrogen (called denitrification). From maps of soil characteristics, managers should be able to predict where the positive effects of denitrification will occur.

The time delay is also compounded by what happens on the front end — the rate of nitrogen leaching into the groundwater in the first place, Staver adds. "There is a separation in time and space between what we do on the fields and what we see in the streams," he says.

Much of this separation is caused by physical properties in different parts of the watershed — so-called "hydrogeomorphic regions." The heavily agricultural coastal plain of Maryland's Eastern Shore is one particular case, says Staver. Here the distance from topsoil to bedrock is typically more than 1000 feet and the substrate is made up of silt, clay and sand. "It's a bit like a bucket of golf balls — lots of open space between the particles," he says. Even though most of the groundwater that feeds streams moves through underground aquifers, huge volumes of water can be stored even in the shallow parts of the subsurface flow system. In the Coastal Plain, the average age of groundwater is 6 to 12 years, according to the USGS study. So even though the Coastal Plain lies close to the Bay, its shallow groundwater systems can retain nitrogen for longer than some of the more distant areas of the Bay watershed where the rocky subsurface has less storage capacity.

Lightening the Load

The uncertainty associated with groundwater delivery of nitrogen to the Bay poses a challenge for management. The current version of the Chesapeake Bay Program watershed model, one of the principal tools used to evaluate progress toward goals of reducing nutrients and sediment delivered to the Bay, does not represent groundwater in a thorough manner, says Phillips. The current model does not account for the time delays associated with nitrogen leaching or delivery to the Bay. "This is one of the reasons that we haven't seen large reductions in nitrogen with the implementation of best management practices (BMPs)," he says.

A new version of the Chesapeake Bay Program's model (Phase 5) is currently under development and this iteration will include estimates for the time lags associated with groundwater nitrogen, says Phillips.

Adding the time-delay information to the model is especially important for calibration, says the Bay Program's Russell Mader. "It will enable us to better see the effects of changes in land use and management practices on nutrient reduction over time."

But the jury is still out on whether nitrogen can be effectively removed from groundwater through active management. Strategically placed riparian buffers may help in areas where the root zone comes into direct contact with the water table.

Two important considerations in whether a buffer will remove nitrogen from groundwater are whether the water table is close to the surface and whether it moves quickly or slowly through an area, says chemical ecologist Thomas Jordan from the Smithsonian Environmental Research Center in Edgewater, Maryland. Riparian buffers can remove more nitrate from groundwater that moves slowly. Slower moving water allows the micro-organisms on the vegetation more of an opportunity to do their work, he explains. In a recent study, Jordan found that groundwater nitrate levels declined as water moved through a buffer from a soybean or corn field.

Since these results were difficult to translate broadly across the watershed, Jordan expanded his efforts to study the effect of buffers on nutrient removal from groundwater in 500 different subwatersheds in the Chesapeake basin. His sites are diverse — with varying proportions of agricultural and nonagricultural lands and a range of spatial configurations of land and water, across different regions of uniform geologic structure and climate (physiographic provinces). Through a statistical analysis of flow paths, Jordan is hoping to tease out such factors as differences in nutrient processing in regions where there are gaps in a buffer, compared to uninterrupted forest along a streambed.

Unfortunately once nitrate gets into groundwater cost-effective options for removing it are limited. "Once nitrogen enters the groundwater, there is not a whole lot you can do about it," says Mader. "Groundwater is a nitrogen sink. The best thing that we can do is to make sure that the sink doesn't get any bigger."

A combination of changing agricultural practices, additional riparian buffers, and better model predictions based on a more complete picture of nitrogen's underground passage, should help stem the nutrient tide and give us a better idea of how long the process of reducing nutrient loads to the Bay will take. Like the growth of another Wye Oak, nutrient reduction won't happen overnight, as Staver says. But we know what we have to do if we want the tree back someday.

Coastal Populations Swell Nationwide

Report Says Chesapeake Is at Risk

That coastlines across the nation continue to experience high rates of population growth comes as no real surprise. So when the National Oceanic and Atmospheric Administration released its once-a-decade update to the report, *Populations Trends Along the Coastal United States: 1980-2008* on March 1, few heads turned at the finding that the nation's coastal population is expected to increase by more than 7 million by 2008 and by 12 million by 2015. But the report does provide an important context for how our nation's coasts are changing and what that growth might mean for the highly populated Chesapeake Bay watershed.

"This is an important study," says coastal resource economist Doug Lipton, leader of Maryland Sea Grant Extension. Lipton says that like the last version of the report, this update should provide decision-makers with key background. "It is not prescriptive. It doesn't form policy or make judgments. But it summarizes data in a useful way and stimulates people to develop policy," he says.

The report ranks the Chesapeake Bay watershed as the second most populated coastal watershed in the country (outpeopled only by the Hudson River watershed) and Maryland and Virginia pop out as "hot spots" of growth in the Northeast Region. Nationwide, the Chesapeake Bay watershed also experienced the greatest change in population from 1980 to 2000,which grew by over two million people. Using data from the U.S. census bureau, combined with the expertise of three private firms, the report projects that between 2003 and 2008 four counties in the Washington, D.C. metro area will experience a surge of population growth. Fairfax County,Virginia is expected to show the greatest increase in population over the whole Northeast region, growing by over 100,000 people in this five-year period.

But these numbers only tell a partial story. "Take the statistics for Fairfax County, for example," says Donald Boesch, president of the University of Maryland Center for Environmental Science. These projections suggest that a large population increase will occur in an already densely populated area, he explains. "What these data don't tell you is the rate of land conversion either in Fairfax County or in adjacent counties such as Loudoun," he says. This is especially important now that the Virginia Supreme Court has decided to throw out Loudoun County's slow-growth regulations that had blocked home building on vast areas of open space, he remarks.

Rather than sprawl development, high population density growth is often a more desirable outcome for the environment, says Gerrit Knapp, executive director of the National Center for Smart Growth Research and Education at the University of Maryland. "Smart Growth encourages high density settlement. The idea is that to protect environmentally sensitive land, it is better to concentrate growth in smaller areas," he says.

Despite its current population and predictions for intense growth, the Chesapeake watershed is better off in some ways than others in the top ten, explains Lipton, since despite recent development trends it still boasts large stretches of open farm- and forestland. The Chesapeake — though it ranks second in total population nationwide — remains the least densely populated watershed of any of the others that are ranked by the report, he explains.

"This means that we still have places to put people and we still have the opportunity to make choices about how we grow in the coastal zone," Lipton says. He feels that we can make decisions about how to minimize the impact of growth on coastal resources based on well-informed decisions.

Maryland in particular may be better prepared than most states to handle the continued pressure of population growth in the coastal zone, says Vicky Carrasco, coastal communities specialist for Maryland Sea Grant Extension.

Maryland's Smart Growth-Anti-Sprawl legislation, passed in 1997, put the idea of planning for growth on people's radar screen, Carrasco says. "Planning for growth is one of the precursors to managing growth effectively," she says.

Carrasco plans to expand the resolution of NOAA's report by looking more closely at the population trends in Maryland coastal communities. She will examine counties on the Chesapeake Bay and the Atlantic Ocean with respect to natural resources, population growth, density, and socio-economic factors. She intends to incorporate narrative profiles of each county to place growth in Maryland into a cultural framework (see "New Sea Grant Specialist" on page 16 for more on Carrasco).

In the Chesapeake Bay region and nationwide, the report suggests that the current population pressure on the coastal zone will only grow and intensify. What we can't do, says Lipton, is just "wade out" blindly and hope that coastal population growth will pass.

— *Erica Goldman*

et cetera

New Sea Grant Specialist

Vicky Carrasco brings a sense of small town to her new position as coastal communities specialist for Sea Grant Extension. Carrasco joined the ranks of Maryland Sea Grant in early February from her home state of Texas, where she was born and raised in the small Spanish-speaking border town of Presidio.

"Although coastal and desert communities have different issues to confront, people share a sense of place and the desire to protect something," Carrasco says.

Carrasco holds a Master's degree in urban planning and a Bachelor's of Science in renewable natural resources from Texas A&M University in College Station. Her thesis work focused on sprawl reduction policies in Florida and she has worked extensively in both urban and rural communities in Texas. She has related experience in watershed education, ecosystem management research and comprehensive urban planning.

Her bilingual upbringing proved

Vicky Carrasco

invaluable in one of her many field-based internship projects. As a Center for Housing and Urban Development Fellow, she worked to develop an address system to assist 911 dispatchers in locating patients in small towns (known as Colonias) in Presidio County. These rural communities, within 150 miles of the U.S.-Mexican border, often lack adequate infrastructure and other basic services.

Carrasco is excited to bring her varied experiences to help shape Maryland Sea Grant's up-and-coming Coastal Communities initiative. "The position offers the opportunity to combine environmental issues and urban planning. And, it's not just the issues," she says, "it's working with people."

Chesapeake Perspectives

Maryland Sea Grant is producing a new series of monographs called *Chesapeake Perspectives*. In these papers scholars from the broad academic community will address issues of particular importance to the Chesapeake Bay. Topics will focus on the biological, chemical and physical sciences, but also the social sciences and other disciplines. The monographs are available from Maryland Sea Grant, both printed and on the web. The inaugural issue, scheduled for release in April, is authored by Michael Paolisso, who draws on anthropology to examine how we define "environmentalism" in the Bay region, and how we may have drawn lines that leave some groups largely excluded. To order a copy, call 301.403.4220, x22 or visit the web at www.mdsg.umd. edu/CB/.

Send us your comments on this issue — visit *Chesapeake Quarterly Online* at www.mdsg.umd.edu/CQ

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