

CHESAPEAKE

BAY JOURNAL

October 2020

Volume 30 Number 7

Independent environmental news for the Chesapeake region



Stream restoration tactics challenged

Some environmentalists, local residents question removing trees to repair waterways PAGE 12

BALTIMORE HARBOR



Swimmable & fishable by 2020?
PAGE 20

'FARMING WHILE BLACK'



Farmers draw on heritage for sustainable practices PAGE 24

WATERFALLS, ANYONE?



Explore Ricketts Glen State Park in Pennsylvania PAGE 30

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Water samples from the Choptank River await examination. What they reveal about nutrient trends in the water may differ from what is expected, highlighting the uncertainty created when comparing monitoring and modeling results. See article on page 18.

CORRECTIONS

The article, *Costs clog efforts to prevent sewage overflows* in the August *Bay Journal* said the Conestoga River is no longer impaired for aquatic life. Nearly 40 of its 62 miles are no longer impaired for that use but there are still 22 miles impaired for aquatic life, mainly due to agricultural practices.

An incorrect credit was given for the photo of the brook floater in the September *Bay Naturalist*. The photo is courtesy of the U.S. Fish and Wildlife Service.

The *Bay Journal* regrets the errors.

ON THE COVER

Hollin Hills residents Barbara Southworth and Marc Shapiro flank a massive white oak, which botanist Rod Simmons estimates to be about 200 years old. Nearly 80 large trees are in line to be cut down for restoration projects on a pair of streams flowing through their neighborhood parks. (Dave Harp)

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EDITOR’S NOTE

Understanding uncertainty



If there is one thing I am certain of, it is that, after decades of effort, we still know too little about too much related to the Bay.

As Whitney Pipkin reports in this issue, shad in the James River are not recovering after decades of work. There seem to be lots of reasons but there is a lot of uncertainty as to how much each impacts the fish; probably all need to be addressed, but few of them are.

Likewise, Tim Wheeler reports on the effectiveness of stream restoration. It’s one of the more widespread — and costly — practices used to reduce nutrient and sediment pollution. But after decades of implementation, it’s still unclear how effective they are in different settings or whether some techniques are better than others.

It is, in fact, unclear whether many of the actions taken to curb nutrient runoff will have their desired effect on the Bay. Certainly discharges from the wastewater plants have been substantially reduced.

But the impacts of other actions sprinkled across the Bay’s 64,000-square-mile watershed, from stream buffers to cover crops, are harder to measure, and slower to produce results — and likely perform very differently from place to place. While the Bay Program’s compute model asserts that those actions are driving nutrient levels down, or will do so eventually, actual water quality monitoring has long produced a more nuanced picture.

As I report in this issue, a recent U.S. Geological Survey study based on monitoring data didn’t detect any nitrogen reductions from farmlands during the 20-year span it examined, though it did find downward trends from the developed lands.

What does that mean? As the saying goes, “All models are wrong. Some are useful.” But comparing and understanding results from different models, and the factors that drive them, can help better understand what the actual trends are and reduce uncertainty.

Questions about the effectiveness of issues as divergent as shad recovery, stream restoration and the effectiveness of Bay cleanup efforts have been around — and reported on in the *Bay Journal* — for decades.

Although progress has been made, the region has, too often, underinvested in trying to reduce that uncertainty. The failure to do so could lead to widespread disappointment if restoration actions do not provide anticipated results.

That’s also something I am pretty certain about.

— Karl Blankenship



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BY THE
numbers

127

Number of miles the Appomattox River flows in Virginia, joining the James River at Hopewell

10

Number of rivers in the Bay watershed slated for major oyster replenishment by 2025

1,161,384

Plastic bottles intercepted by “Mr. Trashwheel” as they flowed toward the Baltimore Harbor

21

Average depth in feet of the Bay and its tidal tributaries

2,500

Approximate acres of tidal wetlands found along the Anacostia River during the 1700s

285,000

Approximate number of adult brook trout that will be stocked in Pennsylvania streams in 2020

Why streamside forests matter

Planting streamside forest buffers is one of the most effective actions to help reduce polluted runoff to local waterways and the Chesapeake Bay. Depending on their setting, forest buffers (also called riparian buffers) can remove 19–65% of the nitrogen and 30–45% of the phosphorus that would otherwise reach the stream. The 2014 *Chesapeake Bay Watershed Agreement* calls for planting buffers along 900 miles of streams a year, but progress has lagged. In 2017, the most recent year for which data is available, only 56 miles were planted.



SHADE & COOLING

Shade from the tree canopy cools the water and helps prevent rapid temperature fluctuations that stress brook trout and other fish. Cool, stable temperatures also promote the growth of beneficial algae and insects.

REDUCING POLLUTION

Forests prevent or reduce a wide range of contaminants, like nutrients and toxics, from reaching the stream

FOOD & HABITAT

Leaves, branches, logs and other woody debris that fall into the stream provide food and habitat for insects, amphibians, crustaceans and small fish.

REDUCING EROSION

Roots and tree branches help prevent erosion by stabilizing stream banks.

A stream flows through Michaux State Forest in Pennsylvania. (Brian Lutz)

LOOKING BACK

25 years ago

Water access guide published

The Chesapeake Bay Program released an update to its public access guide to the Bay and Susquehanna River. The size of a standard highway map, the guide was a comprehensive directory to more than 500 sites — including boat ramps, beaches and natural areas — in the Bay region. ■

— *Bay Journal*, October 1995

20 years ago

DE joins Bay cleanup effort

Delaware pledged to curb its share of nutrient pollution as the region worked to clean up the Bay by 2010. Delaware, New York and West Virginia were not previously part of formal Bay cleanup agreements. New York and West Virginia were expected to join the effort within weeks. ■

— *Bay Journal*, October 2000

15 years ago

‘Dead zone’ hits new record

Monitoring showed the largest-ever area of anoxia — water void of oxygen — reported in the Bay. Averaged over the summer, an estimated 5.1% of the Bay’s deepest water was a “dead zone,” according to Bay Program data. The previous worse year was 1993. ■

— *Bay Journal*, October 2005

10 years ago

Black rail population declines

According to the Center for Conservation Biology, a species of small marshland bird called the black rail declined more than 75% in the Chesapeake region in the last 10–20 years. The number of breeding sites dropped 80–85%. Rising sea level was cited as one of the causes. ■

— *Bay Journal*, October 2010

ABOUT US

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BAY JOURNAL NOTEBOOK



Bay Journal writer Tim Wheeler takes notes during an interview about stream restoration techniques. (Dave Harp)

News coverage in the time of COVID-19

Many people have been asking how COVID-19 has impacted work at the *Bay Journal*. The pandemic has affected the lives of our staff, like most people, both professionally and personally, and introduced uncertainties for the future. But we are fortunate to have a terrific team at the *Bay Journal* that has continued to bring you the same level of environmental news for the Chesapeake region, and we aim to keep it coming.

What changes have COVID-19 brought to news production? Well, getting “into the field” for site visits has become harder. People are sometimes not available to meet in person, and many research and restoration projects are on hold. Luckily, many of our stories take us outdoors, where our reporters and photographers still wear masks and practice social distancing. Long-distance lenses help with safe photography, although many of our subjects’ faces are necessarily obscured by masks.

Phone interviews, of course, take place on a regular basis, though the people we speak with are often scrambling to juggle a new work-life balance and scheduling interviews can be tricky. Our staff, located across the Bay region, has always worked from home offices that keep us close to our coverage areas, so fortunately there was no central *Bay Journal* office closure to further disrupt our routines.

Certainly, COVID-19 is bringing financial challenges to organizations, businesses and households across the nation. As a nonprofit news organization, our operations depend on grants and donations from readers like you, and we are grateful for the enthusiastic and generous support that readers have been sending during this difficult time. But challenges will continue for all of us. We understand that many of our readers have suffered financially during this pandemic but, if you are able, please consider making a donation to the *Bay Journal* in the coming months. Thanks to you, our work continues! ■

— Lara Lutz
Managing Editor

COVID-19 lowers demand for chicken litter from mushroom growers

Here's an unexpected impact of the COVID-19 pandemic on the Chesapeake: Reduced restaurant demand for mushrooms has lowered the demand for poultry litter from the region, the *Delmarva Farmer* recently reported.

Mushroom farms in northern Maryland and Southeast Pennsylvania use some of the excess poultry litter from the region's increasing number of chickens to create the growing medium for mushrooms.

Transporting chicken wastes away from areas where there is an excess is an important technique used to curb nutrient runoff to the Chesapeake.

It's unclear how long the disruption will last, but farmers report a sharp decrease in shipments of excess litter. "It's affected the amount of litter we haul up there dramatically, Ray Ellis, who owns one of the region's largest manure trucking businesses, told the paper. "It's almost cut it in half." ■

Matt Whitbeck honored for effort to reduce marsh loss at Blackwater refuge

U.S. Fish & Wildlife Service biologist Matt



Biologist Matt Whitbeck received the USFWS 2020 Climate Adaptation Leadership Award for Natural Resources for his work at Blackwater National Wildlife Refuge. (U.S. Fish & Wildlife Service)

Whitbeck has been honored by his peers for his leadership during efforts to reduce marsh loss at Blackwater National Wildlife Refuge on Maryland's Eastern Shore. At its virtual annual meeting on Sept. 9, the Association of Fish and Wildlife Agencies gave him its 2020 Climate

Adaptation Leadership Award for Natural Resources.

Whitbeck, supervisory wildlife biologist for the Chesapeake Marshlands National Wildlife Refuge Complex, was recognized for his work with the Conservation Fund and Audubon

Maryland-DC on a strategy to help the shrinking marsh at Blackwater adapt to climate change. Through a combination of land subsidence and rising sea level, Blackwater has lost more than 5,000 acres of marsh since the refuge's creation in 1933.

Sea level is expected to rise another 2.5 feet by 2050 and 5–6 feet by 2100.

Whitbeck oversaw a novel restoration effort begun in 2017 that involved raising the height of some marsh areas with a thin 4– to 6-inch layer of sediment that was pumped from elsewhere in the refuge.

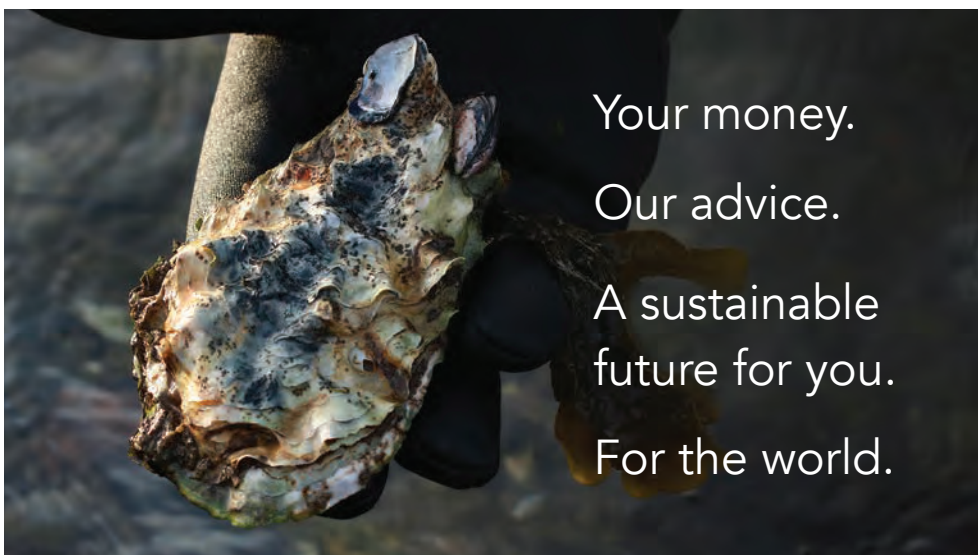
He also pulled together the project's funding, including more than \$2 million in federal aid given to recover from Superstorm Sandy. ■

Bay paddle boarding feat draws big donations to oyster restoration

A Maryland man has become the first person believed to have traveled the 203-mile length of the Chesapeake Bay on a stand up paddle board.

Chris Hopkinson of Arnold, MD, completed the journey from Havre de Grace, MD, to Fisherman's Inlet, VA, in nine days. He was greeted at the

See **BRIEFS**, page 6



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briefs

From page 5

end of his grueling trip at the Atlantic Ocean on Sept. 26 by a boat full of friends, family and supporters. Hopkinson, a 46-year-old chief strategy officer for a mobile communications app, used the expedition to raise money for the Oyster Recovery Partnership, a Maryland-based nonprofit that supports efforts to restore oyster reefs in the Bay.

As of the month's end, the fundraiser had amassed \$177,000 toward its \$200,000 goal, a total that would cover planting 20 million oysters.

"I am truly overwhelmed by the response to the Bay Paddle," Hopkinson said. "The most emotional part wasn't finishing or any one stage or day. It was the amount of support and encouragement from our entire community."

Punishing northeast winds forced a last-minute change in his route, switching from a paddle down the Western Shore to the Eastern Shore. He also battled blisters, rough seas, a sunburn and muscle soreness.

To donate, visit baypaddle.org. ■

Chesapeake's 'dead zone' smaller than average most of summer

The Maryland Department of Natural Resources reported that the size of the Bay's oxygen-starved "dead zone" was smaller than

average through most of the summer.

Monitoring in late August found 0.79 cubic miles of hypoxic water — water with less than 2 parts per million of oxygen. The average for that time of summer is about 1 cubic mile of hypoxic water, which is off limits for most aquatic life in the Bay.

No hypoxia was observed in Virginia's portion of the Bay.

Also, monitoring found no anoxic water — water which essentially has no oxygen — in late August.

Oxygen conditions were better than average all summer, except for late July when the dead zone was larger than normal.

The monitoring results largely match what scientists had predicted in late spring.

While wind, heat and other factors play a role, low oxygen conditions are primarily driven by the amount of nitrogen that enters the Bay. The nutrient spurs algae blooms that die, sink to the bottom, and are decomposed in a process that draws oxygen out of the water.

This spring, the amount of nitrogen entering the Bay was 17% less than normal, largely as a result of below-average river flows, which carry the majority of the nutrient into the Bay. ■

Patuxent Riverkeeper Fred Tutman honored as a clean water champion

Waterkeepers Chesapeake honored Patuxent Riverkeeper Fred Tutman with its Waterkeeper Outstanding Win Award at a virtual gathering in September.



Patuxent Riverkeeper Fred Tutman worked as a volunteer activist on behalf of the river for more than 20 years before founding the Patuxent Riverkeeper organization in 2004. (Dave Harp)

"Fred Tutman is truly deserving of this award for his dedication to bringing clean water and environmental justice to the communities living along the Patuxent River," said Executive

Director Betsy Nicholas.

Tutman was born and raised along the Patuxent River and worked as a volunteer activist on behalf of the river for more than 20 years before founding the Patuxent Riverkeeper organization in 2004.

Tutman has received many awards and recognitions for his environmental work and serves on a variety of boards, task forces and commissions related to protecting the Patuxent and natural environment. He is the only African American riverkeeper in the nation.

Waterkeepers Chesapeake also recognized a Lower Eastern Shore community group, Concerned Citizens Against Industrial CAFOs (concentrated animal feeding operations), with its Water Warrior Award. Over the past five years, the group has engaged a diverse community of citizens and groups to push back against environmental injustice on the Lower Shore.

Waterkeepers Chesapeake presented their Water Warrior Award to the group for a list of accomplishments that include winning zoning ordinance changes to protect rural communities; winning a legal case that stopped a 14-house poultry CAFO; introducing the Community Healthy Air Act to Maryland legislators; and holding events to educate, inform and engage area residents. ■

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Congress extends Bay Program, related conservation efforts

Bill also continues Gateways Network, creates habitats program

By Karl Blankenship

The U.S. House of Representatives has approved a sweeping conservation measure that provides continued support for several key Chesapeake Bay initiatives and creates a new program to support fish and wildlife habitat restoration efforts in the watershed.

America's Conservation Enhancement Act provides support for two dozen conservation initiatives around the nation that were rolled into a single piece of legislation and overwhelmingly approved by the House on Oct. 1.

The Senate had already approved the bill without controversy, and it was expected to be signed by President Trump.

The bill authorizes the continuation of the U.S. Environmental Protection Agency's Chesapeake Bay Program, which has coordinated the state-federal Bay restoration effort since 1983. The program supports research, helps assess cleanup progress and provides grants to states, local

governments, nonprofits and others.

The legislation reauthorizes the Bay Program for another five years at up to \$92 million annually. Congress had allocated \$85 million for the current year.

The bill also reauthorizes the Chesapeake Gateways and Watertrails Network. Administered by the National Park Service, the network includes more than 200 state parks, museums and historic sites that provide access to waterways and highlight the region's natural, historic and cultural heritage.

The legislation reauthorized that program for five years. It received \$3 million in the most recent year. Reauthorization does not guarantee future funding, but it makes Congressional support more likely.

The legislation also creates the Chesapeake Watershed Investments for Landscape Development Program — dubbed WILD — within the U.S. Fish and Wildlife Service. The program is authorized to provide up to \$15 million annually in grants that support fish and wildlife habitat projects in the Bay region. This could include such things as forest buffer plantings, wetland restoration, initiatives that improve stream health, the removal of barriers to fish migration and

efforts to improve habitats for species such as black ducks and brook trout.

Environmental groups praised passage of the measure, which had been in the works since last year.

Noting that outdoor activities generate millions of dollars for the region's economy, Joel Dunn, president of the Chesapeake Conservancy, said "the conservation and restoration of the Chesapeake Bay's waters and wildlife habitats is essential for our region's economic resilience and growth, and the ACE Act will greatly enhance these conservation efforts."

A bipartisan group of lawmakers helped craft different elements of the Bay-related portions of the legislation, including Sens. Ben Cardin (D-MD), Chris Van Hollen (D-MD) and Shelley Moore Capito (R-WV), and Tom Carper (D-DE) as well as Reps. Elaine Luria (D-VA), Bobby Scott (D-VA) and John Sarbanes (D-MD).

"We're pleased to see the overwhelming and bipartisan support for the America's Conservation Enhancement Act," said Jason Rano, who works on federal legislation for the Chesapeake Bay Foundation. "Legislators from both parties recognize the importance

"Legislators from both parties recognize the importance of clean water and a healthy environment."

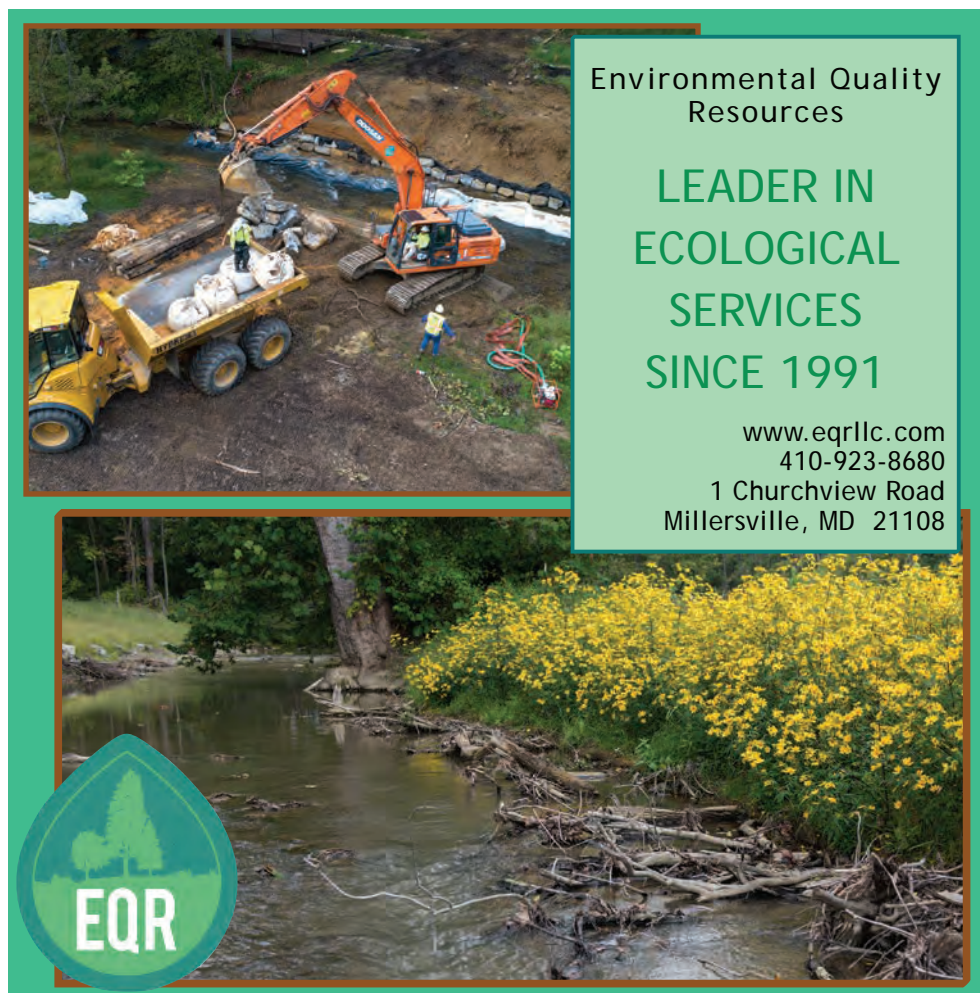
— Jason Rano, Chesapeake Bay Foundation

of clean water and a healthy environment."

Besides the Bay-specific initiatives, the bill reauthorizes a number of national programs that benefit the region, including the North American Wetlands Conservation program, which helps promote wetland restoration, and the National Fish and Wildlife Foundation, which oversees several grant programs that support Bay initiatives.

It also creates a National Fish Habitat Partnership program to provide funding and technical resources to local public-private partnerships to conserve fish habitats.


The final legislation reflected some compromises. For instance, it prohibits the EPA from regulating lead content in hunting and fishing gear for the next five years. Some had pushed to permanently ban the EPA from such action. ■



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Campaign touts Chesapeake National Recreation Area

Status could boost local economy, telling of Bay story

By Whitney Pipkin

Three decades of discussion about the Chesapeake Bay having national park status could come to fruition under a fresh campaign.

The Chesapeake Conservancy in September launched a new website promoting the creation of an overarching national park for the region called the Chesapeake National Recreation Area, which would fall under the U.S. National Park Service. The designation would not create a single park site but encompass dozens of existing parks and public lands in voluntary partnerships and provide a broader framework for the ecological, cultural, historical and recreational resources of the Bay.

Creating a national park requires an act of Congress and a planning process that can stretch out over several years. But a handful of leaders, including the governors of Virginia and Maryland, think that now

is the time to strike.

"I believe the Chesapeake Bay is as grand as the Grand Canyon and as great as the Great Smokies and should be included in a new federal-state partnership," Maryland Gov. Larry Hogan wrote in a Sept. 14 letter to Sens. Ben Cardin and Chris Van Hollen supporting the measure.

The idea of a national park devoted to the Chesapeake was floated as far back as 1986, when the publisher of Annapolis' *Capital Gazette*, Philip Merrill, wrote an opinion piece on why it would be a "good idea." The National Park Service has long had a footprint in the Bay watershed, with more than 400 units located in the region, including major sites such as Fort Mchenry National Monument, Colonial National Historical Park and George Washington's Birthplace National Monument located close to the water.

The Park Service also coordinates the Chesapeake Bay Gateways Network, which is a linked series of more than 100 natural, historic, recreational and cultural sites. Most are owned and managed by other organizations but, together, they highlight

"I believe the Chesapeake Bay is as grand as the Grand Canyon and as great as the Great Smokies."

— MD Gov. Larry Hogan

components of the Bay's "story."

The Park Service scoped out the possibility of a Chesapeake-focused park as part of a special resource study completed in 2004. That study recommended expanding the Bay Gateways Network before working toward national park status.

A devoted national park, though, would make that storytelling more cohesive, advocates say, and could draw additional visitors and dollars to the region. Virginia Gov. Ralph Northam, in a letter to Sens. Tim Kaine and Mark Warner, pointed to the economic benefits such an asset could bring to the state.

The Aug. 3 letter stated that 21 national park units in Maryland, Virginia and Pennsylvania added more than \$800 million to the region's economy in 2018, in addition to the \$586 million generated by

national parks in the District of Columbia.

Joel Dunn, president and CEO of the Chesapeake Conservancy, which is leading the charge for the park, said he landed on the idea of a national recreation area after visiting the Golden Gate National Recreation Area, one of 18 such sites in the country.

"They typically surround water bodies and are structured to allow hunting, boating, fishing and traditional outdoor pursuits, which are values that we want to support in the Chesapeake, too," Dunn said.

Dunn thinks this coming legislative session is the best time for legislators to present the concept in Congress, and having Sen. Van Hollen on the key U.S. Senate Appropriations Committee doesn't hurt.

The Chesapeake Bay Commission also supports the national recreation area and would work closely with. Van Hollen and Maryland Rep. John Sarbanes to advocate for it during the next Congress.

"The COVID crisis has clearly demonstrated that people love their parks," Dunn said. "We'd like to capitalize on the public's expanded use of outdoor recreation to create some lasting infrastructure." ■



11 Anacostia River areas to undergo \$35.5 million cleanup

Sites with highest PCB levels picked for initial work

By Timothy B. Wheeler

The Anacostia River, once dubbed the “forgotten river” because of centuries of abuse and neglect, is forgotten no longer. Its toxic-laced bottom is due for an initial cleanup expected to cost \$35.5 million under a long-anticipated plan released Sept. 30 by the District of Columbia.

The District’s Department of Energy and Environment posted an “interim record of decision” on its website spelling out its intent to dredge or cap and treat contaminated river sediments in 11 “hot spots” along a 9-mile stretch of the lower Anacostia before it joins the Potomac River.

Those areas have the highest levels in the river of PCBs (polychlorinated biphenyls), long-banned chemicals once widely used as coolants or insulators in electrical equipment that are now associated with cancer and other health effects. The presence of PCBs and other toxic metals and chemicals in the sediments make it a health risk to eat many fish caught locally or to go swimming or wading.

The 507-page blueprint calls for dredging PCB-tainted sediment in some areas while capping others with clean sediment and activated carbon granules to keep the toxic chemicals from getting back into the water.

Tommy Wells, the DOE’s director, said the plan’s release means that “District residents can look forward to a future where they can safely swim and fish in what was once a degraded urban waterway.” Officials say the remedial actions outlined in the plan are expected to yield a 90% reduction in people’s risk of exposure to PCBs from eating contaminated fish.

That may still be years away. With more time needed to issue contracts and get permits, Wells said at a meeting previewing the plan that work likely won’t begin until 2023.

District officials stress that this interim plan is likely to be revised as work proceeds. Kingman Lake, an artificial impoundment created in the 1920s, would be the first area targeted, followed by the Washington Channel, a constructed



Jim Foster, president and CEO of the Anacostia Watershed Society, says there are another 14 sites on the river where toxics need to be addressed. (Dave Harp)

waterway paralleling the Potomac that has been the focus of waterfront redevelopment. The mainstem Anacostia is the third area in line for cleanup.

The interim decision is largely unchanged from an “early action” plan originally unveiled in December 2019. After reviewing about 850 comments received since then, officials say they have tweaked it to do more dredging in the Kingman Lake area to allow for safer water recreation around Kingman Island a municipal park undergoing restoration.

The District is fronting the funds to launch the cleanup but is hoping to recover at least some of the remediation costs from companies and federal agencies determined to be responsible for the contamination. Three entities — Pepco, the U.S. Navy and Washington Gas — have already signed consent decrees pledging to clean up pollution left behind by facilities they once operated on the river.

Jim Foster, president and CEO of the Anacostia Watershed Society, welcomed the plan but cautioned that “this isn’t the whole enchilada.” He estimated there are another 14 contaminated areas this plan doesn’t address. He also questioned why the District doesn’t tackle the first 11 hot spots together, which he suggested would speed cleanup and reduce costs. ■



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Manokin River oyster project put on ‘aggressive’ timetable

Restored area could supplant Little Choptank as world’s largest

By Jeremy Cox

The record for the world’s largest oyster restoration project is poised to be broken with a new \$30 million project on Maryland’s Eastern Shore, but some environmentalists would like it to be even bigger.

At 441 acres, the amount of restored area on the bottom of the Manokin River in Somerset County would be the most ever undertaken by the state. With no projects being completed on that scale anywhere else, it would also claim the world’s title.

The river that currently holds that designation is the Little Choptank River in Dorchester County. The initial round of “seeding” of its 358 acres of oyster reefs was completed earlier this year.

The Department of Natural Resources had planned to begin planting baby oysters on the Manokin’s existing reefs this summer. But a backlog of restoration work caused by 2018’s heavy rains, then the COVID-19 pandemic, postponed those efforts until late spring or early summer next year.

The project may turn out to be not only the state’s largest, but also the quickest, officials say.

Under a federal agreement tied to the Chesapeake Bay cleanup, Maryland and Virginia have vowed to replenish oyster reefs in five rivers each by 2025. In June 2019, the Manokin became the last restoration site in either state to be approved by the state-federal Bay program.

“We’re going to have to undertake an aggressive schedule to do it because we have less time than the other tributaries,” said Chris Judy, chief of DNR’s shellfish division.

As they embark on the project’s final design stages, Judy and his colleagues are navigating a narrow path. On one side are watermen who worry that the project will fortify an existing ban on commercial harvesting in the river. On the other are environmentalists who contend the restoration area should be expanded beyond what is currently planned.

“In a river that’s so much larger and had 11,000 acres of oyster habitat in the past, let’s make sure the scale that this happening is on is large enough to make that ecological change,” said Allison Colden, a Maryland fisheries scientist with the Chesapeake Bay Foundation.



Jason Schwab, left, and Josh Kilby, both field technicians with the nonprofit Oyster Recovery Partnership, sort and measure oysters tonged from the Manokin River during a bottom survey in September. (Oyster Recovery Partnership)



With oysters like these already reproducing in the Manokin, scientists are optimistic that the reef restoration will be successful. (Oyster Recovery Partnership)

Oyster bars once dominated the Bay, covering nearly a half-million acres of its bottom as late as the 1800s. But overharvesting, disease and deteriorating water quality caused the bivalve’s population to fall to 1% or less of its historic levels.

Maryland and Virginia are both on track to restore more than 2,000 acres of oyster

habitat in the 10 rivers.

For a reef to be considered fully restored, the density of oysters must be at least 15 per square meter, roughly the area of a bath towel, across at least 30% of the reef’s total surface. The preferred “target,” though, is 50 oysters. Those assessments are conducted six years after the restoration occurred.

State biologists use a formula to calculate how much of a river’s bottom should be restored based, in part, on the historic breadth of its oyster reefs. The formula calls for restoring at least 8% of that acreage, or 401 acres, in the Manokin. The state added a 10% buffer to that amount — in case some areas aren’t up to snuff — bringing the restoration goal to the 441 acres.

Sonar surveys and patent tong tests indicate that as much as 637 acres of bottom would be suitable for restoration. But according to Maryland’s plan for rehabilitating the oyster population in the Manokin, the state lacks the time and resources to restore that amount by the 2025 deadline.

DNR officials say that some waters will be bypassed for practical reasons. Among them: those inhabited by underwater grass meadows, under docks, covered by aquaculture leases or are in or near the boat channel leading to the community of Rumbley.

The Bay Foundation has long pushed

for oyster restoration in the Manokin. The river flows from headwaters near Princess Anne into the Chesapeake Bay on the northern end of Tangier Sound.

After the Manokin was made a sanctuary and closed to oyster harvests in 2010, its oyster population reached a 20-year high in 2015. Meanwhile, the number of diseased specimens dropped by more than half, according to a Bay Foundation analysis of state survey data.

“That shows us it has tremendous potential for oyster restoration,” Colden said.

She argues that the state should build in a bigger buffer than the 10% called for in the plan. Two Maryland tributaries have had their restoration acreage slashed after the initial planning phase: the Little Choptank’s by 22% and the Tred Avon’s by 15%. If such a portion is purged from the Manokin, the total would fall below the minimum set by the federal agreement, Colden said.

Watermen strongly opposed the state’s decision to classify the Manokin as an oyster sanctuary. The move put some of the state’s most productive oystering grounds off-limits to commercial dredges. The restoration project will only bolster arguments to make the sanctuary status permanent, they say.

“We’re going to lose the river,” said Gregory Price, co-chairman of the Somerset County Oyster Committee and a longtime waterman. “It’s something that belongs to us, and we want to keep it.”

But watermen have a ray of hope. Because the U.S. Army Corps of Engineers hasn’t contributed funding to the Manokin project, the state alone can decide whether to reopen the oyster grounds. It remains protected from harvest by state law for now.

In addition to the Manokin, Little Choptank and Tred Avon, Maryland is restoring oysters in Harris Creek in Talbot County and the Upper St. Mary’s River in St. Mary’s County, the lone Western Shore tributary included in the plan.

The second phase of seeding has been completed in Harris Creek. Seeding and reef construction continue in the Tred Avon. The Upper St. Mary’s, like the Manokin, is scheduled to get its first round of seeding next year.

In the Manokin, seeding and construction are set to take place 2021–22, Judy said. If necessary, a second round of building will be conducted three years later in 2025. That would meet the deadline, barring any further delays. ■

Use of switchgrass growing in popularity for ag conservation

Multiple uses that help farmers turn a profit elevate plant's desirability in water quality projects

By Ad Crable

Will switchgrass, a tall, resilient and fast-growing native plant once familiar to pioneers, become the next cash crop for farmers in states in the Chesapeake Bay drainage?

In a convergence of promising developments, a new study gives switchgrass lofty environmental grades and assures skeptics that it would not, like corn-based ethanol, be another biofuel that replaces a food crop with questionable environmental benefits.

Also, states in the Bay watershed are calling for dramatic increases in soil- and nutrient-filtering streamside buffers in an effort to meet Bay restoration goals by 2025. Pennsylvania, for example, has a goal of planting an additional 100,000 acres of grass buffers.

A third factor may provide yet another boost for switchgrass. A new trend, called multi-functional or “productive” buffers, allows farmers to plant profitable vegetation like switchgrass in streamside buffers. And switchgrass has been found to be good habitat for wildlife and bee pollinators, which are in decline.

A workshop led by the state-federal Chesapeake Bay Program highlighted multifunctional buffers with warm-season grasses such as switchgrass as the best hope for planting buffers on a scale large enough to meet Bay restoration goals.

Moreover, markets for switchgrass are evolving, putting it to use in erosion-control silt socks and poultry bedding. That gives farmers economic incentives to grow it in buffers, set-aside land programs and wet or low-performing parts of fields.

“There are major Earth-shattering movements in the environmental spaces right now. Switchgrass is one of them,” said Mike Zock of MKB Company, a Pennsylvania-based startup that in just two years has become the biggest seller of switchgrass silt socks in the eastern United States. The company is buying 10,000 tons of switchgrass a year grown on farms in Pennsylvania, Maryland, Virginia and several other states, as well as Canada.

Environmental agencies in Pennsylvania, West Virginia and Ohio have approved



Switchgrass can serve as filling in the erosion control silt socks used at construction sites and for bedding in poultry houses. (Top: MKB Company / Bottom: Association of Warm Season Grass Producers)

the products for pipeline projects, road construction and other uses.

With alternatives to fossil fuels ever more important to combat climate change, switchgrass has been proposed as a next-generation carbon-negative biofuel. But environmentalists have fretted that it might carry environmental baggage, like displacing carbon-capturing forests or food production or, like corn, cause runoff pollution and need vast amounts of fertilizers and pesticides.

But in a government-supported study published in the August journal of the National Academy of National Sciences, scientists from several universities reported what they call the first “soil to tailpipe emissions” study of switchgrass’ balance sheet.

Researchers found that switchgrass, if used in streamside buffers or as a cash crop, stores harmful carbon at a level similar to trees and better than land planted with other native grasses. If switchgrass takes off as a biofuel, it could be processed in refineries where carbon could be captured and stored, making it even more viable as a significant fuel source.

They also found that switchgrass, even grown as a monoculture, has much more biodiversity than corn and supports more insects, birds and pollinators, partly because it isn’t cut and replanted every year. Soil health practices were augmented by switchgrass, and crop pests were fewer.

“There is evidence that switchgrass could enhance biodiversity on current landscapes,” said Tom Richard, a Penn State



professor of agricultural and biological engineering who worked on the study.

“I like to think of our study as a call to action,” said Erica Smithwick, a Penn State professor of geology who was one of the researchers. “This can make a huge difference if people invest in it. I think the family of advanced biofuels is a potential solution to the climate crisis.”

But, so far, the move to make switchgrass the main source of a new biofuel nationwide is in its infancy, hindered by cheap gas prices, buy-in from policymakers and hesitant support from mainstream environmental groups. “Right now, there are not sufficient subsidies to promote biofuel goals,” Richard said.

One exception is in southeastern Virginia, where the Piedmont Geriatric Hospital is entirely heated and cooled by the burning of switchgrass. To support the hospital’s boiler, 13 farmers in seven Virginia counties are growing switchgrass on 3,300 acres of marginal soil or government land set-aside programs. Surplus switchgrass is sold for silt socks, cattle feed and other byproducts.

“Our business is the conservation industry,” said Fred Circle, CEO of Ohio-based FDC Enterprises, which built and runs the project. “The idea is to be able to do something on a local basis, help farms with underperforming land and solve erosion and invasive species problems.

“If we can turn that land into switchgrass, all these things go away. And we are improving wildlife habitat. That’s the trick,

how do you monetize soil health? There’s got to be a profit motive or it’s never going to get any traction.”

Circle said the company is “very close” to signing contracts for two more similar switchgrass-to-fuel projects in the Bay watershed.

While silk socks and poultry bedding are the two most salient success stories, switchgrass advocates see these possible markets developing: cat litter; bale building blocks for homes; fuel pellets; cover for wild game; feed for cattle; abandoned mine reclamation; medium for growing mushrooms; ornamentals; plantings under solar panels; and burning methane in anaerobic digesters to produce electricity on a farm scale.

Will Brandau, a Pennsylvania farmer, formed the Association of Warm Season Grass Producers four years ago with the idea of selling switchgrass for silt socks.

Another idea was to use switchgrass as poultry bedding for both backyard chicken coops and large poultry operations. It worked. The group has 25 switchgrass producers from all over the East Coast and has gotten grants from groups such as Sustainable Agriculture Research and Education. A prototype machine has just been finished that poultry farmers can share to grind up switchgrass for bedding right on the farm.

A focus of research is to prove that there is vast underperforming farmland right now — not just along streams — that could provide the farmer more income while reducing nutrient pollution.

In fact, using satellite imagery, Penn State researchers estimated that there are more than 500,000 acres of farmland in Pennsylvania that are currently idle or in traditional crops that are not growing well because they are in wet or flood-prone areas. When one adds in existing buffers that could be expanded for switchgrass, or set-aside programs like CREP, the total rises to 800,000 acres.

That’s a potential for 6 million tons of harvestable switchgrass worth perhaps \$590 million annually, according to Stephanie Herbstritt of Pennsylvania’s College of Agricultural Sciences and Biological Engineering.

Dan Arnett of Ernst Conservation Seeds, a Pennsylvania company that is one of the largest switchgrass seed producers in the country, agreed that giving landowners a profitable incentive to improve their land environmentally could be a game changer.

“This is a huge win for everyone, makes a lot of sense and could really take things to scale while helping the Bay in a significant way.” ■



Stream restoration techniques draw pushback

Some scientists, environmentalists, residents question wisdom of tree removal

By Timothy B. Wheeler

During dry weather, two little streams in Hollin Hills trickle gently downhill, shaded by a thick canopy of oak, hickory, beech and tulip trees. Heavy rain can quickly turn those trickles to torrents, though. As a result, portions of both streams have eroded badly over the years. In places, steep gullies 12 feet deep or more have been carved into the ground by runoff from roofs and pavement in this neighborhood of glassy contemporary homes just south of Alexandria, VA.

Now, Fairfax County is preparing to embark on a \$3.6 million project to re-engineer the channels of both streams. Many Hollin Hills residents welcome it, fearing that someone could be hurt falling into the gullies.

But some oppose the plan, arguing that it will destroy the woodsy nature of the two small community parks through which the streams flow. Nearly 80 large trees will be removed, and vegetation along stable stretches of both waterways will be cleared to access eroding areas. Critics contend the fix is worse than the problem.

“Look at the diversity here,” botanist Rod Simmons said as he strolled through the streamside parks. “You’ve got Solomon’s seal

there, you’ve got blue-stemmed goldenrod.”

Simmons, a natural resources manager with Alexandria’s Department of Recreation, Parks and Cultural Activities, has in his spare time become an outspoken critic of many urban stream restoration projects, including one in his own municipality.

Pausing to admire a towering white oak, Simmons said, “these old-age trees are toast. It really is a crime to trash this place.”

County officials say that they’re trying to repair damaged, potentially dangerous streams. Some disruption is inevitable, but temporary, they insist.

“We’re not in the business of cutting down trees to cut down trees,” said Meghan Fellows, the Hollin Hills project manager with the county’s stormwater planning division. “We do the best we can to replace the entire stream corridor’s function,” she added, noting that plans call for replanting more trees and shrubs than are to be removed.

It’s a debate playing out in many places across the Chesapeake Bay region as urban and suburban governments increasingly turn to stream restoration projects to meet their obligations to reduce nutrient and sediment pollution fouling the Bay.

But critics argue that a heavy-handed approach to stream restoration in such settings often does little if anything to restore the waterway’s ecological health. In the process, they argue, precious patches of riparian forest are being sacrificed in what the Chesapeake Bay Foundation’s Rob Schnabel calls a “gold rush” by local and state agencies to accumulate credits toward meeting Bay restoration targets.

It’s a complicated and passionate debate. And there isn’t enough research yet to settle it.

A growing, evolving practice

People have been degrading streams since colonial times by clearing trees, building dams and adding a host of other insults to the

Photo: Nearly 80 large trees like the tulip tree in the foreground are to be removed for a pair of stream restorations in Goodman and Brickelmaier parks in Hollin Hills near Alexandria, VA. (Dave Harp)

landscape. Natural resource managers have been trying to restore them since at least the late 1800s, when they began putting in small dams and sills in an attempt to boost fish habitat.

One approach to stream restoration that's popular today began about 45 years ago. That's when a former U.S. Forest Service hydrologist from Colorado, Dave Rosgen, developed a stream classification system and began promoting what he called "natural channel design." The technique involves re-engineering the stream to create bends and meanders that slow down the current and reconnect the stream to its floodplain to absorb storm-swollen flows. It also calls for putting woody debris in the water to support fish and aquatic insects.

Rosgen's method has grown into a widespread practice nationally. Other techniques also have been developed, including one pioneered in Maryland known as regenerative stormwater conveyance. That involves raising an incised stream bed with sand, mulch and rocks and installing a series of shallow pools and rocky riffles to capture or slow storm-driven runoff.

To date, about 340 miles of streams across the Bay watershed have been re-engineered by one method or another, according to the state-federal Chesapeake Bay Program. Since 2014, Maryland has permitted more than 600 projects and Virginia more than 300.

Most of the restored stream miles are located on current or former farmland, but a growing number are in developed areas, done by local and state agencies to satisfy regulatory requirements that they reduce stormwater pollution. Runoff from buildings and pavement accounts for 16% of the nitrogen, 18% of the phosphorus and 24% of the sediment washing into the Bay, the Bay Program estimates.

The number and scale of projects has grown over the years as states and localities scramble to meet their obligations for restoring the Bay's water quality. States and localities once anticipated doing 655 miles of stream work by 2025 but are now planning to complete 900 miles by that time, Bay Program data show. The estimated total cost: \$500 million.

Local and state officials and restoration specialists say the goals for stream restoration vary from place to place, but it is one of the most cost-effective ways to reduce pollution from stormwater, especially in developed areas where other options are limited. Projects are undertaken, they say, only after careful technical analysis of the stream's condition, its range of flows, the number and types of fish and insects in it

and the vegetation bordering it.

Researchers with the Appalachian Laboratory of the University of Maryland Center for Environmental Science found that restored streams generally do achieve more stable banks and channels, so they're dumping less sediment into the water.

Questions have arisen and persisted, though, about the effectiveness and durability of such projects and about the trade-offs involved in removing trees and vegetation.

A lack of 'ecological uplift'

In addition to reducing sediment and nutrient pollution, stream restoration projects are supposed to provide "ecological uplift" to degraded streams, bringing back long-lost aquatic insects and fish like trout, which need cold, clear water to maintain their populations.

In reviewing 40 different projects across Maryland, researchers at the University of Maryland laboratory didn't find many ecological benefits. The number and type of aquatic insects — food for fish and key indicators of stream health — didn't improve.

According to ecologist Bob Hilderbrand, the study's lead author, there's evidence that a stream's ecosystem can benefit from restoration if the stream wasn't severely impaired to begin with. But in badly degraded urban and suburban streams, he added, "there's not much evidence ... that we can bring the ecology back."

And in some cases, he said, his research suggests the aquatic habitat and life in streams that have undergone restoration work actually wind up worse off than if left alone.

Hilderbrand said his team's study didn't look specifically at how tree removal during restoration affected a stream's ecology. But he noted that even if contractors replace the cleared vegetation along the banks, which is customary in restoration projects, "it's going to take decades for those trees to become re-established."

With their root networks, trees help prevent stream bank erosion. They also soak up rainfall, helping to keep nutrients and sediment from washing off into a stream during a storm. In dry weather, they shade the water from the sun, keeping the temperature down to help sustain fish and amphibians.

But preliminary findings of another University of Maryland study suggest that when streamside trees are cut down during restoration, nutrient seepage into the water may actually increase. A review of five projects constructed since 1999 found elevated nitrogen levels in groundwater downslope from where trees had been removed.

Sujay Kaushal, an associate professor of biogeochemistry at College Park, declined to discuss the study's preliminary findings presented at a workshop last year. He said he's working with one of his graduate students who did the research to complete the analysis and write it up.

"It's such a hot button issue that we want to get all our ducks in a row first," he said.

Hilderbrand's and Kaushal's studies are among dozens funded by Maryland's Chesapeake Bay Trust. The science behind stream restoration is still relatively new, and practices have changed over the years, leading to debate and uncertainty about what's

worked where and what hasn't.

Five years ago, in collaboration with other state and federal agencies, the trust began issuing grants to research the effectiveness of the various techniques being employed.

The trust also helped pull agencies together in a collective effort to gather information on how past projects had performed, because until relatively recently they were monitored for only a few years after completion.

Sadie Drescher, the trust's director of restoration programs, called the impact of tree removal "a burning question. We ask regulators, 'What are the key questions that keep you up at night?' This was one."

A 'temporary band-aid'

Many environmentalists support stream restoration, and some watershed groups actively engage in planning and executing projects in their communities. But some environmental groups have concerns.

The Bay Foundation recently joined some residents of Gaithersburg, MD, in questioning plans to rework 2,400 feet of stream through a city park, reconnecting it to a floodplain and creating 1.5 acres of wetlands in the process. The \$1.8 million project would remove more than 100 large trees, though plans are to replant 120, according to the city's Department of Public Works.

"These days, site selection seems to be based more on landowners' willingness to let it be done than water quality considerations," said the Bay Foundation's Rob

See **STREAMS**, page 14



Botanist Rod Simmons stands in an unnamed tributary of Paul Spring Branch. When it's dry, this stream in the Virginia community of Hollin Hills is no more than a trickle. But portions of it and another nearby stream show evidence of erosion from flashy runoff during rainstorms. (Dave Harp)



The bank is eroding beneath this stormwater outfall that funnels runoff from homes and pavement into a stream in Goodman Park in Hollin Hills. (Dave Harp)

Schnabel. Many projects, in fact, are sited on public land — particularly parks, where the city or county government already owns the property.

In Baltimore, there's pushback against plans by the city's Department of Public Works to re-engineer three streams in Gwynns Falls/Leakin Park, the second largest urban woodland in the United States. Opponents say 90 large trees are to be removed in just one project.

"What we are asking the city to do is what other cities like Washington, DC, and Philadelphia have done," said Jack Lattimore, a board member of the park's friends group. "They have prioritized small green infrastructure over these large hubristic manmade earth-moving projects. You get people to unhook their gutters, you build small ponds, you actually improve neighborhoods rather than wrecking parks."

But Baltimore officials are relying heavily on stream restoration to comply with regulatory requirements to reduce stormwater runoff. Though stream projects aren't cheap, they're far more cost-effective, at least on paper, than trying to curb runoff by planting trees in smaller patches or creating rain gardens.

Rosanna LaPlante, a city public works section chief, wrote last year that one stream project would cost \$84,000 per acre versus \$221,000 per acre to build a "bio-retention" basin elsewhere big enough to capture and soak up equivalent amounts of nutrient- and sediment-laden runoff.

To Schnabel, that's short-sighted. He has been on both sides of the debate, working on environmental mitigation for the Maryland State Highway Administration before joining the Annapolis-based environmental group. He said he's seen some projects that improved water quality, but they tended to be in rural areas, with fewer impervious surfaces to complicate matters.

"When you're jumping into a stream channel, you're not addressing the source of the problem," he said. "You're putting in a temporary Band-Aid." The problem is runoff, he said, and if it isn't somehow reduced, all of the restoration work can be undone over time by one or several storms.

Simmons, the botanist, argues that removal of the tree canopy and other vegetation also makes a stream corridor vulnerable to takeover by invasive plants. He acknowledges that erosion may need to be fixed, but he contends that can be done on a more limited basis.

As an example, he points to work at Arlington National Cemetery where,



Botanist Rod Simmons points out New York ferns growing in Goodman Park, near one of two streams targeted for restoration projects in the Virginia community of Hollin Hills. (Dave Harp)

instead of trying to re-engineer an eroding hillside stream channel, boulders were used to armor its banks against the effects of flashy runoff.

Toward 'minimalist' restorations

Stream restoration specialists and state and local officials involved in planning them say they're sensitive to concerns about tree removal, and there's been a tendency recently toward what one called a "minimalist" approach, taking down as few as possible.

"When impacts to existing forest resources are unavoidable, the designers do the best they can to incorporate these resources into the project," said Mitch Keiler, president of the Maryland Stream Restoration Association. That often involves placing the roots and trunks of felled trees in the stream to provide habitat for fish, aquatic insects and beneficial bacteria.

"But there are realities," he said, "and the constructability of many projects are challenged by site constraints." Runoff does need to be controlled to help ensure the success of restoration projects, he and others acknowledge, but they have to work

with a site chosen by the client — often a budget-conscious local government — and stick to the plan approved by regulators, even if they'd like to go back and tweak it.

Denise Keehner, assistant secretary of the Maryland Department of the Environment, said her agency only approves projects where there's evidence a stream is degraded.

"Stream restoration is a complex and challenging undertaking," Keehner said, "and an approach that works in one place may fail in another."

But in at least some cases, she said, the riparian forest needs to be replaced for ecological reasons. The trees that have grown up along the banks, she said, are upland species that won't survive once the stream is reconnected to its floodplain.

While acknowledging that there are past projects they'd like to have done differently, restoration specialists say they're confident overall that their work will help stabilize eroding streams and recover from damage wrought by decades of abuse. If nothing is done, they say, erosion will continue and maybe worsen, dumping sediment and

nutrients downstream to impair water quality and fish habitat.

"We honestly believe that 100 years down the road, in 99% of the cases, these resource concerns wash out and you have a better site than before restoration," said Kirk Mantay, who oversaw stream restorations for the South River Federation, a watershed group, before becoming executive director of the nonprofit Green Trust Alliance.

The results so far, though, are not encouraging, said the researcher, Hilderbrand. The older projects he looked at showed no more ecological recovery than the recently finished ones, he said.

Hilderbrand said his research indicates that the amount of development in a stream's watershed controls how much recovery can occur. That doesn't mean some re-engineering isn't warranted to reduce sediment or nutrient pollution, he noted. But perhaps the criteria for judging ecological uplift needs to be adjusted for badly degraded urban streams, he said, to make expectations more realistic.

The Bay Program has taken notice of research by Hilderbrand, Kaushal and others indicating that stream restoration can have "unintended environmental consequences."

Its urban stormwater workgroup, made up of regulators, restoration specialists and researchers, proposed new guidelines earlier this year for evaluating stream projects. They recommend planners target the most degraded waterways and address upland runoff as well as channel erosion. They also urge the consideration of other, perhaps less disruptive options.

"I think there are going to be plenty of instances where stream restoration is the best solution for a particular site," said David Wood, coordinator of the workgroup, who's with the nonprofit Chesapeake Stormwater Network. "But I think there are many sites where it's not."

The workgroup's recommendations are just that, Wood noted. The decisions on where, how or even whether to do a stream project rest with local officials and state and federal regulators.

Meanwhile, the Bay Program has scaled back by about a third the amount of stream restoration that can be counted toward the Chesapeake's pollution-reduction goals — at least until state and local agencies can inspect and verify that projects finished years ago are still performing as intended.

The one point on which all sides seem to agree is that more research is needed, and more monitoring.

"These are tough issues," Keiler said, "and we're going to have to continue to learn." ■

EPA hit with lawsuits over Chesapeake Bay cleanup

Two suits fault agency with failing to act on PA, NY for inadequate pollution-reduction plans

By Timothy B. Wheeler

Making good on threats issued months ago, three Chesapeake Bay watershed states, the District of Columbia and Chesapeake Bay Foundation took the U.S. Environmental Protection Agency to court Sept. 10 for failing to push Pennsylvania and New York to do more to clean up the Bay.

In their lawsuit, the attorneys general of Maryland, Virginia, Delaware and the District of Columbia accused the EPA of shirking its responsibility under the Clean Water Act by letting Pennsylvania and New York fall short in reducing their nutrient and sediment pollution fouling the Bay.

“This has to be a collective effort,” said Maryland Attorney General Brian Frosh. “Every state in the Chesapeake Bay watershed has to play a part, and EPA under the law has to ensure that happens.”

The Chesapeake Bay Foundation, joined by the Maryland Watermen’s Association, a pair of Virginia farmers and Anne Arundel County, MD, made similar complaints in a separate federal lawsuit. Both were filed in U.S. District Court for the District of Columbia, where they’re likely to be consolidated into a single case.

“The courts must ensure that EPA does its job,” Will Baker, the Bay Foundation president, said in a press conference with attorneys general from Maryland, Virginia and the District.

At issue is the EPA’s duty to enforce a decade-old plan the agency drew up for restoring the Bay. The plan, known as a total maximum daily load, requires each of the Bay watershed states and the district to do what’s needed by 2025 to reduce their share of pollution harming the Bay.

Progress has been made toward restoring the Bay, though much remains to be done. In particular, Pennsylvania and New York have fallen far behind in meeting their pollution-reduction targets, especially in curbing nutrient runoff from farmland.

All six Bay watershed states and the district were required to submit plans last year spelling out how each would achieve their 2025 goals.

Most of the plans indicate that states will have to increase efforts to unprecedented levels. But Pennsylvania’s and New York’s plans don’t even achieve their goals on

paper. Pennsylvania’s falls short on curbing nitrogen, the most problematic nutrient, by about 25%, while New York’s was around 33% short. Pennsylvania’s plan also identifies an annual funding gap for cleanup activities of approximately \$250 million.

The EPA cited both states for those shortcomings but hasn’t taken any action against them. The lawsuits contend that the federal government is abdicating its legal responsibility by accepting clearly inadequate cleanup plans with no reasonable assurance the two states can achieve their goals.

Without responding directly to the lawsuits’ core complaint, an EPA spokesman issued a statement defending the agency’s role in the Bay cleanup.

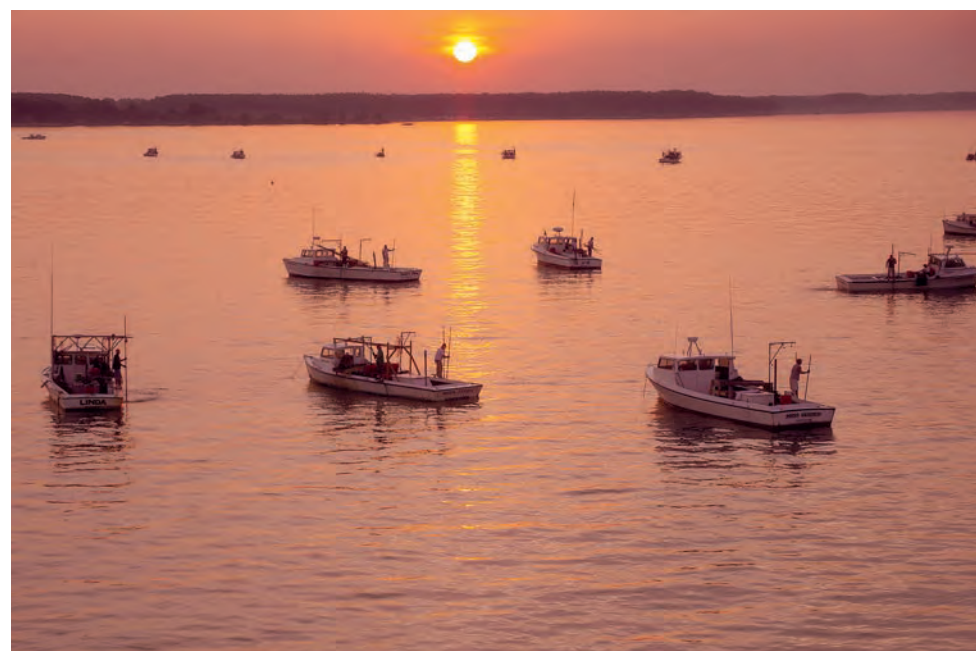
“EPA is fully committed to working with our Bay Program partners to meet the 2025 goals,” the statement said. “We have taken and will continue to take appropriate actions under our Clean Water Act authorities to improve Chesapeake Bay water quality.”

The spokesman noted that in just the past year, the EPA and other federal agencies have supplied “nearly a half billion dollars” to support Bay watershed restoration efforts. The agency also has provided “thousands of hours” of technical assistance to the states, it said. Those filing the lawsuits say that’s not enough.

“When EPA uses its bully pulpit to tell a state that they’re failing to meet their obligations, action follows,” said the foundation’s Baker. “We’ve seen that with Pennsylvania in the past.”

The agency briefly withheld about \$3 million in federal funds from Pennsylvania five years ago to prod it toward getting its cleanup back on track. Critics suggest the EPA also could leverage state compliance by threatening to block permits that are needed to build or expand businesses.

The litigants said they didn’t relish taking the EPA to court but felt they had no choice. They faulted the Trump administration, contending it had not only abandoned the federal government’s role as enforcer of the Bay TMDL but had threatened the cleanup further by rolling back or weakening federal environmental regulations.



Watermen tong for oysters on Broad Creek, a tributary of Maryland’s Choptank River. The Maryland Watermen’s Association is joining the Chesapeake Bay Foundation in its lawsuit against the EPA. (Dave Harp/2013)

“We’re here to enforce the agreements,” said Karl Racine, the district’s attorney general. “It’s not unusual at all that when parties don’t do what they’re supposed to do by law, we go to court to have it enforce the remedy.”

Neither Pennsylvania nor New York are defendants in the lawsuits, though their alleged shortcomings are key issues. Deborah Klenotic, spokeswoman for the Pennsylvania Department of Environmental Protection, declined to comment on the litigation, saying, “We remain focused on our work to improve water quality here in Pennsylvania and in the Chesapeake Bay.”

But Maureen Wren, a spokeswoman for the New York Department of Environmental Conservation, disputed assertions that the state isn’t doing its part. “New York is fulfilling its clean water responsibilities under the Chesapeake Bay TMDL and is a committed partner” in the federal-state Chesapeake Bay Program, she said.

State officials now expect to meet New York’s nitrogen reduction targets based on new information about Susquehanna flows and a change in the Bay Program’s computer model.

Maryland’s Anne Arundel County, which has more than 500 miles of shoreline on the Bay and its tributaries, joined the foundation in its lawsuit.

“Anne Arundel County residents have invested far too much in the Chesapeake Bay restoration effort to watch from the sidelines as upstream states and the EPA

abandon their obligations,” said Anne Arundel County Executive Stuart Pittman. The county has spent more than \$500 million in the last decade on Bay protection and restoration, officials estimate.

The Maryland Watermen’s Association also joined in the group’s lawsuit. Robert T. Brown, Sr., the group’s president, said pollution coming down the Susquehanna River from Pennsylvania and New York are having a devastating effect on watermen.

“So goes the health of the Bay, so goes [our] industry and seafood,” he said. “...We need to have the EPA do its job.”

Also suing are Robert Whitescarver and Jeanne Hoffman, who raise livestock on a farm in Virginia’s Shenandoah Valley.

“All jurisdictions need to do their fair share,” Whitescarver said. “The efforts that Virginia and Maryland farmers have put into sustainable farming are harmed by EPA’s failure to require all jurisdictions to meet the commitments they agreed to.”

At least a couple of the states suing the EPA to put the heat on Pennsylvania and New York could find themselves on the receiving end of similar pressure if their lawsuit succeeds. Only the district and West Virginia have met their 2025 goals ahead of schedule, and none of the others are on track to reduce nitrogen by the needed amount.

“If any of the Bay states fall significantly short in implementation, CBF will call on EPA to take action,” Baker said. ■

Norfolk races to protect vulnerable neighborhoods from floods

Grant money at stake if projects miss 2022 deadline

By Jeremy Cox

Seas are rising. The land is sinking. And hurricanes seem to pose a greater threat with every passing season.

In many ways, the city of Norfolk is racing against time to complete a massive flood-protection project for a pair of its most vulnerable neighborhoods. But city officials and contractors are most concerned about a different kind of threat: a make-or-break September 2022 deadline.

If Virginia's second-largest city doesn't "substantially complete" the work by then, officials say they will have to return the \$112 million grant they received from the federal government.

Nine months after construction began, the project is on pace to meet that target, said Doug Beaver, who oversees the work as Norfolk's chief resilience officer. Some finishing touches will remain. The final tweaks are scheduled to be wrapped up by April 2023.

But the city is hedging its bets just the same. Local leaders are lobbying members of Congress to extend the 2022 deadline.

Bills introduced in the U.S. House and Senate this summer would give Norfolk until September 2025 to finish the work. The measures have bipartisan support but have stalled amid election-year political battles. The reprieve would apply to all 13 state and local governments nationwide that received money from the same \$1 billion pool of Housing and Urban Development funding in 2016.

"We're a lot further along than most localities," Beaver said, "but who would have predicted a pandemic or 26 named storms" would form in the Atlantic this season?

The setting for this bureaucratic drama is two historically black neighborhoods: the Chesterfield Heights community and the 300-unit Grandy Village public housing complex. The neighborhoods lie just east of downtown, squeezed between Interstate 264 to the north and the Elizabeth River's Eastern Branch to the south.

The area's 2,000 residents have long been plagued by floods from heavy rainfall and extremely high tides. Public safety is one of the top concerns. Water routinely covers one of the two access roads, slowing the arrival of ambulances and other first



A floodwall is being built to shield the Chesterfield Heights and Grandy Village neighborhoods from tidal flooding along the Elizabeth River's Eastern Branch as part of a "resilience" project largely funded by a \$112 million federal grant. (Courtesy of the city of Norfolk)

responders, officials say.

The city's plan calls for building walls to keep tidal flooding out — 7,000 feet of earthen berms and 1,000 feet of floodwalls. Workers are constructing two pump stations to get rid of water that collects behind the walls. Excess water also will be allowed to pool in new wetlands and a grassy amenity dubbed "Resilience Park."

After New Orleans, Norfolk is widely considered the city most endangered by sea level rise nationally, Beaver said. Water levels have risen by 18 inches over the last century and are forecast to climb another 4.5 feet by 2100, according to guidelines adopted by the Hampton Roads Planning District Commission. Sea level rise in the area is accelerating at nearly twice the global average, scientists say, because the region's land surface has also been sinking since the last Ice Age.

As the first major infrastructure project to combat climate change effects in Hampton Roads, the Chesterfield Heights and Grandy Village construction is serving as a living experiment, Beaver said.

"This will be a shining example of what we need to do to adapt as coastal communities," said Beaver, a former Naval Station Norfolk commander and city military liaison. "A lot of these homes [in Chesterfield] are 100 years old, and we want them to be here for another 100 years."

The huge public works venture has upended both neighborhoods. Barricades block roads shorn of their asphalt. Bare cinder blocks suggest the outline, if not the height, of the pump stations. A ribbon of gray boulders — the floodwall — is



Doug Beaver, Norfolk's chief resilience officer, says the massive flood-protection project is on track to be "substantially complete" by the September 2022 federal deadline. (Jeremy Cox)

unfurling down the shoreline. Front loaders and backhoes crowd the landscape.

The project is taking shape, but not the way it was originally designed.

After paying for planning and engineering work, the city had about \$90 million remaining for construction. But as city officials sought bids on the lucrative project last year, they ran headlong into fierce competition. With two separate highway tunnel projects vying for the same workforce and materials, the construction cost soared to \$130 million.

"So, we went back to the drawings and decided what we could change" without diminishing the project's flood-fighting capacity, said Selo Qejvani, the city's project construction manager.

None of the changes compromised the city's original flood-protection goals, he said. The floodwall will still stave off tides with a probability of occurring 1% in a

year, and the drainage system is expected to handle rains with a 10% probability of occurring in that span.

Nearly \$4 million in savings came from scaling back the pump stations, he said. One pump was eliminated from each of the stations. Those pumps were only added to handle lighter rains, saving the larger pumps for bigger jobs.

Engineers also removed the pilings that would have been driven 80 feet into the ground to keep the stations secure during strong winds. Their subtraction shouldn't compromise the stations' structural integrity, Qejvani said.

Significant savings came when officials slashed the project's contingency fund and allowances, a kind of rainy day account for unexpected costs, from \$18.5 million to \$10 million. As the design crystallized, Qejvani said, he and his colleagues felt more comfortable about what needed to be spent — and what didn't.

Other deletions included a pedestrian bridge, kiosks, additional lighting at the pump stations, several driveway replacements and several bioswales in the park.

Despite the cuts, the city still faced a nearly \$10 million shortfall. That will be covered by other funding sources: \$5 million from federal Community Development Block Grants reprogrammed from other projects and \$4.5 million from the city's "resilience" tax.

The city managed to wrangle the project's costs but lost time in the process. The project broke ground last February, seven months behind the original schedule. "It's tied to a very tight timeline," Beaver said.

Henry Penn, a retired county administration worker, said he moved to Chesterfield Heights about a decade ago for three main reasons.

"The water, fishing, a lot of places to go," he said.

His home is on high enough ground that he doesn't worry too much about it getting inundated, but he's happy that the project will give some relief to his neighbors. Will it be enough to protect the community in the long run from climate change? That, he isn't so sure about.

"They just talked about another big ice chunk that broke off up there" in Greenland, Penn said from his front porch as he watched the river ripple serenely past. "So, I don't know if it will be enough or not. If it [sea level] rises 6–10 feet here, it's devastating." ■

Forests growing over shale bedrock help fight climate change

Implications boost case to save Appalachian trees

By Ad Crable

A swath of forests in the Appalachian Mountains in Pennsylvania, Virginia, New York and West Virginia store much more harmful carbon than surrounding forests and should be conserved in the name of climate change, a new study says.

The federal government-supported study by two researchers at Penn State University found that trees grow much faster on top of shale bedrock, allowing them to store 25% more carbon — and 55% faster — than trees living above the more prevalent sandstone.

The study, published in *Forest Ecology and Management*, also noted that forests growing over shale have more diversity in tree species. A greater variety of trees will help forests survive better when threatened by shifts in precipitation or invasive species whose populations are projected to increase in a warmer climate, the study found.

Researchers studied forest inventory data from 23,000 trees in the Appalachian Ridge and Valley Region of Pennsylvania. There are about 262,000 acres of forest on shale bedrock in that region. There are four times as many sandstone forests in the region.

Most of the shale forests are on public land, where policy makers in the Pennsylvania Department of Conservation and Natural Resources and the Pennsylvania Game Commission make management decisions.

The researchers said similar ratios of productive shale forests exist throughout the Appalachian Mountains, from northern Georgia to southern New York.

“I have a lot of hope that Pennsylvania and other regions will start to capitalize on our resources in terms of carbon storage. It’s a big tool in the toolbox,” lead researcher Warren Reed said.

Data showing the difference between underlying bedrock has been available for decades, but had not previously been used to understand tree growth or as a possible method of fighting climate change, Reed said.

“I was surprised to find the magnitude of difference so strong in our Ridge and Valley Province,” he said. On average, trees underlain by shale grew more than 19 feet higher than their counterparts in sandstone forests.

Scientists say trees are one of the most



Trees that grow above shale bedrock, left, grow faster and capture more carbon dioxide, a gas that drives climate change, than the more common sandstone forests, researchers have found. Trees growing over sandstone, right, are the predominant forest type in the Appalachians, and grow more slowly, are less tall and less diverse than shale forests (Photos / Warren Reed)



successful and cheapest ways of capturing carbon out of the atmosphere in the fight against global warming. As trees grow, they absorb and store carbon dioxide gas, which traps heat in the atmosphere. Trees soak up the gas and convert it to glucose and oxygen through photosynthesis.

The faster that trees grow, the more carbon they capture. And trees above shale soil grow much faster. That’s because shale breaks down into a soil with a finer texture, allowing trees access to more water during the growing season.

The greater diversity of trees in shale forests also makes them more resilient in dealing with climate change and invasive insects, such as woolly adelgids that are devastating native hemlocks and emerald ash borers that are leveling ash trees.

The study makes the case that shale forests should be high-priority candidates for management and conservation. For example, forest managers could target shale forests for conservation and carbon sequestration, said Margot Kaye, the other Penn State researcher on the project.

Meanwhile, less productive sandstone



The Ridge and Valley Province of Pennsylvania, like some Appalachian forests in other Bay states, grows forests over shale bedrock that may maximize carbon capture to fight climate change. (Warren Reed)

forests could be where recreation and wildlife habitat that involves cutting down trees is concentrated. Pennsylvania’s public forests are a big producer of timber.

In Pennsylvania, the location of shale forests coincides with where hydraulic

fracturing for natural gas is booming. Environmentalists have complained about the loss of trees from well pads, new roads and pipelines.

The newfound value of shale forests may also give private forest landowners an economic incentive to conserve their trees.

There are several private initiatives associated with climate change mitigation in the United States that pay landowners who keep their forests, which creates carbon credits to be applied elsewhere.

For example, in April, Amazon, in association with The Nature Conservancy, American Forest Foundation and Vermont Land Trust, announced a \$10 million program to help family forest landowners in the Appalachian Mountain areas of Pennsylvania and Vermont to sequester carbon by keeping their land forested.

Reed said researchers are already hearing from environmental groups on the East Coast and western states about the findings.

The National Science Foundation and the U.S. Department of Agriculture’s National Institute of Food and Agriculture helped to finance the research. ■

Nutrient trends different from what you think – or not

Modeling, monitoring often at odds over efficacy of practices

By Karl Blankenship

Here are some questions about the Chesapeake Bay restoration effort that might have surprising answers:

- Is the Bay region successfully curbing nutrient runoff from farms?

- Is nitrogen runoff from developed lands really increasing?

- Is the region actually on track to meet its phosphorus reduction goals?

A recent modeling exercise by U.S. Geological Survey scientists suggests the answers to all of those questions might be “no” — conclusions that run counter to conventional notions within the Bay cleanup effort.

The results published in a paper last year are based on a computer modeling exercise that relied heavily on water quality monitoring data within the Bay watershed over a 20-year period.

The exercise found fewer nitrogen reductions from agriculture than estimated by the state-federal Bay Program for the same period, and sharply different phosphorus trends. It also concluded that nitrogen runoff from cities and suburbs is decreasing.

To be sure, there are many caveats to those conclusions, and they do not necessarily mean that Bay Program estimates are wrong.

But the analysis highlights the longstanding question about whether on-the-ground nutrient reduction efforts are producing the expected water quality improvements. It’s an issue scientists have highlighted for years, and it’s drawing increased attention from the scientific community as the region approaches its 2025 Bay cleanup deadline.

The implications are huge. The region has been working since the mid-1980s to reduce the amount of two nutrients, nitrogen and phosphorus, reaching the Bay. In the Chesapeake, they spur water-staining algae blooms that draw oxygen from the water when they die, creating “dead zones” that are off-limits to most aquatic life.

Both the USGS analysis and Bay Program agree that most nutrient reductions achieved to date are from technology upgrades at wastewater treatment plants. With those largely completed, states are counting on greatly ramped-up efforts on agricultural lands, which generate the majority of the nutrient runoff, to meet Bay goals



U.S. Geological Survey employee Michael Brownley collects water samples and other data at Red Bridges on the Choptank River on Maryland’s Eastern Shore. (Dave Harp / 2010)

But the USGS analysis indicates that it’s uncertain when and if those farm-based practices — such as nutrient-absorbing cover crops, vegetated buffers along waterways or plans to guide manure management — will achieve clean water goals.

A second USGS paper published this summer laid out a number of reasons for that uncertainty. For one, it can take a long time for some on-the-ground actions to benefit the water. But other factors could be at play, too. For instance, runoff control practices may not be as effective as thought.

“People want to understand as they’re putting in the practices, are we getting the reductions we anticipate?” said Scott Phillips, USGS Chesapeake Bay coordinator. “We’re seeing that the nutrient reductions in monitoring data vary greatly across the watershed, making the comparison to reduction efforts more difficult. We’re continuing to use multiple tools to explain trends.”

Different approaches, different results

The Bay Program tracks cleanup efforts using its Watershed Model, which has been refined and peer-reviewed over three decades. It predicts how cleanup actions and other factors, such as land use changes and population growth, will affect the amount of nutrients entering the Bay. It suggests slow but steady progress in reducing nitrogen and phosphorus.

But its results have not always aligned with the data collected at scores of water monitoring sites throughout the watershed that paint a more nuanced picture.

From 2009–18, for instance, monitoring showed that for nitrogen, 41% of monitored sites had reductions, 40% had increases and 19% had no trends.

For phosphorus, 44% of locations had reductions, 33% had increases and 23% had no trend.

By the time the water that passes through

those monitoring stations reaches the Bay, the results — at best — are mixed. Most of the Bay’s nine major nontidal rivers have no trends or worsening trends for nitrogen and/or phosphorus over the past decade. Only the James and Patuxent rivers show improving trends for both nutrients.

The USGS analysis examined the implications of those trends over time using data from 1992, 2002 and 2012 in its highly regarded SPARROW model (that stands for SPATIally Referenced Regressions On Watershed attributes). Using those results, and other data — such as nutrient inputs, land use and geographic settings — it analyzed what those various monitoring results meant for the Bay.

The SPARROW model indicated that the amount of nitrogen entering the Bay declined, but about 25% less than what the Bay Program estimates for the same time.

More than 80% of the reductions stemmed from wastewater plant upgrades. Most of the rest came from reductions in air pollution: a decrease in nitrogen oxide, emitted by power plants and vehicles, which enters waterways after it falls to the ground.

The analysis also indicates that nitrogen runoff from developed lands — often called the only major source of nutrients still on the rise — also declined during the study period, though phosphorus was largely unchanged.

Most worrisome, though, it found no overall nitrogen or phosphorus reductions from the region’s vast agricultural lands. The Bay Program model estimates a 17 percent nitrogen reduction from farms and an even larger phosphorus reduction during that 20-year period.

And while the Bay Program considers phosphorus reductions to be largely on track to meet cleanup goals, the USGS analysis showed that overall phosphorus loads actually increased 9% during the study period. The Bay Program estimates phosphorus declined by nearly a third during that time.

Why the difference?

The USGS analysis is part of an effort to explain those differences, a task that is becoming more urgent as the 2025 cleanup deadline approaches. The Bay Program has a workgroup exploring the issue, and its Scientific and Technical Advisory Committee is identifying Bay-related science needs for a report expected next year; a better understanding of factors behind nutrient trends is one of the areas being examined.

In one of its recent papers, the USGS cited four likely reasons for the differences.

■ **Lag time.** Unlike wastewater discharges that go directly into rivers, most other nutrients are applied to the land, usually as fertilizer or manure. A portion of those nutrients may wash directly into streams when it rains. Most of the nitrogen, though, soaks into the soil and flows into waterways through groundwater, a journey that may take years or decades. Phosphorus, which tends to bind with soil particles, flows slowly downstream, typically moving relatively short distances during large storms. Not only is the movement of nutrients to streams slow, but some practices, such as a newly planted forest buffer, can take years to reach its maximum effectiveness.

■ **Unrealistic expectations.** The Bay Program's computer model uses assumptions about the expected nutrient reductions from a wide variety of on-the-ground pollution reduction practices. But the number of studies about the measurable impact of those practices is often limited. And estimates are complicated because differences in soil, topography and other factors may result in different effectiveness from place to place.

■ **Insufficient monitoring.** Much of the monitoring in the watershed is conducted at scales too large to detect small changes. More monitoring in small watersheds where a large number of runoff control practices are installed could provide better insight about their effectiveness.

■ **Competing factors.** The benefits of runoff controls may be offset by other issues. Intensification of farm activities, such as converting low-runoff hay fields to high-runoff crop lands, increasing numbers of farm animals, or changes in fertilizer or manure applications, can offset the impact of nutrient reduction efforts. Over time, the Bay Program has made efforts to address some of those issues, such using more up-to-date data to account for the intensification of farm activities.

Scientists generally agree that lag times almost certainly play a role in explaining some of the differences between the monitoring data and Bay Program estimates.

The Bay Program's Watershed Model is essentially trying to predict whether management actions being taken now will meet cleanup goals when they are fully effective in the future. That predictive capability is needed for states to estimate how many buffers must be installed, cover crops planted, or wetlands restored, to meet Bay goals. Each year, states provide data about actions they took in the past 12 months



Michael Brownley, of the U.S. Geological Survey, examines a water sample in the lab. (Dave Harp / 2010)

so the model can estimate the impact they will have at some point in the future — if they perform as expected.

Because the USGS model relies on water quality monitoring, it would not quickly reflect the impact of those actions because of the lag time in nutrients reaching streams.

The Bay Program model did not include a mechanism to account for lag times until three years ago, and that function is not used for management. But the first attempts to factor lag times into model estimates did show that nitrogen trends in many areas became more similar to monitoring results.

“When we make an estimate of what happens when you incorporate lag time, it makes a big difference,” said Gary Shenk, a USGS hydrologist who coordinates the Bay Program's watershed model.

Concerns continue

While lag times likely cause real delays in water quality responses, many scientists say it's unclear how much of the differences they account for.

Particularly disturbing, some say, is the failure of the SPARROW model to detect

any major changes in nutrient pollution from farm lands, even though it covered a 20-year period when the use of runoff control measures was accelerating.

Bill Dennison, vice president of the University of Maryland Center for Environmental Sciences, and co-chair of a Bay Program workgroup that coordinates monitoring and modeling analysis, said attributing all of the differences to time lags is “a common fallback for dealing with uncertainty and dealing with impatient people. Officials and resource managers really want to see a response.”

The good news, he said, is that the Bay has shown improvements from reduced wastewater discharges. Underwater grass beds have expanded and smaller oxygen dead zones have shrunk. “The Bay is very responsive,” Dennison said. “You can turn off the sewage and get a response and in a year or two.”

But trying to relate actions in the watershed to impacts on the Bay, he said, is “an order of magnitude” more difficult.

Studies show little change in the total amount of nitrogen applied to farmland over the years. That means it's critical to find out whether nutrient control actions

are succeeding in keeping them out of the water.

“We make some assumptions about how effective these practices are, but they may not be performing as we expect,” said Zach Easton, a professor at Virginia Tech and member of the Bay Program's Scientific and Technical Advisory Committee.

One way to help reduce uncertainty, Easton said, would be to increase small-scale monitoring to understand how well, or whether, nutrient concentrations in streams respond to on-the-ground actions. “The level of monitoring just is not sufficient to detect the signals,” Easton said.

More local monitoring could also shed light on the USGS study's conclusion that nitrogen runoff from developed lands is decreasing.

The exact driver for that change is uncertain, but the papers suggested a variety of factors, including impacts of runoff control efforts, reduced sewer line leaks, or better efforts to pick up pet waste. “I don't know if we know the answer to that at this point,” acknowledged Scott Ator, a USGS hydrologist, and lead author of the recent papers.

But his papers were not the only ones to detect that trend. USGS scientists say several limited monitoring efforts have shown a nitrogen decrease from developed lands, and a separate USGS modeling effort reached a similar conclusion.

The different monitoring and modeling results for phosphorus also are not fully explained by lag times. Some factors are known: More phosphorus bound to sediment is passing through Conowingo Dam on the Susquehanna River because its reservoir is filled and no longer trapping it. And some agricultural areas where soils are saturated with phosphorus are leaking it into waterways at increasing rates. But scientists say the full reason for increasing trends is unknown.

Understanding these and other uncertainties has major ramifications for 2025. If all cleanup actions are implemented, would it be acceptable to wait — potentially for decades — to see whether the Bay responds as anticipated? Or, should more work be done as a hedge against the possibility that some actions are not as effective as thought?

The Scientific and Technical Advisory Committee will produce recommendations next year.

But, cautioned Kurt Stephenson, a Virginia Tech professor overseeing the effort, “whatever we recommend is not going to all of a sudden solve the mystery. The uncertainty is inherent. We're never going to eliminate it, so we have to manage in the face of it.” ■



Alice Volpitta, Baltimore Harbor Waterkeeper, shown here collecting water at Canton Waterfront Park, checks bacteria levels weekly around the Inner Harbor. (Dave Harp)

Safe swimming and fishing in Baltimore Harbor? Not so fast

After a decades-long cleanup campaign, views on what constitutes progress differ

By Timothy B. Wheeler

Ten years ago, fed up with floating litter everywhere and frequent whiffs of sewage, Baltimore’s business, government and civic leaders launched a “Healthy Harbor” campaign to clean up the long-polluted waterway in the heart of Maryland’s largest city. They vowed to make it swimmable and fishable by 2020.

Now, with the arrival of that self-imposed deadline, the Waterfront Partnership, as the business-led group is known, has declared victory — sort of.

Amid a multibillion-dollar sewer overhaul in the city and suburban Baltimore County, water sampling shows that bacteria levels from chronic sewage leaks and overflows have improved to the point that much of the harbor is usually safe to swim in, at least during dry weather.

A trio of popular floating “trash wheels” deployed over the last six years, meanwhile, has intercepted nearly 1,500 tons of trash and debris washed down storm drains and feeder streams before they could get into the harbor.

“Today, the harbor is just as swimmable as bodies of water located in or adjacent to other cities across the country,” said Michael Hankin, president and CEO of an investment firm at the Inner Harbor who chaired the partnership when it began the cleanup campaign.

He mentioned Boston, Chicago, San Francisco and the District of Columbia as Baltimore’s peers in cleaning up their water ways — though it’s still illegal to take a dip in the District’s waters despite similarly improved bacteria levels in the Potomac and Anacostia rivers.



Plastic bottles, foam cups and other flotsam collects between a boat and dock in the Inner Harbor. (Dave Harp)

“Like those cities,” Hankin said, “the [Baltimore] harbor isn’t going to be swimmable every day. No urban waterway is or can be.”

But at a livestreamed announcement on Sept. 23, Hankin promised that next year, “as soon as we get through the pandemic,” he’d lead a celebratory swim across Baltimore’s harbor.

He was joined online by Brandon Scott, City Council president and Democratic nominee for mayor in November’s election, who said he was looking forward to kayaking in the harbor after being told growing up that the water was unsafe even to touch.

Adam Lindquist, director of the partnership’s Healthy Harbor campaign, said the group believes it’s time to pivot from a decade-long focus on cleanup to encouraging more recreational activities in the harbor. He said they want to start by holding swim events, but they are also exploring the creation of a kayak launch and water trail for paddlers in the harbor.

And while Lindquist called it “aspirational” for now, the partnership unveiled a conceptual drawing of a permanent swim spot that it would like to establish in the Inner Harbor by the Maryland Science Center.

“We think it’s an amazing natural resource that is underutilized,” he said. “Part of the reason ... is this stigma which is not entirely accurate any more about water quality in the Baltimore Harbor. “

Too soon for swimsuits

Not everyone, though, is as ready to jump in.

Jenn Aiosa, executive director of Blue Water Baltimore, said that while some cleanup efforts seem to be moving in the right direction, her group believes there’s more to do before declaring the harbor swimmable.

“I’m a pragmatist more than anything,” she said in an interview before the partnership released its Harbor Heartbeat report card on the state of the harbor. “And I think it is still too soon to say, ‘Hey, everybody, put on your swimsuit.’”

The partnership’s leaders say they’re not advocating for anyone to start swimming in the harbor right now. It’s still a busy place at times for tour boats, cargo ships and pleasure boats, so suitable areas for swimming need to be identified. And because rainfall can wash sewage and polluted stormwater into the harbor, they first want to work out a system for signaling the public when it’s safe and not safe to get on or in the water.

They also want to wait at least until the city completes its \$430 million “headworks project” aimed at fixing a misaligned sewer connection to the Back River wastewater treatment plant. The problem is believed to be responsible for 80% of the sewage overflows citywide. That work is expected to be finished early next year.

It’s part of a citywide sewer system overhaul mandated in 2002 by a federal consent decree. The effort is expected to cost \$2.6 billion before it’s all done as much as a decade from now. It’s being paid for in part by state and federal funds but also by steep increases in residents’ water bills. Baltimore County, which pipes its

sewage into the city for treatment, also has invested \$1.5 billion over the past 15 years under a separate decree to fix leaks and overflows in its system.

It appears that the lengthy repair efforts are finally getting results, Aiosa said. Water monitoring that her group has been doing since 2009 shows bacteria levels have trended down significantly at 34 of 49 spots sampled in the harbor as well as in its tributaries, the Jones Falls and Gwynns Falls.

But Alice Volpitta, the Baltimore Harbor Waterkeeper, noted that even with those trends, bacteria levels in some spots spike unpredictably, even when the sun is shining.

Volpitta samples the water weekly for fecal bacteria from sewage, but she said it takes at least 24 hours to get results. Until there's a way to reliably measure or predict levels on a given day, Volpitta said, there's still some risk of getting sick by swimming, wading, paddling or even fishing in sewage-tainted water in the city's harbor and streams.

Indeed, Aiosa and Volpitta contend the city should be posting signs around the harbor, as it has in the streams, warning the public that the water could be contaminated at times by sewage overflows, particularly after rainfall. State regulations require notices to be posted in affected areas, and Jennifer Combs, spokesperson for the Department of

Public, said the city posts signage about sewer overflows where required.

Ecological health still poor

Meanwhile, other indicators of the water's ecological health aren't improving, they note. Nutrient and sediment pollution remain a problem in the streams and the harbor. They suspect those worsening trends stem from increased stormwater runoff from pavement and buildings.

"We really don't want to lose sight of the fact our ecosystem health is nowhere near where it needs to be," Aioso said, either to meet the region's responsibility to help restore the Chesapeake Bay or to ensure that local residents have safe, clean water in which they can recreate.

Almost unmentioned in the upbeat announcement of improving bacteria levels was the Healthy Harbor campaign's other goal, which was to make local waters fishable by 2020. In one sense they already are: crabs, striped bass and other fish are routinely caught from piers and other unofficial fishing spots around the city.

But the sediments on the bottom are contaminated with toxic metals, pesticides and other chemicals left behind by industries that have since been largely replaced by tourist attractions, restaurants, offices and condos.

The state has issued advisories urging anglers to limit the frequency with which they eat locally caught fish and crabs because



Tim Marshall prepares to throw back a white perch he caught at the Baltimore Rowing Club pier on the Middle Branch of the Patapsco River. Maryland has issued advisories urging anglers to limit their consumption of perch and a number of other fish because they're contaminated with polychlorinated biphenyls, or PCBs. (Dave Harp)



People jog and stroll along the waterfront promenade in Canton. Contending that bacteria levels are low enough now to safely permit swimming and other water activities, the Waterfront Partnership wants to hold swim events, encourage more kayaking and even install a permanent swim spot. (Dave Harp)

they're contaminated by polychlorinated biphenyls, or PCBs. Once widely used as insulators in all kinds of equipment, PCBs were banned in 1979 because of human health threats, but they linger in sediments and get picked up by fish.

Anglers also are warned about eating some local fish because of mercury contamination, which stems in part from continuing emissions of the toxic metal by coal-burning power plants and trash incinerators — like the one near the Ravens stadium, where the Gwynns Falls flows into the Middle Branch of the Patapsco River.

Those cautions don't always have an impact; there are no signs around the harbor warning anglers about contamination risks. One recent morning, Tim Marshall was working a pair of fishing rods at the end of the Baltimore Rowing Club pier on the Middle Branch. In town from Prince George's County to visit his girlfriend, he said he was just casting for sport and tossed back small perch and spot he hooked. But at the next pier over, two people were crabbing, apparently for keepers.

Unlike the sewage and trash cleanups, there's not been a concerted effort in Baltimore to deal with those contaminants, counting instead on cleaner sediments to gradually bury the toxic ones and reduce the hazards to fish and people. Until the fish are free from toxic contaminants, Aiosa said, the harbor won't truly be fishable for those who crab and fish to feed themselves

and their families. And the contamination even poses some risk to swimmers and waders if they stir up the tainted sediments, she pointed out.

Lindquist said the partnership defines "fishable" differently, considering the harbor fishable if anglers are no longer at risk of getting sick from handling fish caught in sewage-fouled water. They'll still need to heed the fish consumption advisories, he said.

The partnership wants to work with Blue Water Baltimore and city, state and federal agencies on developing a system for letting the public know when bacteria levels are low enough and it's safe to go in or on the water. It's also laid out a 10-point action plan for the next decade, including increasing recycling, reducing waste and making the city a hub for green jobs.

More immediately, the partnership expects to soon deploy a fourth trash wheel, this time at the mouth of the Gwynns Falls, to augment the litter cleanup efforts.

In the meantime, the group thinks it'll help advance further cleanup if the public can get on or in the harbor.

"The people of Baltimore have paid hundreds of millions of dollars in fees and taxes to clean it up," Lindquist said. There's still work to do, he acknowledged, especially in trying to curb stormwater runoff. But the progress seen in reducing sewage in the water "means it's time ... to start managing the harbor as a recreational resource for the city and state." ■

Will loopholes in toxic discharge rule hurt regional waters?

Weakening of federal rule could let some power plants seek to delay or relax cleanup agreements

By Timothy B. Wheeler

The Trump administration's latest move to ease regulatory requirements on the nation's coal-burning power plants is expected to have limited impact in the Chesapeake Bay region because several facilities discharging toxic pollution have already agreed to clean up or decided to shut down their operations.

But environmental groups and at least one state regulator are still worried that the weaker standards set by the U.S. Environmental Protection Agency could lead to more toxics in the region's waterways over the next several years.

The EPA announced in late August that it had revised a 2015 Obama era regulation to give coal plants more leeway and more time to curtail discharges of toxic metals such as arsenic, mercury and selenium into lakes, streams and rivers.

Agency officials said the new rule would save the power industry \$140 million a year while resulting in a greater cleanup. The revisions do so by "leveraging newer, more affordable pollution control technologies and taking a flexible, phased-in implementation approach," according to EPA Administrator Andrew Wheeler.

Critics, though, said the EPA has carved some big loopholes in the Obama rule that will allow plants to continue and even increase their discharges of toxic contaminants.

"The EPA is making it easier for the most-polluting and worst-run coal-fired plants to dump poisons into the waterways our communities depend upon," said Frank Holleman, senior attorney with the Southern Environmental Law Center.

The EPA's revision of its Effluent Limitations Guidelines, as the discharge rule is called, is among dozens of regulatory holdups or rollbacks initiated by the Trump administration, many of which have been challenged in court. This one is significant, Holleman said, because by the EPA's own estimate at least 30% of all by toxic water pollution discharged by industries comes from coal-fired power plants. The technology to prevent and treat the toxic discharges is "widely available," he said.

The 2015 rule, imposed after the EPA was sued by several environmental groups,

required coal plants to treat toxic contaminants in wastewater generated when they wash out their air pollution scrubbers. It also required plants to stop discharging wastewater that contains ash from coal-burning, which also contains toxins.

The original rule would have required most plants to install water-pollution controls by 2020. But the EPA put it on hold in 2017, saying it intended to revise it.

"If EPA were following the law, the coal industry would be close to eliminating its toxic wastewater by now," said Abel Russ, senior attorney for the Environmental Integrity Project.

Ben Grumbles, secretary of the Maryland Department of the Environment, said the new rule is actually more stringent "in a few ways," such as the limits it places on mercury and nutrient discharges.

But it significantly relaxes discharge limits on selenium, which Grumbles called a "big concern." Selenium in water can harm fish and wildlife. In humans, it can cause neurological and respiratory problems and is considered a probable carcinogen.

Grumbles said his biggest concern is that the new rule delays compliance five years to as late as 2028. "That matters for local waters and the Bay," he said.

Still, the EPA's action has less impact in the Bay watershed now than it might have had earlier. Grumbles and others noted that several big coal plants have already shut down or announced plans to do so in the next few years.

GenOn, Texas-based owner of three coal plants in Maryland, has shut down one at Dickerson on the Potomac River in Montgomery County and announced plans to close another at Chalk Point on the Patuxent River in Prince George's County.

Those actions came after Maryland regulators ordered the state's coal plants to meet the discharge limits in the EPA's 2015 rule — though they offered to delay the deadline to 2023 if the plants volunteered to meet even lower limits.

For its Morgantown plant on the Potomac River in Charles County, GenOn opted to comply with the toxic limits set in its renewed discharge permit.

Talen Energy, another Texas company,



The C.P. Crane power plant near Baltimore, shown in 2017, shut down its coal-burning units. Critics of the new EPA rule say it may allow other plants to delay compliance with discharge limits. (Dave Harp)

has indicated plans to do likewise with a pair of plants outside Baltimore on the Patapsco River — Brandon Shores and H.A. Wagner — though possibly delaying compliance to 2023.

A Chicago-based company has shut down coal units at another plant, C.P. Crane, near the mouth of the Gunpowder River north of Baltimore.

The revised EPA rule leaves it up to states to set compliance deadlines. But it also opens the door for plants that had to meet stricter limits under the 2015 rule to petition state regulators to relax them.

David Smedick, coordinator of the Sierra Club's Beyond Coal campaign in Maryland, Delaware and the District of Columbia, said activists would be on guard against any effort by plant owners to take advantage of the new guidelines and roll back the requirements imposed on them. "The new Trump rollback does not entitle GenOn or Talen ... to new permits with the weaker limits or delayed compliance deadlines," Smedick said.

In Pennsylvania, water pollution permits for all of the state's coal-fired power plants had already been updated to include the requirements of the Obama era rule.

That happened after the Sierra Club sued the state Department of Environmental Protection because most of the permits had long since expired and were overdue for updating.

"That said, any plant that hasn't already installed controls to comply with the 2015

limits could apply to amend their permit with the new weaker limits," according to Tom Schuster, clean energy program director for the Sierra Club's Pennsylvania chapter. "But it would be subject to public notice and comment, and we would aggressively fight the change."

There are six large, conventional coal plants left in Pennsylvania, two of which are in the Bay watershed, Schuster noted. Of those, Schuster said, Brunner Island on the Susquehanna River near Harrisburg, also owned by Talen, is scheduled to stop burning coal by 2028. There are 10 smaller plants that mainly burn coal mine waste, he said, but they don't discharge much.

Virginia, likewise, has six coal-fired power plants left operating, but a new law enacted this year committing the state to 100% renewable power by 2024 is expected to force the closure of most. Dominion Energy has already committed to retiring the coal-fired units at its Chesterfield plant on the James River by the end of 2024. The company also has retrofitted the facility's bottom ash system to halt discharges, according to spokesman Jeremy Slayton.

Dominion's spokesman said the company's Mt. Storm plant, in West Virginia, recycles the water used in its air pollution control system so that none is discharged into a lake that drains to the North Branch of the Potomac River. There are plans to retrofit the bottom ash cleanout system to meet the rules, with a deadline to be set by state regulators, Slayton said. ■

Battles over forest conservation continue in Maryland

Suits in Harford County oppose clearing trees for business park

By Timothy B. Wheeler

The forest teems with wildlife behind Michael and Lisa Lyston's home in Abingdon, MD. Over the years, they've been visited by foxes, opossums, deer, raccoons, owls and woodpeckers — not to mention turtles, toads and “tons of butterflies.”

“They just come up here and go back home,” Lisa Lyston said. “They know they're safe here.”

But barring a reprieve from the courts, the neighborhood is destined to become a lot less wild. Most of the woods near their home are to be bulldozed for warehouses, shops, restaurants, a hotel and a gas station.

A developer plans to build Abingdon Business Park on the wooded 326-acre tract, one of the largest patches of forest left in this heavily developed part of Harford County near the head of the Chesapeake Bay.

Opponents say if that happens, it shows how both Harford County and the state government are failing to safeguard Maryland's shrinking supply of ecologically important forestland. “I feel so bad for all these birds and everything that lives back there,” Lisa Lyston said, choking back tears. “It kills me.”

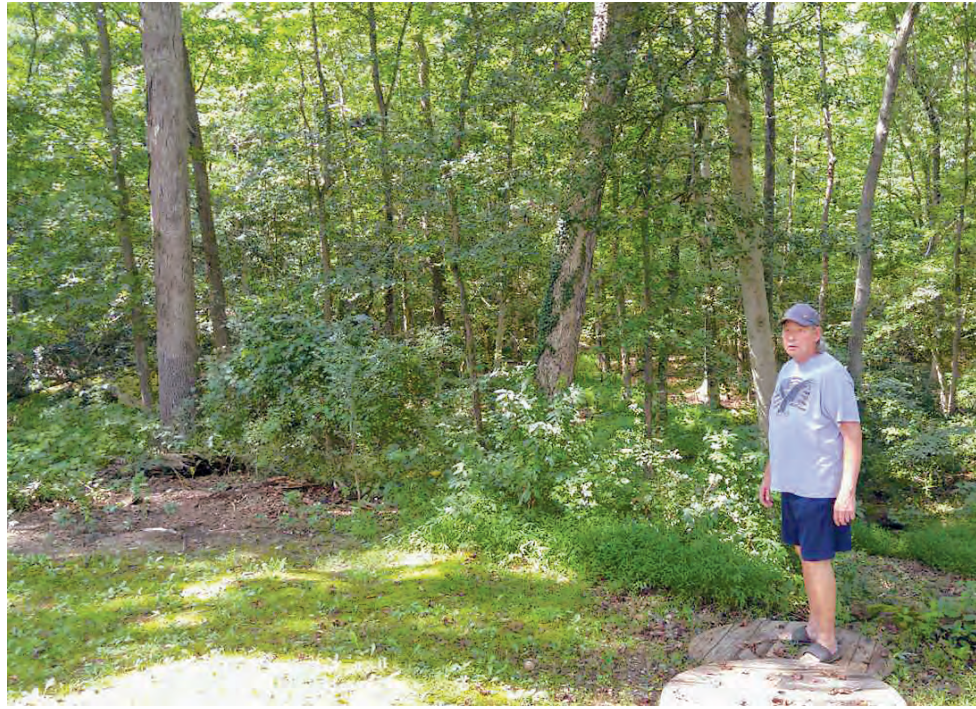
Nearby residents and environmental advocates have been trying since last year, so far unsuccessfully, to save “Abingdon Woods,” as the tract was once known.

But the property by Interstate 95 has long been zoned for commercial and industrial development. The county even placed it in an “enterprise zone” to encourage economic activity there.

Harford County is still mostly rural. But only about a third of its land is forested, according to data from the state-federal Chesapeake Bay Program. Development pressure has been intense along I-95 and, according to the Bay Program, the county could lose nearly 2,300 acres of woodlands between 2013 and 2025.

“We've been opposed to the development on the grounds of loss of forest and wetlands areas so close to the Bay,” said Tracey Waite, president of Harford County Climate Action and head of a coalition opposed to the business park. “Also, in this time of climate change, we don't believe there should be this level of deforestation in our county.”

Harford County Executive Barry



Michael Lyston stands in his backyard, which borders Abingdon Woods in Harford County, MD. He and his wife, Lisa, have lived there for 15 years and say the 300-plus acre forest teems with wildlife. (Lisa Lyston)

Glassman declined to discuss the project in detail. Instead, he pointed to the efforts his administration has made to preserve about 3,500 acres of farmland, recently adding 347 Bayfront acres near Havre de Grace.

But Waite said the county hasn't put as much money or effort into preserving green space in the southern portion of the county, which she said has a greater proportion of people of color and low-income families. Nearly half of the students attending William Paca/Old Post Road Elementary School, which abuts the business park site, are African Americans and nearly 15% are Hispanic, according to Schooldigger.com. Nearly three-fourths are eligible for free lunches because they're from low-income families.

Bonita Holland-Buchanan, vice president of the African American Democratic Club of Harford County, said she's concerned about children at the school having to breathe air laced with vehicle exhaust from business park traffic.

“There's already a problem of so many kids having asthma now,” she said, adding that “our children deserve better than to breathe poisonous fumes from diesel trucks.”

Opponents of the business park have gone to court. The Chesapeake Bay Foundation and four neighbors of the woods filed suit earlier this year challenging Harford County's approval of the developer's forest conservation plan. The Gunpowder Riverkeeper and other neighbors have

filed two suits challenging the Maryland Department of the Environment's permit allowing the developer to build roads across streams and take out some wetlands.

The developer's plan calls for clearing 220 acres of forest to make way for more than 2 million square feet of warehouses plus other commercial buildings and pavement. The remaining 95 acres of woods would be placed under a protective easement meant to prevent further disturbance. As mitigation for removing so much forest, the county is requiring the developer to plant new trees on a little more than 8 acres onsite.

Like most localities in Maryland, Harford's forest conservation ordinance mirrors the state Forest Conservation Act, which requires counties and municipalities to protect important woodlands from development or have trees replanted onsite or elsewhere. Environmentalists contend the state law isn't strong enough, in part because the state exercises little oversight of how localities enforce it. Recently, though, a few counties have beefed up their laws beyond what the state requires.

Opponents of the Abingdon project argue that Harford County isn't even following state law in approving that development. For instance, they note that county officials granted the developer a waiver from the law's requirement to minimize loss of large “specimen trees,” authorizing the cutting down of 49 of the 85 largest

trees identified in Abingdon Woods.

“It's just so obscene,” said Jeanna Tillery, another local resident. “I can't imagine why anybody would think to do something like that, especially in an area like this where we have many warehouses already, many of them unoccupied.”

Jim Lighthizer, managing partner of the Chesapeake Real Estate Group, which is developing the business park, did not respond to requests for comment. In applying for needed permits, the firm said it chose Abingdon Woods for its proximity to I-95 and the Port of Baltimore. While acknowledging there are 18 vacant warehouses in the region, the developer said this is the only suitable site for a large distribution complex.

County officials declined to answer questions about the project, citing the litigation.

“It is the county's position that the development approvals for Abingdon Business Park were appropriate,” said Cynthia Mumby, a county spokeswoman.

County officials have argued that their approval of the developer's forest conservation plan is not appealable. A Harford County Circuit Court judge heard arguments on that point in August. A decision is pending.

The MDE permit for stream crossings and wetlands disturbance has drawn fire. Theaux Le Gardeur, the Gunpowder Riverkeeper, and residents near the site asked the Harford court to review the permit, which includes permission to bridge Haha Branch, which flows into the Bush River.

The Bush River is already impaired by nutrients and suspended sediments, Le Gardeur pointed out. Plus, he noted, some of the tree clearing would occur near Otter Point Creek, which the state has designated a high-quality stream. To make up for clearing more than 5 acres of woods there, the MDE has required the developer to plant trees on half that many acres of farmland elsewhere in the watershed.

The MDE has previously bucked local approval of large-scale removal of forests. In 2019, state regulators denied permits for two large solar energy projects in Charles County that together would have cleared 400 acres of privately owned woodlands.

Asked if he'd join other county executives in seeking to strengthen the local forest conservation law, County Executive Glassman said he's waiting for an update from the state Department of Planning on how much of the county is still forested. “We'll take a look at those trend lines,” he said, “and see if we need to do anything else.” ■

Black farmers embrace African practices as empowering

Many turn to sustainable, methods with roots in their cultural heritage

By Jeremy Cox

At Thelonius Cook's farm, roots aren't just connected to crops and orchards. They're also connected to history.

Cook uses certain plants to attract pests and keep them away from his crops. He also avoids tilling the soil and sows "cover crops" in the fall to reinvigorate fields — all techniques drawn from his African ancestors. In such ways, Cook said he is honoring his heritage while protecting the environment.

"Everything I do, I try to encourage a natural ecosystem, a closed loop," said Cook, founder of the Mighty Thundercloud Edible Forest on Virginia's Eastern Shore.

The share of farms operated by Black people nationwide has plummeted from 14% at its peak in 1920 to 1.7% as of 2017, according to the U.S. Department of Agriculture. Historians point to myriad causes for the decline, but chief among them is racism.

Persistent racist violence forced many African Americans in the South to flee to northern cities. For Blacks who remained, White-dominated loan boards often blocked federal aid from reaching their farms if they were members of the NAACP or other civil rights organizations. Some never prepared wills, leaving their acreage to multiple heirs who ultimately lost the land to tax sales or real estate hucksters.

Cook is part of a small but growing movement within the Black agricultural community that recasts farming — which, for African Americans, has long been associated with forced labor — as a path toward dignity, empowerment and greening the Earth. They are writing a new history, one newly sprouted farm at a time.

Growing food & a movement

Cook grew up across the Chesapeake Bay in Hampton. Agriculture was in his genes. His family raised a garden of green beans, collard greens and other vegetables. His father once grew flowers for his own florist business.

But Cook wound up heading in another direction, studying information technology at James Madison University and jetting off



Thelonius Cook checks on his fall harvest at his farm in Birdsnest, VA, as volunteer Deanna Jamison looks on. The Mighty Thundercloud Edible Forest is patterned on indigenous African farming techniques. (Dave Harp)

to East Africa to work for an international development organization.

In places like Tanzania and Mozambique, he worked closely with farmers, showing them ways to run their businesses more efficiently. Along the way, those farmers gave him informal lessons in the region's homegrown agricultural practices.

Many of those practices have survived for centuries. For instance, because many African farmers lack capital to buy tractors or other large pieces of equipment, tilling — churning the soil to spread oxygen and nutrients throughout the root zone — simply isn't possible on a large scale. So, they turn to compost and animal manure to revive their soil.

"Everywhere I've travelled, I've loved picking farmers' brains," Cook said.

After getting a master's degree in

sustainable development from Royal Holloway, University of London, he returned to Hampton Roads in 2014. When not working as a freelance web developer, he started preparing a new life for himself and his father's old flower field in Northampton County on the Bay's Eastern Shore.

The family had leased the 7.5-acre plot to farmers for decades. The relentless rotation of wheat and soybean crops had left the soil nearly exhausted, Cook said. "You couldn't take a hand tool and break it."

With little expectation beyond growing some food for himself, he began applying the farming lessons he had acquired overseas to his own acreage.

Soon, he was growing enough food for his family. Then enough to sell. Then enough to make a living.

You name it, Cook grows it: hemp,

squash, ginger, callaloo (a leafy green from Jamaica), hibiscus, flowers, mushrooms, cucumbers, peppers, cherry tomatoes, watermelons, broccoli, pumpkins, black garlic and kale.

Don't bother looking for neat rows of crops. Cook's planting beds are loosely organized. Weeds are given room to grow. The only structures in sight are two high tunnels (arched, greenhouse-like growing buildings) and a raised wooden workshop.

If it looks more like a forest than a farm, that's the point, Cook said.

"Any time you see a forest, it's usually a sustainable ecosystem," he said. "There are no pests out of control. The dirt is usually black earth."

Not just for White men

Part of the reason that Black farmers

remain so rare is that working the land still gets a bad rap, Cook said. “They’ve been made to turn away [from farming] because of our history in this country” with slavery, he said. The typical reaction he hears is, “I don’t want to go back to the plantation.”

Many black farmers share similar experiences. “When I first got into this in the early ’80s and told people I was going to school to study agronomy [soil science], folks looked at me like, ‘Why would you do that?’” said Mchezaji “Che” Axum, director of urban agriculture and gardening education at the University of the District of Columbia. Of the dozens of classmates in his major, only three were people of color, he recalled.

In recent years, Axum said he has noticed a “big movement” among Black farmers toward embracing organic methods. These aren’t practices borrowed from White organizations and individuals but rather from within their own cultural heritage, reaching back to the verdant plains and terraced slopes of Africa.

“You can’t really start Black agriculture with slavery and servitude,” Axum said. “It’s way before that.”

A key thought leader and practitioner in the movement calls it “Farming While Black.” In her 2018 book of the same title, Leah Penniman outlines a step-by-step business plan for aspiring Black and Brown farmers seeking a harmonious relationship with the environment.

For Penniman, the path to farm ownership began with a summer job at an urban food project in Boston operated by and largely for people of color. But that was followed by one gig after another at farms throughout the Northeast where the faces she saw were almost invariably White.

“It’s White men who are presented as experts” of organic agriculture, Penniman said. “I had reached a crisis point in my early 20s about whether I was really an agriculturalist.”

A five-month visit to Ghana helped change her mind. Back at home, she forged bonds with other Black farmers. Together, they launched in 2010 the first and now annual National Black Farmers and Urban Gardeners Conference. That year, she struck out on her own, founding the Soul Fire Farm in Petersburg, NY, about 25 miles east of Albany.

Along the way, she discovered that many of the practices embraced by White organic farmers also existed in African and Afro-Caribbean agrarian societies. Among them: a Haitian method of rehabilitating eroded hillsides with trenches and vegetated strips, southern Africa’s Ovambo people’s practice



The 7.5-acre farm on Virginia's Eastern Shore is part of a growing movement of Black-owned agricultural operations that embraces organic practices that can be traced to African cultures. (Dave Harp)

of using raised beds, the Kenyan trick of hurling mucky soil uphill to form terraces.

At Soul Fire Farm, food is a platform for social transformation. Until COVID-19 washed out this year’s programming, the farm offered people of Black, Indigenous and Latinx backgrounds opportunities to work and learn organic farming techniques. The cost is on a sliding scale of \$100-\$1,500.

Since 2014, the farm has been partnering with the Albany County District Attorney’s Office to give youths caught up in the court system a 50-hour training program as an alternative to being incarcerated. Penniman said that all aspects of her work have gained urgency this year after police killings of Black people triggered massive protests across the country.

“Unlike maybe past generations where we see issues as really siloed, the movement for Black lives sees all the issues as integrated. We can’t just isolate one issue,” she said.

Reclaiming the past

Back in Virginia, Cook praises Penniman’s book for resetting the narrative about Black agriculture and slavery.

“It’s just acknowledging the reason we were brought here,” he said. “We were brought here as agricultural experts.”

With each passing year, the soil beneath

Cook’s crops gets darker and healthier. He sells food at three farmers markets on the Eastern Shore. And he participates in the community supported agriculture program for the Hampton Roads region, which seems to be one of the best marketing avenues for local farmers: Customers purchase advance subscriptions for regular food deliveries. About three-dozen clients have signed up with Cook’s farm.

He hopes to inspire other new and aspiring Black farmers. He speaks at conferences (virtually these days), hosts training events and boasts healthy followings on Facebook and Instagram.

As he sees it, the slightly unruly farm is an oasis of green that, unlike many of its neighbors in the rural region, can point to being metaphorically green as well. All of it accomplished while being Black. ■



Thelonius Cook checks on a plant inside one of his tarp-covered greenhouses. (Dave Harp)

James River shad face upriver battle for comeback

Many hurdles, each capable of derailing repopulation efforts on its own, plague fish

By Whitney Pipkin

A pair of professors at Randolph-Macon College near Richmond likes to challenge their students with real-world problems. When they asked the James River Association what puzzle they should task a class of environmental studies majors with solving, Riverkeeper Jamie Brunkow pointed to the near absence of American shad in the river.

“It’s a real example where the experts don’t know what’s going on,” James Brunkow said. “It’s a bit of an environmental mystery.”

Brunkow said shad jumped to the top of his organization’s list of concerns while working on the 2019 *State of the James* report. Nearly every other measurement of water and wildlife health seemed to be improving, except the population of American shad, which came in at 1% of the goal the group had set for the species.

The declining number of shad is not a new concern for local river groups — or for scientists across the Chesapeake Bay region and the entire Atlantic Coast.

All along the coast, shad populations have been idling at a historic low, despite millions of dollars invested in their restoration.

A recent study by the Atlantic States



James Riverkeeper Jamie Brunkow (center) asked a group of students at Randolph-Macon College earlier this year to study why American shad weren’t making a comeback in the river. The organization’s virtual reality goggles helped the students envision a future waterway that is cleaner — and perhaps has more shad than it does now. (Charles Gowan / James River Association)

Marine Fisheries Commission calls the shad population “depleted” from Maine to Florida. In the Bay region, the Rappahannock and York rivers fare slightly better with a death rate described as “sustainable.” But, in the James River, shad numbers have remained stubbornly low despite decades of effort focused on their revival.

Shad setbacks

Fishery authorities began taking the major steps decades ago that should have helped shad rebound in the region — but to little avail.

A state moratorium on the inland harvest of shad has been in place since 1994 to curb overfishing. Also in the early ’90s, the Virginia Department of Game and Inland Fisheries (now the Department of Wildlife Resources) began stocking shad in the upper James River system to encourage them to repopulate historic spawning grounds.

By placing millions of shad fry each year into the river just upstream of Boshers’ Dam, the hope was that the fish would return to that location as adults to mate. In 1999, the department opened a fish passage system at Boshers’ Dam intended to deliver shad to that location and also to open up more than 100 additional miles of river that had been blocked to spawning for decades.

But the fish still aren’t taking hold in the James.

In 2003, the fishway passed close to 1,000 American shad. In recent years, the passage saw a few dozen fish go through and, in 2019, the cameras counted one

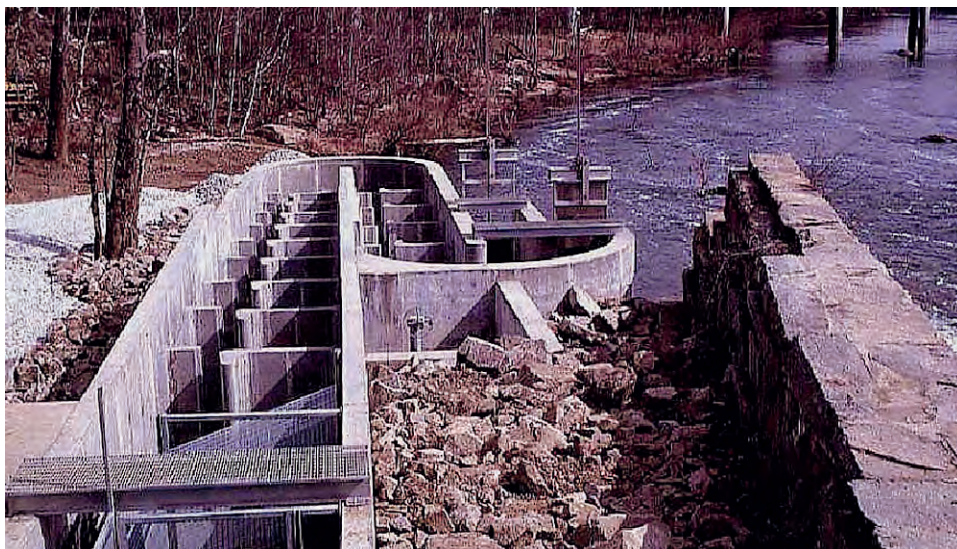
American shad making the trek.

“I always tell people, ‘You can’t pass what isn’t there,’” said Alan Weaver, fish passage coordinator for the Virginia Department of Wildlife. “When there were more fish in the river, we would see more fish in the fishway.”

State and federal agencies that had been pouring funds into shad stocking programs couldn’t ignore the dismal results anymore. Virginia ended its stocking program near Boshers’ Dam in 2017. Were stocking to begin again, it would be because a group of scientists, biologists, fishery managers and others that make up the Virginia Alosine Taskforce recommend stocking as a viable management strategy for restoration.

But, at least in the James River, there is work to be done first. That’s the assumption many organizations involved in shad restoration have made after pouring fish for years into a system that didn’t seem to be reproducing them at the rate it should have. And the Randolph-Macon students, after spending a semester studying shad setbacks, agreed.

Under nearly every rock the environmental problem-solvers turned, they found



This fish passage at Boshers’ Dam was designed to convey American shad to the upper reaches of the James River beyond Richmond where they once spawned. (Courtesy of James River Association)

another steep obstacle facing the fish that were once so plentiful that they sustained early settlers along the James River.

“A lot of students thought we’d find one piece of evidence that has to be what’s causing the problem,” said Brycen Boettcher, a student in the spring class who now works as a fisheries technician at the Virginia Department of Wildlife Resources. “But it’s more than just one simple thing causing a decrease in the whole population.”

Assailed by problems

The students found that nearly every major problem facing American shad in the James River was enough to keep the fish dying faster than they can reproduce.

They looked at the estimated population of shad in the river and started subtracting: How many juvenile fish are sucked into the water intake system of a power plant? Eaten by blue catfish before they make it back to their spawning grounds? Caught as bycatch in the ocean before they even begin their inland run?

Often, the students ran out of fish before the exercise was over. But it demonstrated that any one of these factors could be suppressing the population enough that stocking new fry into the river seems like little more than putting a band-aid on a gaping wound.

“Everyone’s always looking for the smoking gun: What’s the one thing you could change to make it better? And I think it’s really death by a thousand cuts,” Weaver said. “The population of American shad was so low when we started [restoration efforts] in the 1990s. Even though the fish is a prolific spawner, there are so many things that are more difficult than what they faced before.”

Professors Mike Fenster and Charles Gowan, who co-taught the problem-solving class at Randolph-Macon, say the goal of their real-world investigations is to let the students dive into a complex environmental problem and emerge with priority areas for their “client,” in this case the James River Association, to address.

“There are so many threats that the strategy really becomes figuring out what to tackle first,” Fenster said. “That really has to be about where you can get the biggest bang for your buck.”

What to prioritize?

In their reports, the students pointed to many of the factors that the James River Association has been working on for decades, and to some that it could do more to address. Poor water quality plays a part, particularly when too much sediment in the water prevents underwater grasses, a key habitat



These American shad were caught in 2014 using a gill net in the Pamunkey River, a tributary to the York River. Members of the Pamunkey tribe operated a shad hatchery until a few years ago. (Dave Harp)

for shad, from thriving. The nonnative and voracious blue catfish that fill the James River also play a large role, as they feast on juvenile shad, but they are well-established now and seem impossible to eradicate.

The data also began to suggest that the large water withdrawals and intake systems of power plants could be one of the factors causing shad to fare worse in the James than in other Chesapeake Bay rivers. Dominion Energy’s Surry and Chesterfield power stations each withdraw millions of gallons of water from the James.

Each of these withdrawal systems is subject to a permit process that is occasionally up for renewal and scrutiny. After reviewing current state standards, the students said that both facilities could improve their water intake systems to align with current state standards to reduce the number of fish drawn in with the water. The river association is already involved in the water withdrawal permit process for one of those plants and poised to participate in the other

when it begins.

In 2015, the Chesterfield station found two dead Atlantic sturgeon larvae and one adult sturgeon in its water intake system, which triggered a lengthy federal process intended to protect the endangered species. The station is seeking an “incidental take”

permit from the National Marine Fisheries Service that would allow it to continue operating despite a potential impact to the endangered fish, a process that could require changes to the water intake system that could also benefit shad.

Another step that might to help the James’ shad population is to improve fish passage at one of the four dams along the river or remove some of the dams entirely. The students suggested that dam removal, while costly, could benefit from a new windfall of public approval nationwide for such projects and from the river’s increased use by paddle sports enthusiasts. And technological improvements to existing fish passages could give more fish a chance to spawn.

Other factors that could keep shad from rebounding involve coastal challenges. Fisheries experts continue to be concerned about the amount of American shad being harvested as bycatch in the ocean. And there are also a host of other impediments as the fish make their way from inland rivers to overwintering in Canada’s Bay of Fundy.

Erin Reilly, staff scientist at the James River Association, hopes the shad’s story in the James will one day be like that of the river herring or the sturgeon: a species back from the brink after decades of painstaking work. She pointed out that the population of anadromous fish species, which swim upriver to spawn each year, can ebb and flow dramatically; a good spawning year can lay the foundation for a rebound a few years later.

The end of shad stocking is likely to cause more dramatic declines for a few years, “but we haven’t given up on them,” Weaver said.

“I have no idea what the future is,” he said. “It’s not as bad as it was when we started this work, but we’re not where we hoped to be 20 years into it.” ■

“...We haven’t given up on them.”

— Alan Weaver
Virginia Department of Wildlife



A kayak edges near the remains of the Clementtown Mill dam and locks on the Appomattox River in Virginia. William Clement served as one of the county's earliest justices during the 1740s. The Clement family also erected a grist mill just below the confluence of the Appomattox and Bent Creek. (Brendan Burke)

Shadows of a bustling past haunt Appomattox's quiet shores

VA archaeologist inventories historical ruins along river's upper reach

By Tamara Dietrich

In 1612, Capt. John Smith became the first European to produce a detailed map of the Chesapeake Bay region. He used the same mode of transportation that cartographers had used for millennia: a boat.

Water routes — like the vast network of rivers and creeks in the Chesapeake region — have been essential for nearly all of human history: to explore and migrate, to procure and transport food and resources, to wage war, and to conduct trade and commerce.

“Waterways were incredibly important, and have been for thousands of years,” said archaeologist Brendan Burke, president of the Maritime Heritage Chapter of the Archaeological Society of Virginia.

“They’re landmarks. They define areas and places. We now think of boundaries as lines on maps, but very often they were defined by waterways — your country, your province, your kingdom, whatever.”

The mammoth Bay watershed with its extensive maze of tributaries stretching more than 64,000 square miles — from what is today New York to West Virginia to Virginia's southern tip — was particularly appealing to colonists precisely because of the relative ease of travel by water.

Any river or creek navigable by canoe was by nature a water road, Burke said.

But over the centuries, other modes of transportation have replaced water routes. Once-bustling riverside communities petered out, buildings and bridges tumbled

and canals dried up. Wetlands and forests resurged to supplant them.

“Today,” Burke said, “creeks and rivers silently flow through communities largely unaware of their historical importance.”

Field surveys can document what’s left. And Burke, who studies the role of rivers in trade and commerce, recently finished field work on a portion of the Upper Appomattox.

Burke’s work there was not the first. In the 1970s and ‘80s, Virginia historian Bill Trout set out to inventory historic features along the Appomattox, from its confluence with the James River at Hopewell in Prince George County to its navigable head near Planterstown, a historic community in Buckingham County.

Trout, founder of the Virginia Canals & Navigations Society, focused his survey on areas where land and water were altered to enable waterborne commerce — the places where people cleared, deepened and straightened streams, installed canals and locks, and built bridges and aqueducts. He documented the many mills that sprang up along the riverbanks to harness the power of the water.

But Trout’s inventory is starting to show its age. “Anybody that’s lived along the waterways knows that waterways are in constant change,” Burke said. “They never stay the same. The stream bank might be moving to and fro, sandbars cover and uncover things. We have better technology now. Bill had a canoe and his eyeballs and a



This stone abutment at Goode's Bridge marks a former Appomattox crossing. (Brendan Burke)

camera, and Bill did wonderful work — he’s a friend of mine — but much of that work was done 40 years ago.”

Burke’s more recent survey was supported by a \$10,000 grant from the Virginia Department of Historic Resources. He focused on historic navigational structures and resources from 1740–1880 that directly related to commerce.

“It’s an important part of archaeology not to just say, ‘I’ve done it, now I can walk away,’ but, if the site’s still there, to check in on it, see what’s left; or, is there more of the site that was exposed and never seen before,” Burke said.

There was some urgency in the mission: Because of more intense flooding and erosion associated with climate

change, plus easier public access to remote areas, such sites are increasingly at risk from storm damage, vandalism and looting.

The Appomattox flows west-east for 157 miles along or through parts of 10 counties before joining the James. Its largest cities are Farmville and Petersburg. Flat Creek is one of its tributaries, running 34 miles.

Rise & fall of river trade

It was largely the Virginia colony's lucrative tobacco trade that fueled inland migration and the need to get the crop to market and ports in Europe. Other crops like wheat, corn, oats, barley, salt and lime, as well as animal skins and fur, were also loaded on bateaux and canoes and carried on the river.

In the early 1700s, English, Scotch-Irish, German, Swiss, French and Dutch immigrants began trekking farther inland, sometimes bringing enslaved laborers. Homesteads, plantations, towns, ports and navigation rose up along waterways.

It was crucial to keep those waterways navigable. In 1745, the Virginia House of Burgesses forbid felling a tree across a navigable river or creek or failing to clear fish weirs by October each year. It also allowed counties on the upper Appomattox and James to send teams to clear obstructions every spring. Mill owners were not allowed to build dams that blocked boat traffic.

In 1795, the Upper Appomattox Company, a public-private shareholding venture heavily subsidized by the state, was formed to build the river improvements needed to keep boats moving. From 1794 to the 1870s, Burke writes, there were a total of 13 canal companies and 22 navigation companies throughout Virginia.

By 1821, the Appomattox had four mills with dams requiring locks: the Genito, Clementtown, Stony Point and Royaltown. Mills typically became gathering places for farmers and merchants. Communities sprang up around them, often taking on the name of the mill.

By 1840, more than 100 miles of the Appomattox were more navigable. Cargo volumes on the river skyrocketed.

But there was a storm brewing: In the late 1840s, a startup called the Richmond and Danville Railroad was chartered.

Rails could go where rivers couldn't, and carry cargo and people more efficiently and reliably.

Within just a few years, canal companies were crippled. By the end of the Civil War in 1865, river trade had, for all intents and purposes, dried up.

"It was unfortunate, because for a lot of these canals, it was a huge undertaking," Burke said. "It took multiple phases, investment strategies and even failings to get the whole system up and running. And by the time they got all that done, after about 30 years, the railroad comes along and basically buys it and puts the tracks down on top of the towpaths."

Over time, riverside businesses and buildings were abandoned. Mill towns faded. River improvements fell into disrepair. Stretches of the Appomattox and its tributary creeks became less and less navigable, clogged with fallen trees and crumbling bankside infrastructure.

As Burke writes, the last known boatman to ply the Appomattox for commerce was a man named Jim Seay around the turn of the last century.



Giles Mill on Virginia's Appomattox River consisted of a mill, store, corn crib, headrace, millpond and other associated structures. The mill has been known by several names and is thought to have been constructed during the early 1800s. This remaining structure collapsed not long after this photo was taken in March 2020. (Brendan Burke)

'Historic eyes watching you'

To catalog what remains of the heyday of the Upper Appomattox river trade, Burke set out in December 2019 in a 49-pound kayak/canoe. Fourteen days of field work stretched over three months in all kinds of weather.

Field notes were impossible while paddling, so he hung an iPhone on a lanyard around his neck for audio notes and photographs.

"Being on a river by yourself, where you're kind of drifting with the kayak, is a really magical experience. It's just you and the wood ducks," Burke said. "And then you've got a lot of — I don't want to use the term 'ghosts' — but you've got a lot of historic eyes watching you."

Whenever the river became impassable from fallen trees or other impediments, he set out on foot to gather research and interview local landowners. He covered nearly 37 miles by foot and boat.

He augmented field work with LIDAR data downloaded from the Virginia Geographic Information Network's website. LIDAR uses airborne laser technology to gather billions of

points of data, enabling 3D images of ground features.

Burke couldn't find a number of sites from Trout's original survey.

"Some of that might have just been the water was too high at the time," Burke said. "And other sites had just naturally changed over the course of erosion and natural forces. It's good to document that rate of decay. It would be unrealistic to think that everything had stayed the same for 40 years."

But many other features still hang on — the ruins of mills, dikes, canals, bridges and earthen fortifications.

Giles Mill, for instance, also known as Royaltown Mill, was a grand five-story structure and "beautiful piece of architecture," Burke said. It was built in the early 1800s and expanded over generations and is the subject of some of his most striking images.

The building's owner had tried unsuccessfully to find a way to preserve it.

"He was very kind to allow me permission to explore it," Burke said. "And not long after the ink had dried on the report, the mill collapsed. It was the last standing mill in Amelia County, so I was honored to see it before it was taken to its knees."

"But that's what happens to communities: They come, and they go."

All that remains of Goode's Bridge, built in the early 1700s, are large stone abutments rising at least 30 feet high on the riverbanks. The bridge was first mentioned in the House of Burgesses in 1746. In 1781 during the Revolution, it was blocked by Continental forces; during the Civil War, portions were burned in a vain effort to prevent U.S. cavalry from crossing into Amelia County. The bridge was finally abandoned in the 1960s when a new highway was built.

And all that's left of Tucker's Ford, Lock and Dam, a 19th-century river crossing, is a low stone feature, likely part of the original lock, and a shallow depression, once the canal. LIDAR imagery suggests where the old roadbed led to the river and the ford.

In his report, Burke recommends more enhanced surveys of the riverbanks in the summer and during periods of drought when water levels are lower and historical features more visible. He would also like to see more surveys with LIDAR and sonar imaging for deeper water.

Burke encourages local governments and citizen advocacy groups to partner with state tourism agencies and conservation and recreation programs.

He'd like oral histories of inland navigation collected, coordination with local historical societies and riverkeepers, and more emphasis on public outreach and education about a fading heritage.

"Ideally, what you would do is develop a sense of community ownership for historic resources and prehistoric resources," Burke said. "Where folks say, 'Let's preserve these things intact — that way, the grandkids and the great-grandkids can enjoy them just like us.'"

"When you move past a stone pile of rubble that once was a mill dam around which people congregated and shared news and laughed and wept and did all the things that humans do, and now it's just a pile of rubble, it's neat to know and learn about the stories of those folks. About how communities formed and failed and why that matters." ■



Fall in love with Ricketts Glen State Park in PA

By Ad Crable

From the top of the mountain, starting out on Falls Trail in Ricketts Glen State Park in northeastern Pennsylvania, an unnamed stream sidles up to the path, just a wisp of water bathed in filtered sunlight. The sounds of late-summer insects and bird calls drown out even the faint tinkling of the water.

The first murmur of running water soon comes faint through the dense forest, about a half-mile down the trail. Then, rounding a bend, the mild-mannered stream throws itself off a ledge, plunging 37 feet into Mohawk Falls.

Far from being tamed by this abrupt fall, the stream goes wild, dashing into nine other falls in less than a mile through Ganoga Glen. That's 350 feet of waterfalls. A parallel ravine, Glen Leigh, has another eight named waterfalls, and there are three more after the two streams hook up and flow through Ricketts Glen.

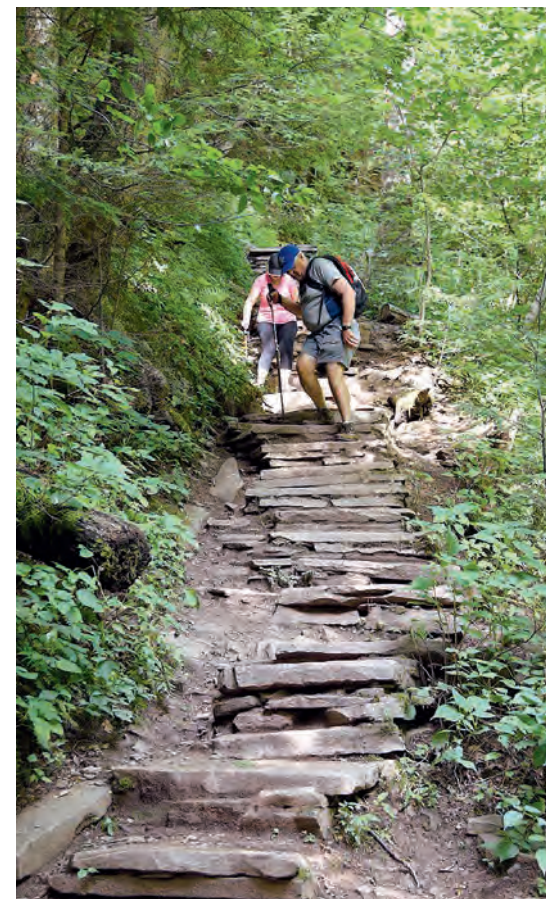
The 21 waterfalls, ranging in height from 11 to 94 feet, are the largest concentration of significant cataracts in the eastern United States and many consider the Falls Trail network, which can range from 3.2 to 7.2 miles in loops, the most scenic hike in Pennsylvania.

The waterfalls are located in the 13,000-acre

park's Glens Natural Area, which was designated a National Natural Landmark in 1969. Some think the scenery is worthy of being a national park; in fact, in the 1930s, the area was approved for just that, but World War II scuttled the idea. Instead, it opened as a state park in 1944.

If the necklace of scenic falls wasn't enough of an attraction, the sprawling park in Pennsylvania's Endless Mountains also has a beautiful mountaintop lake, 245-acre Lake Jean, where only paddling and nonmotorized boats are allowed. Though closed in 2020 because of the coronavirus, you can normally rent paddle boats, kayaks, canoes and paddle boards to tour the lake. Fishing is allowed. Swimming along the 600-foot beach also is a popular draw.

There are approximately 28 miles of hiking trails in the park. Though overshadowed by the famous waterfall hikes, I was bowled over by the 1.2-mile Highland Trail, which connects two of the major waterfall glens. A ridgetop gem in its own right, the trail passes through jumbles of house-size boulders and tabletop cliffs distributed by glaciers. At Midway Crevasse, you actually shimmy through a fracture in the Pocono sandstone.



Top photo: Oneida Waterfall in Ricketts Glen State Park in Pennsylvania plunges over a curved rock rim. (Ad Crable)

Bottom photo: Much of the trail along the waterfalls in Ricketts Glen State Park is on uneven and often slippery rock staircases. Appropriate footwear is a must. (Ad Crable)



If views are your thing, hike the 1.9-mile Grand View Trail to an old fire tower. You can't climb the tower but you will find wide views of the entire park, the Allegheny Front that you are atop and the distant Susquehanna Valley. On a clear day, you can see three states.

These features attract hundreds of thousands of visitors a year from all over the country. But, no question, the falls are the marquis display.

They were formed by glaciers. Though Native Americans undoubtedly knew of them, the story goes that they were "discovered" by a father and son on a fishing expedition in 1865. The land was owned by Col. Robert Bruce Ricketts, who fought for the Union at the Battle of Gettysburg.

A lumber baron who owned a stately mansion on a nearby lake, Ricketts declared the two glens containing the waterfalls off-limits. He hired a crew of six men to build a trail along the falls from 1889 to 1893. The land that makes up a majority of the park was sold by Ricketts' son to the state.

Another 48,000 acres became state game lands.

The first thing you need to know about the Falls Trail is that, despite its popularity, it is no walk in the park. The ravines are steep and much of the trail consists of uneven slabs of stone steps that have no hand rails. The staircases, as well as soil and tree roots on other parts of the trail, are almost always wet and slippery. There are injuries and rescues every year in the park, some for people who have fallen and some for those unprepared for a rigorous hike who become exhausted or dehydrated.

It's not a place for those with bad knees. And don't tackle the hike wearing sandals or sneakers. Sturdy hiking boots with ankle support are advised. I hiked with two trekking poles that saved a couple missteps. And beware the crowds, especially on weekends, that can make the trail a crowded pathway. I went in the morning on a September weekday and encountered relatively few people. But when I returned to the trailhead

parking lot at noon, it was almost full.

I ran into one couple from Texas who were exploring the falls after camping in Shenandoah National Park and were told by a Pennsylvania camper that they just had to see the waterfalls at Ricketts Glen. The couple said they were not disappointed. Tina Guenther said she hardly found so many waterfalls monotonous. Each waterfall, she said, had its own sound.

Amanda Brown, 26, on the other hand, was trekking up the gorges for the third time in three months. Asked why, she said she is humbled by the wonders around her. "I like feeling small so this is where I come," she explained.

I found myself fantasizing about seeing the waterfalls in autumn, with orange, red and yellow leaves falling like confetti and forming rafts of color in the splash pools. Park officials say peak color is usually around mid-October.

No matter what direction you enter the glens from, the series of falls come fast and furious once you reach the first one. In between, the creek forms slides, tubs, flumes and subtle patches of whitewater. Moistened boulders in the creek are clothed in ferns. Rock formations tower overhead.

At almost all of the waterfalls, there are opportunities to pick your way to the base to stare up at the freefalling water and sometimes enjoy the mist on your skin. In a few places, you can almost stick your hand in a waterfall from the trail itself. No wading is allowed, though.

Most waterfalls were named by Col. Ricketts after family members, friends and Native American communities that lived in the area. The names of falls are displayed unobtrusively on signs off to the side.

Like snowflakes, no two waterfalls are alike. Some tumble in steps, some split, some form freefalls. One falls gracefully over a long, curved overhang. Some navigate around boulders and islands of trees as they tumble. Who knew moving water could be so creative? ■

RICKETTS GLEN STATE PARK in Benton, PA, is open year-round. Entrance is free. For information, visit dcnr.pa.gov/StateParks/FindAPark and search for Ricketts Glen.

STAY THE NIGHT

The park has 10 cabins, 5 cottages, 120 tent and trailer campsites and group camping for up to 240 people. Some sites allow pets.

ACTIVITIES

Picnic facilities are scattered throughout the park.

A 600-foot beach is located on Lake Jean. Boat rentals are normally available but have been discontinued for now due to COVID-19. Only electric motors are allowed on fishing boats. Swim at your own risk. Winter activities include ice fishing, cross-country skiing, snowmobiling, winter camping and ice climbing.

Find your way among the falls

There are several ways to hike the three glens containing the 22 waterfalls.

One popular route is also the shortest, passing 19 of the falls in a 3.2-mile loop that begins at the Lake Rose Trailhead parking area. After a short hike, go straight onto the Falls Trail and head downstream into Ganoga Glen. At Waters Meet, cross a bridge and head upstream into Glen Leigh. At the top of the glen, turn left onto Highland Trail back to the parking area.

If you don't think you can handle the steep Falls Trail, take the 1-mile Evergreen Trail loop beginning on route 118. Adams Falls, which some consider the most scenic, is located only about 100 yards down the trail.



Top photo: Kayaks rest along the shore of Lake Jean. (Ad Crable)

Bottom photo: Hikers take a break in front of the B. Reynolds Waterfall. (Ad Crable)



Dave Harp's Chesapeake: 'Where Land & Water Meet'

By Lara Lutz

Photographer Dave Harp has spent decades living life on the edge — of the Chesapeake Bay. Now, in the first exhibition to provide a retrospective look at his work, Harp's photographs trace the beauty of Chesapeake shorelines over a span of 40 years. They also evoke an aching sense of change taking place in both the landscape and the people who inhabit it.

Where Land and Water Meet: The Chesapeake Bay Photography of David W. Harp is on view at the Chesapeake Bay Maritime Museum in St. Michaels, MD, until Sept. 20, 2021, and will be available for virtual visits on the museum's website by mid to late October. While viewing the exhibition online won't compare with seeing it in person, it's a better option than missing it entirely.

"They are beautiful, compelling photos," said chief curator Pete Leshner, "but they also have a message. They tell a story about a changing Bay."

Harp worked closely with Leshner, associate curator Jenifer Dolde and exhibits specialist

Jim Koerner to select images for the show and arrange an attractive and COVID-conscious display. They culled his enormous archives down to about 300 photos, from which they chose approximately 60 as framed pieces and another 60 for a looping slide show.

To promote a safe viewing experience, the wall-mounted photos are spaced a bit farther apart than would have been the case before COVID-19 arrived. Visitors must also wear masks. An interactive kiosk with trailers from *Bay Journal* films, created by Harp, Tom Horton and Sandy Cannon-Brown, provides touch-free operations — you select from the menu by waving your hand across a beam of light.

The theme of Chesapeake shorelines, especially the marshy ones, has been Harp's passion since the 1980s. "So much of life in the Bay is on the edges," he said. "It's where the abundance of life is, whether it's grasses or butterflies or otters. That's where I like to be. It's in the marsh where I'm happiest."



Most of the photographs in the exhibition are in full color, taken from both film and digital formats. But a 9-minute slide show highlights black and white images taken during two weeks in 1976 on a skipjack. They are striking images, including portraits of African American and White watermen, their ships and grueling workdays; many will be seen by the public for the first time. They also document the lost era of working skipjacks.

Top photo: The image of a barn nestled in the mist along a marsh near Maryland's Nanticoke River is one of Dave Harp's favorites. (Dave Harp)

Bottom photo: Photographer Dave Harp sorts through the enormous archive of slides that have accumulated during his career, much of which took place before digital photography became common. (Barbara Harp)



Top photo: A great blue heron shoots the gap between two stands of phragmites along the shore of the upper Choptank River in Maryland. (Dave Harp)

Bottom photo: Icicles on the Rebecca T. Ruark catch a glint of sunshine as the well-known skipjack cruises the Choptank River. (Dave Harp)

As Harp looks at the array of images in the two-story gallery, he sees many other scenes that have changed dramatically or no longer exist: islands that have eroded away, grand trees that collapsed into the water and stalwart residents of Bay communities who have passed away. In one underwater image, fish swim across an old gravestone in the Honga River that was pulled down by rising water.

“Dave is at a point when he’s reflecting on his career in what is arguably a pivotal time for the Bay,” Leshar said.

And despite the untold hours Harp has spent with the Bay and with his photos, the exhibition gives him a new sense of the story his work tells. “It’s an emotional thing to see all of this in one place,” he said. “I’ve never had this perspective before. I want my grandchildren to see it.”

Coupons for a camera

A very young Dave Harp got his start in photography from butter boxes. In the 1950s, he collected coupons printed on butter packages that could be exchanged for different items — and Harp used them to get his first (plastic) camera. His father, Joe Harp, was the likely inspiration.

“My father was a word guy, a newspaper writer and editor, but he was also an avid, obsessive photographer,” Harp said. “So I guess that was the influence that probably got me started.”

The senior Harp was editor of the Hagerstown *Morning Herald* in Western Maryland. As a teen, Harp began helping out in the newsroom. There, he learned about composition, film and processing from news photographer David Cottingham.

At high school, Harp set up “a lovely little darkroom” and served as photographer for the school newspaper and yearbook.

On Nov. 22, 1963, when John F. Kennedy was assassinated, Harp left school midday and headed for the newsroom. He spent the afternoon developing photos that arrived by way of the Associated Press machine and running them to the news desk. Harp said he felt like a part of history. And the experience sealed his interest in photojournalism.

After graduating from Ohio University, Harp got a job at the *Morning Herald* while his father moved on to become editor of the evening edition. He later took on some work at the *Sun* in Baltimore and was offered the position of photographer for the Sunday *Sun Magazine* in 1980.

“It was a dream job,” he said, providing the chance to photograph lots of stories at home and abroad. His work there included the skipjack assignment, which resulted in several images for the magazine and the larger collection of images now on display at the Maritime Museum.

Harp’s time at the *Sun* also introduced him to reporter Tom Horton, whom Harp calls his “work husband.” They began covering the Chesapeake Bay together and have remained in cahoots for decades, collaborating on news articles, columns, books and films about the Chesapeake Bay.

“Dave’s taught me how to see, to appreciate the nuances of light and to embrace dawn and dusk and ignore noon,” Horton said.

After leaving the *Sun*, Harp launched his own

photography business and took on a variety of projects. But he returned to a full focus on his outdoor passions when he went to work for the *Chesapeake Bay Journal* in 2009, and is still on the staff today.

Harp continues to describe himself as a photojournalist or documentary photographer rather than an artist. But the artistry emanating from the Maritime Museum’s walls can’t be denied.

And he prefers, often without success, to emphasize the images rather than talk about his

See **HARP**, page 36



WHERE LAND & WATER MEET: THE CHESAPEAKE BAY PHOTOGRAPHY OF DAVID W. HARP

is an exhibition at the Chesapeake Bay Maritime Museum in St. Michaels, MD, on the Bay's Eastern Shore. You can view the exhibit online or in person through Sept. 20, 2021. The virtual exhibit will be available at cbmm.org starting in mid- to late-October. Access to the exhibition gallery is included with admission to the museum's waterfront campus.

DAILY HOURS

9 a.m.–5 p.m. May–Oct.
10 a.m.–4 p.m. Nov.–April
Closed: Thanksgiving,
Christmas Day and New
Year's Day

ADMISSION

\$14 for adults, \$11 for seniors. Other discounts apply for children, college students and retired military personnel. Admission is free for museum members, active military personnel, and children ages 5 and younger.



Top photo: The last house on Holland Island in the Chesapeake Bay makes a final stand amidst hungry waves and the jagged remains of drowned vegetation. (Dave Harp)

Bottom photo: Louis Phillips, shown here in 1976, was a deckhand on the skipjack Rebecca T. Ruark.

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own role in creating them.

“That’s the artist mindset,” said the museum’s Dolde. “Artists think more about getting their work out there, and not about themselves.”

She noted that Harp is very articulate about his work. “He has a very strong sense of his mission and his method,” she said.

Stories within stories

“Every image [in the exhibition] has a story,” Dolde said. “There’s the literal story, which you can hear from Dave in the captions, and the story you can find in the image personally.”

There are also stories that Harp carries with him from years of intimate moments with the landscape and its people. “Every photo reminds me of an experience,” he said, and the body of work he has produced serves as a kind of family album of memories.

One of his favorite images centers on an old barn in a marsh on Chicone Creek on the Eastern Shore, its wooden white sides pairing with the mist that curls around it. The gold tones of early light on the marsh plants give it a glow of serenity. Yet Harp’s memory of the moment is a little less serene.

“I almost lost my life taking that one,” Harp said, only half joking. “I was standing pushed against the railing of a Route 50 bridge, and the tractor trailers were whipping past in what felt like inches from my head.”

In another image, a group of workboats are tussling in surprisingly close proximity on a churning Bay, its surface nearly midnight blue,

etched by choppy waves.

“It’s very dramatic,” Doyle observed.

“I was literally throwing up trying to shoot that,” Harp said.

More recently, he traveled by kayak to snag shots of a shoreline scene on the Choptank River where a cute otter rose above the surface to watch him. That pair of photos cost Harp two bloody arms and a trip to the doctor’s office: The otter swam up and bit one forearm as he paddled, then shot under the kayak to come up and bite the other one.

The adventure ended with a series of tetanus and rabies shots, but Harp recovered quickly and added the story to his compendium.

You won’t find those stories in captions, but you might hear some of them during an online series of talks the museum is hosting to further highlight Harp’s work. They take place on Oct. 7, Nov. 4 and Dec. 9. For information about registration and fees, visit cbmm.org/HarpArtistSeries.

For beginning photographers or those who photograph the Bay and its rivers for fun, Harp offers this advice: Go out early and go out often. Much of the magic lies in the early morning light. Composition, he says, is critical. “What’s in the frame? What do you want to show? What do you want to say?”

Regarding his own work, Harp is clear about the takeaway message he hopes is in all of his photos. “This is the beauty of what we have and what we stand to lose,” he said. “We really do need to pay attention.” ■



Possumhaw *Viburnum* (*Viburnum nudum*) blooms in all of its fall glory at Dipping Pond Run in Baltimore County. (Dave Harp)

Bay Journal donors are the berry best!

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A beech tree lights up an autumn forest in the Chesapeake watershed. (Dave Harp)

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It's time to reward Bay cleanup *performance*

By Rich Batiuk & Joel Dunn

Partners in the Chesapeake Bay watershed are familiar with the monumental challenges of a pandemic that crosses every border and threatens our health. For 40 years, we have been working tirelessly to address an ecosystemwide threat — a disease, if you will — caused by excess nitrogen, phosphorous and sediment harming the health of our rivers and streams, the Bay itself, much of the Chesapeake's terrestrial and aquatic wildlife and human health.

A total maximum daily load or “pollution diet” now guides the restoration of the Bay and its watershed. The TMDL is the Chesapeake's treatment plan. It is grounded in systemwide science and monitoring coordinated and enforced by the U.S. Environmental Protection Agency and implemented by the states and localities in the watershed. While partners have been successful on a number of fronts, we now face the most difficult stage of treatment.

The sources of pollution that plague the Chesapeake's waterways are well-known: In addition to atmospheric deposition of nitrogen in the Bay, excess nitrogen, phosphorous and sediment flow in from wastewater, urban storm water runoff and farms.

Clean Water Act regulations largely address wastewater pollution and, to a lesser extent, stormwater runoff. Polluted runoff from agricultural landscapes, though, is mainly addressed through voluntary measures like agricultural best management practices, and this presents an entirely different challenge.

Determining the amount of pollution emitted from the end of a pipe (like wastewater) is relatively simple. It is much more difficult to determine the amount and source of pollution dispersed across wide areas, such as farms, lawns and parking lots.

Partners in the state-federal Chesapeake Bay Program use a suite of watershed modeling tools, including the Chesapeake Assessment Scenario Tool (CAST), to understand how nutrient and sediment pollution impacts the Bay and determine how best to restore and protect local waterways.

New innovations, including high resolution satellite imagery and land cover/land use mapping, enable us to estimate



Chesapeake Conservancy team members apply GIS technology for restoration projects in Pennsylvania. (Jody Couser/Chesapeake Conservancy)

pollution loads with more detail than ever before and to prioritize and tailor restoration actions on individual tracts of land. Just as contact tracing and mapping are critical for fighting the COVID-19 pandemic, restoring the Chesapeake will depend on enhanced data collection and high-resolution geospatial analysis to show partners more precisely which conservation and restoration actions are most needed and where best to use them.

With these new tools, partners can better address nonpoint source pollution and revolutionize the cleanup by shifting it from effort-based to performance-based metrics.

The Bay watershed model currently credits the value of a pollution-reduction activity on farmland by watershed sub-basin. The model determines credits for best management practices in almost 2,000 sub-basins with an average size of 33 square miles. In practice, this means that a credit is based on the average performance of restoration practices in that location and the number of acres treated. But with higher resolution data, it is possible to estimate pollutant reduction opportunities

of different BMPs specific to each parcel of land.

For example, it has been known for decades that forest buffers help to prevent nutrient and sediment pollution from entering local waterways. Now we are able to compare restoration opportunities across the landscape by rapidly mapping the agricultural land that drains to each potential buffer. This means that in the near future we may be able to differentiate the projects that filter the most pollution and accelerate Bay restoration with performance-based crediting of the best restoration projects.

Therefore, in the near future, the Bay watershed model could employ higher resolution geospatial data and change how BMPs are valued at the very local scale. Crediting BMPs at a finer scale means that the pollution reduction and the benefits to the local landscape are incorporated in the value of the credit. The location of a BMP on an individual farm and within a local watershed can make a significant difference in water quality outcomes, and this new approach rewards farmers, municipalities and others for the full extent of water quality benefits they provide to our streams and rivers.

The implications of this new approach cannot be understated. To refer back to our medical analogy, this is like diagnosing each patient individually and sending the most effective medicine to the exact part of the body where it's most needed.

The EPA and its Bay Program partners' support for this work has been and continues to be critical to our collective impact on the Bay. By enhancing the accuracy and precision of the data input to the Bay watershed model, as well as how it credits the specific location of individual BMPs, we can optimize the entire restoration approach and meet our cleanup goals faster and at lower costs. ■

Rich Batiuk is the former associate director for science, analysis and implementation with the EPA Chesapeake Bay Program Office. Joel Dunn is the president and CEO of the Chesapeake Conservancy.

LETTER TO THE EDITOR

Natural gas is necessary

I would like to offer the following thoughts in support of the proposed Del-Mar Energy Pathway Project, including the proposed pipeline extension from Salisbury to Princess Anne, MD.

1) The pipeline route generally follows existing road and railroad rights-of-way, and the purported impacts are temporary and appear to be minimal on nontidal streams, nontidal wetlands and wetlands buffers. In total, less than one acre of land will be temporarily disturbed. In comparison, a new central station solar farm has permanent impacts and requires between 5–10 acres per megawatt.

2) Too often, natural gas is viewed as a competitor to renewables. In reality, natural gas is a necessary complement to renewables. For every megawatt of new wind and solar, you have to construct approximately 1 MW of fast start combustion turbines fueled with natural gas. How else do you keep the lights on when the wind does not blow and the sun does not shine? Longer-term, we may get technology breakthroughs that allow us to economically store electricity from renewables, but right now we have no choice but to back up renewables with natural gas.

3) Natural gas does have some greenhouse gas emissions, but it is the cleanest fuel we have available. Natural gas has approximately half the greenhouse gas emissions of coal. New household appliances such as gas furnaces can burn natural gas at more than 95% efficiency.

4) The proposed pipeline will spur economic development in a more sustainable way on the Eastern Shore. Will there be environmental impacts? Sure. But these impacts will be less than any of the current alternatives.

And, by burning more natural gas today, we will displace more egregious fossil fuels like coal and make it less of a challenge for our kids to clean up the environmental mess we leave behind.

*Brad Johnson
President, ACN Energy Investments*

Environmental justice: Equal footing in all decision-making

By Taylor Lilley

Environmental injustice comes in many forms. Throughout the Chesapeake Bay watershed, there are stories of sewage backing up from city pipes into homes, massive power plants built in the middle of rural communities, and neighborhoods surrounded by toxic Superfund sites.

More than 18 million of us share the Bay watershed, but marginalized and vulnerable communities disproportionately shoulder the burden of more pollution, less access to green space and environmental resources and less say in the decision-making processes that affect their well-being.

The consequences of this historic and systematic injustice are devastating. Higher exposure to air pollution has been linked to higher death rates during the COVID-19 pandemic. The neighborhoods most vulnerable to extreme, deadly heat in cities — including Baltimore and Richmond — are the same neighborhoods once redlined under racially discriminatory home lending practices. A 2017 study commissioned by the Chesapeake Bay Foundation found that pollution from the Wheelabrator trash incinerator in Baltimore caused nearly \$55 million in health costs per year, with the greatest health impact occurring in the city's neighborhoods.

The Chesapeake Bay Executive Council acknowledged these disparities at its annual meeting in August and affirmed that the success of Bay restoration efforts depends on the “equitable, just and inclusive engagement of all communities living throughout the watershed.”

As the environmental justice staff attorney for the Chesapeake Bay Foundation, I work to aid and support watershed communities in their fights for clean air and water, with the ultimate goal of dismantling these unfair systems.

Access

To effectively engage in the decision-making process, individuals must become versed in the details of a proposed project and in the regulatory body that governs it.

Most communities become familiar with regulatory processes after learning of the approval of a proposed project — too

late in the game. For example, when the Virginia Department of Environmental Quality held public meetings for the Chickahominy Power Station's groundwater withdrawal application in January, many community members remarked that it was the first time they'd heard about it. At that point, the proposed Chickahominy Power Station had already received an air permit, and the public meeting was the last in a series of meetings that had been held for the groundwater permit.

While most regulators require that notice of a public meeting be posted in a newspaper or on a regulator's website, the notice process is often the subject of great debate. One resident at the Chickahominy public meeting, who lived less than a mile from the proposed facility site, noted that the public meeting notice ran in the paper the day after Christmas. He told DEQ representatives at the hearing that he didn't read the paper that day because he didn't think anyone would put anything important in the newspaper the day after Christmas.

While there are many suggestions for reforming this process, most grassroots advocates agree that expanding notices to include outreach to community centers, churches and direct mail to addresses in affected communities would be a meaningful step in the right direction.

What is more, between jobs, families and transportation, it is not always feasible for community members to attend meetings. Moreover, COVID-19 has illuminated the lack of reliable internet access throughout the watershed and the country. Currently, it is practically impossible to attend and participate in public meetings if you do not have internet access, and updates about a proposed project/application are often found solely online.

Responsive engagement

Once communities understand the project and the process, they must determine how to engage. They may develop a direct response or seek out partners to support their efforts or engage on their behalf. Potential partners might include other community members and grassroots



Bernadette “BJ” Brown speaks to a group on May 17, 2019, to protest a proposed natural gas compressor station in Union Hill, VA. (Nina Ernest/Southern Environmental Law Center)

advocates, nonprofits groups or lawyers — or a mix of these.

Additionally, if a community decides to engage directly, they face the insurmountable task of developing an equal and appropriate response to a project. The projects that most often concern environmental justice communities are extremely complex, and the applications/proposals are often full of scientific and technical conclusions. To respond to those proposals, communities must attempt to craft an equally scientific and technical response.

Litigation process

Engaging in environmental justice litigation is difficult because the process is not meant to be equitable and just; it is meant to be efficient — largely for the government and its agencies.

To challenge a regulator's decision in court, communities must first exhaust all of their administrative remedies. Often, a community will have a legitimate concern or grievance, but it is too late in the process to engage. Further, even if it is obvious that a regulator or project applicant should have done something differently, it only matters

legally if they were required to do something differently. These situations require creativity and persistence. For example, in a case challenging the proposed Buckingham Compressor Station in Virginia, the law didn't specifically mention environmental justice or vulnerable communities. The CBF and the Southern Environmental Law Center argued — and the court agreed — that the law required the regulator to do a meaningful analysis of environmental justice impacts before granting the project approval. That decision likely changed the air permitting process in Virginia to be one that affirmatively requires an environmental justice analysis.

It is impossible to adequately summarize all of the challenges communities with environmental justice concerns might face because every case and situation is different. However, the need to engage as early as possible and collect as much information as possible is a consistent and crucial component of environmental justice advocacy.

It is the responsibility of those who have the capacity and expertise to engage to be a resource for communities and endeavor to support their efforts. To truly achieve environmental justice in the Bay watershed, the Chesapeake Bay Executive Council, as well as the governments and institutions it represents, must address the barriers to meaningful participation that communities continue to face. ■

Taylor Lilley is the environmental justice staff attorney for the Chesapeake Bay Foundation.

SHARE YOUR THOUGHTS

The Bay Journal welcomes comments and perspectives on environmental issues in the Chesapeake region. Letters to the editor should be 300 words or less and may be edited for style or length. Opinion columns should be arranged in advance. Contact editor Karl Blankenship at kblankenship@bayjournal.com or 717-428-2819. You can also reach the Bay Journal by mail at 619 Oakwood Drive, Seven Valleys, PA 17360-9395. Please include your phone number or email address.

It's time to match cleanup assumptions with results, not give up

By Donald F. Boesch

Missed again? That was the discouraging headline on the front page of the September *Bay Journal*. Karl Blankenship's article explains that the Chesapeake Bay states are far off the mark in achieving the nutrient pollution reductions they agreed to put in place by 2025 to reach Bay cleanup goals.

The reductions credited by the U.S. Environmental Protection Agency over the past decade, even in Maryland and Virginia, are predominantly from improved wastewater treatment. Most states would have to accomplish unprecedented reductions from agricultural sources over the next five years to meet their commitments.

I was one of the scientists who participated in the five-year study during the late 1970s that led to the focus on reducing nutrient pollution as key to the recovery of the Bay ecosystem. I was around to see the Chesapeake Bay Program partnership miss its 2000 deadline, and then its 2010 deadline for achieving those reductions. All hands must redouble their efforts to avoid missing the third deadline, but, as a data geek, I have to point out another elephant in the room.

How confident are we that the actions taken will, in reality, result in the nutrient reductions that are credited? When will the Bay actually see their impact? These are not easy questions to answer.

Loads of nitrogen and phosphorus from wastewater treatment facilities are well-monitored, giving us confidence that those reductions have been achieved. Estimated loads from other sources are based on reported on-the-ground runoff control actions, assumptions about their effectiveness in reducing nutrient losses, and computer simulations of how those actions ultimately affect the amount of nutrients reaching the Bay's tidal waters. The EPA's official tallies of nutrient loads from developed lands and agriculture are based on those computer model estimates, not direct measurements.

The model also assumes those actions quickly reduce loads entering the Bay. It does not include multiyear "lags" in delivery as some nutrients linger in soils or move slowly through groundwater. Consequently,



The EPA's official tallies of nutrient loads from agriculture are based on computer model estimates, not direct measurements. (Dave Harp)

the computer model load estimates are difficult to verify with actual monitoring.

Reconciling model estimates with real-world observations is not a new concern. In a 2004 front page *Washington Post* article, *Bay Pollution Progress Overstated*, alleged that estimates derived from computer models were based on overgenerous assumptions and did not agree with water quality monitoring data. The next year, the U.S. Government Accountability Office faulted the Bay Program for comingling various kinds of data such as monitoring data, results of program actions and the results of its predictive model.

In 2009, the EPA requested that the National Academy of Sciences evaluate the Bay Program's accounting of nutrient management practice implementation. It was unable to quantify the likely magnitude or even the likely direction of errors in the Bay Program's tracking of nutrient reductions resulting from management actions in the watershed.

In May 2020, scientists from the U.S. Geological Survey published an important paper on factors driving nutrient trends in streams of the Bay watershed. They also

used a computer model, but one based on the statistical patterns and trends in water quality monitoring at locations throughout the watershed. The estimated loads are normalized for variations in streamflow, but are influenced by whatever lags in management effects acting in the watershed.

Based on this empirical estimation, the USGS scientists concluded that over the 20 years between 1992 and 2012 the declining nutrient fluxes to the Bay were mainly due to wastewater treatment upgrades. The trends also reflected widespread declines in atmospheric nitrogen inputs. On the other hand, their empirical model showed essentially no change in nitrogen loads and increasing loads of phosphorus emanating from agriculture, despite considerable efforts to control nutrients. Surprisingly, estimated fluxes from urban areas declined slightly for nitrogen, despite ongoing urbanization.

In the Bay Program's management model, the reductions in wastewater loadings in both nitrogen and phosphorus are generally similar to those in the empirical model. This is not surprising, because the discharges are monitored and directly enter surface waters, without appreciable lag times. But the management model shows reductions of both nitrogen and phosphorus from agricultural sources of 24% and 45% respectively from 1985 to 2019. And, it shows loads from developed lands increasing by about 45%, opposite the declining trend suggested by the empirical model.

I am not suggesting that one modeling approach is right and the other is wrong. There are a number of possible reasons for the discrepancies between the Bay Program's watershed management model and the USGS empirical model. There are, of course, methodological differences in how the two models simulate the way nutrients are transported to the Bay, including the effects of climatic variability. The management model does not include lag times so on-the-ground actions result in immediate reductions. But those reductions may not yet be fully evident in the observed concentrations used by the empirical model. However, it is also possible that the agricultural practices credited in the management

model have not been implemented to the extent reported by the states or they may not be as effective as assumed.

I have been a nag the past 25 years about the need to reconcile model estimates of reductions with real-world observations because it is critically important in order to adapt practices to achieve desired results. There are only five years left in what, starting with the 1987 Bay Agreement, will be a 38-year effort to reduce nutrient pollution to the Bay. It is past time to verify what the credited management actions will achieve in reality, and in what time frame. I am heartened that USGS and Bay Program scientists are working hard to sort out the degree to which differences in the estimations are attributable to lags in response or erroneous assumptions on the effectiveness of actions that have been, and will be, taken.

This is no time to give up on meeting the Bay nutrient reduction targets, as challenging as they may be. In a flood of new papers, my scientific colleagues have documented improvements in water quality and living components of the ecosystem as a result of those nutrient reductions that have actually been measured. This gives us confidence that substantial further improvements will result if and when the reductions needed to meet Bay cleanup goals are actually achieved.

Come 2025, if the Bay Program partnership falls short, it will have to consider more effective approaches. This is particularly true for agriculture, which is responsible for the largest portion of remaining nitrogen and phosphorus loads to the Bay in both management and empirical models. In a recent review of campaigns to reduce coastal nutrient pollution around the world, I found that substantial agricultural load reductions could only be documented where nutrient management was regulated or public subsidies depended on meeting performance standards. Reconciling management assumptions with empirical observations should inform such future pathways. ■

Donald F. Boesch, the retired president of the University of Maryland Center for Environmental Science, is a member of the Bay Journal's Science Advisory Committee.

To engineer is human; doing it right might require beavers



By Tom Horton

Behold the concrete road culvert: straight and narrow and lifeless, having whisked the previous day's rains from oceans of hard-baked asphalt with ruthless efficiency, swelling quickly to 6 feet deep with stormwater, then receding to less than an inch of water hours later.

Now follow Erik Michelsen across the road, which is Maryland Route 2, a busy four-lane traffic artery connecting Annapolis to Baltimore.

Duck behind a seniors' apartment complex and enter lush expanses of ponds, wetlands and forested creek bottoms that sponsor natural diversity, slow stormwater runoff so it can soak into underground aquifers, allow natural processes time to cleanse and clarify the discharge, and reduce downstream flooding.

One side of the road represents the worst of human engineering, maximizing one thing, water removal, to the ruin of all else. The other maximizes nothing, except life in all of its buzzy, croaky, splashy, winged wonder — water as resource. The latter represents a most hopeful collaboration between humans and beavers, the animals that once engineered the Chesapeake watershed with a thoroughness unmatched even by today's 18 million people.

Before the mid-1700s, when they were virtually trapped out, millions of beavers and their dams and ponds were key to a Chesapeake that was clean and clear almost beyond imagining. Scientific analyses of deep Bay sediments deposited through the centuries have provided us with insights into that astounding ecosystem.

Beavers are coming back, even to the inimical conurbation that is most of northern Anne Arundel County. Michelsen, acting deputy director of the county's Bureau of Watershed Protection and Restoration, is my guide to what is no less than a demonstration project, with beavers themselves doing much of the construction.

For Michelsen, it was good news around 2015 when beavers started showing up on the county restoration project that enhanced the north branch of Cypress Creek here. It drains to the Magothy River and then the Chesapeake Bay. What humans began, the beavers enhanced, impounding the whole stream with a series of dams and ponds.

Until recently, the beavers would not have been embraced for their ecosystem contributions. They'd have been removed, meaning trapped and killed. That's still too common around much of the Bay watershed.

Beavers are compelled to chew, to control their marvelous, self-sharpening teeth that never stop growing; compelled also to dam, annoyed by the sound of flowing water.

The beaver dams here were raising water levels, with a potential to flood Ritchie Highway. The county responded by installing a simple, low-tech device called a pond leveler. A sturdy metal cage toward the lower end of the pond protects one end of an 18-inch diameter plastic drainpipe.

The other end of the pipe exits downstream of the beavers' dam, carrying the sound of flowing water far enough away so they are not motivated to plug it. The whole affair is set up to keep the pond deep enough to make the beavers feel at home, but not so deep as to flood the roadway.

Michelsen estimates there are hundreds of beavers now in Anne Arundel County.

Complaints about beavers typically run about "50/50, flooding and chewing down peoples' trees," said Peter Bendel, with the Wildlife and Heritage division of the state Department of Natural Resources.

"So now it's a matter of education, teaching co-existence, offering solutions, explaining beavers' benefits," Michelsen said.

We headed north up the highway toward where Cattail Creek meanders down



Erik Michelsen stands atop a beaver dam in Anne Arundel County, MD. (Dave Harp)

from big shopping malls and passes under the road by Joe's Seafood and Precision Auto Tune. Clambering down a slope, we picked up an improbable nature trail that skirts several acres of beautiful pond and wetlands. Chisel-like beaver chews are evident on sticks and felled trees as big as 18 inches in diameter. Beavers feed on the bark and use the wood to construct dams and lodges.

The beavers have done the "restoration" here by themselves, Michelsen said. At least twice, the county Department of Public Works trapped them out and tore out their dam. The beavers just moved back in.

The problem was a fear of flooding that raised manhole covers, allowing access to a major sewer line that runs along the creek floodplain. The solution was as simple as pouring a bit more concrete to raise the manhole covers a few feet higher, beyond the threat of flooding. It was a lot cheaper than never-ending trapping, too.

Later that day, south of Annapolis on Flat Creek, a tributary of the South River, we saw an expanse of beaver-wrought wild rice wetlands that looks completely wild, save for twin pond levelers protecting

Governor's Bridge Road from flooding. No single-channel babbling brook here — just a broad and languid flow of water, moving in braids across an expansive floodplain. This was water's chosen way back when both the watershed and the Bay were healthier.

The shift toward an ecological beaver ethic remains slow and uneven across the watershed. Tools like pond levelers, abrasive paint and other techniques to protect trees are available, notably from Mike Callahan's Beaver Solutions in Massachusetts. Callahan's companion Beaver Institute provides both hands-on and do-it-yourself training for organizations or individuals working for a peaceful coexistence with the beavers.

We've scarcely begun to plumb the potential of beavers to restore water's rightful way throughout Bay landscapes. But Michelsen has high hopes. "I am convinced that, even in a highly urban watershed, they can do wonders," he said, "if we just allow them to work." ■

Tom Horton has written about the Chesapeake Bay for more than 40 years, including eight books.



BULLETIN BOARD

VOLUNTEER OPPORTUNITIES

WATERSHEDWIDE

Citizen Science: Creek Critters

Use Audubon Naturalist's Creek Critters app to check a stream's health by identifying small organisms, then creating a report based on what is found. Get the free program at App Store or Google Play. Info: anshome.org/creek-critters. Learn about partnerships / host a Creek Critters event: cleanstreams@anshome.org.

Chesapeake Network

Join the Alliance for the Chesapeake Bay's Chesapeake Network to learn about events or opportunities that protect or restore the Bay, including webinars, job postings, networking. Info: put "Chesapeake Network" in search engine.

DELAWARE

Chapel Branch Nature Area

Join the Nanticoke River Watershed Conservancy 8 a.m.–12 p.m. Oct. 17 at the Chapel Branch Nature Area in Seaford to plant native plants, small trees; cut back encroaching vegetation on trails; move old ties; till an area for a butterfly garden; weed the entry sign location. Bring gloves, tools, if possible. The NRW will provide water, snacks. Bring masks for when social distancing is required. Registration required: 302-337-884, mhmervine@aol.com. To sign up for a specific task, info about the coloring contest: rb.gy/uydbjg.



WORKDAY WISDOM

Make sure that when you participate in cleanup or invasive plant removal workdays to protect the Chesapeake Bay watershed and its resources that you also protect yourself. Organizers of almost every workday strongly urge their volunteers to wear long pants, long-sleeved shirts, socks and closed-toe shoes (hiking or waterproof). This helps to minimize skin exposure to poison ivy and ticks, which might be found at the site. Light-colored clothing also makes it easier to spot ticks. Hats are strongly recommended. Although some events provide work gloves, not all do; ask when registering. Events near water require closed-toe shoes and clothing that can get wet or muddy. **Always bring water.** Sunscreen and an insect repellent designed to repel both deer ticks and mosquitoes help. Lastly, most organizers ask that volunteers register ahead of time. Knowing how many people are going to show up ensures that they will have enough tools and supervisors. They can also give directions to the site or offer any suggestions for apparel or gear not mentioned here.

VIRGINIA

Occoquan River cleanups

Join Friends for Occoquan River and Prince William Trails and Streams Coalition for these cleanups:

- **Lake Ridge Marina in Lake Ridge:** 9 a.m.–1 p.m. Oct. 10. Contact: Renate Vanegas at 703-674-6659.
- **Town of Occoquan:** 9 a.m.–1 p.m. Oct. 10. Contact: Julie Little at 703-491-2168.
- **Occoquan Regional Park in Lorton:** 9 a.m.–12 p.m. Oct. 17. Contact: Alex Vanegas at 703-674-784.
- **Fountainhead Regional Park in Fairfax Station:** Contact: Sonia Monson at 703-581-5487.

Note: Registration for each event will be limited to 10 volunteers per time slot. Grab & go packaged snacks, bottled drinks provided. Wear sturdy shoes, masks. Info / registration: friendsoftheoccoquan.org, foto@friendsoftheoccoquan.org. There is no rain date. In the event of inclement weather, visit facebook.com/www.Friendsoftheoccoquan.org for updates.

International Coastal Cleanup

Clean Virginia's Water, which is participating in the Ocean Conservancy's International Coastal Cleanup, will be following social distancing requirements mostly by replacing larger events with many mini cleanups using a smaller number of volunteers. Small groups register their own time / date in October and pick up cleanup supplies at locations around the state. Volunteers also record data about what they find. This information is used to keep up with trends and develop solutions to marine debris and plastic pollution. Use the forms at longwood.edu/cleanva/VolunteerSiteCaptain.html or the CleanSwell App on a smartphone.

Contacts for supplies:

- **Fairfax:** Clean Fairfax Council. Order supplies, pick them up at various locations. Sign up at least 10 days before cleanup: cleanfairfax.org/programs-events/community-clean-up-program/.
 - **Farmville:** (Prince Edward, Buckingham & Cumberland counties): Borrow cleanup supplies from Clean Virginia Waterways of Longwood University. Call 434-395-2602 at least seven days before event for pickup in Farmville.
 - **Hampton:** Hampton Clean City Commission, Info: causink@hampton.gov.
 - **Hampton:** Hampton Public Libraries have cleanup kits to check out, then return after the cleanup year-round. Call your local library branch for details.
 - **Richmond:** Sign up at least seven days before cleanup for pickup. Contact the Alliance for the Chesapeake Bay at ssstern@allianceforthebay.org or 804-775-0951.
- Registration / info / if your organization has a staffed location and can serve as a supply pickup location: cleanva@longwood.edu, 434-395-2602. Clean Virginia Waterways will send each group/family a certificate of appreciation. Safety guidelines: longwood.edu/cleanva/SafetyPlan.html.

Tree planting sites needed

Goose Creek Association has partnered locally with Friends of the Rappahannock and Weplanttrees.org

to plant 50,000 trees this fall within their watersheds, particularly farms in Fauquier and Loudoun counties. They are looking to plant at least 60 trees for a riparian buffer or reforestation project at each location. There is no cost to the landowner. Volunteers are also needed. Info: info@goosecreek.org.

VA Master Naturalists

VA Master Naturalists are a corps of volunteers who help to manage and protect natural areas through plant & animal surveys, stream monitoring, trail rehabilitation, teaching in nature centers. Training covers ecology, geology, soils, native flora & fauna, habitat management. Info: virginiamasternaturalist.org.

Cleanup support & supplies

The Prince William Soil & Water Conservation District in Manassas, VA, gives stream cleanup events the supplies and support they need for trash removal projects. Groups also receive an Adopt-A-Stream sign recognizing their efforts. For info / to adopt a stream / get a proposed site: waterquality@pwsacd.org. Register events: trashnetwork.fergusonfoundation.org.

Chemical Water Quality Monitoring Teams

Volunteers with the Prince William (County) Soil and Water Conservation District and Department of Environmental Quality Chemical Water Quality Monitoring Teams collect data from local streams. Training includes collection techniques, reading data. Monitoring sites are accessible for easy collection. Info: waterquality@pwsacd.org, pwsacd.org.

PENNSYLVANIA

Middle Susquehanna River

There are many ways to get involved with the Middle Susquehanna Riverkeeper Association:

- **Susquehanna Stewards:** Deliver programming, information to people in their region and help develop new initiatives. Info: middlesusquehannariverkeeper.org.
- **Water Reporter App:** Help to track the health of various fish species in the Middle Susquehanna watershed by sharing photos, locations, other info about your catches via the app. Reports are made available to view via an interactive map at middlesusquehannariverkeeper.org.
- **Share Concerns:** The Middle Susquehanna Riverkeeper Association takes reports of any concern regarding the river or its tributaries very seriously. If you have a report of something out of the ordinary, contact Riverkeeper John Zaktansky at 570-768-6300, midsusriver@gmail.com.

MARYLAND

Free streamside buffers

Stream-Link Education is looking for Frederick County residents who own streamside or riverside property on 2 or more acres of land and are interested in joining a large-scale reforestation effort to protect the Monocacy river and its tributaries. Stream-Link raises funds through grant awards



Submission Guidelines

ONLINE

The *Bay Journal* website has a new look! It also has a new section called **Bulletin Board**, where you can log in and post your own events — and even include a photo. Visit bayjournal.com and click on "Bulletin Board."

IN PRINT

Because of space limitations, the *Bay Journal* is not always able to print every submission. Priority goes to events or programs that most closely relate to the environmental health and resources of the Chesapeake Bay region.

DEADLINES

The printed edition of **Bulletin Board** contains events that take place (or have registration deadlines) on or after the 11th of the month in which the item is published through the 11th of the next issue. Deadlines run at least two months in advance.

November issue: October 11
December issue: November 11

FORMAT

Submissions to **Bulletin Board** must be sent either as a Word or Pages document or in the body of an e-mail. Other formats, including pdfs or Mailchimp, or Constant Contact *will only be considered if space allows* and information can be easily extracted.

CONTENT

You must include the title, time, date and place of the event or program, and a phone number (with area code) or e-mail address of a contact person. State whether the program is free or has a fee; has an age requirement or other restrictions; or has a registration deadline or welcomes drop-ins.

CONTACT

Email your submission to kgaskell@bayjournal.com. Items sent to other addresses are not always forwarded before the deadline.



BULLETIN BOARD

and corporate sponsorships to take on buffer planting projects at no cost to the landowner and without restrictions (no easement required). Its volunteers plant and maintain the young forest for at least three years to ensure an 85% survival rate. Interested landowners should fill out the form at streamlinededucation.org/landowners. Info: streamlinededucation.org/about, 301-473-6844, lisa.streamlink@gmail.com.

Anita C. Leight Estuary Center

Help out at the Anita C. Leight Estuary Center in Abingdon:

■ **Invasinators:** 1–3 p.m. Oct. 18, weather permitting. Ages 14+ Remove nonnative invasive plants, restore native species. Learn why invasives are a threat to ecosystems; how to identify them; removal, restoration strategies. Wear sturdy shoes, long sleeves, work gloves.

■ **iNaturalist Trek:** 10:30 – 11:30 a.m. Oct. 10. All ages, 12 & younger w/adult. Use the iNaturalist app while searching for, collecting biodiversity data on plants, animals.

Registration is required for both workdays. Info: 410-612-1688, 410-879-2000 x1688, otterpointcreek.org.

Cromwell Valley Park

Join the Habitat Restoration Team at Cromwell Valley Park in Parkville, 2–4 p.m. Oct. 10 & 24; and Nov. 14 & 21. (Dates are canceled if there is heavy rain, thunderstorms.) Remove invasive plants, plant natives, maintain restored habitat. Bring your own tools. Gloves, mask must be worn for the initial work discussion. All volunteers must sign waivers; parents or guardians must sign waivers for ages 13–18. Work is inappropriate for ages 12 & younger. Wear long pants, closed-toe shoes, sunscreen, hat. Bring water bottle, insect repellent. Meet at Sherwood House parking lot. Volunteer three times to earn a Cromwell Valley Park Habitat Restoration hat; five times, a handbook, *Native Plants for Wildlife Habitat and Conservation Landscaping: Chesapeake Bay Watershed*. Pre-registration required. Info: Laurie Taylor-Mitchell at lmitchell4@comcast.net. Groups of two or more interested in helping but cannot work on scheduled workdays should contact Taylor-Mitchell. For disability-related accommodations, call 410-887-5370 or 410-887-5319 (TTY), giving as much notice as possible.

Plant a streamside buffer

Stream-Link Education needs volunteers to help plant a streamside buffer 9–11 a.m. Oct. 24 & 31 and Nov. 7 & 14 at Libertytown Farm on Lingamore Creek in Frederick. Registration / info: streamlinededucation.org/plantings.

Report a fish kill

If you see a fish kill, call the Maryland Department of Environment's Fish Kill Investigation Section. Normal work hours: 443-224-2731 or 800-285-8195. Evenings, weekends, holidays, call the Chesapeake Bay Safety and Environmen-

tal Hotline: 877-224-7229.

Breeding Bird Atlas project

Help the Breeding Bird Atlas of Maryland & the District of Columbia, a five-year project documenting the distribution and abundance of local breeding bird populations through looking for nests in backyards, forests. Information collected is used to manage habitat, sustain healthy ecosystems. Info: ebird.org/atlasmdcc/about.

Project FeederWatch

Learn how to count birds for science during Project FeederWatch 10:30–11:30 a.m. Nov. 12 at Cromwell Valley Park in Parkville. After the training, adult volunteers meet weekly for a 1-hour shift (Nov. 18–April 8) Wednesdays and Thursdays at the center. Dress for weather, training takes place outside. Reservations not required. For details, including COVID-19 protocols: cromwellvalleypark.org. Info: info@cromwellvalleypark.org, 410-887-2503.

Severn River Association

Work independently on land & water to track conditions in the Severn River's watershed using COVID-19 safety protocols developed with the MD Department of Natural Resources to protect staff and volunteers working in the field. Training will be offered as circumstances allow. Citizen scientist opportunities include:

■ **Water Quality Monitoring:** Through October. Conduct weekly boat tours to monitor the river's health.

■ **Water Quality Crew:** Morning river cruise collects scientific data and monitors wildlife habitat.

■ **Tell Severn's Story?** Writers, photographers, reporters, memoirists are needed to record tales of river's wildlife, people, forests, history, culture and sailing. SRA can create internships for journalists of all ages who want to tell a story, cover meetings, take pictures.

■ **GEMS Expedition:** Explorers, naturalists, foresters are needed for a land-based expedition to map 500 ecological features throughout the Severn watershed: wetlands, trees, ferns, plants, wildlife, creeks, historical & cultural features to create a GIS map of watershed's ecology. Info: Info@severnriver.org. Put "volunteer" in message box.

Patuxent Research Refuge

Volunteer in the Wildlife Images Bookstore at the National Wildlife Visitor Center of the U.S. Fish and Wildlife Service's Patuxent Research Refuge in Laurel. Responsibilities include opening & closing store, helping customers select merchandise, operating point-of-sale register. Training provided. Info: 301-497-5771, lindaleechilds@hotmail.com.

Ruth Swann Park

Remove invasive plants. 10 a.m.–4 p.m. the second Saturday in October, November and December. Meet at Ruth Swann Park-Potomac Branch Library parking lot. Bring lunch. Run by

Maryland Native Plant Society, Sierra Club and Chapman Forest Foundation. Info: ialm@erols.com, 301-283-0808 (301-442-5657 day of event). Carpoolers meet at Sierra Club MD Chapter office at 9 a.m. & return at 5 p.m. Carpool contact: 301-277-7111.

Chesapeake Bay Environmental Center

Help the Chesapeake Bay Environmental Center in Grasonville. Drop in a few times a month or help more frequently. Openings: help with educational programs; guide kayak trips & hikes; staff front desk; maintain trails, landscapes & pollinator garden; feed or handle captive birds of prey; maintain birds' living quarters; participate in CBEC team of wood duck box monitors or other wildlife initiatives. Other opportunities: fundraising, website development, writing for newsletters & events, developing photo archives; supporting office staff. Volunteers donating more than 100 hours of service per year receive a free one-year family membership to CBEC. Info: volunteercoordinator@bayrestoration.org.

Chesapeake Biological Laboratory

Lend a hand at Chesapeake Biological Laboratory's Visitor Center on Solomons Island. Ages 16+ Volunteers must commit to a minimum of two, 3– to 4-hour shifts each month in spring, summer, fall. Training required. Info: brzezins@umces.edu.

Citizen Science: volunteer angler survey

Help the Department of Natural Resources collect species, location, size data using its Volunteer Angler Survey on a smartphone. Data are used to develop management strategies. The artificial reef initiative, blue crab, freshwater fisheries, muskie, shad and striped bass programs also have mobile-friendly methods to record data. Win quarterly prizes. Info: dnr.maryland.gov/Fisheries/Pages/survey/index.aspx.

Mount Harmon Plantation

Help with manor house student tours, colonial crafts, hearth cooking, guided nature walks, herb garden at Mount Harmon Plantation in Earleville, MD. Special events needs include manor house tours, admission/ticket sales, gift shop, auction & raffle fundraisers. Training provided. Docents are asked to commit to eight service hours per month during tour season: 10 a.m.–3 p.m. Thursdays–Sundays, May–October. Info: 410-275-8819, info@mountharmon.org.

CONFERENCES

WATERSHEDWIDE

Coastal resilience webinars

The Horn Point Lab of the University of Maryland Center for Environmental Science has put together a virtual seminar series by experts in coastal resilience, Assessing Coastal Risk and Enhancing Resilience. A question and discus-

sion session is scheduled after each 30-minute seminar. Seminars begin at 11 a.m. Upcoming topics include:

■ **Marsh Collapse Does Not Require Sea Level Rise:** Oct. 14 with Sergio Fagherazzi, Boston University.

■ **Sea Level Rise Consequences in a Highly Developed Shoreline:** Oct. 21 with Jim O'Donnell, University of Connecticut.

■ **North Carolina Salt Marshes - Threats to a Fragile Ecosystem & Conservation Opportunities:** Oct. 28 with Carolyn Currin, NOAA/NOS Beaufort.

■ **Relocation is the Tree; Adaptation is the Forest - A Better Coastal Quality of Life Ahead in New York City:** Nov. 4 with Adam Parris, New York City Mayor's Office of Resiliency Laboratory.

■ **Adapting to Coastal Change: Opportunities & Challenges for Coupled Human-Natural Systems:** Nov. 11 with Michelle Hummel, University of Texas, Arlington.

The Zoom webinar program can accommodate up to 500 participants; registration is required: zoom.us/webinar/register/WN_xh4KUKWVTsu_X77JdA_1w.

PENNSYLVANIA

Stormwater workshops for townships

The Pennsylvania State Association of Township Supervisors is presenting, MS4 Great Ideas Stormwater Conference, 9 a.m.–3:30 p.m. at three regional locations: Oct. 22 in Butler County; Oct. 28 in Montgomery; Nov. 13 in Cumberland County. Each registrant must select either the technical or policy workshop track.

■ **Technical Track:** (Ideal for consulting engineers, municipal stormwater operations staff) Learn how to select competent BMP inspectors; work with road crews, public works departments to integrate green infrastructure improvements that reduce flooding, improve stormwater quality during normal maintenance and building operations; calculate costs of BMPs to develop a realistic municipal stormwater budget; work with private landowners to design and install BMPs that help one's municipality achieve cost-effective compliance.

■ **Policy Track:** (Ideal for those with managerial, administrative stormwater responsibilities) Learn to create partnerships with other municipalities,

See **BULLETIN**, page 44



CHESAPEAKE CHALLENGE

ANSWERS

Long-tailed weasel: 1, 4, 5, 7, 9, 12

Least weasel: 2, 3, 6, 8, 10, 11



BULLETIN BOARD

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private stakeholders to improve compliance, lower overall costs; develop joint municipal pollutant reduction plans to lower overall costs; implement a rural stormwater fee to help farmers meet responsibilities at the lowest cost; balancing the construction of gray and green infrastructure projects for cost, appearance reasons. Registration fee of \$125 includes lunch, breaks, certificate of attendance, workshop handouts. Info: James Wheeler at atbjwheeler@psats.org, 717-763-0930 x128.

EVENTS / PROGRAMS

VIRGINIA

VA Environmental Film Contest

The 11th annual Richmond Virginia Environmental Film Festival is accepting submissions for the 2021 Virginia Environmental Film Contest. The contest is open to state residents with films based on environmental topics pertaining to the state. Films of all formats and genres will be considered. A juried panel will select the winning films and award the \$1,000 grand prize, \$500 first prize; \$100 best cinematography; \$100 best short film; and two \$100 honorable mentions. Films must be submitted by Dec. 31 to RVAEFF.org. Click the film contest button to be taken to FilmFreeway.com, which explains contest rules, deadlines, how to submit films. Winning entries will be announced Jan. 15. Award-winning and other submitted films will be shown Feb. 12–28 at various venues in the Richmond area and/or streamed online. Specific venues, platforms will be announced later and comply with Covid-19 guidelines. Admission is free, open to the public. Info: put “rvaeff film contest” in search engine.

MARYLAND

Chesapeake Bay Maritime Museum

Events at the Chesapeake Bay Museum in St. Michaels, include:

- **Where Land & Water Meet - The Chesapeake Bay Photography of David W. Harp:** Through Sept. 20, 2021. Steamboat Building Gallery. Exhibit features work from throughout Harp’s career. Included w/ admission. A virtual exhibition will be offered later this fall.
- **Artist Talk / The Photographer & the Writer – David Harp with Tom Horton:** 2 p.m. Nov. 4. Via Zoom. The pair reflects on the evolution of Harp’s four decades of taking Chesapeake photos. Fee: \$7.50. Info / registration: cbmm.org/HarpArtistSeries.
- **Climate Change in the Chesapeake Speaker Series (Virtual)/Chesapeake Climate Science for the Non-Scientist:** 2 p.m. Oct. 14. In this session, Bill Boicourt, professor emeritus at University of Maryland Center for Environmental Science, discusses current research to help

participants better understand the changes throughout the region, from increasing river flow, to rising sea levels, to impacts on the atmosphere, forests, Bay’s wildlife. Fee: \$7.50. Info: cbmm.org/speakerseries.

- **Climate Change in the Chesapeake Speaker Series (Virtual)/ Engaging Waterman Heritage in Climate Change Adaptation Planning on the Deal Island Peninsula:** 2 p.m. Oct. 21. Liz Van Dolah, coordinator of the Deal Island Peninsula Partnership, will share insights on how watermen draw upon their heritage in discussions about climate change, how local heritage can be harnessed to help planning that supports local needs, goals. Fee: \$7.50. Info: cbmm.org/speakerseries.
- **Climate Change in the Chesapeake Speaker Series (Virtual)/ Protecting Nature, Strengthening Communities - The Role of Land Conservation in Climate Resilience:** 2 p.m. Nov. 11. Jim Bass, coastal resilience program manager at Eastern Shore Land Conservancy, will discuss the role of land conservation in the region’s climate adaptation work and ESLC’s newest initiative: Delmarva Oasis. Fee: \$7.50. Info: cbmm.org/speakerseries.
- **Rising Tide Program:** 3:30–5:30 p.m. Tuesdays & Thursdays (in-person) and 3:30–5:30 p.m. Wednesdays (virtual). Grades 6–9. Both versions of the program offer challenging projects that build skills in design, woodworking, project management. Virtual projects subject material is different from in-person classes; participants may sign up for either or both. Info / registration (required): cbmm.org/risingtide, risingtide@cbmm.org. In-person participants *must* wear facial coverings inside buildings at all times and outdoors when within 6 feet of other guests: welcome.cbmm.org.

Program pairs novice, veteran hunters

The Department of Natural Resources’ new Maryland Mentored Hunt Program pairs new, novice or lapsed hunters of any age with skilled veteran hunters, who will help them build their skills, culminating in a hunt. Mentors and mentees submit applications and will be matched based on agency review and other criteria. The pair works at its own pace to schedule all aspects of the hunt. All participants are required to follow the state guidance on preventing spread of COVID-19. The program encourages using video meetings, email, texts, phone calls as much as possible. For in-person meetings, individuals must practice social distancing and wear masks. Info: Chris Markin at Christopher.markin@maryland.gov, or put “Maryland Mentored Hunt Program” in your search engine.

Cromwell Valley Park

Programs at the nature center at Cromwell Valley Park in Cockeysville:

- **Doe, a Deer!** 1–3 p.m. Oct. 11. Ages 5+ Hike in the forest to look for signs of deer. Wear sturdy shoes. Fee: \$4.

- **Paint a Pumpkin:** 1–3 p.m. Oct. 17. All ages. Choose a pumpkin to decorate from the park’s patch. Fee *per pumpkin*: \$5.
- **Nature Quest Fest at Lake Roland:** 12–2 p.m. Oct. 18. Meet at Lake Roland. All ages. Complete at least five trails in a Nature Quest Passport to receive free admission. Activities include canoeing, dam tours, live animals. Get a passport at Wegmans grocery stores, Cromwell Nature Center. Fee: \$5 or free with Quest course completion. Reservations not required.
- **Spooky Campfire Stories:** 7:30–9 p.m. Oct. 23. Ages 8+ Swap scary tales around the campfire. Bring a flashlight, story to share. Fee: \$4.
- **Leaf Peepin’:** 1–2:30 p.m. Oct. 24. All ages. Leaf ID hike. Fee: \$4.
- **We’re all Nuts!** 1–2 p.m. Oct. 25. Ages 8+ Do the walnut stomp to make walnut ink to use in your own feathered pen. Bring a paring or X-Acto knife with you. The park will handle the nuts for those with nut allergies. Fee: \$4.
- **Halloween Treat Trek:** 11 a.m.–3 p.m. Oct. 31. Families, all ages. Follow clues on a self-guided journey, then return to center for a treat. Costumes welcome! Fee: \$4.
- **Animal Antics - Disguises & Tricks:** 1–2 p.m. Nov. 1. All ages. Discover what predators do to trick their prey; what prey do to trick their predators. Fee: \$4.
- **Marsupial Madness:** 1–2 p.m. Nov. 7. All ages. Meet Grinchy, Cromwell’s resident opossum. Fee: \$4.
- **Tree of Life:** 1–2 p.m. Nov. 8. Ages 5+ Explore inside, under fallen trees to see what creatures live there. Fee: \$4. Info / registration (including COVID-19 protocols: cromwellvalleypark.org, info@cromwellvalleypark.org, 410-887-2503.

Anita C. Leight Estuary Center

Programs at the Anita C. Leight Estuary Center in Abingdon include:

- **Survival Skills:** 2–3:30 p.m. Oct. 10. Ages 8+ Learn to build fires, look for wild edibles, construct a shelter. Fee: \$5.
- **Migration Madness Canoe:** 9:30 a.m.–12 p.m. Oct. 17. Ages 8+ Look for travelers in the marsh. Binoculars, cameras recommended. Fee: \$12.
- **Upper Bush River Rambling Pontoon:** 9–10:45 a.m. Oct. 18. Ages 6+ Take in the fall color along the shoreline. Fee: \$10.
- **Tails & Tots:** 2 p.m. Oct. 18. Ages 0–6. Stories, songs, animal movement. Free.
- **Creepy Crawlies:** 10–11 a.m. Oct. 24. Ages 8+ Search for strange creatures in the woods, by the water. Fee: \$3.
- **Critter Dinner Time:** 10:30 a.m. Oct. 24. All ages. Learn about turtles, fish, snakes while watching them eat. Free.
- **Meet a Critter:** 12 p.m. Oct. 25. All ages. Close-up animal encounter. Free.
- **Trail Running Series:** 9–10 a.m. Oct. 31. Ages 8+ Note: Ages 15 & younger must be with an adult for this event. All skill levels/paces welcome to use 2-mile out-and-back, single track course. Free.

- **Halloween Scavenger Hunt:** Families, ages 2+ register for a 1-hour time slot from 10 a.m.–2 p.m. (Only 2 families per time slot.) Oct. 31. Don costumes, search for clues hidden at creature stations in the woods. Complete a puzzle, earn a prize. Fee: \$12/family.
- **Full Moon Halloween Canoe:** 6:30–9 p.m. Oct. 31. Paddle under the full moon’s light. Costumes welcome but must be paddle safe. Ages 12+, 14 & younger w/adult. Fee: \$12. Except where noted ages 12 & younger must be accompanied by an adult for all programs. Events meet at the center and require registration unless otherwise noted. Payment is due at time of registration. Info: 410-612-1688, 410-879-2000 x1688, otterpointcreek.org.

RESOURCES

Property pointers

The Alliance for the Chesapeake Bay offers resources for property owners who want to make their landscapes more friendly:

- **Wood you Like to Learn about Forests?** Put “Alliance Websites, Resources, Videos, Blogs” in your search engine, then scroll to the Tree Talks under Videos. Titles include: How to Plant A Tree, What’s That Conifer?, Live Staking, Gray Dogwood, Boxelder, Poison Ivy, Black Raspberry, Pawpaw, Blackgum, Snags, Witch Hazel, Christmas Fern, White Cedar, Mountain Laurel, Atlantic White Cedar, and A Hobbyist’s Guide to Maple Sugaring.
- **Bouquets for the Bay:** Visit NativePlantCenter.net to find the perfect native species for your landscape.
- **Right as Rain Landscape:** Learn how to design a stormwater runoff plan to help you better manage water running off your property. Visit the Alliance for the Chesapeake Bay’s Yard Design Tool at stormwater.allianceforthebay.org.

Stormwater class

The Alliance for the Chesapeake Bay’s Municipal Online Stormwater Training Center’s Dig Once Course suggests how local leaders can integrate green infrastructure into community capital projects: road construction and school & park improvements. Interactive lessons and videos in a user-friendly format give communities tools to build and enhance local stormwater programs. Info: mostcenter.org.

Wetlands Work website

The Chesapeake Bay Program’s website, Wetlands Work, at wetlandwork.org, connects agricultural landowners with people and programs that can support wetland development and restoration on their land.

Bilingual educator resources

Educational programs are available in English and Spanish from the Interstate Commission on the Potomac River Basin. Info: potomacriver.org/resources/educator.

— Kathleen A. Gaskell



A boogle of beasties

Did you know that content weasels can purr like a kitty?

Aww... And just look at those cute little critter photos! But don't let those furry little faces fool you. Here are some fierce facts (and one fantastic fiction) about weasels.

Not so itty-bitty bite: The needlelike teeth of a weasel have a bite strength of 150 pounds per square inch. For comparison, humans have a bite strength of 85 pounds per square inch.

Who are you calling a sucker? Weasels kill their prey with a quick, crushing bite to the jugular. The copious amount of blood that stained the beasts' faces led to the mistaken belief that they were bloodsuckers.

Zombeasels! Weasels can eat their entire prey — skin, bones and organs. If food is overly plentiful, though, they may eat only part of their prey. The favorite tidbit is brains.

Warrior weasels: Plagued by a basilisk, a monster with a deadly gaze and venomous spit? According to Leonardo da Vinci, "[The weasel] finding the lair of the basilisk kills it with the smell of its urine, and this smell, indeed, often kills the weasel itself." (Author's note: That last part stinks!) First Nations Algonquian tribes of North America credit the weasel with the ability to kill a wendigo, a voracious man-eating monster. (This is the fiction, by the way.)

What do you call an army of weasels?

Groups of weasels go by gang, colony, pack, sneak, confusion and — boogle.

Chicken feed: Weasels often get a bad reputation for hen homicides. But maybe it's a small price to pay for all of the mice and rats that weasels eat.

Pop (goes the weasel) Quiz

No one is sure of the original meaning of the song, *Pop Goes the Weasel*. What is known is that weasels are able to pop in and out of holes with such agility that hunters sometime believed that they were able to dodge bullets! The Chesapeake watershed is home to two weasel species: the least and the long-tailed weasels. Here is a pop quiz to see if you can tell them apart. Answers are on page 43.

1. I am the most widespread weasel in the Western Hemisphere. I live in all six Bay states and the District of Columbia.
2. I am only found in Pennsylvania, Virginia and West Virginia.
3. I am the world's smallest mammal carnivore. I weigh 2–5 ounces (the weight of 10–25 quarters) and grow to be around 8 inches long from nose to tail. I do not have a black-tipped tail.
4. I can grow up to 16 inches long. Half of my length is my black-tipped tail.
5. My skull ranges from a little more than 1.5 inches across (female) to almost 2 inches (male).
6. My skull is the size of a jelly bean.
7. I occasionally eat the other weasel in this quiz. I also eat rats, insects, small snakes, frogs and birds. I have also been seen dragging a snowshoe hare, which is much larger than I am, back to my den.
8. Aside from the occasional shrew, sparrow or insect, I mostly eat meadow mice, which can weigh more than I do. This might be the reason I am sometimes called the mouse weasel.
9. I give birth to one litter of five to six young. My gestation ranges from 103–337 days. "Delayed implantation" lets me mate year-round but give birth only in the spring, the easiest season for finding prey.
10. I give birth to multiple litters of four to six young a year. Good thing, too. I am prey to snakes, bobcats, feral cats, bears, owls, hawks, and yes — my larger weasel cousins. If it weren't for these constant litters, the world would run out of me.
11. I am active in all weather. I have been found in my den in the winter, snug in the warm fur of my mouse prey.
12. In 1915, the Pennsylvania Game Commission put a \$1.00 bounty on weasels. (It was rescinded a few decades later.) Eighty percent of the roughly 50,000 pelts turned in annually were my species. ■

A: The least weasel's thin body makes it easy for it to get into tight places when chasing prey or escaping predators. (Jean Beaufort / PublicDomainPictures.net)

B: The fierceness of the least weasel, the world's smallest mammal predator, earned its reputation as the killer of some of the most feared medieval monsters, here a basilisk. (University of Toronto Wenceslaus Hollar Digital Collection)

C: A long-tailed weasel scampers off with its prey, a vole. (J. Barney / U.S. Fish and Wildlife Service)

Icon: The least weasel. (Keven Law / CC by-SA 2.0)

Celebrate the 15th Chesapeake Watershed Forum virtually



By Jenny McGarvey

2020 marks the 15th year of the Alliance for the Chesapeake Bay's annual Chesapeake Watershed Forum — which takes place Oct. 29–30. In today's world, we measure so much of our work in five- and 10-year spans that reaching 15 feels particularly momentous. It is a milestone to reflect on, measure and celebrate.

When I reflect on the impact of the past 14 forums, I can't help but think of the partnerships and projects created from the connections made during those autumn days. To me, participating in the Forum is about opening yourself up to new and different experiences, swapping ideas with someone who is not your typical collaborator and using this new information to rethink and evolve your work.

The experience is rejuvenating. Kate Fritz, the Alliance's executive director, calls it "Forum magic."

Kate and I are not alone in our opinions: Year after year, half of all of the participants report networking as the most valuable aspect of the Forum.

So what does this amount to over 14 years? Here's some quick math: Approximately 400 people attend the Forum each year. If every one of them experiences forum magic at least once during those two days, that equals 5,600 connections since 2006. It's a hefty number even before you consider how those connections exponentially foster new ones after we return to our day-to-day work.

In January, we at the Alliance pondered how to celebrate this important milestone at the 2020 Forum. Ideas included a massive group photo taken by drone, a Halloween costume contest and trick-or-treating for the children who often join their parents during the weekend.

Then March brought COVID-19. In



Signs on the grounds of the National Conservation Training Center in Shepherdstown, WV, inspired participants at the 2019 Forum. (Will Parson / Chesapeake Bay Program)

June, we knew the only way to hold the Forum safely was virtually, instead of at the National Conservation Training Center in Shepherdstown, WV, our host of prior years. Suddenly the question was not how to stand out, but how to foster the connections that came so naturally at our in-person gatherings.

My short answer is that, much like everything else this year, connecting at the Forum will be different. But we will succeed.

For example, we know that a Zoom happy hour cannot replicate dreaming and laughing together around a bonfire into the late hours of the night. We have made our networking activities more selective and focused.

More than half of our Forum audience is self-identified as young professionals (18–35 years old) and a quarter are younger than 24. For many, this will be their first Forum and possibly their first

conference. Recognizing this, we are partnering with the Choose Clean Water Coalition and Chesapeake Bay Trust to offer virtual learning sessions on October 27–28 on the Young Professionals of Color mentorship program and the Chesapeake Conservation Corps, two incredible programs for people getting started in the Chesapeake Bay restoration community.

For more established professionals, the River Network and National Fish and Wildlife Foundation will offer one-on-one office hours on Thursday and Friday of the Forum to provide interested participants with professional coaching and feedback on project proposal concepts.

I also expect many Forum participants will still experience moments of Forum magic while attending our workshop sessions. More so than any other year, we are striving to offer especially meaningful and engaging content. To assist our speakers in this process, the

Alliance has partnered with the Institute for Conservation Leadership to coach presenters on engagement techniques for virtual presentations.

The terms I ascribe to planning this year's Forum are retreat, adapt and evolve. I also see them for what they are: an echo to the message behind our theme for this year's Forum, *Climate Resilience in a Changing Chesapeake Watershed*. A theme, I will add, that we decided upon well before COVID-19 became a part of our daily lives.

This summer, I read *Rising: Dispatches from the New American Shore*, a 2018 Pulitzer Prize finalist in general non-Fiction written by our plenary speaker, Elizabeth Rush. It was while reading her book that the concepts of retreat, adapt and evolve first came to me in the context of this year's Forum.

Across the country, Rush serves as witness to the unstoppable and now inevitable loss of land to sea level rise and shares the stories of many communities, often low and middle income and people of color, who are forced to abandon their generational homes. For Rush, the only solution for these coastal communities is retreat. The remaining question is what are we doing to buffer the economic and cultural loss that comes with that retreat?

While Rush's book deals with sea level rise, many of our workshop sessions cover the inland impacts of climate change. Some present climate change adaptation through best management practices: managing healthy and resilient forests; reducing the urban heat island effect through tree canopy; and adapting stormwater practices that can withstand more frequent and intense rain events.

Other sessions focus on the disproportionate impacts of climate change experienced by communities of color and low-income communities. Now more than ever, our movement must become a diverse and inclusive one. It is through diversity, equity and inclusion that we achieve climate resiliency.

Registration for the 2020 Chesapeake Watershed Forum is open until Oct. 29. You can learn more about the Forum at allianceforthebay.org. ■

Jenny McGarvey, a senior program manager at the Alliance for the Chesapeake Bay, coordinates the annual Chesapeake Watershed Forum.

Black vultures: Nature's cleaning service soars above us



By Mike Burke

The big trash truck's engine rumbled as a single worker methodically emptied the apartment building's bins. He attached the receptacles to the lift device, pulled a lever and watched as the bin rose and then tipped its contents into the truck's gaping rear.

I was joined in watching the proceedings by a pair of vultures, perched expectantly on the adjacent carport. They waited in vain. The young man at the controls expertly emptied every bin without spilling a single item.

Black vultures (*Coragyps atratus*) are regulars in this area. I usually see them soaring high overhead, or on the side of the highway feeding on roadkill. On this day, I was in the parking lot behind our apartment and had a close-up view of the raptors.

Their cousin, the turkey vulture, has an unfeathered head that shows its red flesh. Black vultures have the same featherless look, but their skin is gray to black. (The head is ashy gray in young birds and turns sooty black over the years.)

On the wing, the two species display other differences. Turkey vultures show gray-white underwings, while black vultures have all-black wings except for silvery-white tips on the five longest wing feathers. The tail of the black is noticeably shorter and broader than that of the turkey. Its head, too, is smaller.

Although slightly smaller overall than turkey vultures, black vultures are still very large birds. They stand 2 feet high and have wingspans that reach 4.5 feet. The birds weigh more than 4 pounds. The sexes look alike.

Turkey vultures outnumber black vultures in the United States. But the opposite is true when considering all of the Western Hemisphere. Black vultures breed from Pennsylvania southwest through Texas, Mexico and down through Central and South America. Black vultures are permanent residents on their established territories.

Turkey vultures have an extraordinary sense of smell. They can identify carrion



Black vultures feast on the carcass of a large animal. By eating dead animals, they help to stop the spread of disease. (Jerry Friedman)

from hundreds of feet overhead. Black vultures lack that keen nose. Instead, they soar above turkey vultures. Once the bigger bird finds carrion, black vultures follow behind. One-on-one, turkey vultures use their superior size to dominate. But black vultures feed in groups, and they will often displace the relatively solitary turkey vulture.

Vultures, sometimes called buzzards, are best known as carrion feeders. In open fields or alongside roads, they are often seen feeding on the carcasses of deer, feral pigs, skunks and the like. On farms, they will feast on downed pigs, cattle and sheep. On rare occasions, they take live animals, almost always newborns. And despite their lack of success when I was watching, black vultures do a good job of consuming human trash.

Turkey vultures do more than serve as scouts. With bigger, stronger beaks, turkey vultures can tear open the tough hides of carrion, which black vultures often can't. Once opened, the dead animal is devoured quickly and aggressively. Viscera and soft muscle are consumed in big bites. How appealing.

Given its feeding habits and frankly unattractive looks, black vultures can be tough to love. That can be especially true if their roost is on your property, along with the mess and smell that come with it. Nevertheless, there is much to commend the black vulture.

They play a key role in the cycle of life. Quickly removing dead animals stops the spread of disease. The vulture's stomach acid is so powerful it will destroy most



To tell the difference between black and turkey vultures soaring above, look at the wings. Blacks' wings are black with silvery white tips. Turkeys' underwings are grayish white. (Mike Burke)

pathogens. Black vultures can eat sick animals without becoming ill themselves. They are ecological cleaners of the highest order.

Strictly monogamous, black vultures mate for life. Although their territory can cover miles, they use the exact same nesting spot year after year. Black vultures lay their eggs directly on a bare surface in a dark cavity such as in a dead tree, in an

abandoned building or atop a firetower.

The two or three eggs in the single annual clutch are incubated for 38–39 days, with both parents sharing duties. Chicks are helpless when born. Parents tend them constantly for up to 90 days. Even after the young birds fledge, they rely on their parents for many weeks. Ornithologists have found parents still feeding young birds eight months post-fledge.

Favorite roosting areas can be host to dozens of vultures and other raptors. Within those roosts, families stick together. If one set of birds has identified a productive feeding area, they will lead relatives to the site the next day. At feeding sites, family members will drive away non-kindred birds.

It takes eight years before birds start breeding. In the meantime, these young birds stick close to parents and other family members. Extended families support one another on roosts, at feeding sites and in protecting territory from intruders.

I thought back to the worker operating the trash truck. Over the course of the pandemic, society has begun to recognize the value of many "invisible" jobs. Consequently, today we are more likely to recognize that trash truck operator as an essential part of society. Maybe it's time to give black vultures a second look as well. After all, in the avian world, they are essential workers, too. ■

Mike Burke, an amateur naturalist, lives in Mitchellville, MD.

Wild brook trout: If they're seen, the water's pristine

BAY NATURALIST

By Kathy Reshetiloff

"If you have a brook trout population that survives in a stream, that stream is in good shape, and if you have reproducing populations in the stream, it's fantastic."

— John Kies

The brook trout (*Salvelinus fontinalis*) is a small, brilliantly colored freshwater fish native to clear, cold streams and rivers in the headwaters of the Chesapeake Bay watershed. It is also the state fish of New York, Pennsylvania, Virginia and West Virginia.

Brook trout are recognized by a dark green back covered with lighter worm-shaped markings. These markings, which resemble the pattern created when the sun shines through rippled water, helps to camouflage brook trout from predators such as larger fish, herons and even fly fishers. Bluish sides are sprinkled with yellow spots and red spots surrounded by blue halos. The brook trout's fins are starkly edged in white, which is unique among other common trout.

These fish thrive in clear, silt-free, well-shaded freshwater streams with numerous pools and a substrate made of mixed gravel, cobble and sand. Brook trout are not tolerant of water temperatures above 75 degrees Fahrenheit, so they are rarely found in developed areas.

They are not picky eaters and feed on a wide variety of food items. Opportunistic feeders, brook trout eat whatever they can find including aquatic insects, like mayflies, caddisflies and stoneflies; land insects that fall into the water, like ants and beetles; small crayfish; and even small fish and minnows, but only when they are easy to catch.

Brook trout spawn in autumn, mainly October to November. The female uses her tail to create a shallow nest or "redd," often near the lower end of the pools where the gravel is swept clean of silt and fresh



This brightly colored eastern brook trout was caught and released in a West Virginia stream. (Steve Droter / U.S. Fish and Wildlife Service)

oxygenated water is abundant. There, she deposits eggs which males then fertilize. During spawning, the lower flanks of males become brilliant orange and older males may develop a slightly hooked lower jaw.

The female covers the fertilized eggs with gravel. The eggs incubate through the winter months and hatch in the spring. Brook trout mature in two to three years and live about six years. Most grow no more than 9–10 inches. A 12-inch brook trout is rare and considered a real trophy.

Though small, brook trout have always been a prized game fish, and are especially popular among fly fishermen. Historically noted for their recreational value, brook trout are very significant biologically. Because they require pristine, stable habitat with high water quality conditions, brook trout are viewed as indicators of the biological integrity of streams. As water quality in headwater streams has declined, so have brook trout populations.

Urbanization affects brook trout through the loss of streamside vegetation and stream shading, increased sedimentation, reduced flow, increased high flow events, changes in the physical makeup of stream beds and increased impervious surface.

Agricultural impacts on brook trout populations are similar to those of urbanization: increased water temperature and sedimentation, changes in hydrology,

and loss of streamside vegetation. Additionally, livestock can pollute water and damage stream banks, increasing the erosion of sediments into waterways.

Mining activities impact brook trout populations through acid mine drainage, hydrological changes and physical habitat degradation.

Nonnative fish, such as brown trout, compete with native brook trout for food and habitat.

Brook trout populations can also become isolated because of physical barriers like dams, decreasing genetic diversity and the survival of the species.

Recognizing the uniqueness of eastern brook trout and its decline in this region, an alliance, the Eastern Brook Trout Joint Venture, was formed in 2004. This partnership of state and federal agencies, regional and local governments, businesses, conservation organizations, academia, scientific societies and private citizens is working to protect, restore and enhance brook trout populations and their habitats across their native range.

Eastern Brook Trout Joint Venture works on a variety of activities including identifying and prioritizing brook trout restoration and conservation projects; restoring brook trout habitat using bank stabilization, instream structures and streamside plantings; removing dams and other stream blockages; and promoting

livestock fencing.

These efforts not only help brook trout but provide economic benefits to local communities by providing buffers against flooding, increasing fishing and other recreational opportunities, and improving the local environment.

From 2006 through 2018, the U.S. Fish and Wildlife Service's National Fish Habitat Action Plan funded 88 eastern brook trout conservation projects from Maine to Georgia: three in Maryland, 14 in Pennsylvania, three in New York, five in Virginia and nine in West Virginia. Two hundred forty different organizations were involved in these projects at the local level.

Forty-nine projects enhanced 240 stream miles, while another project enhanced 157 acres of lake habitat. Twelve projects resulted in enhancing and/or restoring 357 acres of riparian habitat.

Forty-three projects removed 103 barriers to fish passage, reopening 321 miles of stream to brook trout and other fish species.

For information about protecting and restoring brook trout, visit the Eastern Brook Trout Joint Venture at easternbrooktrout.org. ■

Kathy Reshetiloff is with the U.S. Fish and Wildlife Service's Chesapeake Bay Field Office in Annapolis.