

FROM THE MOUNTAINS TO THE SEA...



FROM GENES TO ECOSYSTEMS.



University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE

2018 ANNUAL REPORT

The University of Maryland Center for Environmental Science is an independent and globally eminent research and educational institution aimed at advancing scientific knowledge of the environment.



LEADERSHIP

As trusted scientific advisors, our faculty provide unbiased research to inform management decisions and public policy on pressing environmental issues in our local communities and around the globe.



INNOVATION

We work across disciplines and in diverse settings—from the Appalachian Mountains to the Arctic—seeking solutions that improve people’s lives and sustain the natural world.



EDUCATION

Our renowned faculty train the next generation of environmental leaders as part of the University System of Maryland’s nationally ranked graduate program in marine and environmental science.



Headquarters: Cambridge, Maryland

Year founded: 1925

Faculty members: 70

Graduate students: 95

Research laboratories: 4

HARNESSING THE **POWER OF SCIENCE** TO TRANSFORM THE WAY SOCIETY UNDERSTANDS AND MANAGES THE ENVIRONMENT

MESSAGE FROM THE PRESIDENT

Dear friends,

This fall, University of Maryland Center for Environmental Science (UMCES) faculty, students, and staff gathered with leaders from Maryland and big thinkers from around the world to begin work on an important question: What can be done to maximize the impact of our research to help resolve some of the most pressing environmental challenges for both the State of Maryland and the world?



Dr. Peter Goodwin

UMCES is not just unique within Maryland but also in the United States. We were founded in 1925 by statute to be an institution that provides the predictive ecology to inform the State of Maryland about managing Chesapeake Bay and the state's natural resources through research, public service, and education. We take those three missions very seriously.

We as an institution do genes to ecosystems, mountains to oceans. We look at scales from cell biology to landscape and ocean scales. We are excited to be charting our course for not only our future, but how to make an impact on the world around us. We are already making great strides.

Maryland's bi-partisan approach for addressing mitigation and adaptation to climate change is emerging as an exemplar for the nation. UMCES is proud to serve the Maryland Climate Change Commission through activities such as coordinating the 2018 sea-level rise projections for Chesapeake Bay. Another prominent example of our commitment to the issues of importance to Marylanders is supporting the Department of Natural Resources to develop the first oyster stock assessment in 135 years.

Researchers like Cat Stylinksi and Laura Lapham are committed to making an impact on STEM education with programs to get girls interested in science early through augmented reality and hands-on research opportunities. Rose Jagus is using her prestigious Elkins Professorship to inspire and engage inner-city youth in pursuing careers in the environmental sciences.

The curricula of our graduate education programs have been transformed to ensure our students are well-prepared and competitive in the workforce. Opportunities are provided to graduate students, the next generation of environmental leaders, to cultivate entrepreneurial and leadership skills through our Ratcliffe Environmental Entrepreneurs Fellowship program at the Institute of Marine and Environmental Technology, which has already launched startups such as Manta Biofuel and Minnowtech.

As a signatory to the American College & University Presidents' Climate Commitment, UMCES was awarded a Mark of Distinction for meeting our 25% carbon reduction goal, in part because of a new solar field at our Horn Point Laboratory and the incredible new LEED certified research laboratory building at the Chesapeake Biological Laboratory. This was one of four environmental leadership awards UMCES received in 2018 for facilities management, demonstrating that UMCES walks the talk.

We continue to explore what actions, partnerships, innovations, and technological advances could be pursued to ensure that the vision in UMCES' recent strategic plan becomes a reality. I encourage you to join us as we chart the course for our future and explore how we can best use our expertise to address the grand environmental challenges facing us here at home and around the world.

Regards,

A handwritten signature in black ink that reads "P. Goodwin". The signature is written in a cursive, slightly stylized font.

Dr. Peter Goodwin
President

MISSION: The University of Maryland Center for Environmental Science has a unique statutory mandate to conduct a comprehensive scientific program and apply predictive ecology for the improvement and preservation of Maryland's physical environment. This mission is accomplished through research, education, and public service.

SCIENCE TO INFORM POLICY DEVELOPMENT

UMCES provides the science for policymakers to address the pressing environmental issues in our communities



While it's widely understood that climate change affects temperature, rainfall, and sea level rise, UMCES is looking for answers to questions critical to the region's future. How will increased climate variability and its increase of "wet years" and "dry years" impact Chesapeake Bay restoration? How will sea-level rise impact coastal ecosystems across the country? And, how can the State of Maryland adapt to these changes?

UMCES provides sea-level rise projections for Maryland's coastal areas to study the impact of rising waters and the ability of our coastal communities to respond

An essential part of Maryland's scientific community since 1925, the University of Maryland Center for Environmental Science is recognized as an independent source of expertise that has been helping Maryland better understand and protect its natural resources, from the Appalachian mountains to the Atlantic coast, from genes to ecosystems.

Our renowned scientists have been at the core of discovery in understanding changes in the Chesapeake Bay, from recording its decline to recommending actions that restore water quality, seagrasses, oysters, blue crabs, and rockfish. We continue to advise our leaders on how to achieve effective environmental policy and natural resource management.

As one of the 12 universities in the University System of Maryland, UMCES has a state-mandated mission to "develop and apply predictive ecology for Maryland for the improvement and preservation of the physical environment, through a program of research, public service, and education."

From the mountains to the sea, from genes to ecosystems

UMCES provides an invaluable source of information to the Maryland General Assembly, State and federal agencies, and local governments, as well as the private and non-profit sector. We are often called upon to provide analysis and testimony on environmental bills that require scientific input and interpretation. Our faculty have provided much-needed expertise in helping Maryland with blue crab management; studies on striped bass, menhaden, and sturgeon; dredge material management



World leaders in understanding fisheries, UMCES' scientists monitor menhaden to rockfish to help the state develop sustainable stock management plans.

and the restoration of Poplar Island; studying green ports and how to reduce introduced species; and understanding emerging energy sources and their impacts on wildlife and greenhouse gas emissions.

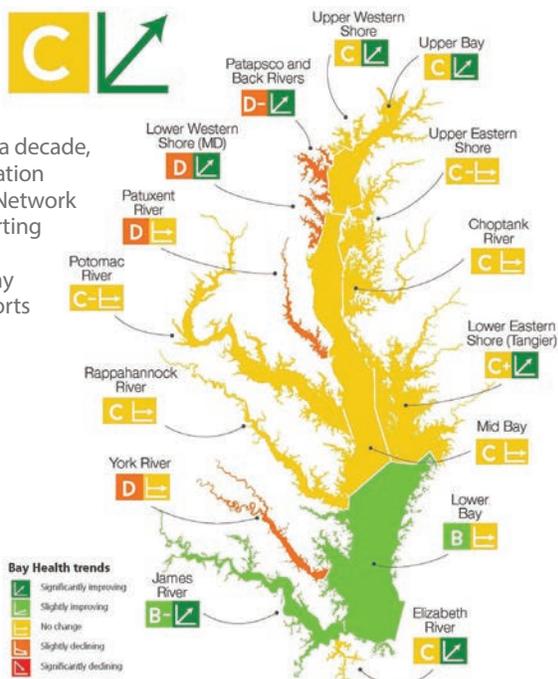
By collaborating with colleagues and providing institutional support to policymakers, UMCES scientists and graduate students are rising to the challenge of understanding the regional effects of climate change and charting a path to a more sustainable future.

Maryland is unique to have a public university devoted entirely to scientific discovery and education of the environment. With locations across the state, from the Appalachian Laboratory in Frostburg to the Chesapeake Biological Laboratory in Solomons to the Horn Point Laboratory in Cambridge to the Institute of Marine and Environmental Technology in Baltimore, we are able to study multiple ecosystems.

Chesapeake Bay Restoration

UMCES has played an essential role in the decades-long Chesapeake Bay restoration effort, providing the scientific foundation that has supported measurable improvements in its water quality, fisheries, and ecological health. Our annual **Bay Health Report Card** serves as the primary communications tool for reaching watershed residents about the health of their local waters.

Our scientists led research that has documented the unprecedented comeback of underwater grasses in Chesapeake Bay, a signal of improving water quality, and found that pervasive dead zones are beginning to break up earlier, reflective of the way the Bay used to react to summer algal blooms. UMCES scientists have also been examining all aspects of the impact of Conowingo dam on the upper bay, from nutrient levels to impacts of sediment on underwater grasses, and how recent increases in rain will impact the Bay's recovery.



For more than a decade, UMCES' Integration & Application Network has been reporting on progress in Chesapeake Bay restoration efforts with its annual report card.



Image by Will Parson/Chesapeake Bay Program

UMCES scientists helped assemble the first oyster stock assessment in Maryland waters in 135 years to help inform future management decisions for the fishery.

Fisheries

Our researchers—international leaders in fisheries science—provide independent analysis of Bay-related data, including annual blue crab and striped bass population surveys that recommend catch limits to keep the fisheries sustainable, assessments of stream aquatic health and water quality sampling, and numerous studies on biology, ecology, and populations of fish including Atlantic sturgeon, menhaden, and others.

Our oyster expertise has played a vital role in improving the management of the Bay's iconic species. The Horn Point Laboratory oyster hatchery, the largest oyster culture facility on the East Coast, annually provides billions of oyster spat destined for tributaries in the Chesapeake Bay. UMCES researchers recently assisted the Maryland Department of Natural Resources with the first comprehensive population assessment of the oyster stock in 135 years while also piloting an innovative consensus-building effort to bring various stakeholders together to develop a sustainable management plan.

Sea Level Rise

Maryland, with 3,100 miles of tidal shoreline, is one of the most vulnerable states to sea-level rise. UMCES works with State agencies to provide science-based sea-level rise projections for Maryland's coastal areas and continues to study the impact of rising waters and the ability of our coastal communities to respond. The State of Maryland has relied on these scientific assessments for its planning purposes to invest wisely in facilities while supporting coastal management for the communities along the shoreline.

UMCES has a rich tradition of scientific innovation and discovery that has supported the citizens and agencies of the State of Maryland for nearly 100 years.

YEAR IN REVIEW

A snapshot of news and research from our laboratories across the state



Jacqueline Grebmeier



Jeffrey Cornwell

People in the News

Jacqueline Grebmeier was named a **Fellow of the American Association for the Advancement of Science**, the world's largest scientific society, for her decades of study and leadership on the ecological responses of the Arctic to climate change. ... **Jeffrey Cornwell** received a **University System of Maryland (USM) Regents' Faculty Award for Excellence in Public Service**, the highest honor that the Board bestows to recognize exemplary faculty achievement, for decades of leadership on some of the most challenging scientific issues related to Chesapeake Bay, including Poplar Island restoration, the impact of Conowingo Dam, and the role of oyster reefs in reducing pollutants in Chesapeake Bay. ... **Helen Bailey** was honored with the UMCES' **President's Award for Excellence in Application of Science** for her work to understand the movements and habitat use of protected species such as dolphins and whales to inform conservation and management. ... **Tsetso Bachvaroff** won UMCES' first **Outstanding Faculty Mentor Award**, an honor bestowed by the graduate students to recognize faculty for their commitment to students beyond the classroom. ... **Brian Duke** was awarded the **USM Board of Regents Staff Award for Effectiveness and Efficiency** for creating a facilities team at the Chesapeake Biological Laboratory that operates a complex, sophisticated, and sustainable campus. ... **Barbara Jenkins** at the Appalachian Laboratory won the first **UMCES Staff Excellence Award** for her high level of commitment and dedication.



Environmental Summit lays groundwork for UMCES' impact on grand environmental challenges

UMCES hosted an Environmental Summit November 30 to explore how we can make a difference in the grand environmental challenges facing our planet. Through presentations and panel discussions with global thought leaders and input from faculty, students, and partners, we considered what actions, partnerships, and innovations could be pursued to ensure that the vision in UMCES' recent strategic plan becomes a reality. Visit umces.edu/environmental-summit for more.

Sustainability

A signatory to the **American College & University Presidents' Climate Commitment**, UMCES has launched several programs aimed at reducing our environmental footprint and was awarded a Mark of Distinction for meeting our 25% carbon reduction goal. A "strong commitment to sustainable practices" also earned the sustainability and facilities teams the Maryland Department of the Environment's **Maryland Green Registry Leadership Award** for 2018. ... **A new solar field** at the Horn Point Laboratory will generate the equivalent of approximately 50% of the campus' annual energy consumption. UMCES also received a grant from the Maryland Energy Administration to install four electrical vehicle-charging stations under a new solar canopy. ... **The cutting-edge R.V. Truitt Laboratory Building** at the Chesapeake Biological Laboratory was awarded the 2017 **U.S. Green Building Council's Maryland Community Leader Award for Higher Education** in recognition of overall commitment to sustainability and efficiency.

Global Leadership

Fredrika Moser was elected president of the national Sea Grant Association. ... **Eric Davidson** served as president of the American Geophysical Union. ... **Russell Hill** is president of the International Marine Biotechnology Association.



RESEARCH HIGHLIGHTS

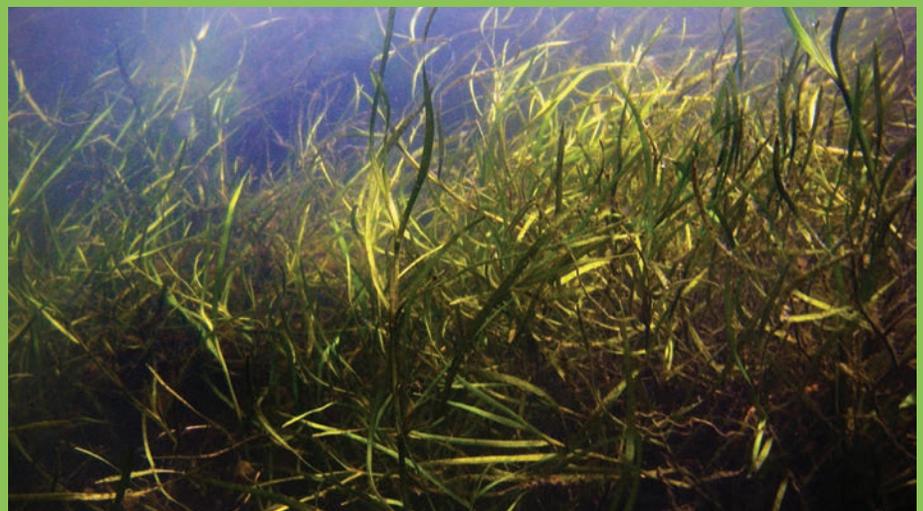
- ▶ **Availability of nitrogen to plants is declining as climate warms** Researchers at the **Appalachian Laboratory** have found that global changes, including warming temperatures and increased levels of carbon dioxide in the atmosphere, are causing a decrease in the availability of a key nutrient for terrestrial plants. This could affect the ability of forests to absorb carbon dioxide from the atmosphere and reduce the amount of nutrients available for the creatures that eat them. “Even if atmospheric carbon dioxide is stabilized at low enough levels to mitigate the most serious impacts of climate change, many terrestrial ecosystems will increasingly display signs of too little nitrogen as opposed to too much,” said **Andrew Elmore**.
- ▶ **e-DNA emerges as powerful tool for tracking threatened river herring in Chesapeake Bay** Researchers at the **Horn Point Laboratory** have found that tracking and quantifying herring DNA from the environment corresponded well to more traditional field methods and has great potential to assist future monitoring efforts of river herring abundance and habitat use. “The goal is to do more of this with other species, using new tools to inform conservation and restoration efforts,” said **Louis Plough**.
- ▶ **Scientists explore how to engineer better water quality with aerators** Scientists at the **Chesapeake Biological Laboratory** are exploring a technological approach that uses large-scale aerators to force atmospheric oxygen into deep- water “dead zones” and improve water quality in lakes, reservoirs, and coastal estuaries. Researchers are working to understand both the intended and unintended consequences of this approach and its potential impact on bigger waterways, especially its effects on oxygenation and the chemical cycles that control greenhouse gas and toxic chemical production.
- ▶ **Tracking biodiversity in Inner Harbor deepens understanding of urban waterfronts** Scientists at the **Institute of Marine and Environmental Technology** are working in partnership with the National Aquarium and Maryland Sea Grant to use DNA barcoding to build a database on the biodiversity and water quality in the Inner Harbor to understand the various ways urban environments and shorelines impact marine health.
- ▶ **Long-term reduction in nutrient pollution spurs unprecedented recovery of aquatic grasses in Chesapeake Bay** An analysis of more than 30 years of data shows that sustained management actions over the past two decades to reduce nutrient pollution in the Chesapeake Bay and have led to a resurgence of ecologically and economically important aquatic grasses. Aquatic grasses are known as a sentinel species, an indicator of broader ecological function or an early warning of ecological impairment. “We’re very glad to report the largest resurgence of aquatic grasses due to management actions ever recorded, right here in Chesapeake Bay,” said **Bill Dennison**.



Matt Fitzpatrick helps a young scientist get a closer look at the Appalachian Laboratory Open House, one of numerous UMCES outreach events to educate the public across the state.

Education and Outreach

Cat Stylinski and colleagues around the country received a **\$1 million three-year National Science Foundation grant** to explore using augmented reality design experiences to pique teen girls’ interest in science and technology. ... **Laura Lapham** was awarded her second **Changing the Face of STEM grant** from the L’Oréal USA For Women in Science program to build on the success of her hands-on research program to encourage interest in science at the local community college. ... **The educational outreach** of UMCES’ campuses across the state has brought science to **more than 23,000 people** in the community through lectures with faculty experts, campus tours, special events and open houses, and programs in local schools.



UMCES Class of 2018: “The world needs your leadership”

The University of Maryland Center for Environmental Science's fifth annual Commencement ceremony was held at its Horn Point Laboratory campus in Cambridge, Maryland, and featured keynote speaker **Rear Admiral Tim Gallaudet**, Assistant Secretary of Commerce for Oceans and Atmosphere. "Become a policy maker and decision maker. Get in there and learn how to do that and speak that language. Understand how decision-making occurs," he said. "You can be that flickering candle or a solar bright star. My charge to you is to be that solar bright sun."



GRADUATE PROGRAM

Student startup makes a splash in Accelerate Baltimore program

Graduate student **Suzan Shahrestani** is using the technical expertise she has developed in her pursuit of a fisheries science doctorate at the Chesapeake Biological Laboratory to launch her own company, Minnowtech. After completing the Ratcliffe Environmental Entrepreneurs Fellowship at the Institute of Marine and Environmental Technology, she went on to win a place in the prestigious Accelerate Baltimore program, which includes \$25,000 of seed funding and several weeks of mentoring, plus the chance to compete for an additional \$100,000. Minnowtech's real-time fish measurements and simplified analyses will help fishers and managers track, interpret, and understand what is being caught.

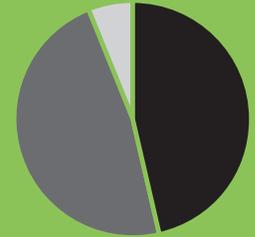


Students impact science policy with Knauss Fellowships

UMCES graduate students captured four coveted John A. Knauss Marine Policy Fellowships from Maryland Sea Grant College. **Melanie Jackson, Maureen Brooks, Emily Russ, and Zoraida Perez-Delgado** will be hosted in a branch of government for one year to learn about ocean and coastal resources and national policy decisions.

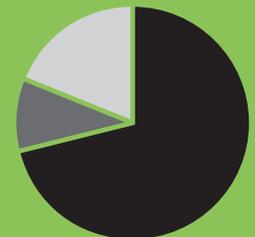
2018 FINANCIALS

Sources of Expenditures



- State Appropriations: \$22.6M (45%)
 - Grants: \$23.5M (47%)
 - Other: \$4.4M (9%)
- \$50.5 million**

Sources of Grants



- Federal: \$18.3M (72%)
 - State: \$2.6M (10%)
 - Private: \$4.4M (19%)
- \$25.3 million**

Sources of Federal Grants



- National Oceanic and Atmospheric Administration (NOAA): \$5.7M (31%)
 - Environmental Protection Agency (EPA): \$2.6M (14%)
 - National Science Foundation (NSF): \$6.2M (34%)
 - Other: \$3.8M (21%)
- \$18.3 million**

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UMCES' work is made possible by the generosity of our donors. Thank you.

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DolphinWatch engages citizen scientists to report sightings

The DolphinWatch app asks citizen scientists to report sightings of bottlenose dolphins in Chesapeake Bay and its tributaries. As of October, 1,128 sightings were reported and 847 confirmed by photos, videos, and interviews. July had the highest number of sightings with 314 in one month. Visit umces.edu/dolphinwatch.



*A sailing group reported their dolphin sightings on the Patuxent River near Solomons to the DolphinWatch app
Photo courtesy of Carolyn Wilson*



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