



Environmental CHALLENGES

of the 21st Century



University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE

2019 ANNUAL REPORT

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

The University of Maryland Center for Environmental Science has led the way toward better management of Maryland's natural resources and the protection and restoration of the Chesapeake Bay since 1925. From a network of laboratories located across the state, our scientists provide sound advice to help state and national leaders manage the environment and prepare future scientists to meet the global challenges of the 21st century.



RESEARCH

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.



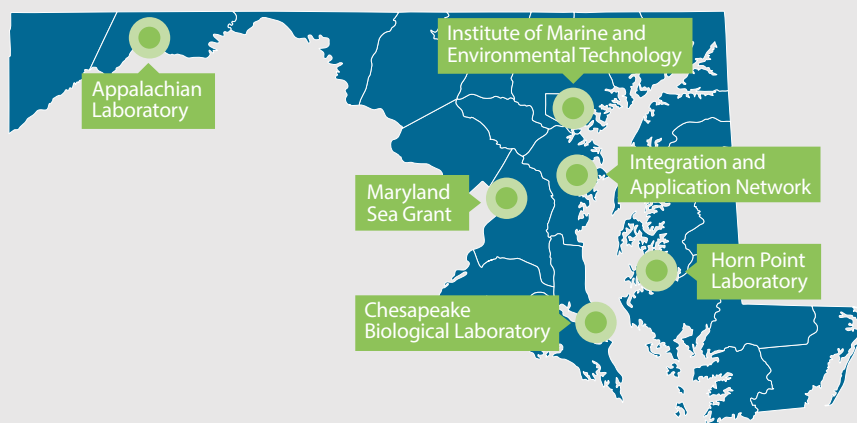
PUBLIC SERVICE

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

MESSAGE FROM THE PRESIDENT

Dear friends,

Thanks to your support, we have begun a significant transformation of the University of Maryland Center for Environmental Science. We publicly launched our new Strategic Initiatives at the UMCES Environmental Summit at the end of 2018, and we've begun to take some meaningful strides in 2019. Many of the factors driving the Strategic Initiatives have become more critical in the past year.



Dr. Peter Goodwin

The last decade was the warmest on record, and recent scientific findings demonstrate that in the past 2,000 years there have been no other similar warming or cooling periods that affect the entire planet. We have experienced 1° C temperature rise since 1970, as has been predicted by science and despite major positive steps taken by several countries. Much needs to be done to curb greenhouse gas emissions to limit global warming to a further 1.5° C and to prepare communities and the environment to adapt.

Our focus is on four critical environmental challenges in which we will be targeting our research investment and effort—maintaining sustainable landscapes and seascapes; building coastal resilience; creating healthy urban waterfronts; and accelerating the science of changing oceans and climate—and four areas in which we will work to strengthen our capacity and deepen our service to Maryland and to the nation. These include expanding and strengthening our educational offerings, deepening our engagement with citizens and decision-makers, contributing to a more diverse workforce in the field of environmental science, and contributing to Maryland's innovation economy.

We expect that clearly articulating and pursuing these priority commitments will strengthen collaborative work across the University, elevate and sharpen our public profile, and ultimately improve our ability to secure expanded support for the great work we do. Over the last year, we have spent time sharing our Strategic Initiatives with various constituencies. Their feedback convinces us that we are on the right track, and there is no time to lose.

The UMCES contribution to these major challenges is possible due to the preeminence of our faculty and students who are pursuing the broad range of fundamental research, from genes to ecosystems, that can be integrated to address the complex questions posed in the Strategic Initiatives. Through this interdisciplinary research, we are training an increasingly diverse set of excellent students to pursue these existential issues as the next generation of environmental scientists; we are informing and advising decision-makers to help them effectively navigate the most important environmental challenges; and we are educating and inspiring citizens so that they can and will hold themselves and others to high standards of environmental stewardship.

We are very proud of the work that we have accomplished, but also recognize that there is more to do—indeed, more that we must do—to help meet the profound environmental challenges facing our state, our nation, and the world. Thank you for your continued support to help us build on our legacy of actionable science and influential alumni.

Regards,

A handwritten signature in black ink that reads "P. Goodwin". The signature is fluid and cursive.

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.

TACKLING PRESSING ENVIRONMENTAL CHALLENGES

University of Maryland Center for Environmental Science faculty work across disciplines and in diverse settings—from the Appalachian Mountains to the Arctic, and from fisheries to climate change—to understand and discover solutions to challenges in the Chesapeake Bay and around the world. As trusted advisors to state and national leaders, we provide the scientific basis to address pressing environmental issues in our communities and around the globe.

We've recently identified four critical challenges in which we will be focusing our research investment and effort in the coming years:

BUILDING COASTAL RESILIENCE



UMCES scientists provide modeling for local governments to plan for flooding and impacts of sea-level rise to coastal communities.

Coastal resilience is the ability of coastal communities and coastal ecosystems to adapt to external disturbances such as hurricanes, flooding and coastal inundation, and extreme heat and precipitation events. Adaptation can reduce the net cost of climate change and its associated consequences, such as sea-level rise and extreme weather events. Leading research on green restoration activities can help increase the protection of shorelines and coastal communities while maintaining ecosystem services.

OYSTER BREAKWATERS: Scientists are building an oyster breakwater to understand how these man-made structures, working in partnership with nature, could help stabilize shorelines around Chesapeake Bay as the threat of shoreline erosion and property loss is increasing.

SEA-LEVEL RISE: An UMCES-led group of scientists provides sea-level rise projections every five years (expected to range from 0.8 to 1.6 feet from 2000 and 2050) to aid managers in planning for changes to Maryland's 3,000+ miles of coastline. Scientists are developing new high-resolution models to predict the effects of storms and sea-level rise on Maryland's coastal communities.

MAINTAINING SUSTAINABLE LANDSCAPES AND SEASCAPES



State-of-the-art advances at the oyster cultivation facility have led to record-breaking numbers of spat-on-shell being used to help restore the Bay ecosystem and aid in aquaculture efforts.

The iconic Chesapeake Bay and its multi-state watershed and airshed provide a living laboratory for UMCES scientists to understand water- and land-use. Improved management practices offer opportunities to meet ambitious goals to reduce greenhouse gas emissions, improve soil health, and improve water quality in Maryland and beyond.

SUSTAINABLE AGRICULTURE: UMCES scientists are leading an international effort to develop a sustainable agriculture matrix, a collection of indicators measuring nutrient use and agricultural practices from environmental, social, and economic dimensions on a national scale to help guide evolving international policies.

OYSTERS FOR RESTORATION: UMCES' oyster expertise maintains a vital role in improving the management of the Bay's iconic species, the Eastern oyster. Recently scientists led the first oyster stock assessment in 135 years to help natural resource managers form a plan for oyster restoration in Chesapeake Bay, and state-of-the-art advances at the oyster cultivation facility at Horn Point Laboratory have led to record-breaking numbers of oysters produced to help restore the Bay ecosystem, aid in aquaculture efforts, and support the wild fishery.

ACCELERATING THE SCIENCE OF CHANGING OCEANS AND CLIMATE



UMCES oceanographers and fisheries scientists are at the forefront of what is one of the most globally integrated and interdisciplinary scientific fields.

The oceans are an important driver of climate. Already the impacts of sea-level rise, ocean acidification, extreme weather events, and declining oxygen levels are evident. UMCES oceanographers and fisheries scientists are at the forefront of a global effort to resolve and ultimately safeguard the impacts of a changing climate on our global ocean.

OCEANS LOSING OXYGEN: UMCES experts authored chapters on ocean deoxygenation and its significance for estuarine and coastal plankton, the basis of marine ecosystem's food web, and fisheries in a ground-breaking new report by the International Union for Conservation of Nature (IUCN) that explores the causes and consequences of ocean deoxygenation and how we, as a planet, must react.

HARMFUL ALGAL BLOOMS: Researchers have been working on developing a new model to better predict the long-term occurrences of dangerous and costly harmful algal blooms in the Chesapeake Bay and have joined a six-institution team to investigate how climate change and extreme precipitation events exacerbate harmful algal blooms, such as red tide, in the eastern Gulf of Mexico.

CHESAPEAKE DOLPHINWATCH: Using "citizen scientists," over than 5,000 users have signed up to help researchers track dolphins in Chesapeake Bay. More than 2,000 sightings were reported since 2017, and scientists are beginning to link dolphin movement to the temperature, salinity, and oxygen in the water.

FUTURE URBAN CLIMATES: This interactive web app reveals how 540 urban areas will feel in 60 years and has helped more than half a billion people visualize the impact of climate change on their lives. UMCES and National Geographic have partnered to expand the app to cities globally.

CREATING HEALTHY URBAN WATERFRONTS



Urban waterfronts like Baltimore's Inner Harbor are particularly vulnerable to intensified coastal development, storms, and flooding.

Urbanized and industrial waterfronts must prepare for and adapt to environmental and climate changes to ensure their ecological, environmental, and economic sustainability. UMCES research can help understand how to improve ecosystem function and biological biodiversity while increasing resilience to coastal inundation due to sea-level rise and storm surge.

HARBOR HEALTH: Scientists are using DNA barcoding to understand and identify what is living in urban waterways, such as Baltimore's Inner Harbor, to be able to have a baseline to judge ecosystem health.

GREEN HARBORS: UMCES brings together expertise to address green ship issues in the Chesapeake Bay and around the world, including vessel biofouling, alternative fuels, and methods to reduce air emissions, and is dedicated to developing effective and reliable sensors and platforms for monitoring water quality.

CORE RESEARCH AREAS

- Biodiversity & Invasive Species
- Climate & Energy
- Coastal & Estuarine Science
- Environmental Chemistry & Toxicology
- Fisheries & Aquaculture
- Genes & Microbes
- Ocean Science
- Restoring & Sustaining Ecosystems
- Terrestrial Ecology & Land Management
- Water Resources & Watersheds

STRATEGIC DIRECTIONS

UMCES seeks to strengthen our capacity and deepen our service to Maryland and to the nation in the following areas:



UMCES hosted European Union Ambassadors to the United States to talk about how their countries are addressing the growing climate crisis.

LOCAL AND GLOBAL ENGAGEMENT TO IMPROVE DECISION-MAKING

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

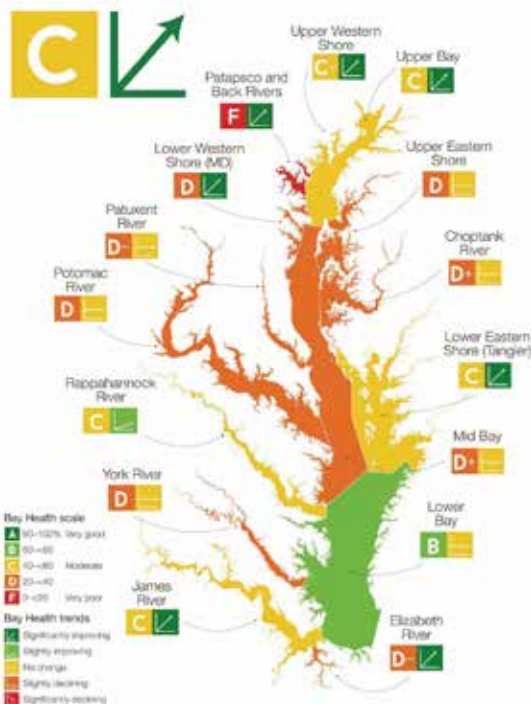
Over the years UMCES has become an indispensable component of the policy-making process for Chesapeake Bay restoration, improving decision-makers' understanding of the challenges and potential solutions before them.

As awareness and the urgency of the climate crisis has grown, so has our role in helping Maryland identify, develop, and employ measures to reduce our greenhouse gas emissions and our vulnerability to climate impacts.

UMCES helps provide the scientific foundation behind the statewide effort to track and communicate the Bay's health and restoration. Our annual **Bay Health Report Card** serves as the primary scientific communications tool for reaching watershed residents about the health of their local waters.

UMCES scientists recently completed a study to understand the potential impacts of nutrient pollution associated with sediment transported from behind **Conowingo Dam** to the Chesapeake Bay. This synthesis is important for bringing the best science to Bay management decisions by considering the entire Susquehanna-Conowingo-upper Bay system.

UMCES had the unique opportunity to host and facilitate a public forum on the **climate crisis** featuring participants from a European Union delegation to Maryland. The European Union Member State Ambassadors from France, Portugal, Sweden, and Spain shared climate policies that their countries are implementing and opened lines of communication about potential collaborative projects in the future.





BUILDING A DIVERSE ENVIRONMENTAL SCIENCE PIPELINE

UMCES strives to be an exemplar of environmental science professionals reflecting the face of the communities served by our work.

UMCES and Maryland Sea Grant College have been awarded a \$2.5 million grant from the National Science Foundation (NSF) to help grow the number and diversity of students who are interested in education and careers in Science, Technology, Engineering and Mathematics (STEM) fields. This grant is part of a \$10 million, eight-institution **SEAS Islands Alliance** that will engage underrepresented minority students from the U.S. Virgin Islands, Puerto Rico, and Guam in marine and environmental sciences. The funded work will help to illuminate a full career pathway from middle school to graduate school and job placement.



PROMOTING ENVIRONMENTAL ENTREPRENEURSHIP

UMCES' research and researchers have the capacity and the opportunity to make significant contributions to Maryland's innovation economy.

Through the **Ratcliffe Environmental Entrepreneurs Fellowship**, local business leaders train students to be science entrepreneurs. Recent graduate Suzan Sharestani has completed seed funding for her startup Minnowtech, an aquaculture technology company that helps shrimp farmers around the world determine the number and size of the shrimp they can harvest from ponds with low visibility, thanks in part to investments by the University System of Maryland's Momentum Fund.



TRANSFORMING LIVES THROUGH EDUCATION

UMCES offers research-based graduate programs, internships for undergraduates, outreach for K-12 students and teachers, and informal learning programs for the public.

UMCES scientists train and inspire the nation's **next generation of environmental leaders** as part of the University System of Maryland's nationally ranked graduate program in marine and environmental science. Graduates conduct research at major universities, manage natural resources in public agencies, and drive entrepreneurial innovation in the private sector.

Four of our graduate students received highly prestigious **John A. Knauss Marine Policy Fellowship** enabling them to apply their expertise to policy issues in the executive and legislative branches of the federal government.

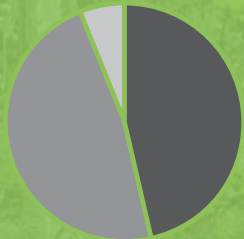
Wave of Plastic, the NOAA-sponsored education partnership at Chesapeake Biological Laboratory will help Southern Maryland students understand the connections between actions on land, plastic pollution in local waterways and the Chesapeake Bay, and student environmental stewardship.

The annual **summer undergraduate internship** at the Institute of Marine and Environmental Technology celebrated its 17th year supporting increased diversity in STEM fields. Each summer, IMET offers undergraduates the opportunity to conduct a nine-week project research in marine sciences applying molecular tools.

Public outreach of UMCES' campuses across the state has brought science of the environment to more than 23,000 people through lectures with faculty experts, campus tours, special events and open houses and local K-12 programs.

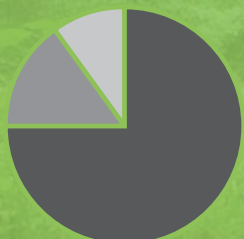
2019 FINANCIALS

SOURCES OF EXPENDITURES



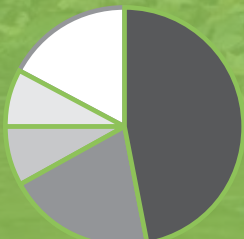
- State Appropriations: \$22.8M (45%)
 - Grants: \$23.6M (47%)
 - Other: \$3.8M (8%)
- \$50.2 million**

SOURCES OF GRANTS



- Federal: \$15.7M (75%)
 - State: \$3.2M (15%)
 - Private: \$2.1M (10%)
- \$21 million**

SOURCES OF FEDERAL GRANTS



- National Oceanic and Atmospheric Administration (NOAA): \$7.4M (47%)
 - Environmental Protection Agency (EPA): \$3.2M (20%)
 - National Science Foundation (NSF): \$1.2M (8%)
 - NASA: \$1.2M (8%)
 - Other: \$2.7M (17%)
- \$15.7 million**



CONTRIBUTORS

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

AES Warrior Run, Inc.
Anonymous
Calvert Nature Society Inc.
Frostburg Vision Center
Southern Maryland Audubon Society
Akridge Family Foundation
Allegany College of Maryland
Miike Allen
Alliance Coal, LLC/Mettiki Coal, LLC
Thomas T. and Catherine Alspach
Robert and Lucy Anderson
Bruce C. and Blenda Armistead
Atlantic Concrete Co., Inc.
Atlantic Tractor, LLC
James Attlee
B.A.S. Construction Inc.
Bailey Wildlife Foundation
Russel and Ida Jane Baker
David and Pamela Baker
Steve and Dawn Balinski
John N. and Karen M. Bambacus
Martin Barley
Judith Ann Barnes
Matthew Bash
David J. Bates
Duane W. Beckhorn
Ivan and Pat Behel
Rebecca Benton
Alice Besterman
Jay and Wendy Johnson Bilas
Brian Bills
Wendy B. Bishop
Neal W. and Mrs. Karin K. Blizzard
Shelby W. and Francesca Blythe
Donald and Michaelyn Boesch
Sara Schofield Booker
John P. and Anne Marie Borneman
Barabra Boyd
Walter and Mary Ellen Boynton
Kenneth L. and
Dr. Ann R. Bristow Braitman
Leslie J. Brodник
Gaylord and Mrs. Shirley Brooks, III
Diana H. Brooks
Omer F. Brown and
Sandra Cannon-Brown
Kevin and Cathy Bruce
Kenneth Bruchey
Mr. Thomas L. and
Sheila Buckmaster
Rachel Budd
Sarah Beth Burdette
James and Mary Campbell
Patrick Campfield
Donna F. Cantor
Robert L. Case
Linda Cherkassky
Chesapeake Bay Seafood Industries Association
Chesapeake Garden Club
Mrs. Victoria W. Childs
Carolyn Chuatiuco
John B. Churchill
Lorraine Claggett
Howard L. Clark
Larry Clark
William and Juniata Clarke
Stephen R. and Lin Clineburg
George and Eleanor Cogswell
Victoria J. Coles
Rita R. Colwell
Community Foundation of Greenville Inc.
Community Foundation of New Jersey
Community Foundation of Southern MD Inc.
Doug Cook
Cooper-Grebmeier Family Fund
Shirley Coops
Jeffery and Deborah Cornwell
Ms. Patricia C. Crane
James and Betty Crothers
Kiersten L. Curti
Moira Daly
Eric A. Davidson and Jean Talbert
Anne B. Davis
Deerbrook Charitable Trust
George Degnon
Patrick R. Delaney
William C. Dennison
John and Martha Detweiler
Dominion Energy Service, Inc.
Dorchester Soil Conservation District
Andrew and Mary Dowdell
Michael J. Dowdy
Aimee Doyle
Martin H. Duby
Jay Dumont
William H. Dunton
Chuck and Natalie Durney
EA Engineering Science & Technology, Inc., PBC
The Honorable Adelaide C. Eckardt
W.B. and Beverly C. Edgell
A. H. and Suzanne L. Edwards
Craig R. Ellis
Willard and Elaine Entwisle
Gary and Jeri Epstein
Charles C.G. Evans, Jr.
Ron Evans
George P.A. and
Jocelyn Eysymontt
Tiffany D. Farrell
Edward W. Fedosky
Richard Feit
Robert H. Feldhuhn and
Barbara Rosenbaum
Fidelity Brokerage Services, LLC
Fidelity Charitable Gift Fund
Gabriel Filippelli
Thomas B. Finan, Jr.
Douglas and Rebecca Firth
William and Joyce Fletcher
Karen Fornwalt and
Sherman Severson
George and Julie Fox
France-Merrick Foundation, Inc.
Jerry and Kerri Thompson Frank
Howard S. and Liz Freedlander
Curtis and Nancy Friedenber
John and Barbara Fringer
Sara Furr
Jerry and Julie Gaff
Frank P. Gallagher, III
Anne L. Gauzens
George B. Todd Fund
Doreen Getsinger
Keith and Lisa Marie Ghezzi
David M. Gillespie
Albert B. Gipe
Dagmar Dunn Pickens Gipe
Eliot Girsang
Richard and Janice Gnospelius
Milton and Delores Goldberg
Mariano A. and
Brenda E. Gonzalez
Chris Goodreau
Peter and Michal Goodwin
Wesley M. and
Katherine D. Gordon
Mr. Barry P. Gossett
Chris and Janice Goudreau
Donald and Tami Graf
Lindsay Grasso
Grayce B. Kerr Fund, Inc.
Jane H. Greene
Gary Michael Greenwood
Mr. Peter Gross
Jan Gustin
Douglas Hackney
Alice E. Hadley
Hamilton Chaney Herrington
Barbour N. Marina
Alan Hammond
Meredith Bullamore Hanna
Dan M. and Amy L. Harman
Jerrold B. and Bobette Harris
Anne L. Harrison
Harry R. Hughes Center for Agro-Ecology
Vicki S. Hatch
Chip and Patty Heaps
Harold H. Hipsley
Marjorie Wax and
Brian P. Hochheimer
Thomas L. Hollingshead
Home Ground Inc.
Jerry Hook and Jacqueline Smith
Porter and Patty Hopkins
Steven and Susie Hopkins
Martha F. Horner
Edward D. Houde
Nina R. Houghton
Ann Houpt
Michael Housley
Michael Housley
Richard and Sue Hu
Donna A. Huggins
Hutchison Brothers
Richard and Jan Hynson
Steven E. Icardi
Norma Imershein
IWLA Mid-Shore Chapter
Jen Edgell
JES Avanti Foundation
Christopher A. Johnson
Barbara M. Johnson
Donald F. and Joan Johnson
Beth Ann Johnson
Dawn A. Jones
Elisabeth Kaemmerlen
Martha C. Keating
Janice S. Keene
Keith Campbell Foundation for the Environment
Margaret D. Keller
Robert Kelly and Sarah Ramsey
Patrick Kennedy and Jill Timmons
Lauren E. Kenworthy
Wells Fargo Community Support Campaign
Laura W. Keohane
Iffat Khan
Robert Killius
Houston M. and
Mrs. Yvonne M. Kimbrough, Jr.
Jerome F. and Mary K. Kinney, IV
Toni Knisley
John P. Knud-Hansen, MD
Koolhof Earth, Inc.
William H. and Gabrielle Korab
Dr. Jonathan G. Kramer
Ronald M. and Marianne Kreitner
Marcia Lapham
Laura L. Lapham
R. Jason Larson
Richard H. Leavy



Philip Lemkau
 Mark J. Levine and Sara Imershein
 Stacy Levinrad
 Ming Li
 Dong Liang
 Thomas L. Lilly
 Kathleen M. Linehan and
 Ed Gabriel
 Kyle J. and Jenna E. Linhart
 Llandaff Family TR
 Mr. Robert A. and Joan Locastro
 Steven M. Long
 Amy Haines and Richard Marks
 Lowell Martin
 Stanley Martin, Jr.
 Richard J. Mason
 Thomas P. and
 Mrs. Carolyn A. Mathews
 Jacques and Kennie Mauche
 Joseph and Sally Mayasich
 Mike and Margot McConnel
 Joe R. and Carol A. McDaniel
 Liz A. McDowell and
 Ronald C. Boyer
 Stacy M. McElhinry
 David McGowan
 Pamela Aall McPherson
 Edward Melisky
 Michael H. Mertz
 J. Bradley and Barbara S. Metzger
 Jack and Jill Meyerhoff
 Mid Atlantic Farm Credit
 Mid-Shore Community
 Foundation Inc.
 Sarah Joy Milbourne
 Donna D. Miller
 Thomas and Gail Miller
 Robert G. Miller
 Monet Family Fund
 Kenneth A. Moore

Ray P. and Merry C. Morgan
 Dr. Fredrika C. Moser
 Michael and Lorraine
 Moskewicz
 Joyce Mumaw
 Ellen R. Musante
 Mr. Stephen R. and
 Diana Mysliwicz
 Nagel Farm Service Inc.
 Mr. J. Mitchell Neitzey
 Mrs. Karen J. Neitzey
 David A. and Cheryl A. Nemazie
 Elizabeth Watkins North
 Northrop Grumman Corp
 Charity Trust
 Nuttall Ornithological Club
 Jan Samet O'leary
 Judith M. O'Neil
 Janel Olde
 Helen Olde
 Linn W. Ong
 Elizabeth Oster
 Jim and Norma Osterhouse
 James T. and Patricia Palinkas
 Cynthia Palinkas
 Lorna Parsons
 Mark L. Pellerin
 Joseph E. and Mary Lou Peters
 Katherine Petty
 Pioneer Hi-Bred International,
 Inc.
 Dan Pirtle
 PNC Financial Services
 Group, Inc.
 Lisa M. Polyak
 John D. Powell
 Anna M. Priester
 Susan C. Priester
 Princeton Area Community
 Foundation
 Corey Pudhorodsky

Mike and Kathy Quattrone
 Ellen Rajacich
 Catherine Putnam Rankin
 Lynn Marie Rehn
 John and Monika Relman
 Jimmie Reynolds
 Thomas H. Reynolds, Jr.
 Lucy F. Richards
 Nancy Riddell
 Anne C. Ridenour
 Mark and Juanita Rilling
 Eleanor Ritchie
 William and Elspeth Ritchie
 Cynthia Robbins
 Robert and Dale Rauch
 Ken and Margie Roberts
 Jessica Roberts
 Jessica Roberts
 Katherine E. Robinson
 David Robson
 Bill and Janet Rochow
 Diane Rohman
 Reed and Patricia Rollo
 Michael R. and Jennie L. Roman
 Scott Romans
 Kenneth A. and Julie Rose
 Christopher L. Rowe
 Raymond Todd Rowley
 Jeffrey S. Ruark
 Harriet Russell
 William F. Ryan
 Michael Sarin
 Saul Ewing Arnstein & Lehr LLP
 Kathleen Burns Scanlon
 Mary Ann Schindler and
 Martin Hughes
 Edward and Marilyn Schmidt
 Matthew Schneider
 Jim Schofield
 Kaherine Schoonover
 Michael E. and Dale Schrader
 Rhonda K. Schwinabart
 David and Eriko Secor
 Martha C. Sewell
 Ben Shaw
 Anita Shepherd
 Shore United Bank
 ShoreRivers Inc.
 Dewees and Kelly Ann Showell
 John D. Shuman
 Carol R. Simpson
 Laurence E. Skinner and
 Maris Wicker
 Steven G. Smith
 Edgar A. Smith
 Lesley Smith-Morrill
 Eva M. Smorzaniuk, MD
 Anna Snow
 Solomons United Methodist
 Church
 Kimbol Soques

Southern Maryland Alumni
 Network UM
 Southern Maryland Electric Co-Op
 Southern Maryland Recreational
 Fishing Organization
 Wayne C. and E. Betty Spiggle
 Milford Sprecher
 Heather M. Stapleton
 Mike and Linda Starling
 Jock Beebe and Carin Starr
 Kenneth W. and Lorie Staver
 Mary Stephenson
 Stephenson Pope Babcock
 Foundation
 J. Court and Catherine P. Stevenson
 George and Mrs. Beverly Stimmel
 Joseph T. N. Suarez, CFRE
 Haven Sweet
 Henry and Dorothy Szymanski
 Francis and Margaret Tam
 The Ed and Andy Smith Fund
 The Foundation for Enhancing
 Communities (TFEC)
 The Peoples Bank
 The Philip E. & Carole R. Ratcliffe
 Foundation
 Frances A. Thorington
 Bonnie Thornton
 Richard and Beverly Tilghman
 Toyota of Southern Maryland/
 Team Hyundai
 Luther and Cordelia Tucker
 Alfred Tyler, II and Cleo Braver
 UMS HPEL Working Fund
 John R. and Lise Valliant
 Ms. Elizabeth K. Vanden Heuvel
 Vanguard Charitable
 Lisa A. Wainger
 Wilmer Waller and Michael Hash
 Walt Disney Company Foundation
 Frank M. Watkins, MD
 Stanley P. and Gail Watkins
 Daniel Watson and Brenda Stone
 Philip J. and Irmhild G. Webster
 Dale L. Whalen
 Jeane Wharton
 Elizabeth Wheeler
 Robertson Williams
 Joseph L. Winters
 Douglas G. and Margaret Worrall
 Rochelle Wyatt
 Mr. David Wye
 Charles and Ann Yonkers
 Dottie Yunger
 David and Lois Zonderman
 Howard A. Zwemer

We greatly appreciate your support and regret any inadvertent omissions. To make a contribution, visit umces.edu/giving or call 410-221-2001.

UNIVERSITY SYSTEM OF MARYLAND

Jay A. Perman, M.D., *Chancellor*

BOARD OF REGENTS 2020

Linda R. Gooden, *Chair*
Gary L. Attman
Joseph Bartenfelder, *ex officio*
Ellen Fish
Geoff J. Gonella
Barry P. Gossett
Michelle A. Gourdine, M.D.
James Holzapfel
D'Ana Johnson
Isiah (Ike) Leggett
Sam Malhotra
Meredith M. Mears
Robert R. Neall
Louis Pope
Robert D. Rauch
Kelly M. Schulz, *ex officio*
Robert L. Wallace
William T. "Bill" Wood
Drew M. Needham, *Student Regent*

LEADERSHIP

Peter Goodwin, *President*

Stuart Clarke
Vice President for Strategic Initiatives

William C. Dennison
Vice President for Science Applications

David A. Nemazie, *Chief of Staff*

Lynn M. Rehn
Vice President for Administration

Lawrence Sanford
Vice President for Education

LABORATORY DIRECTORS

Eric A. Davidson
Appalachian Laboratory

Russell T. Hill
Institute of Marine and Environmental Technology

Thomas J. Miller
Chesapeake Biological Laboratory

Fredrika C. Moser
Maryland Sea Grant College

Michael R. Roman
Horn Point Laboratory

BOARD OF VISITORS

Charles O. Monk II, Esq., *Chair*
Paul J. Allen
Thomas L. Buckmaster
Victoria Childs
Peggy Derrick
Gary M. Epstein
Joseph E. Farren
Donald Graf
Ronald Kreitner
Mark Levine
Thomas Lingan, Esq.
William (Sandy) McAllister, Jr.
J. Mitchell Neitzey
Eileen Straughan
Joe Suarez

LOCATIONS

Center Administration

P.O. Box 775
Cambridge, MD 21613 | 410-228-9250

Appalachian Laboratory

301 Braddock Road
Frostburg, MD 21532 | 301-689-7100

Chesapeake Biological Laboratory

146 Williams Street
Solomons, MD 20688 | 410-326-4281

Horn Point Laboratory

2020 Horns Point Road
Cambridge, MD 21613 | 410-228-8200

Institute of Marine and Environmental Technology

701 E. Pratt Street
Baltimore, MD 21202 | 410-234-8800

Maryland Sea Grant College

4321 Hartwick Road, Suite 300
College Park, MD 20740 | 301-405-7500



University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE

umces.edu





The University of Maryland Center for Environmental Science's sixth annual Commencement ceremony featured Professor Vicki Arroyo, Executive Director of the Georgetown Climate Center and Assistant Dean for Centers and Institutes at the Georgetown University Law Center.

"For major environmental challenges—saving Chesapeake Bay, curbing or preparing for climate change, individual institutions (even relatively small ones like UMCES and Georgetown Climate Center)—can play a vital role. And individual people like each of you graduating today can make a difference."



University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE