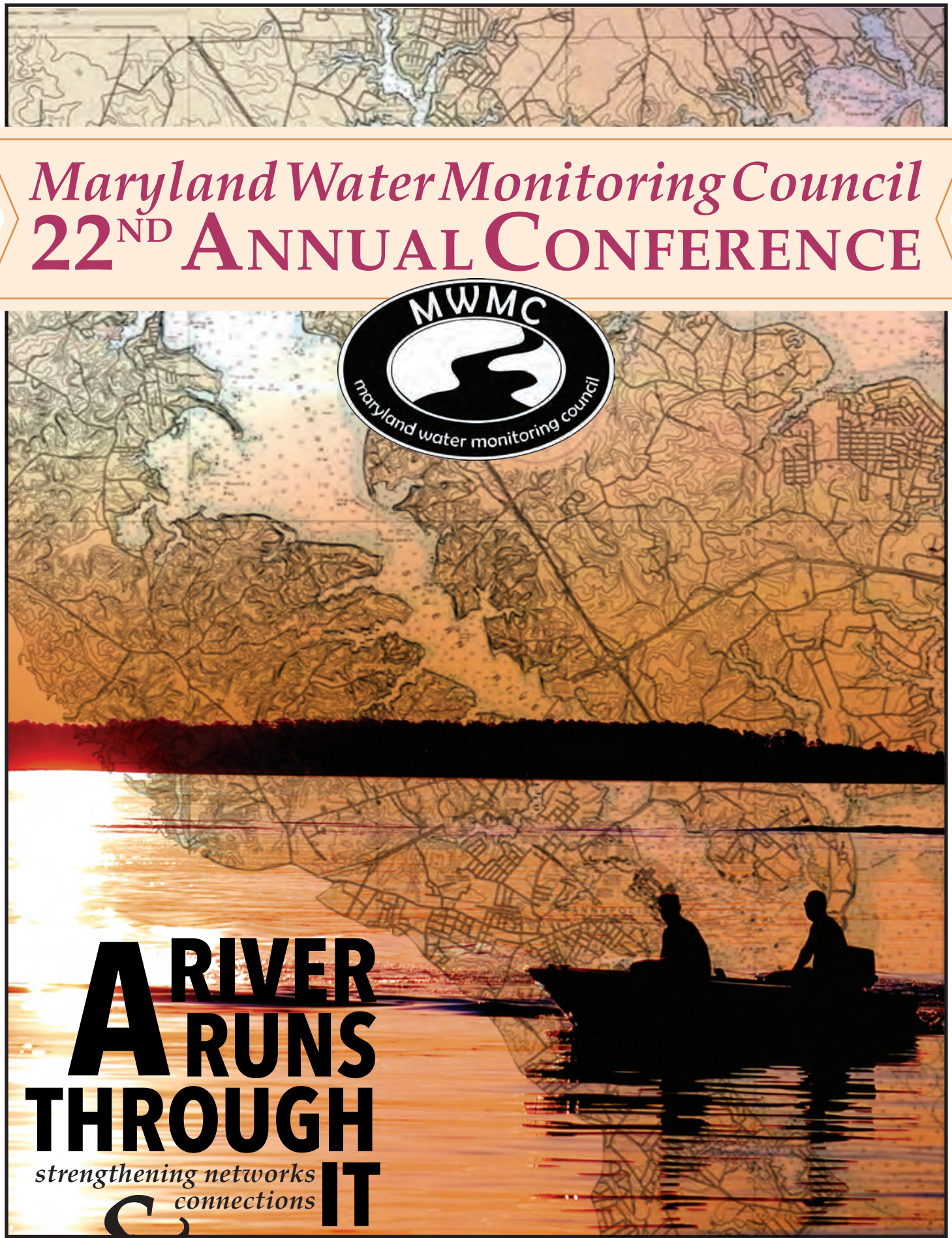
Maryland Water Monitoring Council
22ND ANNUAL CONFERENCE



A RIVER RUNS THROUGH IT

strengthening networks & connections

DECEMBER 2, 2016 • THE MARITIME INSTITUTE • LINTHICUM, MARYLAND

2016 MWMC Annual Conference
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The 22nd Annual Conference of the Maryland Water Monitoring Council

A River Runs Through It – Strengthening Networks and Connections

The 2016 MWMC Annual Conference Planning Committee and I would like to welcome you to the 22nd Annual Conference of the Maryland Water Monitoring Council. We are excited to have put together another great day of terrific speakers, posters and breakout sessions providing insight into the ways in which the monitoring community has helped to protect and sustain Maryland's waters. This year's conference theme "A River Runs Through it – Strengthening Networks and Connections" was selected to help make a connection between the efforts of the monitoring community to protect water quality and the educators, volunteers, legislators and agency planners that help to implement policies and practices that support our efforts to preserve Maryland's water resources.

We are honored to have with us for the morning plenary session two fantastic speakers - Wayne Gilchrest, Former US Representative from Maryland's 1st District and George Hawkins, CEO and General Manager for the District of Columbia Water and Sewer Authority - who will discuss how to monitoring data can be used to make more informed decisions, the operational and budget challenges that face DC Water and how collaborative connections with our upstream colleagues provide a natural approach for the future management of water resources.

Also continuing this year, we will be awarding the Carl Weber Award as a way to recognize the extraordinary contributions that Dr. Carl Weber made to the field of water monitoring. The Council presents this award in Carl's name as a lasting reminder of the affection and respect that we hold for Carl and his work, and to inspire others to emulate his passion, dedication, and good humor. In addition, a new "Above and Beyond Award" will be presented to a member of the monitoring community who represents the next generation of Maryland's water monitors and has shown outstanding drive in increasing watershed awareness, advocacy, education and stewardship.

The MWMC and the Board of Directors would like to thank the monitoring community for their efforts and look forward to working with all of you to continue to find new ways to facilitate collaboration and cooperation between all of the individuals and organizations that work every day to maintain our valuable state water resources. As with any organization, the MWMC is only as strong as the members and individuals who participate in Council activities.

The MWMC continues today as an effective statewide collaborative body because of the many contributed hours that individuals and organizations have donated to furthering the Council's goal of serving as a vehicle for the effective collection, interpretation, and dissemination of environmental data related to issues, policies, and resource management objectives involving water monitoring. We encourage you to strengthen the MWMC by getting involved, communicating your needs to us, and using the Council to enhance your water monitoring programs, resource management, and environmental stewardship initiatives. Talk with a MWMC member at today's conference at the MWMC table or in the halls and find out how the Council can help you help enhance water monitoring through the Council. To learn more about the MWMC, go to **www.marylandwatermonitoring.org**.

The Annual Conference is a "green" conference. We would like to thank the Maritime Institute who has partnered with us to provide on-site recycling, motion-activated lighting in the hallways, and washable/compostable tableware for our breaks. And the recently-renovated cafeteria now provides many vegan and vegetarian options to help us make healthy food choices. Please enjoy the facility and today's conference program.

Let's make this a great conference!

Clark Howells
Chair, Maryland Water Monitoring Council

The Carl S. Weber Award

For Vision and Leadership in Monitoring Maryland's Waters

Our vision for monitoring in Maryland…

The MWMC envisions a time when monitoring methods, programs, projects, and data are the product of collaboration and comparability among agencies and organizations. The resulting information will be accessible for use by all stakeholders and will facilitate sound decision-making in environmental management and protection.

Dr. Carl S. Weber. Among many other things, Carl was one of the founding Board members serving a term on the MWMC Board in the mid-1990s representing the academic community. Today we honor Carl's life and work and celebrate the qualities that made him such an important part of the Maryland monitoring community with the annual presentation of the Carl S. Weber Award. Beginning in 2007, the Award has been presented annually to an individual involved in water monitoring in Maryland who exhibits the spirit, vision and leadership so exemplified by Carl. One person can make a difference!

Carl was a founding member of the University of Maryland-Baltimore County (UMBC) Biological Sciences Department and taught there for nearly 40 years. Although his training was in biochemistry, he developed an interest in stream ecology in the 1980s and became a self-taught aquatic biologist, eventually creating and teaching extremely popular courses on stream and river ecology at UMBC. Carl used Herbert Run, a Patapsco tributary that flows through UMBC, as a living classroom for his students that spurred research and restoration activities on the stream. In 2002, Carl won the UMBC 2002 Alumni Association Award for Mentoring. Many of the students Carl taught and mentored went on to internships and careers in the environmental protection field. Carl was instrumental in bringing the National Science Foundation's Long-Term Ecological Research Network to UMBC through the Baltimore Ecosystem Study. He also served as the first chair of the Patapsco Tributary Team.

Carl's entry into the monitoring world began when he got involved with the Friends of Gwynns Falls/Leakin Park in his home watershed. In 1989, he took on an amazing volunteer task—leading a unique and innovative new project for Maryland Save Our Streams and Baltimore County. "Project Heartbeat" was the first program in the United States to train volunteers to collect and analyze benthic macroinvertebrates and to assess physical habitat using EPA's 1989 Rapid Bioassessment Protocol. Carl jumped right in and became involved in every aspect of the program. Over a 10 year period, thousands of volunteers were trained to collect benthic samples and identify them to the taxonomic family level in a controlled lab setting. Through Carl, UMBC provided lab space and equipment, and for several years, Carl taught and supervised all the lab volunteers to ID 200-300 samples a year. He chaired both the community steering committee and the technical advisory committee, building a bridge among volunteers, watershed organizations, academia, the County, the State, EPA, and other stakeholders—all represented on these committees.

For years, Carl performed all the lab quality control and data analysis for Heartbeat. He co-authored Project Heartbeat's Quality Assurance Project Plan, the first of its kind for a volunteer biological monitoring program. In the 1990s, Project Heartbeat had a profound impact on volunteer water monitoring, environmental education, and watershed collaboration— not only in Maryland, but across the country. Because of this program, Baltimore County has a quality baseline data set on the health of its streams spanning more than 10 years. Project Heartbeat maintained a high level of scientific credibility and the program contributed to advances made in stream assessment and analysis methods within the

Maryland Department of Natural Resources and the Maryland Department of Environment. Certainly the road to DNR's "Streamwaders" program was paved, in part, by Project Heartbeat's success. No one person is more responsible for any of these accomplishments than Carl Weber.

Through this award, we celebrate Carl's life and work by acknowledging others who share his generous spirit, his commitment to Maryland's waters, his vision for collaboration, and his leadership in advancing monitoring and assessment.

Previous Winners

2015 – Frank Dawson

2014 – Jim Long

2013 - Paul Kazyak

2012 - Charlie Conklin

2011 - Bill Stack

2010 - Sally G. Horner

2009 - Peter Bergstrom

2008 - Ron Klauda

2007 - Susan "Abby" Markowitz and Dr. Paul Massicot

New in 2016 – Above and Beyond Award

Many of the previous Carl Weber Award recipients have had lengthy careers and been a part of public agencies. The Above and Beyond Award will allow the MWMC to recognize someone who represents the next generation of Maryland's water monitors and the future of the MWMC. Presented annually to recognize contributions of an up-and-coming member of the Maryland's environmental community, the Above and Beyond Award is presented to a member who has volunteered time and energy towards the monitoring of Maryland's waters and has made a significant contribution to increasing watershed awareness, advocacy, education and stewardship. The MWMC is proud to include this new award in our 2016 conference and many more.

2016 Annual Conference Planning Committee

Andy Becker	KCI Technologies, Inc.
Dan Boward (Chair)	Maryland Department of Natural Resources
Kevin Brittingham	Baltimore County Department of Environmental Protection and Sustainability
Clark Howells	Baltimore City Department of Public Works
Mike Pieper	KCI Technologies, Inc.
Charlie Poukish	Maryland Department of the Environment
Matt Stover	Maryland Department of the Environment
Angel Valdez	Maryland Department of the Environment
Kathy Stecker	Maryland Department of the Environment

Plus additional thanks to:

Katherine Hanna	Maryland Department of Natural Resources (MWMC Web Master and Graphics Support)
Jackie Sivalia	Maryland Department of Natural Resources (Conference preparation)
Rachel Denby	Maryland Department of Natural Resources (Conference preparation)
Joanne Alewine	Maryland Department of Natural Resources (Conference preparation and registration table)

MARYLAND WATER MONITORING COUNCIL

22nd Annual Conference Agenda

Friday, December 2, 2016

A River Runs Through It – Strengthening Networks and Connections

7:30 **Registration/Poster Set-up/Continental Breakfast**

Morning Plenary Session (8:30-10:00) in the Auditorium (simulcast in Classroom 1)

8:30 **MWMC Board Chair's Call to Order – Clark Howells; Baltimore City Department of Public Works; Chairman, MWMC Board of Directors**

8:45 **Knowledge is the Solvent for Danger – Wayne Gilchrest; Former US Representative from Maryland's 1st District**

9:15 **Upstream Downstream: an Imperative Alliance –George Hawkins; CEO and General Manager - District of Columbia Water and Sewer Authority**

9:45 **Carl S. Weber Awards – Sandy Hertz; Maryland Department of Transportation and Cathy Weber**

10:00 **Break/Poster Session – Authors Present**

	Auditorium	Room A-300	Classroom 3	Room A-111/113	Classroom 2	Bridge Room
10:30 – 12:00	*STREAM RESTORATION MONITORING RESULTS – WHAT ARE WE LEARNING?- Moderator, Mark Southerland (AKRF)*	*SALT OF THE EARTH?: UNINTENDED CONNECTIONS BETWEEN DE-ICERS AND OUR WATER RESOURCES – Moderator, Mat Pajerowski (USGS)*	*NUTRIENT TRADING - FROM BASEBALL CARDS TO WATER QUALITY – TRADING IS THE GAME – Moderator, Jim Caldwell (Howard Co.)*	*CREATING RESILIENCY THROUGH NATURE: ROLES FOR GREEN INFRASTRUCTURE IN A CHANGING CLIMATE – Moderator, Clark Howells (Balto. City)*	*AIR POLLUTION IMPACTS ON SURFACE WATERS – Moderator, Lew Linker (EPA)*	*ADVOCACY AND OUTREACH – Moderator, Tim Goodfellow (Fred. Co.)*
	RESTORATION RESEARCH AWARD PROGRAM - Sadie Drescher (Ches. Bay Trust) *PERFORMANCE OF HEADWATER REGENERATIVE STREAMWATER CONVEYANCE (RSC) STRUCTURES - Michael Williams (SERC)* *TRADING NITROGEN AND PHOSPHORUS FOR ORGANIC CARBON AND HYPOXIA IN A STREAM RESTORATION - Thomas Jordan (SERC)* *STREAM AND WETLAND RESTORATION THROUGH THE LENS OF MS4 COMPLIANCE AND THE CHESAPEAKE BAY TMDL: CAN WE GET THERE WITHOUT IT? – Erik Michelsen (Anne Arundel Co.)*	*STORMWATER MANAGEMENT BASINS AS A YEAR-ROUND SOURCE FOR NA AND CL TO URBAN AND SUBURBAN STREAMS - Joel Moore (Towson Univ.)* *CONTINUOUS MONITORING OF INSTREAM TEMPERATURE AND SPECIFIC CONDUCTANCE VALUES TO REFINE CONCENTRATION AND LOAD ESTIMATES OF CHLORIDE IN AREA STREAMS - Joseph Bell (USGS)* *SODIUM, CALCIUM AND CHLORIDE REMOVAL EFFICIENCIES OF SELF-CONVERTED DRY DETENTION PONDS IN BALTIMORE COUNTY, MD - Rob Owen (KCI)*	*THREE EXPERTS WILL PROVIDE THEIR PERSPECTIVE ON MARYLAND'S UPCOMING NUTRIENT TRADING PROGRAM* *THE MARKET PERSPECTIVE - Brent Fewell (Earth & Water Group)* *THE GOVERNMENT PERSPECTIVE - Susan Payne (MD Department of Agriculture)* *THE ENVIRONMENTAL PERSPECTIVE - Doug Myers (CBF)*	*COASTAL PLANNING: MAPPING NATURAL SOLUTIONS FOR RESILIENT COASTAL COMMUNITIES - Nicole Carlozo (MDNR)* *INLAND RESILIENCY PLANNING THROUGH THE GREATER BALTIMORE WILDERNESS COALITION - Jeff Lerner (American Forests/Greater Baltimore Wilderness Coalition)* *GREEN INFRASTRUCTURE FINANCING - Megan Granato (MDNR)* *PERSPECTIVES ON ELLICOTT CITY FLOOD MITIGATION - Lori Lilly (Lori A. Lilly – Env. Solutions)*	*LONG-TERM RESPONSE OF SURFACE WATER ACID NEUTRALIZING CAPACITY IN A WESTERN MARYLAND RIVER BASIN TO DECLINING ACID DEPOSITION – Katie Kline (UMCES)* *INTEGRATING AIR AND WATER ENVIRONMENTAL MANAGEMENT IN THE CHESAPEAKE BAY PROGRAM - Lew Linker (EPA)* *WHERE DOES THE MERCURY IN MARYLAND COME FROM? - Mark Cohen (NOAA)*	*REDUCING SANITARY SEWER OVERFLOWS THROUGH TARGETED OUTREACH CAMPAIGNS - Eric Eckl (Water Words That Work) and Lori Lilly (Lori A. Lilly – Env. Solutions)* *HOW FISH MONITORING AND ADVOCACY SAVED CHARLES COUNTY - Kimberly Brandt (1000 Friends of MD) and Jim Long (Mattawoman Watershed Soc.)* *THINKWATER: BUILDING A MOVEMENT OF PEOPLE WHO CARE AND THINK DEEPLY ABOUT WATER - Jeremy Solin (ThinkWater; Univ. of Wisc.) and Ken Belt (USDA Forest Service)* *MEETING EVOLVING WATER CHALLENGES THROUGH INNOVATIVE EDUCATION PLATFORMS – John Munro and Robert Ouellette (UMUC)*

Two Lunch Groups – 12:00 – 1:00 (Orange Nametag Sticker) - 12:30 – 1:30 (Blue Nametag Sticker)

12:00 - 12:30 and 1:00 – 1:30 Poster Session – Authors Present

	Auditorium	Room A-300	Classroom 3	Room A-111/113	Classroom 2	Bridge Room
1:30 – 3:00	***STREAM RESTORATION MONITORING RESULTS – WHAT'S LEFT TO LEARN?*** - Moderator, Mark Southerland (AKRF)	***SUSTAINABLE BAY FISHERIES*** – Moderator, Charlie Poukish (MDE)	***COLLABORATING WITH COMMUNITY PARTNERS*** – Moderator, Kathy Stecker (MDE)	***URBAN WATERS: LIFE IN THE BIG CITY*** – Moderator, Mark Trice (MDNR)	***NATIONAL AQUATIC RESOURCE SURVEYS*** – Moderator, Richard Mitchell (EPA)	***TEACHERS, TIDEWATER, AND TRIBUTARIES - CITIZEN SCIENTISTS GET THE JOB DONE!*** – Moderator, Amanda Sullivan (MDNR)
	INTERACTION OF TEMPERATURE AND BROWN TROUT AFFECT BROOK TROUT HABITAT USE - Nathaniel Hitt (USGS) ***PREDICTING THE BENEFITS OF STREAM AND WATERSHED RESTORATION ON BIOTA THROUGH AN IMPROVED QUANTITATIVE UNDERSTANDING OF IMPACT MECHANISMS: USING RIVER CHUB AS AN EXAMPLE - Stanley Kemp (Univ. of Balt.)*** ***CHANGES THROUGH TIME IN THE BENTHIC MACROINVERTEBRATE COMMUNITIES OF SITES NEAR AND WITHIN RESTORED STREAMS IN ANNE ARUNDEL COUNTY, MARYLAND - Christopher J. Victoria (Anne Arundel Co.)*** ***MONITORING CREATED VERNAL POOLS AND WETLANDS IN BALTIMORE COUNTY - Kate Traut (Straughan Env.)***	***MANAGING CHESAPEAKE BAY'S LAND USE, FISH HABIT AND FISHERIES: DEVELOPING AND APPLYING IMPERVIOUS SURFACE REFERENCE POINTS – Jim Uphoff (MDNR)*** ***HAS STRIPED BASS MOVEMENT CHANGED IN THE POTOMAC AND LOWER BAY? - Tom Parham and Jim Uphoff (MDNR)*** ***PLANNING WITH THE FUTURE IN MIND: INCORPORATION OF IMPERVIOUS SURFACE ECOLOGICAL THRESHOLDS IN THE COMPREHENSIVE DEVELOPMENT PLAN PROCESS - Marek Topolski (MDNR)*** ***OYSTERS: TWO SHELLS BUT MANY FACETS. A PRIMER ON BIOLOGY, ECOLOGY, AND MANAGEMENT - Christopher Judy (MDNR)***	***HOA LANDSCAPING REVISIONED: COMMON SPACE FOR THE GREATER GOOD -Gem Bingol (Piedmont Envir. Council)*** ***AMEN! REACHING BEYOND THE CHOIR - Jodi Rose (Interfaith Partners for the Chesapeake)*** ***IT'S EVERYONE'S BUSINESS TO BE GREEN - Corinne Stephens (Alliance for the Chesapeake Bay)***	***DEFINING THE BEST NATURAL ENHANCEMENTS AND INNOVATIVE TECHNOLOGIES TO DELIVER ECOSYSTEM SERVICES TO HIGHLY URBANIZED WATERFRONTS - Charmaine Dahlenburg (National Aquarium)*** ***GHOST STREAMS OF BALTIMORE AND THEIR VALUE TO SCIENCE, THE SOCIAL FABRIC, AND HISTORY - Kenneth Belt (USDA)*** ***THE EVOLUTION OF ION CHEMISTRY IN URBAN STREAMS IN THE MARYLAND PIEDMONT AND IMPLICATIONS FOR FRESHWATER BIOTA - Darcy Bird (Towson Univ.)*** ***ACTIONABLE SCIENCE IN THE BALTIMORE URBAN WATERS PARTNERSHIP- Robert Shedlock (USGS)***	***NATIONAL WETLAND CONDITION ASSESSMENT: FINDINGS, DATA APPLICATIONS, AND FUTURE DIRECTIONS - Gregg Serenbetz (EPA)*** ***THE NATIONAL COASTAL CONDITION ASSESSMENT: 2010 RESULTS AND STATUS OF THE 2015 ASSESSMENT – Hugh Sullivan (EPA)*** ***NUTRIENT POLLUTION ACROSS THE CONTINENTAL UNITED STATES: AN OVERVIEW OF FINDINGS FROM THE NATIONAL LAKES ASSESSMENT AND NATIONAL RIVERS AND STREAMS SURVEY - Amina Pollard (EPA)***	***CHESAPEAKE MONITORING COOPERATIVE: STRENGTHENING CONNECTIONS BETWEEN CITIZEN SCIENCE AND MANAGEMENT AGENCIES - Lea Rubin (IWLA)*** ***STATEWIDE WATERSHED REPORT CARD: STUDENTS SCIENTISTS IN ACTION - Ann Strozyk (Howard Co. Public Schools) and Sara Weglein (MDNR)*** ***CITIZEN SCIENCE - THE BACKBONE OF WATERSHED GROUPS - Timothy Rosen (Midshore Riverkeeper Conservancy)***

3:00 – 3:30 Break/Poster Session – *Authors Present* – Announcement of Student Poster Award Winners (Auditorium)

	Auditorium	Room A-300	Classroom 3	Room A-111/113	Classroom 2	Bridge Room
3:30 – 4:30	***STREAM RESTORATION MONITORING RESULTS – PUTTING LESSONS INTO ACTION*** **- Moderator, Mark Southerland (AKRF)**	***THOSE BLUE-GREENS (AKA CYANOBACTERIA), PRIMITIVE PHOTOSYNTHETIC MACHINES?*** **– Moderator, Kevin Sellner (Hood College)**	***CLIMATE CHANGE-WETLANDS, THE BAY AND BEYOND*** **– Moderator, Britta Bierwagen (EPA)**	***URBAN WATERS: LIFE IN THE BIG CITY*** **II – Moderator, Matt Stover (MDE)**	***SAVE THE TROUT! – LAND USE, BMPS AND STRONG PARTNERSHIPS*** **– Moderator, Caroline Donovan (UMCES)**	***WHY DID THE STREAM CROSS THE ROAD?*** **– Moderator, Joel Moore (Towson Univ.)**
	GORGAS RUN STREAM RESTORATION: INNOVATIVE APPROACHES FOR NATURAL CHANNEL DESIGN IN A WOODLAND PARK SETTING -Shandor Szalay (AKRF) ***HOW MUCH MONEY IS GOOD DATA WORTH?: AN EXAMINATION OF THE MONETARY IMPACTS THAT OCCUR WITHIN THE RANGE OF VARIABLES ASSOCIATED WITH NUTRIENT REDUCTION ESTIMATES FROM TMDL BASED STREAM PROJECTS IN MARYLAND AND VIRGINIA – Josh Running (Stantec)*** ***URBAN STREAM RESTORATION AND CONSERVATION: A CASE STUDY OF HERRING RUN - Archana Sharma (Morgan State Univ.)***	***DISTRIBUTIONS AND POTENTIAL EFFECTS OF BENTHIC CYANOBACTERIA IN THE UPPER POTOMAC RIVER - Josh Henesy (MDNR)*** ***CYANOBACTERIAL PERSISTENCE IN MARYLAND LAKES: YEAR-ROUND PRESENCE OF COLD-ADAPTED SPECIES - Jeff Mattheiss (Hood College)*** ***CYANOBACTERIA BLOOM MITIGATION: BARLEY STRAW (HORDEUM VULGARE) AND OTHER APPROACHES - Kevin Sellner (Hood College)***	***CLIMATE CHANGE AND MONITORING IN AQUATIC ECOSYSTEMS: DATA NEEDS AND GAPS – Britta Bierwagen (EPA)*** ***BUILDING CLIMATE RESILIENCY: MONITORING, ASSESSING AND DETECTING TRENDS AND IMPACTS - Zoe Johnson (NOAA) and Peter Tango (USGS)*** ***INCREASING SALT MARSH ACREAGE AND RESILIENCY FOR BLACKWATER NATIONAL WILDLIFE REFUGE - David Curson (Audubon MD-DC)***	***BACKSCATTER AS A SURROGATE FOR SUSPENDED SEDIMENT, NUTRIENT, AND BACTERIA CONCENTRATIONS IN AN URBAN STREAM WITHIN ROCK CREEK NATIONAL PARK, WASHINGTON D.C. - Joseph Bell (USGS)*** ***NUTRIENT DYNAMICS IN URBAN HEADWATER STREAMS: THE ROLE OF LEAF LITTER - Neely L. Law (Center for Watershed Protection) and Sadie Drescher (Ches. Bay Trust)*** ***OPTIMIZING MONITORING DESIGN TO ASSESS THE EFFECTS OF STORM WATER BEST MANAGEMENT PRACTICES ON WATER RESOTRATION - Dong Liang (UMCES)***	***MONITORING RESULTS TO VERIFY CONTINUOUS MONITORING AND ADAPTIVE CONTROL BMPS - Jamie Lefkowitz (OptiRTC)*** ***DATA AND WEB TOOLS FOR IMPROVING WATER QUALITY- Cassandra Pallai and Colin Stief (Chesapeake Conservancy)*** ***2016 STATUS REPORT - UPPER GUNPOWDER FALLS WATERSHED BROOK TROUT CONSERVATION PARTNERSHIP - Adam Nabors (Trout Unlimited) and Mark Staley (MDNR)***	***THE INFLUENCE OF ROADS AND IMPOUNDMENTS ON AQUATIC COMMUNITY STRUCTURE IN HEADWATER STREAMS - Sean Sipple (Coastal Resources)*** ***ROAD-STREAM CROSSING ASSESSMENTS IN MARYLAND: WORKING WITH PARTNERS TO SET FISH PASSAGE PRIORITIES - Chris Reily (USFWS)***

4:30 Adjourn - SOCIAL AT HEAVY SEAS BREWERY STARTING AT 5:00 (registration required)

Poster Presentations (In Order of Primary Author's Last Name)

THE SMALL SCALE SPATIAL EFFECT OF CONSERVATION AREAS ON WATER QUALITY: IMPLICATIONS FOR CHESAPEAKE BAY AND ITS TRIBUTARIES - STUDENT POSTER - Lark Amoa (Stevenson University)

THE TENTH ANNUAL MARYLAND STREAMS ROUNDTABLE - Andy Becker (KCI Technologies, Inc.) and Dan Boward (MDNR)

GHOST STREAMS OF BALTIMORE AND THEIR VALUE AND THEIR VALUE TO SCIENCE, THE SOCIAL FABRIC, AND HISTORY - Kenneth T. Belt (USDA Forest Service), Sujay Kaushal (University of MD), Jeremy Solin (University of WI Cooperative Extension), and Raymond Bahr (Watershed Advocate)

USING ENTEROCOCCI TO MONITOR WATER QUALITY OF STREAMS IN HARFORD COUNTY, MARYLAND - John Biondo, Gracie Shannahan, and Tami Imbierowicz (Harford Community College)

HOW SAFE ARE SAFENERS? A BENTHIC MICROCOSM STUDY - Kasey Bolyard, Susan Gresens, John Sivey, and Christopher Salice (Towson University)

THE EFFECT OF DEVELOPMENT ON THE HYDROLOGY OF THE UPPER GWYNNS FALLS - STUDENT POSTER - Laura Brezinski (Stevenson University)

USING LOGGERS TO INCREASE TEMPORAL COVERAGE OF SURFACE WATER-GROUDWATER INTERACTIONS - STUDENT POSTER - Joseph Broome, Gregory Woodward, and Joel Moore (Towson University)

BANK-DERIVED SEDIMENT DOMINATES SUSPENDED SEDIMENT FINGERPRINTS IN A SUBURBAN CHESAPEAKE BAY WATERSHED, UPPER DIFFICULT RUN, VIRGINIA, USA - Matthew J Cashman and Allen Gellis (USGS)

THE SMALL SCALE EFFECT OF CONSERVATION BUFFERS ON SOIL MICROBE ACTIVITY AND IMPLICATIONS FOR WATER QUALITY - STUDENT POSTER - Debra-Leigh Corbie, and Erin McLoughlin (Stevenson University)

QUANTIFYING CARBON SPECIES FROM A RURAL TO URBAN GRADIENT - STUDENT POSTER - Seth Dobbis, Amy Williams, and Joel Moore (Towson University)

USING QPCR FOR MICROBIAL SOURCE TRACKING OF FREDERICK COUNTY WATERWAYS - STUDENT POSTER - Bria Dunlap, Fatimah Spall, Craig Laufer, Drew Ferrier, and Susan Carney (Hood College)

FRAMEWORK TO PREDICT TOXICITY OF ION PULSES IN BALTIMORE REGION STREAMS - Andrew East, Tim J. Woo, and Chris J. Salice (Towson University)

PINNING OUR HOPES ON CITIZEN SCIENCE MONITORING: JOIN THE CHESAPEAKE MONITORING COOPERATIVE TODAY - Alexandra Fries, Caroline Donovan (UMCES), and Lea Rubin (Izaak Walton League of America)

INTEGRATED WATER QUALITY MODELING IN TIDAL STREAM: A MARYLAND CASE - Amanuel Ghebreegziabher and Reza Khanblivardi (CCNY-CUNY and MDE)

IMPACT OF CHURCH CREEK'S REGENERATIVE STREAM CONVEYANCE SYSTEM ON WATER QUALITY DURING LARGE RAIN EVENTS - Sarah Giordano and Wayne Martin (South River Federation)

THE SIGNIFICANCE OF SMYD1B_TV1 AND SMYD1B_TV2 IN ZEBRAFISH - STUDENT POSTER - Carentxa Goede (Coppin State University), Mengxin Cai, Chien Chien-Ju, Dr. Jim Du (University of MD)

FACTORS CONSIDERED FOR CONDUCTING A FISH CROSSING ANALYSIS FOR CULVERT PROJECTS IN MARYLAND - Jeff Gring and Sean Sipple (Coastal Resources, Inc.)

ESTIMATING THE WHITE-TAILED DEER (ODOCOILEUS VIRGINIANUS) POPULATION IN THE UPPER GWYNNS FALLS WATERSHED AND THE EFFECT OF BROWSING ON FOREST ECOLOGY - STUDENT POSTER - Marissa Hoffman (Stevenson University)

INFLUENCE OF WATERSHED-SCALE STORMWATER MANAGEMENT PRACTICES ON SEDIMENT AND NUTRIENT EXPORT - Krissy Hopkins (USGS), J.V. Loperfido (McAdams Co.), Dianna Hogan, and Greg Noe (USGS)

EFFICACY EVALUATION OF A NOVEL COLD ATMOSPHERIC AIR PLASMA FOR WATER DECONTAMINATION - Hosan Kim Salman Izadjoo (Trideum Biosciences), Huan Truong (ChiScan LLC), and Mina Izadjoo (Trideum Biosciences)

PERSISTENTLY ELEVATED CONDUCTANCE IN MATTAWOMAN CREEK AND BIOLOGICAL IMPLICATIONS - Jim Long (Mattawoman Watershed Society), Margaret McGinty, Alexis Park, Carrie Hoover, Marek Topolski, Jim Uphoff (MDNR), and Laurie Fortis Snow (Mattawoman Watershed Society)

POTENTIAL OF INVASIVE CRAYFISH IN GWYNN'S FALLS RIVER - STUDENT POSTER - Jonathan Mann and John Prettyman (Stevenson University)

FISHERIES RESOURCE INVENTORY NEAR ABERDEEN PROVING GROUND, MARYLAND - Martha McCauley, Elizabeth Methratta, and Michael Stephens (EA Engineering, Science, and Technology, Inc.)

MONITORING NUTRIENTS AND CHLOROPHYLL NEAR A WASTEWATER TREATMENT PLANT OUTFLOW IN THE WESTERN BRANCH, PATUXENT RIVER ESTUARY - Amy Moody (Friends of Jug Bay)

AN ANALYSIS OF THE EFFECTIVENESS OF STREAM CLEANUPS TO IMPROVE FISH HABITAT AND POPULATIONS IN MARYLAND RIVERS - STUDENT POSTER - Mark Moody and Joseph Matanoski (Stevenson University)

OXYGEN DEPLETION IN A RECENTLY RESTORED STREAM DOMINATED BY AN IRON OXIDIZING BACTERIUM - STUDENT POSTER - Lauren Mosesso (University of Mary Washington and SERC), Joshua Thompson, and Thomas Jordan (SERC)

WATER QUALITY IN THE BALTIMORE WATERSHED: A SOCIO-ENVIRONMENTAL AND PHYSICOCHEMICAL ANALYSIS - STUDENT POSTER - Jannett North, Aisha Ward, Brije Smith, Christodia Forson, Tatiana Roth, and Mintesinot Jiru (Coppin State University)

TRACKING METHYLMERCURY PRODUCTION AND EXPORT IN FIRST-ORDER STREAM ECOSYSTEMS - Jacob Oster (Chesapeake Biological Laboratory /UMCES), Andrew Heyes, Laura Lapham (Chesapeake Biological Laboratory), and William Lamp (University of MD, College Park)

REGENERATIVE STORMWATER CONVEYANCE AND ITS EFFECT ON CARBON LABILITY AND PRIMING - STUDENT POSTER - Brendan Player (Christopher Newport University and SERC), Joshua Thompson, and Thomas Jordan (SERC)

HART-MILLER ISLAND EXTERIOR MONITORING: EXAMINATION OF SPATIAL AND TEMPORAL TRENDS IN SEDIMENT METALS CHEMISTRY - Michael Powell (EA Engineering, Science, and Tech., Inc.), Holly Miller (Maryland Port Administration), George Harman (Phoenix Engineering), Amanda Peñafiel (Maryland Environmental Service), and Peggy Derrick (EA Engineering, Science, and Tech., Inc.)

ANACOSTIA RIVER CONTAMINANTS: AN INTERJURISDICTIONAL PROBLEM – Sania Rose and Harriette Phelps (University of the District of Columbia)

CITIZEN SCIENCE FROM COMMUNTY CLEANUPS - Julia Saintz and Hannah Seligmann (Alice Ferguson Foundation; Trash Free Potomac Watershed Initiative)

AN INVENTORY OF NATIVE AND NON-NATIVE PLANTS WITHIN A CONSERVATION AREA OF THE GWYNNS FALLS WATERSHED - STUDENT POSTER - Lydia Shreeve (Stevenson University)

BIOENERGETIC ENDPOINTS FOR STREAM ASSESSMENT: LIPID CONTENT IN SURFACE WATER AND CADDISFLY LARVAE VARIES ACROSS AN URBAN TO RURAL GRADIENT - STUDENT POSTER - Madison Smith, Andrew East, and Christopher Salice (Towson University)

HOWARD COUNTY COMMERCIAL STORMWATER SOLUTIONS WORK GROUP – Mark Southerland (AKRF), Jim Caldwell (Howard County Office of Community Sustainability), and Cole Schnorf (Manekin)

CONCENTRATION OF DISSOLVED METALS IN MINIMALLY DISTURBED STREAMS - Bronson Waite and Matthew Ashton (MDNR), Katie M. Kline and Raymond P. Morgan (AL; University of MD)

FINGERPRINTING SOURCES OF NITROGEN POLLUTION ON SCHOOLYARDS IN WESTERN MARYLAND - STUDENT POSTER - Gabriella White, Colton Houser, Jenna Ruggiero, Rebecca Kenyon-Sisler (Northern Garrett High School), Andrew Elmore, Cassie Doty, David Nelson, Joel Bostic, and Cathlyn Stylinski (UMCES; Appalachian Lab.)

STREAM HEALTH OF TOWSON UNIVERSITY CAMPUS WATERWAYS - Amy Williams, Seth Dobbis, Jeremy Becraft, and Joel Moore (Towson University)

SEDIMENT AND CONTAMINANT LOADS IN TRIBUTARIES TO THE ANACOSTIA RIVER - Timothy Wilson, Brian Banks, Brenda Majedi, Melanie Mathesz, and Charles Walker (USGS)

HEALTH OF MONTGOMERY COUNTY STREAMS - Cathy Wiss (Audubon Naturalist Society)

ROAD SALT (NACL) INPUTS SIGNIFICANTLY ALTER SOIL PH AND CATION EXCHANGE CHEMISTRY IN SOIL AND AQUIFERS - Gregory Woodward and Joel Moore (Towson University)

LAKE LINGANORE WATER QUALITY AND POTENTIAL FOR CYANOBACTERIA BLOOMS - Hannah Zinnert, K. Sellner, D. Ferrier, J. Mattheiss, S. Simonson, C. Hudson (Hood College Center for Coastal and Watershed Studies), and J. Cornwell (UMCES-HPL)

BACKSCATTER AS A SURROGATE FOR SUSPENDED SEDIMENT, NUTRIENT, AND BACTERIA CONCENTRATIONS IN AN URBAN STREAM WITHIN ROCK CREEK NATIONAL PARK, WASHINGTON D.C.

Joseph Bell; jmbell@usgs.gov; U.S. Geological Survey

Anthropogenic and naturogenic processes continuously morph landscape and stream geomorphology within Rock Creek National Park, in Washington D.C. To accurately model suspended sediment, nutrient, and bacteria concentrations in Rock Creek, a robust surrogate is required. Robust surrogates are collected at frequencies that capture change, are absent of hysteresis effects, are capable of measuring large sampling volumes, and are resistant to physical and biological fouling. Backscatter (a measure of the reflectance of waves back to a source) from acoustic Doppler velocity meters (ADVM) is used as a robust surrogate for estimating continuous suspended sediment, nutrient, and bacteria concentrations over periods when discrete samples are not collected. Due to rapidly changing conditions within urban streams, innovative approaches are required to install and collect backscatter data from deployed ADVM. In October 2014, the United States Geological Survey began collecting velocity and backscatter data from two ADVM deployed in Rock Creek at the Joyce Road station to use as a surrogate for concentrations of suspended sediment, nutrients, and bacteria. Statistical modeling returned backscatter as a significant (p-value < 0.1) predictor variable for estimating in-stream concentrations of suspended sediment, total phosphorus, and Escherichia coli in Rock Creek.

Joseph is a hydrologist with the USGS working out of the MD-DE-DC Water Science Center in Baltimore MD. He works with the Water-Quality Monitoring and Modeling team as well as the Geomorphology team. His work covers the full spectrum of continuous monitoring and modeling: from servicing and troubleshooting equipment in the field to surrogate modeling for the estimation of concentrations and loads. He is here today to present his work on evaluating velocity and backscatter as surrogates for suspended-sediment, nutrient, and bacteria concentrations in an urban stream.

CONTINUOUS MONITORING OF INSTREAM TEMPERATURE AND SPECIFIC CONDUCTANCE VALUES TO REFINE CONCENTRATION AND LOAD ESTIMATES OF CHLORIDE IN AREA STREAMS

Joseph Bell; jmbell@usgs.gov; U.S. Geological Survey

The United States Geological Survey is continuously monitoring water temperature and specific conductance values in Maryland and Washington, D.C. area streams for the computation of instream chloride concentrations and improved chloride-load estimates. Computed instream chloride concentrations show variability that relates with the application of deicing chemicals on area roads, parking lots, and sidewalks during winter months. Diurnal variations in chloride concentrations after snowfall events correlate with the melting and refreezing of area snowpack. Increased chloride concentrations are associated with the first flush of deicing chemicals from impervious surfaces and precede peak discharges in response to prolonged snowmelt or rain-on-snow runoff events. Seasonal patterns display exponential increases in chloride concentrations that begin during late fall and persist through mid-spring. Additionally, continuous instream temperature and specific conductance values are being evaluated as surrogates for the computation of continuous chloride concentrations and loads on varying temporal scales. This approach reduces uncertainty in chloride concentrations and load computations relative to traditional techniques that employ concentration-discharge methodologies.

Joseph Bell is a Hydrologist at the USGS MD-DE-DC Water Science Center in Baltimore, MD. He is a member of the Water-Quality Motioning and Modeling team as well as the Geomorphology team. His duties range from servicing and troubleshooting equipment in the field to water-quality modeling. He is also involved in monitoring and modeling floodplain restoration efforts.

GHOST STREAMS OF BALTIMORE AND THEIR VALUE AND THEIR VALUE TO SCIENCE, THE SOCIAL FABRIC, AND HISTORY

Kenneth T. Belt; kbelt@fs.fed.us; USDA Forest Service

Co-authors: Sujay Kaushal, University of Maryland; Jeremy Solin, University of Wisconsin Cooperative Extension; Raymond Bahr, Baltimore Watershed Advocate

Unknown to all but a few, a living aquatic system lives beneath the streets of Baltimore. They are part of a buried network of streams that once provided water, food and habitat to plants, critters and people. Today, most of these streams from pre-European colonization are known only from old maps and meticulously drawn DPW storm drain construction contracts that were over the last few centuries witness to the paving-over and burial of those aquatic ecosystems. Such has been the fate of headwater streams and rivers in many cities. However, there is a building realization of the importance of their many ecosystem and eco-sociological functions (i.e., ecosystem services) especially in current urban water management efforts, where concrete is giving way to green infrastructure and urban landscapes feature "daylighting" of buried streams to create blue-green focal points for public use, education and enjoyment, as well as ecosystem habitat, functions and other services. We discuss what we know about these subterranean networks, their role in the urban watershed continuum (UWC), their potential value to groundwater and urban stream ecology research as well as a historical and educational resource for residents. We wish to initiate a dialogue to propose a collaborative to encourage new science coupled with contributions to a blue-green urban landscape.

Ken is a hydrologist, engineer and aquatic ecologist, and has been with the USDA Forest Service Baltimore Field Station & Baltimore Ecosystem Study for almost 19 years, and was with the Baltimore City DPW for 19 years before that. He has bachelor degrees in biology and civil engineering, master degrees in aquatic ecology end environmental engineering, and a PhD in ecology. His interests include the biogeochemistry and ecohydrology of the urban stream networks, groundwater ecology and the urban watershed continuum.

CLIMATE CHANGE AND MONITORING IN AQUATIC ECOSYSTEMS: DATA NEEDS AND GAPS

Britta Bierwagen; bierwagen.britta@epa.gov; US EPA

Coauthors: Jen Stamp, Tetra Tech; Anna Hamilton, Tetra Tech

The development of regional monitoring networks to detect climate change effects in streams highlights a variety of data needs and gaps. Climate change effects will range in magnitude and severity, as well as geographically and seasonally. This presents challenges for meaningful data collection, including coordination across jurisdictions and among sampling and analysis methods, use of novel sensors and data management systems, and development of climate-sensitive metrics. In terms of coordination, the spatial scale of climate change effects presents an opportunity for collaboration among organizations. However, such collaborations also present challenges in terms of harmonizing data collection methods and sample analysis to develop a shared dataset. Another challenge is the nature of climate change effects, which can be small annually. Detection of such changes in a time frame relevant for decision making may require more frequent sampling. For example, biological samples may need to be collected annually, while temperature and hydrologic sensors may need to be deployed continuously. Data volumes resulting from such deployments present data management challenges for some organizations. Additionally, depending on monitoring goals, new metrics may need to be developed.

DISCLAIMER: Views expressed are the authors' and do not necessarily reflect views or policies of the USEPA.

Britta Bierwagen is a Branch Chief in the National Center for Environmental Assessment within the U.S. Environmental Protection Agency's (EPA) Office of Research and Development. Dr. Bierwagen earned a B.S. in Chemistry and Biology (College of William and Mary) and a Ph.D. in Environmental Science and Management (Bren School, University of California, Santa Barbara). She joined the EPA as a post-doc focusing on vulnerability assessments of aquatic ecosystems, design of monitoring to detect climate change-related impacts, and opportunities to increase resilience. Her research includes the development of land use change scenarios and assessments of BMP effectiveness under climate change.

HOA LANDSCAPING REVISIONED: COMMON SPACE FOR THE GREATER GOOD

Gem Bingol; gbingol@pecva.org; The Piedmont Environmental Council

Homeowners associations (HOAs) manage large landscapes across the Chesapeake Bay watershed, especially where major land use changes are occurring regularly. They often have substantial dollars allocated to landscaping services, but many standard practices are harmful for water quality and ecological health and there is little awareness of this or the consequences of HOA decisions. The Piedmont Environmental Council (PEC) is a land trust focused on conservation and land use issues in nine counties and communities in the Northern Piedmont of Virginia. As part of its region-wide effort to raise awareness of and promote conservation practices that benefit local water quality and ecology and reduce impacts on the Chesapeake Bay, PEC has led a four year old HOA outreach program in Loudoun County. The goal is to engage residents, board members and property managers in HOA communities in a better understanding of their relationship to their surroundings, and support change. PEC has partnered with County staff and other agencies and local non-profits in the effort. The program strives to inspire participation and success by highlighting the costs of business-as-usual alongside the benefits of ecologically supportive practices, and actions that will make a positive difference. Gem will describe the program, its evolution and projects, and how it has nurtured interest in the community.

Gem Bingol is Land Use Field Staff in Virginia's Loudoun and Clarke Counties for The Piedmont Environmental Council (PEC). She joined PEC in 1998, making a career shift to embrace her newfound passion for helping people better understand natural systems and how they support life. She has been dedicated to getting people involved at the local level to protect and improve the environment that most personally affects them and understand the impacts of all kinds of local land use decisions. She has an MA in Environmental Education and Ecopsychology from Leslie University, and a BA in Psychology from Arcadia University.

THE EVOLUTION OF ION CHEMISTRY IN URBAN STREAMS IN THE MARYLAND PIEDMONT AND IMPLICATIONS FOR FRESHWATER BIOTA

Darcy Bird; darcylynn216@gmail.com; Towson University

Coauthors: Peter Groffman, Advanced Science Research Center, City University of New York; Joel Moore, Towson University

Many urban streams have relatively high major ion concentrations due to contributions from anthropogenic sources (e.g., road salts, fertilizer, concrete, wastewater treatment). Elevated ion concentrations and associated increases in specific conductivity have implications for freshwater organisms. However, little work has been done to determine the sources of elevated ion concentrations and how concentrations change through time. We used the USGS analysis tool Weighted Regressions on Time, Discharge, and Season to analyze 15 years of weekly anion concentrations along with selected cation concentrations from 4 Baltimore Ecosystem Study watersheds along a forested to urban gradient. Average annual Cl– concentrations were elevated and increased over the 15 year study period despite little change in land use in the three developed (1% ISC- 21% ISC) watersheds. In the two urban (17% and 21% ISC) watersheds, the weekly Cl– concentrations regularly exceeded the EPA ambient life criterion of 230 mg/L. Ca2+, Mg2+, and Na+ concentrations also were elevated in developed watersheds. Elevated Ca2+ concentrations may partially ameliorate the negative effects of elevated Cl– concentrations on freshwater organisms.

Darcy Bird is a currently a Master's student in Environmental Science Department at Towson University, set to graduate Spring 2017. Prior to attending Towson, Darcy graduated from the University of Washington in Seattle with a degree in Geology and worked as an Environmental Scientist with the State of California in policy and research.

HOW FISH MONITORING AND ADVOCACY SAVED CHARLES COUNTY

Kimberly Brandt; kim@friendsofmd.org; 1000 Friends of Maryland

Coauthor: Dr. Jim Long, Mattawoman Watershed Society

The session will describe a successful campaign by the Smarter Growth Alliance for Charles County to win a sustainable comprehensive plan for the county's future, and the importance of fish monitoring in that effort. The process of developing the plan, which has a horizon of 2040, began in 2011 and concluded with adoption in July 2016. A 2012 Interagency Task Force report entitled The Case for Protection of the Watershed Resources of Mattawoman Creek was critical to our success. Citing extensive monitoring by the Department of Natural Resources, the report notes that Mattawoman Creek, which was once had "near to ideal conditions," is at a tipping point. Serious declines in the health of fish communities are identified. The report plainly states that the new plan for the county's future is the last chance to stem the decline of Mattawoman Creek by addressing overdevelopment in the watershed. The alliance persistently cited the report, especially the fish monitoring results, in our efforts to educate decision makers and the public, and we won a plan that reflects the report's recommendations.

Kimberly Brandt is the Local Policy Director at 1000 Friends of Maryland. She advises officials and advocates working to advance sustainable growth in their communities and provides technical analysis of local planning efforts. Kimberly has a Master of Urban and Regional Planning degree and has worked as a professional planner for eighteen years.

Jim Long is a retired physicist and president of the Mattawoman Watershed Society. He has been active in conservation issues affecting water resources in southern Maryland for over twenty years. He has assisted biologists in surveying Mattawoman Creek's terrestrial and aquatic resources, including habitat usage by migratory fish.

COASTAL PLANNING: MAPPING NATURAL SOLUTIONS FOR RESILIENT COASTAL COMMUNITIES

Nicole Carlozo; nicole.carlozo@maryland.gov; Maryland Department of Natural Resources

Coauthor: Michelle Canick, The Nature Conservancy

Natural features can enhance the ability of communities to prepare for and respond to coastal hazard events. Recognizing the risk-reduction benefits of natural features, the Maryland Department of Natural Resources partnered with The Nature Conservancy to evaluate how the state's existing coastal forests, marshes, dunes, underwater grasses, and oyster reefs work together to protect residents. This study modified national and regional models for application at a state scale. By working with federal, state and non-profit partners, a landscape-level GIS analysis was completed to evaluate coastal exposure to erosion and inundation, and assess how habitats can reduce relative exposure along Bay and Ocean shorelines. Census and floodplain data were applied to identify socially vulnerable communities at risk to coastal flooding. The results of this modeling effort were used to prioritize shoreline and marsh areas where conservation and restoration activities will enhance the resiliency of Maryland's vulnerable coastal communities. This presentation will highlight how cross-agency collaboration led to multiple resiliency datasets that are being integrated into local and state conservation, restoration, and hazard mitigation planning.

Nicole Carlozo is a Natural Resource Resiliency Planner at the Maryland Department of Natural Resources, where she integrates climate change data and other technical and spatial information into the state's restoration, conservation, and waterfront enhancement activities. Previously, she served as Maryland's 2012-2014 NOAA Coastal Management Fellow. Nicole holds a Master's Degree in Coastal Environmental Management and a Certificate of Geospatial Analysis from Duke University, and a Bachelor's Degree in Biology & English from St. Mary's College of Maryland.

WHERE DOES THE MERCURY IN MARYLAND COME FROM?

Mark Cohen; mark.cohen@noaa.gov; NOAA Air Resources Laboratory

Mercury is an ongoing public and wildlife health concern in Maryland and elsewhere due to consumption of contaminated fish. An important loading pathway to ecosystems is atmospheric emissions of mercury followed by atmospheric deposition downwind of the emissions source. Local, regional, and more remote sources may all be important contributors. The NOAA Air Resources Laboratory, in collaboration with the State of MD, the USEPA, and others, are carrying out atmospheric mercury measurements and modeling. Measurements have been made a Beltsville MD site for the past 10 years. Despite increasing emissions in the rest of the world over this time, declining mercury emissions in the U.S. appear to have led to declining concentrations and deposition of mercury at the site. A special version of the NOAA HYSPLIT model has been developed to simulate the atmospheric fate and transport of mercury. This model has been recently applied to simulate the global atmospheric transport and deposition of mercury to the Great Lakes. It is currently being applied to estimate deposition -- and source attribution for that deposition -- to support a Total Maximum Daily Load (TMDL) analysis for selected, mercury-impacted Maryland waterbodies. The modeling results will be evaluated by comparison with ambient measurements. Previous modeling results and the current efforts will be described.

Dr. Mark Cohen has worked as a Physical Scientist at the NOAA Air Resources Laboratory, in College Park, MD, for the past 18 years. His work has focused on modeling the atmospheric fate and transport of toxic pollutants, such as mercury, atrazine, and dioxin. The primary objective of his work has been to elucidate "Source-Receptor" relationships, to answer the question: Where do the pollutants come from that we see at any given location? Or put more generally, what are the relative contributions of different sources and source regions to the concentrations and deposition of a given pollutant observed at a given location of interest?

INCREASING SALT MARSH ACREAGE AND RESILIENCY FOR BLACKWATER NATIONAL WILDLIFE REFUGE

David Curson; dcurson@audubon.org; Audubon Maryland-DC

Blackwater National Wildlife Refuge in Maryland lies at the heart of one of the largest tidal marsh complexes in the northeastern United States, which is recognized as an Important Bird Area (Southern Dorchester County IBA) supporting globally important populations of Black Rail and Saltmarsh Sparrow. Rapid sea level rise threatens the survival of this ecosystem during the current century. Strategies to increase resiliency of Blackwater's marshes are being implemented by a nonprofit-public agency partnership as part of a larger climate adaptation project that was established in 2011. Current projects underway include the sediment enhancement of 30 acres of disintegrating high tidal marsh using sediment dredged from the Blackwater River, and a detailed study of hydrological issues that are causing erosion of a nearby tidal marsh that has recently transitioned from former agricultural uplands. These projects are being undertaken by a diverse partnership including the National Audubon Society, U.S. Fish and Wildlife Service, The Conservation Fund, USGS MD-DE-DC Water Science Center, and Sustainable Science LLC.

David Curson has worked as Director of Bird Conservation for Audubon Maryland-DC, since 2004, overseeing the Important Bird Areas (IBA) Program and running conservation projects for birds and their habitats. In recent years, Dave's work has focused on tidal marsh conservation and climate change issues in the Chesapeake Bay. David also teaches ecology classes at Johns Hopkins University as an adjunct professor.

David received his BSc in Ecology at the University of East Anglia, UK and earned MS and PhD degrees in the Department of Wildlife Ecology at the University of Wisconsin-Madison. His graduate research focused on the ecology and behavior of Brown-headed Cowbirds.

DEFINING THE BEST NATURAL ENHANCEMENTS AND INNOVATIVE TECHNOLOGIES TO DELIVER ECOSYSTEM SERVICES TO HIGHLY URBANIZED WATERFRONTS

Charmaine Dahlenburg; cdahlenburg@aqua.org; National Aquarium

Coauthors: Eric Schott, University of Maryland Center for Environmental Science; Adam Frederick, Maryland Sea Grant; Brian Smith, Maryland Department of Natural Resources

Worldwide, the development of waterfront cities has resulted in the loss of ecosystem services and a decline in water quality and the health of aquatic communities. With two-thirds of the human population concentrated along shorelines, modification of natural coastlines is inevitable. Baltimore's Inner Harbor is no exception to these modified critical habitats. The 300-year-old city is located within the Chesapeake Bay watershed with a hardened shoreline, offering a limited opportunity for the restoration of a natural "living" shoreline. Today, it is essential a healthy harbor be restored to promote recreation, visitor appeal, healthy human communities and aquatic life within and adjacent to the harbor waters. The National Aquarium is committed to creating a waterside campus that models and interprets best practices for redeveloping urban waterfronts worldwide. Waterfront Campus Plan (WCP) is a comprehensive, campus-wide strategy that will demonstrate not only how urban waterfronts can improve water quality and aquatic habitat, but also how green gathering spaces can foster a sense of community and advance aquatic stewardship. Scoped to break ground in 2017, a comprehensive baseline monitoring study is being conducted to evaluate current water quality trends and animal biodiversity within the understudied Inner Harbor.

Charmaine Dahlenburg, is the Manager of the Chesapeake Bay Program at the National Aquarium. She leads multiple ongoing habitat restoration and establishment projects including the Biohut pilot project, floating wetland island project, Department of Defense sand dune restoration, and the Fort McHenry wetland restoration. She has a master's degree in environmental sciences and policy from Johns Hopkins University, and has worked at the Aquarium since 2004.

RESTORATION RESEARCH AWARD PROGRAM

Sadie Drescher; sdrescher@cbtrust.org; Chesapeake Bay Trust

Coauthors: Jana Davis, Ph.D., Chesapeake Bay Trust; Scott Stranko, Maryland Department of Natural Resources

Efforts to restore the Chesapeake Bay and its tributaries call for a significant increase in the number of watershed restoration projects intended to improve both water quality and habitat. Questions about the performance and function of some of these practices persist in the regulatory community as well as the restoration practitioner community. As a result, a new initiative called the Restoration Research Program was developed. Pressing research questions were articulated over the last several years with input from the regulatory and practitioner communities. Examples include research to address cumulative impacts of restoration practices in a watershed (as posed in the Municipal Separate Storm Sewer System (MS4) permits) and research to better understand the differences among stream restoration techniques, trade-offs among different resources impacted both positively and potentially negatively to accomplish the restoration, the impact of site condition, the most cost-effective environmental site design strategy, how and if iron flocculate is associated with restoration techniques, and how to predict or model structural stability of certain features used. Results of the research are then communicated back to the regulatory and restoration communities in a way that maximizes their ability to inform work in those realms.

Sadie joined the Chesapeake Bay Trust in 2014. At the Trust she leads the Chesapeake Bay Trust restoration programs that include implementation projects, research efforts, and citizen engagement. She has a background in environmental science with a M.S. in Environmental Studies from the College of Charleston and a B.S. in Environmental Biology from Tennessee Technological University. Prior to joining the Trust, Sadie worked at the Center for Watershed Protection, for SC's coastal management program, the USDA Center for Forested Wetlands in SC, and was an ORISE fellow for the US Department of Energy in TN.

REDUCING SANITARY SEWER OVERFLOWS THROUGH TARGETED OUTREACH CAMPAIGNS

Eric Eckl; eric.eckl@waterwordsthatwork.com; Water Words That Work, LLC

Coauthor: Lori Lilly, Lori A. Lilly - Environmental Solutions

In 2017, the City of Baltimore and a suite of partners will run an innovative outreach and education campaign to encourage proper disposal of household grease and baby wipes properly. Their goal: Prevent sanitary sewer overflows (SSOs) that contribute pathogens, nutrients and other contaminants to surface waters across the state. According to the MD Department of Environment, between 2005-2015, more than 9,000 SSOs discharged approximately 900 million gallons of raw untreated sewage into MD streams. Of these, 40% were reported to be caused by blockages of grease, rags, trash and other inappropriate material placed into the sanitary sewer system, resulting in nearly 16 million gallons of untreated sewage discharges.

With funding from the Chesapeake Bay Trust, we have been developing the campaign in partnership with the City of Baltimore and Ridge to Reefs and plan to implement our project in spring, 2017. We will share our overall process and preliminary findings of the campaign as well as lessons learned from similar campaigns run in other areas of the Mid-Atlantic.

Eric Eckl founded Water Words That Work, LLC and oversees all the company's client projects. Eric has more than 20 years experience planning and executing environmental outreach and communications programs. Before starting the firm, Eric worked for Beaconfire Consulting, American Rivers, the U.S. Fish and Wildlife Service, and the Environmental Law Institute.

Lori A. Lilly is an independent environmental consultant located in Howard County, MD. Lori has a background in non-profit management, watershed planning and restoration, and Illicit Discharge Detection & Elimination (IDDE). Lori has a B.S. in Natural Resource Management and an M.S. in Marine Estuarine and Environmental Science.

THE STATUS OF MARYLAND'S NUTRIENT TRADING PROGRAM

Brent Fewell; brent.fewell@earthandwatergroup.com; Founder and Chair, Earth & Water Group

After several decades of efforts to restore the Chesapeake Bay, the Bay States continue to pursue market-based approaches to meet aggressive watershed implementation plan (WIPs) goals and accelerate the restoration process, including the use of nutrient trading programs. Pennsylvania, Maryland, and Virginia have all adopted trading programs in some form or fashion.

The State of Maryland is in the process of developing its trading program and is committed to a water quality nutrient trading program that

- Accelerates the restoration of the Chesapeake Bay while reducing the costs of implementation
- Maintains consistency with the federal Clean Water Act, Maryland law and regulation, and any other applicable requirements
- Offers competitive alternatives for accomplishing both regulatory and environmental goals
- Protects local water quality
- Uses the best available science and appropriate metrics to estimate and/or measure pollution reductions, manage risk, and ensure the validity of credits
- Provides accountability, transparency, and accessibility for all interested parties
- Includes necessary compliance and enforcement provisions
- Creates incentives for investment, innovation, and job creation
- Fosters collaborative partnerships between public and private entities and among diverse stakeholders
- Positions Maryland to participate in interstate trading activities

The presenters will address many of the issues noted above from the market, regulatory, and environmental perspectives.

Brent Fewell is the Founder and Chairman of Earth & Water Group. Prior to Earth & Water, Brent was a partner in the environmental section of Troutman Sanders in the firm's DC office. Brent was a Senior Vice President for Environmental Health and Safety at United Water, where he oversaw day-to-day regulatory compliance of the company's water and wastewater operations. Brent works closely with States and various stakeholders to advise on the development of water quality trading programs. Prior to his time in private industry, he served as the Principal Deputy Assistant Administrator for the Office of Water at the U.S. EPA, with responsibilities for overseeing the development and implementation of policies and regulations affecting the nation's drinking water and clean water programs, including EPA's water quality trading initiatives. He also served as the Acting Associate Administrator for EPA's Office of Congressional and Intergovernmental relations where he helped to manage critical relationships between the Agency and federal, state and local governments. Brent is widely published in the area of water quality trading and has testified before the U.S. Congress and U.S. Senate on related matters. Brent currently serves on the Maryland Water Quality Trading Advisory Committee and on numerous boards, including Wine to Water and the Alliance for the Chesapeake Bay.

GREEN INFRASTRUCTURE FINANCING

Megan Granato; megan.granato@maryland.gov; Maryland Department of Natural Resources

The results of climate assessments indicate that Maryland's future precipitation regime will include more extreme rainfall events. These events are anticipated to increase the incidence and severity of flooding, which damages infrastructure and degrades water quality. Green infrastructure can reduce flooding by allowing stormwater to infiltrate in place, which simultaneously provides water quality benefits. The Maryland Department of Natural Resources administers several financing programs to help local counties and municipalities implement green infrastructure projects. One of these programs, the Green Infrastructure Resiliency Grant (GIRG), specifically focuses on the connection between green infrastructure and climate resiliency. This program was developed in 2015 and is supported by Environmental Protection Agency funding made available through Maryland's Chesapeake Bay Implementation Grant. The GIRG supports projects that evaluate and respond to stormwater and floodplain management vulnerabilities and risk caused by the changing climate. Funding is available for projects that help communities understand their vulnerability and risks, develop plans to address those risks, and implement green infrastructure practices to increase resiliency. This presentation will review this funding program in terms of the project selection process and examples of supported projects.

Megan Granato is a Natural Resources Planner at the Maryland Department of Natural Resources, where she specializes on restoration financing programs. Megan provides grant management for the Chesapeake and Atlantic Coastal Bays Trust Fund, which supports non-point source nutrient and sediment reduction projects. Megan also manages the Chesapeake Bay Implementation Grant funding provided by the Environmental Protection Agency, which supports progress towards the 2014 Watershed Agreement goals. Megan has a B.A. in Biology from Hamilton College and a M.S. in Natural Resource Management from North Carolina State University, where she focused on restoration ecology.

DISTRIBUTIONS AND POTENTIAL EFFECTS OF BENTHIC CYANOBACTERIA IN THE UPPER POTOMAC RIVER

Josh Henesy; josh.henesy@maryland.gov; Maryland Department of Natural Resources Freshwater Fisheries

Coauthors: J. Mullican, Maryland Department of Natural Resources Freshwater Fisheries; M. Kashiwagi, Maryland Department of Natural Resources Freshwater Fisheries; A. Strock, Hood College Center for Coastal & Watershed Studies; D. Ferrier, Hood College Center for Coastal & Watershed Studies; C. Hudson, Hood College Center for Coastal & Watershed Studies; K. Sellner, Hood College Center for Coastal & Watershed Studies; A. Place, University of Maryland Center for Environmental Studies-IMET

The nontidal Potomac River is Maryland's most popular fishing destination for freshwater anglers and is also a popular destination for recreational boaters and tubers. Nuisance blooms of cyanobacteria, particularly the blue-green algae *Planktothrix isothrix* (and to a lesser extent *Lyngbia* spp.), have resulted in unsightly and odorous mats that discourage recreational use and may be having negative impacts on aquatic life. An investigation (2013 – current) was initiated to: 1) Explain the spatial and temporal growth of *Planktothrix isothrix* (determine if chlorophyll *a* and phycocyanin concentrations differ among sites and between seasons and among sites and seasons between years (2013 - 2015)). 2) Explain how algal blooms may respond to and affect water quality and macroinvertebrates. Transverse cross-sectional transects were established at three geographical locations, each containing three plots: one 20 m from each shoreline (Maryland (MD) & Virginia (VA)), and river center (RC). Each plot was sampled biweekly from May – September, and the following water quality parameters were recorded: water temperature, conductivity, dissolved oxygen, pH, and accessory pigments chlorophyll-a and phycocyanin; additionally, a 1.0m² quadrat was placed on the river bottom and the percent algal/SAV coverage estimated visually. Statistical analyses detected significant ($P = <0.05$) temporal (between early summer (June & July) & late summer (August & September)), and spatial (across cross-sectional transects (MD, RC, and VA)) differences in phycocyanin, chlorophyll a, and macroinvertebrate community compositions. Seasonal differences were evident throughout the study period (2013 – 2015), and largely attributed to cyclic patterns that are not directly influenced by the production of cyanobacteria. Spatial differences, however, were consistent with proliferations of cyanobacteria blooms (2014 & 2015), indicating that *Planktothrix isothrix* and *Lyngbia* spp. were most dense from river center to the Maryland shoreline. Additionally, macroinvertebrate investigations revealed a distinct and obvious difference in community assemblages, which were attributed to the occurrence of benthic mats; suggesting that benthic cyanobacteria are impacting aquatic life. In 2016, microcystin toxicity samples (fish and benthic macroinvertebrates) were collected within the study site. Future efforts will seek to identify and quantify toxin productions from these blooms and aim to determine the direct implications these taxa may have on aquatic ecology and human health within the freshwater Potomac River.

Josh Henesy is a member of the MD DNR Freshwater Fisheries staff in Thurmont, MD focusing on estimating health and size of Maryland's freshwater fish stocks, assessing habitats conducive to fish reproduction, and overseeing the on-going upper Potomac River cyanobacteria project. Working with DNR staff and now Hood and UMCES collaborators, Henesy has documented the proliferation of potentially toxic cyanobacteria that may threaten local food webs culminating in valued recreational fish populations.

INTERACTION OF TEMPERATURE AND BROWN TROUT AFFECT BROOK TROUT HABITAT USE

Nathaniel (Than) P. Hitt; nhitt@usgs.gov; US Geological Survey, Leetown Science Center

Coauthors: Erin Snook, US Geological Survey, Leetown Science Center; Danielle Massie, Pennsylvania State University, Department of Ecosystem Science and Management

Native brook trout are often limited by temperature and introduced brown trout, but their relative importance is poorly understood. We evaluated how brown trout affect brook trout habitat use in experimental streams across increasing temperatures (14-23 °C) with simulated groundwater upwelling zones providing thermal refugia (6-9 °C below ambient temperatures). Allopatric brook trout exhibited greater movement rates and more even spatial distributions than sympatric populations, indicating competition with brown trout for access to forage habitats located outside thermal refugia. Our results indicate decreasing abundances of brown trout may facilitate brook trout expansion in downstream reaches depending in part on the presence of groundwater upwelling zones.

Dr. Nathaniel Hitt is a Research Fish Biologist with the USGS Leetown Science Center. He holds a B.A. in Biology from the College of Wooster, an M.S. in Organismal Biology and Ecology from the University of Montana, and a Ph.D. in Fisheries and Wildlife Sciences from Virginia Tech. Dr. Hitt's research investigates freshwater fish ecology and community ecotoxicology from a landscape perspective, focusing on stream ecosystems in the Appalachian highlands.

BUILDING CLIMATE RESILIENCY: MONITORING, ASSESSING AND DETECTING TRENDS AND IMPACTS

Zoe Johnson; zoe.johnson@noaa.gov; NOAA Chesapeake Bay Office

To gain a better understanding of the likely impacts of climate change as well as potential management solutions for the watershed, the 2014 Chesapeake Bay Watershed Agreement, includes a goal to "increase the resiliency of the Chesapeake Bay watershed, including its living resources, habitats, public infrastructure and communities, to withstand adverse impacts from changing environmental and climate conditions." An outcome of this goal is to continually monitor and assess the trends and likely impacts of changing climatic and sea level conditions on the Chesapeake Bay ecosystem, including the effectiveness of restoration and protection policies, programs and projects. To achieve this outcome, participating partners have committed to: 1) Assessing climatic trends, documenting observed changes and conducting climate vulnerability assessments; 2) Defining goals and establishing baselines for the monitoring, modeling and assessment of climate change, including water quality trends; 3) Identifying and prioritizing gaps in assessment tools, scientific understanding and baseline monitoring; and 4) Designing climate monitoring and modeling plans. This presentation will highlight current efforts to implement activities related to Bay Agreement's Climate Resiliency Goal, with a focus on water-related monitoring and assessment components.

Zoë coordinates the NOAA Chesapeake Bay Office and the Chesapeake Bay Program Partnership's climate change research, planning and policy efforts. In this capacity, she works along with many partners and on many fronts to enhance the resiliency of the Chesapeake Bay watershed, including its living resources, habitats, public infrastructure, to withstand adverse impacts from changing environmental and climate conditions. Zoë has been actively involved in climate change planning and policy initiatives in the Chesapeake Bay for almost 20 years and is the author of various reports and publications on climate change and sea level rise adaptation.

TRADING NITROGEN AND PHOSPHORUS FOR ORGANIC CARBON AND HYPOXIA IN A STREAM RESTORATION

Thomas E. Jordan; jordanth@si.edu; Smithsonian Environmental Research Center

Coauthors: J. J. D. Thompson, Washington Suburban Sanitary Commission; W. R. Brogan III, Pennsylvania Department of Environmental Protection; C. E. Pelc, Smithsonian Environmental Research Center; L. Mosesso, University of Mary Washington; B. Player, Christopher Newport University

Total maximum daily load limits for the Chesapeake Bay have motivated restorations of streams to reduce nutrient and suspended sediment loads. We measured fluxes of organic carbon, nutrients, and sediments through a stream reach before and after it was restored by filling the eroded channel with a sand-woodchip mixture and placing a series of rock weirs across the channel. By four months post-restoration, the reach had removed 72% of the suspended sediment, 53% of the nitrate, 76% of the phosphate, and 11% of the total phosphorus that entered from upstream. During that same period, dissolved organic carbon (DOC) flux out of the restored reach was greater than DOC flux entering from upstream. The DOC concentration in groundwater near stream banks tripled after restoration. The DOC concentration in groundwater emerging through the stream bed was 7-fold that in groundwater near stream banks. The increased DOC influx, possibly from decomposition of the woodchips and organic matter from the stream banks, may account for the spread of the iron-oxidizing bacterium Leptothrix over much of the restored area. Iron oxidation and bacterial respiration may have caused oxygen concentrations to decline from about 8 mg/L entering the restored reach to <1 mg/L leaving. Continued monitoring will reveal whether the DOC load declines and whether that affects nutrient removal.

Tom Jordan is a Senior Scientist at the Smithsonian Environmental Research Center. He received a BS in Biology from Bucknell University, Pennsylvania; and a PhD in Biology from Boston University, Massachusetts. His research is on the transport and transformation of the nitrogen and phosphorus in ecosystems. Since starting at SERC in 1980, he has studied the sources of nutrient releases from watersheds, the uptake of nutrients by wetlands and riparian forests, and the fates and effects of nutrients in estuaries, especially in Chesapeake Bay and its watershed.

OYSTERS: TWO SHELLS BUT MANY FACETS. A PRIMER ON BIOLOGY, ECOLOGY, AND MANAGEMENT

Christopher Judy; chris.judy@maryland.gov; MD Department of Natural Resources

Oysters are fascinating creatures, living in two shells appearing simply as rocks, yet their biology and ecology are complex. Even more complex is their management, which balances competing interests of saving them and eating them. The presentation will cover the many facets of oyster biology, ecology, and management. What they eat and don't eat, how they live and reproduce, why they collapsed in the mid 1980's, why they are valuable, and how "oyster partners" are trying to restore them are topics that will be covered. This primer on oysters will give you a basic understanding of the bay's living rocks.

Chris is currently the Shellfish Division Director at DNR and has held the position for over 10 years. He has worked in the Shellfish Division for over 25 years conducting many restoration projects for both the oyster industry and the Bay's ecology. Part of his experience includes 8 years running the largest oyster gardening program in the country: Marylanders Grow Oysters, which has over 7,000 cages growing oysters in 30 tributaries and engages over 5,000 residents and students. As a diversion from all this oyster mania....he collects oyster shells!

PREDICTING THE BENEFITS OF STREAM AND WATERSHED RESTORATION ON BIOTA THROUGH AN IMPROVED QUANTITATIVE UNDERSTANDING OF IMPACT MECHANISMS: USING RIVER CHUB AS AN EXAMPLE

Stanley J. Kemp; skemp@ubalt.edu; University of Baltimore

Improving biodiversity in streams is one of the most important goals of stream restoration, and is often the criteria by which projects are considered to be a success. However, efforts to incorporate stream biota into restoration and protection strategies are limited by a lack of quantitative knowledge of their attributes and requirements. River chub are a native fish species that may qualify as a focus for conservation in Maryland streams. Studies of river chub nesting activity over the last four years have quantified the relationship between high flows and disruption of river chub nests. The relationship between high flow magnitude and nest integrity allows for the prediction of the frequency of potentially damaging flows from discharge monitoring data alone. Streams within the range of river chub which have been impacted by urbanization show a significantly greater number of these disruptive events. While this represents a useful advance in understanding, further information is necessary to fully describe the link between high flows and river chub population dynamics. Insights from the river chub study may prove useful in guiding strategies in restoration and protection of freshwater fish communities in Maryland streams.

Stanley Kemp is an Assistant Professor at University of Baltimore where he has been faculty since 2008. His main research interests include studying the impacts of urbanization on fish communities and restoration and protection of streams and watersheds. Freshwater fish communities in Maryland have been his main research topic during the last five years, with a focus on river chub, an important and urbanization-sensitive keystone fish species.

LONG-TERM RESPONSE OF SURFACE WATER ACID NEUTRALIZING CAPACITY IN A WESTERN MARYLAND RIVER BASIN TO DECLINING ACID DEPOSITION

Kathleen Kline; kkline@al.umces.edu; University of Maryland Center for Environmental Science - Appalachian Laboratory

Coauthors: Keith Eshleman, UMCES - Appalachian Laboratory; Jim Garlitz, UMCES - Appalachian Laboratory; Sarah H. U'Ren, The Watershed Center of Grand Traverse Bay

Changes in acid-base chemistry resulting from declines in regional acid deposition of both nitrate and sulfate were examined using a randomly selected set of 40 stream reaches sampled between 1999 and 2014 within the Upper Savage River Watershed (USRW) in western Maryland in order to characterize the acid-base status of an entire river basin; determine whether more extensive network of streams of varying order has shown signs of recovery in acid neutralizing capacity (ANC); and understand the key factors controlling the rate of ANC recovery across the river network. Trends analysis suggests that USRW has significantly recovered, which is demonstrated by significant declines in sulfate and nitrate surface water concentrations. Statistically significant trends for declining surface water potassium, magnesium, and calcium were also observed. The sum of which exceeds the nitrate and sulfate recovery by about 1 μeq L-1 yr-1, suggesting that the lack of recovery trends in ANC could be a result of corresponding declines in base cation concentrations. Although a handful of more acid-sensitive individual reaches showed significant ANC recovery, basin-wide conclusions cannot be made about ANC recovery within USRW.

Katie Kline has worked as a researcher at the UMCES - Appalachian Laboratory in Frostburg, Maryland since 1993. She manages the Water Chemistry Laboratory at AL, which provides quality monitoring data for various projects throughout Maryland, including for the MBSS since its inception. She earned her B.S. in Biology from the University of Dayton and an M.S. in Fisheries from Frostburg State University.

NUTRIENT DYNAMICS IN URBAN HEADWATER STREAMS: THE ROLE OF LEAF LITTER

Neely L. Law; nll@cwp.org; Center for Watershed Protection

Coauthors: Bill Stack, Center for Watershed Protection; Sadie Drescher, Chesapeake Bay Trust

An emerging topic in urban stormwater management is the effect of nutrients from leaf litter on urban streams. Recommendations from the Chesapeake Bay Expert Panel report on street and storm drain cleaning practices state that research on the fate, transport and processing of leaf litter and other organic detritus in urban streets is a priority to determine its significance as a nutrient source. While leaf litter is a needed energy and food source to streams, research finds that urban development dramatically alters the delivery of leaf litter to streams, as well as factors and processes affecting nutrient processing and uptake. A comprehensive review of the collective research nationwide on this topic has yet to be done, and agreement on how best to manage leaf litter as part of stormwater management programs is also needed. As such, a debate has emerged with two diverse perspectives about leaf litter management in urban areas: one being "Don't starve our streams," and the other "Pick-up leaf litter from our streets to keep excessive nutrients out of our streams." This presentation will make the case for a synthesis of current research findings to identify the potential importance of leaf litter in urban streams and key factors affecting nutrient dynamics that may improve the way stormwater management programs address leaf litter.

Neely Law, PhD, is a Senior Research Analyst at the Center for Watershed Protection with over 20 years of experience in the water resources field. Neely works on projects that include coordination of inter-disciplinary teams, data management and facilitation. Her technical area of expertise is applied research and development of stormwater and watershed management strategies based on existing data, or new information generated from watershed and stream assessments or monitoring efforts. Neely's recent work at the Center involves development of a nationally accredited training program to place under and unemployed individuals to work in the stormwater industry.

MONITORING RESULTS TO VERIFY CONTINUOUS MONITORING AND ADAPTIVE CONTROL BMPS

Jamie Lefkowitz; jlefkowitz@optirtc.com; OptiRTC, Inc.

A new approach to managing stormwater has emerged as an alternative to passive stormwater management facilities. This approach involves automatically controlling the discharge from stormwater storage with an actuated valve based on real-time site conditions and weather forecast data. Known as Continuously Monitored Adaptive Control (CMAC), this approach can optimize the facility for multiple objectives and be adapted over time as regulations, land-use, and climate changes. A pilot program has been underway since 2015 to validate and monitor the hydraulic and water quality benefits of CMAC retrofits in the Anacostia River Watershed. The program is executed in partnership with MWCOG and is funded by NFWF. This presentation will present the findings after 11 months of monitoring at three sites, including rainfall, water level, nutrients, and total suspended solids. The preliminary findings show water quality improvements through the use of adaptive controls, which effectively redesign BMP facilities to optimize performance for a wide range of actual rainfall events instead of compromising performance to target static criteria. As CMAC technology moves from pilot projects to wider adoption and regulatory approval in Maryland, these research project findings are an important validation to claims made in support of innovative BMP effectiveness.

Ms. Lefkowitz is the Director of Project Development at Opti, a company focused on providing continuous monitoring and adaptive control solutions for stormwater management in the Chesapeake Bay. She is a professional engineer with 10 years of experience in water resources modeling and watershed data analysis. She has worked directly with communities looking to adopt innovative stormwater management solutions and with regulators aiming to approve effective new BMP technologies in the Bay.

Ms. Lefkowitz holds a bachelors and masters degree of civil, environmental, and water resources engineering from Villanova University.

INLAND RESILIENCY PLANNING THROUGH THE GREATER BALTIMORE WILDERNESS COALITION

Jeff Lerner; jlerner@americanforests.org; American Forests/Greater Baltimore Wilderness Coalition

Coauthors: Erik Meyers, The Conservation Fund; Ted Weber, The Conservation Fund; Will Allen, The Conservation Fund; David Rouse, American Planning Association; David Morley, American Planning Association; Anna Read, American Planning Association; Ed Doheny, USGS; Jon Dillow, USGS; John Hammond, USGS; Bob Shedlock, USGS; Gary Allen, Center for Chesapeake Communities; Jeff Allenby, Chesapeake Conservancy; Colin Stief, Chesapeake Conservancy

The Greater Baltimore Wilderness Coalition is a voluntary alliance of public agencies, non-governmental organizations, professional associations, and conservation coalitions that supports the vision of expanding a connected and protected green infrastructure network in populous central Maryland from the Chesapeake Bay to the Piedmont. Among its activities, the Coalition seeks to improve regional capacity to respond to the impacts of a changing climate. In the aftermath of Hurricane Sandy, The Conservation Fund received a two year grant to design a green infrastructure framework for the greater Baltimore metropolitan area that would address future extreme weather events. Green infrastructure investments on a regional basis at all scales, landscape through site-specific, can provide cost-effective protection for valuable transportation, energy and water treatment infrastructure, shield homes and businesses from adverse impacts, and provide additional benefits, particularly for underserved and vulnerable populations. Using existing data and new green infrastructure modeling the Project Team has identified and mapped five key strategies which together can increase landscape resilience across the Patapsco, Patuxent and Gunpowder river watersheds. The project also examined local land use planning tools and is developing a toolkit for local implementation and regional collaboration.

Jeff currently serves as Vice President for Conservation Programs at American Forests, leading programs to restore key forested wildlife habitats, regreen cities by expanding urban tree canopy and accelerate the protection of intact forested watersheds. He has served as the project manager for The Conservation Fund's landscape resilience work in the Greater Baltimore metro area. Over the past 20 years he has also worked on national level planning, policy and funding for habitat conservation for several conservation organizations including The Nature Conservancy, Defenders of Wildlife and the Doris Duke Charitable Foundation.

OPTIMIZING MONITORING DESIGN TO ASSESS THE EFFECTS OF STORM WATER BEST MANAGEMENT PRACTICES ON WATER RESOTRATION

Dong Liang; dliang@umces.edu; Chesapeake Biological Laboratory, UMCES

Coauthors: Vyacheslav Lyubchich, Lora Harris, Jeremy Testa

Municipal storm water permitting process requires comprehensive programs to assess watershed. The unpredictable timing and magnitude of precipitation events are major complications to effective monitoring. The before-after-control-impact (BACI) design is often used to assess the effects of an environmental change made at a known point in time. However, the relative contribution of monitoring density and the number of paired control sites have not been studied in an river and stream monitoring context, i.e. "what is the tradeoff between maintaining several pairs of restored and control sites, versus increasing the monitoring density and duration?" The Chesapeake Bay management effort has a water quality model that hindcasts daily estimates of watershed loads of TN, TP and TSS to the estuary. The hindcasts can be sampled to measure how a given strategy would capture the true loading from a watershed. Coupled with the CBP Phase 5 model parameterized at various impervious cover, we will develop statistical measures of the effectiveness of a given monitoring scheme in revealing the true restoration effort. Our approach will be illustrated at the Baltimore Long Term Ecological Research sites, and past monitoring sites in the Corsica watersheds. We will discuss the use of empirical data to address the model uncertainty.

He is an statistician with inter-disciplinary trainings in geography and epidemiology. His work focuses on application of Bayesian spatial modeling in environmental modeling and monitoring. He has served as consultants and reviewers on Chesapeake based projects in next phase of water quality monitoring and criteria assessments.

PERSPECTIVES ON ELLICOTT CITY FLOOD MITIGATION

Lori Lilly; lorililly@gmail.com; Lori A. Lilly - Environmental Solutions

Ellicott City, MD has a history of flooding. The latest flood was experienced on July 30, 2016 and cost lives, businesses and significant damage to property. Efforts have been on-going to mitigate flood damage prior to the 7/30 event, and have increased since. Lori has been working with the community in both a professional and volunteer capacity since the 2011 Tropical Storm Lee flood to assist with mitigation. She will share knowledge gained from these experiences including the development and implementation of a watershed plan, initiation and implementation of a channel debris maintenance program, education and outreach efforts as Chair and Member of the Ellicott City Partnership's Clean, Safe and Green Committee and voluntary service on two Ellicott City flood advisory groups.

Lori A. Lilly is an independent environmental consultant located in Howard County, MD. In her professional career, Lori directed an NGO, implemented watershed restoration projects in Oregon and worked for the Center for Watershed Protection as a Watershed Ecologist & Planner. Lori is currently leading grassroots watershed restoration efforts in Howard County, including managing the Restoring the Environment and Developing Youth (READY) program and forming a new non-profit, Howard EcoWorks.

INTEGRATING AIR AND WATER ENVIRONMENTAL MANAGEMENT IN THE CHESAPEAKE BAY PROGRAM

Lew Linker; llinker@chesapeakebay.net; U.S. EPA Chesapeake Bay Program

Application of integrated Chesapeake Bay models of the airshed, watershed, and estuary support air and water nitrogen controls in the Chesapeake. The models include an airshed model of the mid-Atlantic region which tracks the estimated atmospheric deposition loads of nitrogen to the watershed, tidal Bay, and adjacent coastal ocean. The three integrated models allow tracking of the transport and fate of nitrogen air emissions, including deposition in the Chesapeake watershed, the subsequent uptake, transformation, and transport to Bay tidal waters, and their ultimate influence on Chesapeake water quality. This presentation describes the development of the airshed model, the observed data used in its development, and key findings from the scenarios. Key findings are that the atmospheric deposition loads are among the largest input loads of nitrogen in the watershed, and that the indirect nitrogen deposition loads to the watershed, which are subsequently delivered to the Bay are larger than the direct loads of atmospheric nitrogen deposition to Chesapeake tidal waters. Atmospheric deposition loads of nitrogen deposited in coastal waters, which are exchanged with the Chesapeake, are also estimated. About half the atmospheric deposition loads of nitrogen originate from outside the Chesapeake watershed.

Lewis Linker is the Chesapeake Bay Program Modeling Coordinator, and works with colleagues throughout the Chesapeake Bay Program to develop linked models of the airshed, watershed, estuary, and living resources of the Chesapeake. The linked models of the Chesapeake have provided the basis for the nutrient and sediment reductions in the historic 2010 Chesapeake TMDL. The nutrient and sediment allocations Chesapeake TMDL will reduce Chesapeake nutrient and sediment loads by about a half and one third, respectively, from the high point of nutrient and sediment loading in the mid-1980's.

CYANOBACTERIAL PERSISTENCE IN MARYLAND LAKES: YEAR-ROUND PRESENCE OF COLD-ADAPTED SPECIES

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Many freshwater lake and stream systems experience toxic algal blooms enhanced by anthropogenic nutrient loading. In 2015-16 Lake Anita Louise near Frederick, MD experienced a winter algal bloom of Planktothrix rubescens, a filamentous cyanobacterium tolerant of low temperatures. A similar taxon, P. prolifica, resides in nearby Fountain Rock Quarry and appears under ice in winter as well. Planktothrix species produce hepatotoxic microcystins, which induce liver hydrolysis at high concentrations and tumors with chronic low exposures. While the surface bloom dissipated in the spring, P. rubescens was hypothesized to inhabit the colder, deeper waters of Lake Anita Louise during the summer months, with similar distributions proposed for P. prolifica in the quarry. Lake Anita Louise monitoring was conducted to determine whether P. rubescens persists in the lake year-round. Through 10 months of monitoring, we have shown that P. rubescens survives in the lake at low light conditions between the thermocline and hypolimnion. Natural lake turnover events in the late fall and winter are predicted to reposition both taxa back to the surface.

Mattheiss is a member of the Conservation Corps working with Center staff on water quality, cyanobacteria, and microcystin impacts on food webs. He currently oversees monitoring projects in two Frederick County systems, Lake Linganore and Lake Anita Louise and is conducting microcystin assays of benthic macroinvertebrates and fish tissue from the upper Potomac River experiencing summer benthic cyanobacteia blooms.

STREAM AND WETLAND RESTORATION THROUGH THE LENS OF MS4 COMPLIANCE AND THE CHESAPEAKE BAY TMDL: CAN WE GET THERE WITHOUT IT?

Erik Michelsen; pwmich20@aacounty.org; Anne Arundel County Watershed Protection and Restoration Program

Nitrogen, phosphorus, sediment, and impervious acres treated: These are now the currencies of the Chesapeake Bay's +$1 billion restoration economy. Counties, cities, and states across the region are struggling with how best to achieve their pollution reduction goals in a timely and cost effective fashion, and they're getting many conflicting messages. This presentation will present cost information, leading edge research on the efficacy of water quality improvement practices, and describe the implementation obstacles to improving the health of our waterways in a cost-effective manner that improves habitat at a scale that is meaningful.

Erik Michelsen is currently the Administrator of Anne Arundel County's Watershed Protection and Restoration Program and is charged with its restoration program to clean up the County's waterways and satisfy its Municipal Separate Storm Sewer System (MS4) and Chesapeake Bay TMDL requirements.

STORMWATER MANAGEMENT BASINS AS A YEAR-ROUND SOURCE FOR NA AND CL TO URBAN AND SUBURBAN STREAMS

Joel Moore; moore@towson.edu; Department of Physics, Astronomy, & Geosciences and the Urban Environmental Biogeochemistry Laboratory, Towson University, Towson, MD

Coauthors: Ryan E. Casey, Department of Chemistry and the Urban Environmental Biogeochemistry Laboratory, Towson University; Steven M. Lev, Urban Environmental Biogeochemistry Laboratory, Towson University and IDA Science and Technology Policy Institute; David R. Ownby, Department of Chemistry and the Urban Environmental Biogeochemistry Laboratory, Towson University; Joel W. Snodgrass, Urban Environmental Biogeochemistry Laboratory, Towson University and Department of Fish and Wildlife Conservation, Virginia Tech; Gregory Woodward, Department of Physics, Astronomy, & Geosciences and the Urban Environmental Biogeochemistry Laboratory, Towson University

Over the last two decades, many studies have documented that road salt application in regions receiving frozen precipitation is leading to ground and surface water contamination. However, little is known about the pathways by which road salt moves from impervious surfaces to urban streams and, in particular, the effects of modern stormwater management practices on road salt contamination are not well documented. We investigated ground and surface water chemistry along with soil chemistry in the Red Run watershed near Owings Mills, Maryland. Groundwater chemistry downgradient of two stormwater management basins (SMBs) showed persistent, elevated Cl (and Na) concentrations throughout the year with more variable concentrations in shallow groundwater (30 – 9000 mg/L, ~1 m depth) and more consistent concentrations in deeper groundwater (970 – 2950 mg/L, ~2.4 m depth). Not only does this groundwater represents a year-round source of Cl and Na to the adjacent secondary stream, but the high Na concentrations in the groundwater have altered the soil chemistry, resulting in long-term impacts at this site. At a larger scale, tributaries of Red Run with SMBs have the same or higher Cl concentrations throughout the year than tributaries without SMBs. SMBs do not protect streams from road salt contamination and may shift part of the problem to non-winter months or subsequent years.

Joel Moore is an Assistant Professor of Geosciences at Towson University. He received his Ph.D. in Geosciences from Penn State University and was a postdoctoral fellow at Northwestern University. Since starting at Towson in 2011, a major focus for his research lab has been urban geochemistry, including road salt impacts on streams and groundwater.

MEETING EVOLVING WATER CHALLENGES THROUGH INNOVATIVE EDUCATION PLATFORMS

Dr. John F. Munro; john.munro@faculty.umuc.edu; University of Maryland, University College

Coauthor: Dr. Robert Ouellette, University of Maryland, University College

Achieving sustainability objectives under conditions of uncertainty brought about by climate change requires the involvement of water professionals who have an inter-disciplinary perspective. Not only does continuing education---at the graduate level---enable professionals to develop advanced interdisciplinary skills, it builds critical connections between experts with diverse backgrounds ranging from engineering to public participation to resource economics to alternative planning methods. Unfortunately, many water professionals lack the time to participate in programs that require on-campus commitments. The solution is the development of innovative, on-line programs that provide exposure to new technical skills, at the student's convenience and control, while enabling interdisciplinary connections. The University of Maryland is currently making significant investments in innovative graduate environmental curricula that together represent a paradigm change in on-line learning.

Dr. Munro is currently an Adjunct Associate Professor at the University of Maryland, University College (UMUC) where he teaches environmental land use management and sustainability. Dr. Munro wrote his dissertation (UCLA) on long-term policy and institutional change within the California water supply and distribution system.

Dr. Robert P. Ouellette, is Chair of the Environmental Management (ENVM) Graduate Program in UMUC's Information and Technology Program (ITS).

ENVIRONMENTAL PERSPECIVES ON NUTRIENT TRADING

Doug Myers; dmyers@cbf.org; Chesapeake Bay Foundation

Chesapeake Bay Foundation has always supported nutrient trading in concept and has actively engaged in the details of developing a sound nutrient trading policy in Maryland. From the environmental perspective, trades must result in real, additional, and properly verified nutrient load reductions for the bay and the overall effect of the trading program must be protective of local water quality. The potential of nutreint trading is to accelerate overall load reductions of nitrogen, phosphorus and sediment to the bay by focusing on the most cost-effective practices, regardless of the sector in which those practices are built and with some flexibility in where they are built. Our job in the environmental community is to help the regulatory program assure proper safeguards within the framework of an entrepreneurial program that will monetize nutrient pollutants. If we are successful, those physical and chemical substance may transform from a bay pollutant to a valuable resource commodity.

Doug Myers is the Maryland Senior Scientist for Chesapeake Bay Foundation since 2013. He has spent his career in diverse fields and locations such as fisheries and marine mammal biology in the Bering Sea, environmental education and coastal resource management on the Texas Gulf Coast and wetlands policy and coastal habitat restoration in Puget Sound for forage fish species, salmon and endangered Southern Resident Orcas. Since coming to the Foundation, Doug reviews and advises on policies affecting the health of Chesapeake Bay's waters and species especially from the agriculture, urban stormwater and navigational dredging sectors.

THE STATUS OF MARYLAND'S NUTRIENT TRADING PROGRAM

Doug Myers; DMyers@cbf.org; Maryland Senior Scientist, Chesapeake Bay Foundation

After several decades of efforts to restore the Chesapeake Bay, the Bay States continue to pursue market-based approaches to meet aggressive watershed implementation plan (WIPs) goals and accelerate the restoration process, including the use of nutrient trading programs. Pennsylvania, Maryland, and Virginia have all adopted trading programs in some form or fashion.

The State of Maryland is in the process of developing its trading program and is committed to a water quality nutrient trading program that

- Accelerates the restoration of the Chesapeake Bay while reducing the costs of implementation
- Maintains consistency with the federal Clean Water Act, Maryland law and regulation, and any other applicable requirements
- Offers competitive alternatives for accomplishing both regulatory and environmental goals
- Protects local water quality
- Uses the best available science and appropriate metrics to estimate and/or measure pollution reductions, manage risk, and ensure the validity of credits
- Provides accountability, transparency, and accessibility for all interested parties
- Includes necessary compliance and enforcement provisions
- Creates incentives for investment, innovation, and job creation
- Fosters collaborative partnerships between public and private entities and among diverse stakeholders
- Positions Maryland to participate in interstate trading activities

The presenters will address many of the issues noted above from the market, regulatory, and environmental perspectives.

Doug Myers is the Maryland Senior Scientist for Chesapeake Bay Foundation since 2013. Doug has a Bachelor of Science in Marine Biology from Millersville University in Pennsylvania and a Master of Science in Environmental Science from University of Houston Clear Lake in Texas. He has spent his career in diverse fields and locations such as fisheries and marine mammal biology in the Bering Sea, environmental education and coastal resource management on the Texas Gulf Coast and wetlands policy and coastal habitat restoration in Puget Sound for forage fish species, salmon and endangered Southern Resident Orcas. Since coming to the Foundation, Doug reviews and advises on policies affecting the health of Chesapeake Bay's waters and species especially from the agriculture, urban stormwater and navigational dredging sectors.

2016 STATUS REPORT - UPPER GUNPOWDER FALLS WATERSHED BROOK TROUT CONSERVATION PARTNERSHIP

Adam Nabors; anabors@eqri.com; MD Chapter of Trout Unlimited (MDTU)

Coauthors: Mark Staley, Maryland DNR; Scott Scarfone, MDTU; Sean Beattie, MDTU

An iconic symbol of persistence and adaptability, the eastern brook trout (Salvelinus fontinalis) represents the pristine wilderness that once covered North America prior to European settlement. Today it is estimated that less than 9% of the habitat that historically supported brook trout remains viable, and the Maryland Department of Natural Resources (DNR) has listed brook trout as a Species in Greatest Need of Conservation. In the fall of 2014, the Maryland Chapter of Trout Unlimited (MDTU) convened a meeting at the National Aquarium inviting interested parties to explore the possibility of establishing a brook trout conservation effort in the eastern part of Maryland. At the initial meeting, DNR biologists led the group in an analysis of multiple sub-watersheds in the Gunpowder basin, highlighting each area's future potential to support thriving, interconnected brook trout habitat. In effort to facilitate conservation and enhancement of this catchment, the Upper Gunpowder Falls Watershed Brook Trout Conservation Partnership was born. This session will recap two years of Partnership activity (electro-fishing population survey, stream temperature monitoring via data logger, fish tagging, road-stream crossing assessment, etc.) in the Upper Gunpowder Falls watershed, and discuss plans to move this critical conservation effort forward.

As an MDTU Board member and volunteer coordinator, Adam brings his diverse background in stream restoration design, freshwater ecosystem assessment, baseline data collection, and restoration project implementation to Partnership efforts. When not volunteering, he works in the ecological restoration industry and enjoys exploring the Maryland wilderness (fly rod in hand).

SODIUM, CALCIUM AND CHLORIDE REMOVAL EFFICIENCIES OF SELF-CONVERTED DRY DETENTION PONDS IN BALTIMORE COUNTY, MD

Rob Owen; robert.owen@kci.com; KCI Technologies, Inc.

Coauthors: Michael Pieper, KCI Technologies; Colin Hill, KCI Technologies; Dr. David Ownby, Towson University; Dr. Ryan Casey, Towson University

Road de-icing materials, such as road salt (NaCl and CaCl2) and brine, have become common practices for pre and post winter storm application in Maryland. High salinity runoff goes either directly into streams or into stormwater ponds. Stormwater ponds are a common best management practice (BMP) for the management of runoff from impervious surfaces in suburban and urban landscapes. Stormwater BMPs have shown to be beneficial for nutrient removal, but what about for de-icing materials in the winter. In this study, dry detention ponds were evaluated for their Na, Ca and Cl removal efficiencies. Over time, these ponds can convert from "dry" ponds to ponds that have wetland characteristics (soils, plants) and may also hold water for longer periods of time. This study collected data from six ponds (three control and three self-converted), over the course of a year. Water level sensors were installed for continuous flow records at each inlet and outlet and during selected rainfall events, grab samples were collected at inlet(s) and outfalls during the rise, at the peak, and during the falling limb of the hydrograph. Grab samples were analyzed for Na, Ca and Cl. Ion loading and removal efficiencies are based on flow-weighted event mean concentrations. This study showed that in all six ponds, there were no reductions in loading and/or concentrations of Na, Ca or Cl leaving the pond.

Rob Owen is an Environmental Scientist at KCI Technologies where he specializes in aquatic ecology, stream and watershed assessments, and BMP effectiveness monitoring. Rob is a graduate of Mt. St. Mary's University and he is currently pursuing his masters degree in Environmental Science with a concentration in Water Resource Management and Assessment at Towson University.

DATA AND WEB TOOLS FOR IMPROVING WATER QUALITY

Cassandra Pallai; cpallai@chesapeakeconservancy.org; Geospatial Project Manager, Chesapeake Conservancy

Coauthor: Colin Stief, Applications Designer, Chesapeake Conservancy

The Chesapeake Conservancy has cooperated with the Chesapeake Bay Program (CBP) and partners to generate high-resolution land cover data. At one-meter cell size, this information is 900x more specific than the alternative Bay-wide National Land Cover Dataset. It provides complete coverage of all counties that touch or are within the watershed boundary - a total of nearly 100,000 square miles - and will be the basis of CBP's Phase 6 TMDL Model updates to their pollution load calculations. Beyond a regulatory setting, the land cover is helping to push water quality improvement efforts toward precision and maximum impact per dollar spent. Unfortunately, barriers to implementing data-driven solutions can be high and pervasive; they include computing as well as staff time and expertise limitations, small contracting budgets, and expensive software licenses. Participants to this session will learn about not only the new land cover dataset, but also about a complimentary flow path analysis and innovative, highly customized web tools that allow partners to access all of this information without special expertise or licenses. Together, these facilitate improved efficiency with first-pass conservation and restoration decisions, such as queries of suitable properties, drainage area and land cover calculations for stormwater projects, and report generation.

Cassandra manages geospatial projects for the Chesapeake Conservancy. With her team, she specializes in large landscape analyses, as well as in the translating and scaling up of research into digestible information for diverse partners. At the Conservancy, Colin uses digital media and geospatial technology to inform conservation efforts in the Chesapeake. In particular, he works on developing intuitive web applications that can provide task automation, data analysis, and decision support. Both Cassandra and Colin hold Masters of Environmental Management degrees from Duke University. Cassandra earned her Bachelors from Case Western Reserve University, and Colin from Miami University of Ohio.

HAS STRIPED BASS MOVEMENT CHANGED IN THE POTOMAC RIVER AND LOWER CHESAPEAKE BAY?

Tom Parham; tom.parham@maryland.gov; Maryland Department of Natural Resources Resource Assessment Service

Coauthor: Jim Uphoff, Maryland Department of Natural Resources Boating and Fisheries Service

Lower Chesapeake Bay charter Captains contacted Maryland Department of Natural Resources (MD-DNR) to find out why pre-migrant Striped Bass appeared to be less abundant in the lower Potomac River and Lower Maryland Portion of the Chesapeake Bay after 2007. Habitat and Striped Bass related fisheries monitoring data was examined to determine if the striped Bass were less abundant in the lower Potomac River and Lower Maryland Portion of the Chesapeake Bay after 2007 and if any changes in habitat had occurred during prior to 2007. After extensive analyses, available information does not offer a clear explanation to what fishermen are reporting. While Striped Bass tagging data does not support a distributional population shift, gill net survey on the Potomac River spawning grounds indicate that resident Striped Bass may have been at low abundance in some years. However, Habitat conditions in the deeper waters of the lower Potomac/lower Bay became poorer and Striped Bass may not have been able to use habitat they once did.

Tom Parham works for Maryland DNR's Resource Assessment Service and oversees Maryland's tidal water quality monitoring program.

Jim Uphoff is a native Marylander who received his B.S. from University of Maryland in 1976. He has sampled and analyzed most everything that moves in Chesapeake Bay and some things that don't. He is the Fish Habitat and Ecosystem Assessment Program Chief for Maryland DNR.

THE STATUS OF MARYLAND'S NUTRIENT TRADING PROGRAM

Susan Payne; susan.payne@maryland.gov; Coordinator, Ecosystem Markets and Certainty Programs, Maryland Department of Agriculture

After several decades of efforts to restore the Chesapeake Bay, the Bay States continue to pursue market-based approaches to meet aggressive watershed implementation plan (WIPs) goals and accelerate the restoration process, including the use of nutrient trading programs. Pennsylvania, Maryland, and Virginia have all adopted trading programs in some form or fashion.

The State of Maryland is in the process of developing its trading program and is committed to a water quality nutrient trading program that

- Accelerates the restoration of the Chesapeake Bay while reducing the costs of implementation
- Maintains consistency with the federal Clean Water Act, Maryland law and regulation, and any other applicable requirements
- Offers competitive alternatives for accomplishing both regulatory and environmental goals
- Protects local water quality
- Uses the best available science and appropriate metrics to estimate and/or measure pollution reductions, manage risk, and ensure the validity of credits
- Provides accountability, transparency, and accessibility for all interested parties
- Includes necessary compliance and enforcement provisions
- Creates incentives for investment, innovation, and job creation
- Fosters collaborative partnerships between public and private entities and among diverse stakeholders
- Positions Maryland to participate in interstate trading activities

The presenters will address many of the issues noted above from the market, regulatory, and environmental perspectives.

Susan Payne coordinates the Maryland Department of Agriculture's Certainty and Ecosystem Markets Programs and administers the Department's Agricultural Nutrient and Sediment Credit Certification Program. In addition to working with relevant federal and state agencies and entities, she sits on a number of national, regional, and inter-agency committees addressing water quality trading, interstate ecosystem markets, regenerative agriculture, climate change, and greenhouse gas reductions. Ms. Payne holds BA and MS degrees from the University of Pennsylvania, and her credentials include service as the Director of International and Inter-governmental Affairs for the State of Maryland and almost 20 years of experience in the securities industry in New York City.

NUTRIENT POLLUTION ACROSS THE CONTINENTAL UNITED STATES: AN OVERVIEW OF FINDINGS FROM THE NATIONAL LAKES ASSESSMENT AND NATIONAL RIVERS AND STREAMS SURVEY

Amina Pollard; pollard.amina@epa.gov; U.S. EPA

Coauthor: Richard Mitchell

Nutrient pollution is a common occurrence in lakes and rivers and streams. National monitoring programs like the Lakes Assessment and the National Rivers and Streams Assessment can provide information about the extent of nutrient pollution across these waters in the conterminous US. This presentation will bring together the results from these two assessment efforts and discuss common findings as related to nutrients. Data from NLA 2012 indicates that 55.2% of lakes in the national population and 86% of lakes in the EPA Region 3 had TP pollution. Similarly in NRSA 2008/2009, we found that 63.2% of river and stream miles nationally and 64.4% of river and streams miles in EPA Region 3 had TP pollution. In addition to exploring existing patterns, we will discuss short-term changes in nutrient concentrations in waters, with a focus on least disturbed lakes and streams.

Amina Pollard is an ecologist with the U.S. EPA, and is the Program/Technical Lead of the National Lakes Assessment, which is part of the U.S. EPA's National Aquatic Resource Surveys program.

ROAD-STREAM CROSSING ASSESSMENTS IN MARYLAND: WORKING WITH PARTNERS TO SET FISH PASSAGE PRIORITIES

Chris Reily; christopher_reily@fws.gov; United States Fish and Wildlife

Coauthor: Julie Devers, US Fish and Wildlife

Since July of 2015, the U.S. Fish and Wildlife Service (USFWS) and partners have assessed over 1300 road-stream crossings for fish passage and flood resiliency using the North Atlantic Aquatic Connectivity Collaborative (NAACC) survey protocols. In collaboration with the Maryland Department of Natural Resources, Maryland Department of Environment, National Oceanic and Atmospheric Administration Fisheries, and Maryland State Highways Administration, the USFWS determined a list of priority watersheds and road-stream crossings to assess based on presence of spawning habitat for anadromous species, freshwater mussel habitat, and brook trout presence. Results of road-stream crossing assessments have been given an aquatic organism passage score using the NAACC criteria. The information gathered from these assessments will be used to set priorities for selection of flood resiliency and fish passage projects including culvert maintenance, culvert replacement or culvert removal in the state of Maryland.

Chris Reily is a biological science technician with the US Fish and Wildlife Service. As a Level 1 coordinator with the NAACC, his primary responsibilities include prioritizing and mapping target regions and training or supervising lead observers and volunteers in the field. He completed his master's in Environmental Biology from Hood College in May, 2014 where he focused his research on riparian arthopod input into freshwater streams.

AMEN! REACHING BEYOND THE CHOIR

Jodi Rose; jodi@interfaithchesapeake.org; Interfaith Partners for the Chesapeake

There are over 5,000 places of worship in Maryland where hundreds of thousands of people look to their pastor, rabbi, imam, or spiritual leader for moral guidance. Interfaith Partners for the Chesapeake works to educate the faith community on the moral implications of not caring about water, and provide resources and activities to engage them in hands-on projects. The faith community movement is creating a transformative shift: installing rain gardens and tree canopy at congregations is the new norm! In exploring partnerships with the broader community, Interfaith Partners for the Chesapeake will provide insight on engaging the faith community, and understanding their motivation and challenges. Attendees will explore models of successful collaboration, and the measurable outcomes that can be counted as well as the unquantifiable transformative outcomes. Attendees will also hear about governmental partnerships and how separation of church and state is being sustained even while collaborating.

Jodi Rose graduated from the University of Illinois with a degree in Biochemistry and worked in the environmental consulting field for 15 years. As a volunteer in her Catholic church, she spearheaded several environmental and social justice programs that engaged fellow parishioners to live out their faith in action. It was during this time that Jodi discovered a strong interest in working at the intersection of faith and environment. Under Jodi's leadership as Executive Director, Interfaith Partners for the Chesapeake has worked with over 170 congregations throughout Maryland. Jodi also serves on the Diversity and Inclusion Committee advising the board of the Chesapeake Bay Trust.

CITIZEN SCIENCE-THE BACKBONE OF WATERSHED GROUPS

Timothy Rosen; trosen@midshoreriverkeeper.org; Midshore Riverkeeper Conservancy

Citizen science is the backbone of many watershed groups. Water quality data collected by these volunteers provide important information on the health of many local tributaries that would otherwise go unsampled by state and federal agencies. Midshore Riverkeeper Conservancy (MRC) is fortunate to have a robust group of volunteer "Creekwatchers" who help monitor over 120 sites in the Choptank River, Miles River, Wye River, and Eastern Bay. This group started sampling Talbot County waterways in 1998, was incorporated into MRC in 2010, and have slowly transformed from collecting Tier I water quality data to Tier III. Data collected by these MRC volunteers has gone towards evaluating oyster restoration in the Choptank, has been presented at hearings, and used in data analyses conducted by DNR, UMCES, VIMS, and USACE. As budgets get tighter the importance of high quality data collected by citizen scientist becomes more important.

Timothy Rosen has a Masters of Science degree in watershed hydrology from Louisiana State University where he was a graduate research assistant, and has a Bachelors of Science degree in biology from Mount St. Mary's University in Emmitsburg, Maryland. He manages the water quality program at Midshore Riverkeeper Conservancy that collects data from 120 sites in the Choptank, Miles, Wye, and Eastern Bay. He also completes research on agricultural best management practices, oversees agricultural outreach, and manages restoration projects. Tim has authored numerous scientific publications and presentations. He grew up outside Baltimore and harbors a deep affection for Maryland's tributaries.

CHESAPEAKE MONITORING COOPERATIVE: STRENGTHENING CONNECTIONS BETWEEN CITIZEN SCIENCE AND MANAGEMENT AGENCIES

Lea Rubin; lrubin@iwla.org; Izaak Walton League of America

The Chesapeake Monitoring Cooperative (CMC) is a new initiative from the EPA's Chesapeake Bay Program (CBP) to incorporate citizen science water quality monitoring data into the health assessments of the Chesapeake Bay Watershed. This project is harnessing the width and breadth of volunteer monitoring data that's available throughout the Chesapeake Bay watershed. In order to increase the visibility and accessibility of data collected by the citizen science and nontraditional monitoring community, CMC is developing several important pieces—a rigorous yet inclusive quality assurance program; a central database that is free and easy to use; and, a framework to funnel data to state and federal environmental management agencies. This talk will describe the overall project as well as how the project will strengthen the connections between citizen science and management agencies. Participants will learn how to find the technical support and resources that CMC has to offer.

Lea Rubin joined the Izaak Walton League of America in December 2015 as the Chesapeake Monitoring Cooperative Project Coordinator. Prior to becoming the project coordinator, Lea had a fellowship with the Chesapeake Research Consortium, part of the Chesapeake Bay Program Partnership, where she worked with Scientific, Technical Assessment and Reporting Team to explored new, smarter approaches for sustaining and growing the Program's vast water quality monitoring efforts. This work contributed to the push to integrate data from volunteer and nontraditional monitoring groups.

HOW MUCH MONEY IS GOOD DATA WORTH?: AN EXAMINATION OF THE MONETARY IMPACTS THAT OCCURS WITHIN THE RANGE OF VARIABLES ASSOCIATED WITH NUTRIENT REDUCTION ESTIMATES FROM TMDL BASED STREAM PROJECTS IN MARYLAND AND VIRGINIA

Josh Running; josh.running@stantec.com; Stantec

Beginning in 2010 with the establishment of TMDL's within the 6 Bay States and DC, municipalities have been scrambling to implement projects across the mid-Atlantic to meet nutrient reduction requirements. The projected overall costs of this massive clean-up effort are staggering and have MS4 localities re-prioritizing capital improvement projects in order to meet these goals. As a result, stream restoration has come to the forefront of these efforts as preliminary cost-benefit data analysis exposes the economic advantages of stabilizing stream bank erosion as a nutrient management practice. Costs to implement these types of projects can vary and are often driven by the best "bang for the buck". However, there is a lack of quality data available across the Bay watershed, often leading to utilizing non-validated information that fall outside what some would consider applicable for the region. This presentation will use case study data from projects in VA and MD, examining costs per pound of nutrient removed, and the sensitivity that nutrient soil concentration rates, bulk density, and erosion rate curves play in accurately estimating outputs and costs in the implementation of these projects.

Josh Running is a Senior Environmental Planner and Associate for Stantec. He has been working in the stream restoration field for 15 years and received his BS in Watershed Management, with a Minor in Soil Science, from UW – Stevens Point. He lives in Williamsburg, VA with his wife, Amanda, dogs (Casey and Conway) and cats (Eve and Walle). He is an avid outdoorsman and enjoys a cold beer from time to time.

CYANOBACTERIA BLOOM MITIGATION: BARLEY STRAW (HORDEUM VULGARE) AND OTHER APPROACHES

Kevin Sellner; sellnerk@si.edu; Hood College Center for Coastal and Watershed Studies

Coauthors: Allen Place; Judith O'Neil; Michelle Osborn; Robert Foote; Cathy Wazniak

Many nutrient-rich freshwater and oligohaline systems are dominated by summer blooms of cyanobacteria, some toxic. In Lake Williston near Denton, MD, summer blooms of toxic Microcystis aeruginosa have been a major threat to use of the lake due to microcystin concentrations exceeding 2 ppm (2 mg L-1). Similarly, M. aeruginosa dominated Cell 6, a sediment disposal lagoon on Poplar Island offshore of Tilghman, MD, in the summer of 2012. Bloom mitigation was implemented in both systems through the addition of barley straw (Hordeum vulgare), with large reductions in Microcystis abundances and in Lake Williston, toxin concentrations. Barley straw coupled with other strategies such as flushing and sediment capping are even more effective in reducing blooms. These results plus an extensive literature documenting similar responses in other waters indicate that this inexpensive and readily available substrate could be routinely used effectively in cyanobacteria mitigation in many systems. Other techniques will be described with a summary of likely effectiveness and limitations for general use in cyanobacteria-rich waters.

Over 35 years, Sellner's interests have focused on harmful algal blooms (HAB), conducting basic research primarily in the Chesapeake watershed and bay, serving as the first program manager for the interagency Ecology and Oceanography of Harmful Algal Blooms in NOAA, assisting colleagues in drafting national HAB reports, testifying before Congress, and mentoring students. Through his recent appointment to Hood College's Center for Coastal and Watershed Studies, he collaborates on 4 projects in cyanobacteria-dominated systems in western Maryland. Sellner also serves on Frederick County's Sustainability Commission and drafting portions of the county's 2040 Comprehensive Plan.

NATIONAL WETLAND CONDITION ASSESSMENT: FINDINGS, DATA APPLICATIONS, AND FUTURE DIRECTIONS

Gregg Serenbetz; serenbetz.gregg@epa.gov; U.S. Environmental Protection Agency

The National Wetland Condition Assessment (NWCA) is one in a series of National Aquatic Resource Surveys (NARS) to assess and report on the ecological condition of water resources nationally. A report documenting the results from the first NWCA, conducted in 2011, was released earlier this year and field sampling for the second NWCA was completed in October 2016. The presentation will discuss the major findings of the NWCA 2011, including national and regional results based on a biological indicator of condition and physical, chemical, and biological indicators of stress, and explore applications of the data for wetland protection and restoration. The presentation will also discuss future directions of NWCA, including the implementation of the second assessment in 2016.

Gregg is an Environmental Protection Specialist with U.S. EPA's Wetlands Division, where he works on the development and implementation of wetland monitoring and assessment programs. He is the program lead for the National Wetland Condition Assessment, one of a series of National Aquatic Resource Surveys to assess and report on the ecological condition of water resources nationally.

URBAN STREAM RESTORATION AND CONSERVATION: A CASE STUDY OF HERRING RUN

Archana Sharma; archana.sharma@morgan.edu; Morgan State University

The Herring Run stream flows through one of the most urbanized area in northeast Baltimore, Maryland into Back River and the upper Chesapeake Bay. The Herring Run Watershed drains approximately 32.6 square miles and most of it falls under residential or commercial land use zoning, in much of northeastern Baltimore City and a portion of central Baltimore County near Towson.This presentation focuses on 1.5 mile segment of the stream flowing through the Morgan State University Campus, reviews and maps the locations of derelict stream bed and bank conditions, investigates underlying reasons for degradation and closes with articulation of a restoration strategies and sustainable conservation plan based in community advocacy and stewardship.

Dr. Archana Sharma is a Professor of Landscape Architecture Program at Morgan State University. Critical design thinking in greenways, blueways, urban landscapes and sustainable cities has been funded and refined through 60 publications and presentations, over time. Iterations of theoretical and design frameworks have been recognized through honors and awards.

ACTIONABLE SCIENCE IN THE BALTIMORE URBAN WATERS PARTNERSHIP

Robert Shedlock; rjshedlo@usgs.gov; USGS

Coauthors: J.M. Grove, U.S. Forest Service, USDA; M. Galvin, SavATree; E. H. Majcher, U.S. Geological Survey

Baltimore is a pilot area in the National Urban Waters Initiative, a program started in 2011 to bring federal, state, and local organizations together to better connect underserved populations to their waterways and promote community-led revitalization efforts. The U.S. Forest Service leads the Baltimore Urban Waters Partnership (BUWP) with support from other federal and state agencies. The partnership is driven by guidance from local agencies and organizations, including several agencies in Baltimore City and surrounding counties, and non-government organizations such as Blue Water Baltimore, the Parks and People Foundation, Alliance for Chesapeake Bay, Baltimore Neighborhood Indicators Alliance, and others. Since 2014, BUWP has held two major workshops on water and environmental monitoring with participation from all jurisdictions in the Greater Baltimore area and contributions from university researchers, including scientists from the Baltimore Ecosystem Study. Partners involved in those workshops have formed the Actionable Science committee, and are working to connect policy-makers with scientists so that scientific information can be more effectively used by regulators and planners. The committee plans to hold future workshops on topics such as trash in waterways, toxics in water, and the effectiveness of best management practices, and is welcoming new members.

Bob Shedlock currently works part-time as a Scientist Emeritus at the USGS office in Baltimore. He retired at the end of 2014 as the Director of the USGS Water Science Center that covers Maryland, Delaware, and the District of Columbia. His work at the USGS included regional water-quality assessments, water supply studies, wetland hydrology, and urban studies. He has been a member of MWMC since its inception and served on the original Board of Directors and as the Vice Chair of the Board for a few years. His current work is on the Baltimore Urban Waters Initiative on which he serves as the co-chair of a team on Actionable Science.

THE INFLUENCE OF ROADS AND IMPOUNDMENTS ON AQUATIC COMMUNITY STRUCTURE IN HEADWATER STREAMS

Sean Sipple; seans@CRI.biz; Coastal Resources, Inc.

Headwater streams comprise at least 80 percent of the stream network in the United States. Due to their extent, linear nature, and location within the stream network, headwater streams are vulnerable to fragmentation from roads and impoundments. Impoundments such as farm and stormwater ponds are also frequent in small streams. Using benthic macroinvertebrate and fish data from the Maryland Biological Stream Survey for Maryland's Piedmont Region, the impacts of fragmentation (from roads and ponds) and supplementation (from ponds) on headwater streams was explored. Several fragmentation and source variables were measured in ArcGIS and incorporated into models to determine their impact on benthic macroinvertebrate and fish community structure. Fish and benthic macroinvertebrate results were also compared to determine whether top-down effects could be present due to shifts in fish community structure.

Sean Sipple is a Senior Environmental Scientist with Coastal Resources, Inc. He has over 14 years of experience working in natural resources, in the research, government, and private sectors. Sean conducts, reviews, and assembles natural resource studies related to residential, commercial, transportation, and utility projects, focusing on water quality and wetlands.

THINKWATER: BUILDING A MOVEMENT OF PEOPLE WHO CARE AND THINK DEEPLY ABOUT WATER

Jeremy Solin; jeremy.solin@ces.uwex.edu; ThinkWater, University of Wisconsin

Coauthor: Ken Belt

Urban streams are complex, living aquatic systems that mostly live beneath the streets of urban watersheds, largely unseen and unknown. And, if you ThinkWater, the true stream "riparian" zone extends across the entire surface and subsurface of a four dimensional watershed due to a maze of water, sewer and storm drain pipes, runoff management facilities, groundwater, wetlands, and riparian zones that are part of a typical, highly connected urban stream network. ThinkWater is a national movement of educators, students, managers, stewards, scientists, and citizens who think and care deeply about water. They know that future water security and sustainability starts with deeper learning, understanding, and caring, and that true understanding and behavior change requires more than new information. They know that the next big thing in water education, research, and outreach isn't water, it's thinking. That's where systems thinking comes in. During the presentation, we'll highlight the ThinkWater systems thinking framework and share key strategies and resources ThinkWater is using to build the movement of water thinkers in urban and rural watershed across the country. Participants will gain new tools and resources to enhance their water and other natural resources-based education and research programs. Participants will also learn about ways to partner with ThinkWater.

Jeremy Solin is the Wisconsin Coordinator and National Program Manager of ThinkWater, a national campaign supported by USDA to help people of all backgrounds and ages think and care deeply about water. He's worked in the environmental and sustainability education fields for the past 15 years. He has a bachelor's degree in water resources, a master's degree in environmental education and a PhD in sustainability education.

Ken Belt's biography submitted as part of another abstract.

IT'S EVERYONE'S BUSINESS TO BE GREEN

Corinne Stephens; cstephens@allianceforthebay.org; Alliance for the Chesapeake Bay

Businesses can play a critical role in protecting and restoring the Chesapeake Bay and its watershed. Businesses for the Bay (B4B), a partnership of the Alliance for the Chesapeake Bay and the business community, is a membership association providing the business community with a unique opportunity to network, reach social and sustainability goals, be recognized, potentially save money, motivate employees, and promote environmental efforts that are important to them, their customers, and their communities. The mission of B4B is to encourage businesses throughout the Chesapeake region to find voluntary, innovative, and measurable solutions to improve water quality and the health of the local rivers and streams, and to raise public understanding of the valuable role these business members play in environmental restoration. B4B will create lasting impact in environmental protection and restoration by linking business sustainability goals with regional watershed-wide goals. The actions B4B business members take uniquely correlate to the 2014 Chesapeake Bay Watershed Agreement, providing a regional context for accomplishments. Corinne will discuss the new program, which was kicked-off in February 2016, and will present case studies to show what businesses in Maryland can and are doing to help protect our local rivers, streams, and habitats.

Corinne is the Business Partnerships Manager at the Alliance for the Chesapeake Bay. She holds a Master of Science degree in animals and public policy from Tufts University Cummings School of Veterinary Medicine and received her Bachelor of Science in animal science with a minor in environmental policy from Rutgers University, Cook College. Before joining the Alliance in 2015, Corinne worked for the Wildlife Habitat Council in Silver Spring, MD and Defenders of Wildlife in Washington, DC. At the Alliance, Corinne uses her knowledge of corporate environmental stewardship to develop & manage the Businesses for the Bay partnership, as well as grow other initiatives with the business community in the Chesapeake region.

STATEWIDE WATERSHED REPORT CARD: STUDENTS SCIENTISTS IN ACTION

Ann Strozyk; ann_strozyk@hcpss.org; Howard County Public School System

Coauthor: Sara Weglein, DNR

Maryland students are working alongside volunteers, teachers, and Maryland Department of Natural Resources (DNR) biologists in cooperation with the Howard County Conservancy (HCC) to implement science standards through the "Watershed Report Card" program. The Howard County Watershed Report Card was introduced in 2014 to provide the opportunity for all Howard County public high school biology students to participate in quarterly watershed analysis activities, examine and critique local policies, advocate with decision makers and make informed environmental decisions. In 2015, HCC partnered with DNR biologists through a Chesapeake Bay Implementation (CBI) grant to increase the scientific rigor of the student stream survey tool. The program has been such a success that HCC was awarded another CBI grant in 2016 to initiate the "Statewide Watershed Report Card" which will culminate in May 2017 in Annapolis where Maryland students will gather to advocate for their watersheds before state legislators. This presentation will detail the development, implementation, and future expansion of this citizen science effort that engages students in genuine scientific inquiry alongside their teachers and STEM professionals to measure, evaluate, and advocate on behalf of Maryland watersheds and the Chesapeake Bay.

Ann Strozyk, Howard County Public School System, Environmental Educator, has been teaching for 18 years. Placed at the Howard County Conservancy, much of her work has been focused on engaging middle and high school students in a meaningful way in streams and forests.

NATIONAL COASTAL CONDITION ASSESSMENT: 2010 NATIONAL AND REGIONAL RESULTS

Hugh Sullivan; sullivan.hugh@epa.gov; U.S. EPA Office of Water

The USEPA implements the National Coastal Condition Assessment (NCCA) under the National Aquatic Resource Survey program with the support from states, tribes and academia, and in collaboration with other federal agencies and partners. The NCCA employs a probabilistic survey design and utilizes core indicators of water quality, benthic and sediment condition, and fish tissue contamination to determine the ecological condition of the waters of US estuaries at the national and regional scales.

This presentation will describe the probabilistic design and indicators used in the survey, and will review the NCCA 2010 national and regional results and provide estimates of conditions of Maryland coastal waters for each of the four core indicators.

Hugh Sullivan is the acting lead of the U.S. EPA Office of Water's National Coastal Condition Assessment. He is an Environmental Protection Specialist who has worked on NCCA quality assurance issues since 2011. Prior to joining the EPA in 2008, Hugh taught high school biology in Northern Virginia, where he enjoyed helping his students learn about how their actions upstream impact the Chesapeake Bay many miles downstream.

GORGAS RUN STREAM RESTORATION: INNOVATIVE APPROACHES FOR NATURAL CHANNEL DESIGN IN A WOODLAND PARK SETTING

Shandor Szalay; sszalay@akrf.com; AKRF, Inc.

Coauthor: Art Wawiernia, AKRF, Inc.

The authors describe a comprehensive restoration of Gorgas Run, a steep, over-widened headwater stream flowing through the Wissahickon Creek Park in Philadelphia, Pennsylvania. Like many incised streams in urban areas, Gorgas Run has incised and widened over time due to intensive watershed urbanization, resulting in high rates of bank erosion, poor aquatic habitat, and damage to near stream assets such as water and sewer lines, culverts, and retaining walls. The integrated project design successfully addressed multiple design objectives, including reducing rates of bank erosion, enhancing in-stream habitat, protecting near-stream infrastructure, and enhancing the aesthetic value of the stream corridor. Designers also incorporated several unique design approaches that could be applied to similar restoration projects throughout the region. Most notably, the project incorporated boulder channel bars, features that narrow the low flow aquatic channel while limiting impacts to bankfull channel geometry and flood-stage hydraulics. In addition, the project designers developed new approaches for replicating the vegetation/rock complexes that typify many natural streambanks in steeply-sloping environments. This technique uses soil encapsulation as a means for establishing herbaceous vegetation within designed gaps in boulder channel bar and boulder wall revetments.

Shandor J. Szalay is Senior Vice President of Water Resources with AKRF, Inc. where he heads the firm's Water Resources Practice. Mr. Szalay's 17-year career has focused on helping municipalities and organizations implement science-based, ecologically-oriented, integrated strategies for improving water resource quality. Mr. Szalay is Adjunct Assistant Professor of Civil and Environmental Engineering at Villanova University and holds an M.S. in Water Resources Science from the University of Minnesota and a B.S. in Environmental Biology from the State University of New York College of Environmental Science and Forestry and Syracuse University.

PLANNING WITH THE FUTURE IN MIND: INCORPORATION OF IMPERVIOUS SURFACE ECOLOGICAL THRESHOLDS IN THE COMPREHENSIVE DEVELOPMENT PLAN PROCESS

Marek Topolski; marek.topolski@maryland.gov; MD Department of Natural Resources, Fishing and Boating Services

The land planning community has become acutely aware that land development has the capacity to severely degrade and disrupt the bio-chemical and ecological processes of aquatic ecosystems. Cumulative impacts from disparate factors significantly impact fishery resources. Impairment to fish reproduction and survival severely limits management options and effectiveness available to the MD Department of Natural Resources' Fisheries Service. A large body of research has identified general percent impervious surface thresholds where biological communities undergo significant change. Recognizing the ecological significance of impervious surface, the Charles County Department of Planning and Growth Management's Office of Planning and the MD Department of Natural Resources have partnered to forecast likely development impacts within the Mattawoman Creek watershed. This presentation will explore incorporation of ecological impervious surface thresholds into the comprehensive development planning process.

Marek is a Natural Resources Biologist in the Fish Habitat and Ecosystem Program at the Maryland Department of Natural Resources. His primary task is the use of spatial and non-spatial statistics to identify factors that affect fish habitat quality and leverage those relationships to assist local decision makers. Marek is also the Maryland representative on both the Atlantic States Marine Fisheries Commission Habitat Committee, and Atlantic Coastal Fish Habitat Partnership Steering Committee and current chair of its Science and Data Working Group.

MONITORING CREATED VERNAL POOLS AND WETLANDS IN BALTIMORE COUNTY

Kate Traut; ktraut@straughanenvironmental.com; Straughan Environmental, Inc.

To compensate for unavoidable impacts associated with approximately 8 miles of roadway improvements (the Section 100 – I-95 Express Toll Lanes SM [ETLs SM] Project), the Maryland Transportation Authority (MDTA) has created two mitigation sites, including the Whitemarsh Run Mitigation Site located off of Route 40 near White Marsh Boulevard (MD 43) in Baltimore County. This unique, 185-acre site includes 2 created wetlands, 2 enhanced wetlands, 36 created vernal pools, stream restoration, reforestation, and areas of wetland, upland, and floodplain preservation. In accordance with protocols set forth in the agency approved Compensatory Mitigation and Monitoring Plan (CMMP) for the site, Straughan Environmental, Inc., has conducted preliminary and Year 1 monitoring of the wetlands and vernal pools. As there are no standard monitoring protocols in Maryland for created vernal pools, the CMMP relies on three methods adapted from those used in Massachusetts, Ohio, and by the EPA. The created and enhanced wetland performance standards are consistent with MDE's 2011 guidance, including the use of IRIS tubes in the created wetlands. The focus of the presentation will be on the goals and performance standards for these components, with discussion of preliminary analysis of the results.

Kate Traut is a project manager and Professional Wetland Scientist who has been with Straughan Environmental for over 10 years. Prior to working at Straughan, Ms. Traut worked as volunteer coordinator and field botanist with the Maryland Department of Natural Resources, and as a scientific writer for the EPA's Mid-Atlantic Integrated Assessment. Her current work with Straughan includes overseeing the annual monitoring at MDTA's Whitemarsh Run Mitigation Site, as well as managing permitting and mitigation efforts for various clients in central Maryland.

MANAGING CHESAPEAKE BAY'S LAND USE, FISH HABIT AND FISHERIES: DEVELOPING AND APPLYING IMPERVIOUS SURFACE REFERENCE POINTS

Jim Uphoff; jim.uphoff@maryland.gov; DNR Fisheries

Coauthor: Margaret M. McGinty

Development (measured as percent impervious surface in a watershed or IS) has added a major new ecological feature, suburbs and cities, to Chesapeake Bay watersheds. As development proceeds, multiple stressors of fish habitat (altered stream flow, nutrients, sediment, toxic contaminants, endocrine disruptors, etc.) accumulate. Productivity lowers and fisheries deteriorate as habitat becomes unsuitable for egg through adult life stages due to watershed development. We adapted the biological reference point target and threshold concept employed in marine fisheries management to develop watershed IS reference points (ISRPs). ISRPs should help regulators recognize levels of development that conserve fish habitat (target of 5% or less IS, a rural watershed) or degrade fish habitat (a suburban threshold of 10% IS).

DNR Fisheries Biologist

CHANGES THROUGH TIME IN THE BENTHIC MACROINVERTEBRATE COMMUNITIES OF SITES NEAR AND WITHIN RESTORED STREAMS IN ANNE ARUNDEL COUNTY, MARYLAND.

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The impact of stream restoration on the biological health of stream reaches is a topic of active research. This presentation will summarize benthic macroinvertebrate data collected at four urban stream restoration sites in northern Anne Arundel County and examine how the sample sites have changed over time. At these sites, a version of the wetland seepage system approach to stream restoration has been implemented. At two of four sites, a limited comparison of pre and post-restoration conditions will be made. Observed conditions are compared to a variety of benchmarks, including a reference site sampled over the same time period. To date, there have been noticeable shifts in benthic communities in some locations when comparing sites found upstream, within, and downstream of restoration reaches to each other.

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PERFORMANCE OF HEADWATER REGENERATIVE STREAMWATER CONVEYANCE (RSC) STRUCTURES

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Regenerative stream / stormwater conveyance (RSC) structures are being extensively implemented in an attempt to reduce nutrient and sediment loads from urban watersheds. Nevertheless, there is currently a paucity of peer-reviewed literature concerning their effectiveness. Paired catchments were studied in the Coastal Plain and Piedmont physiographic provinces of MD to determine RSC effectiveness. In the most intensively studied RSC structure located in the Piedmont, precipitation, runoff, and groundwater were measured throughout the pre- and post-construction periods (17 and 24 months, respectively). In the post- compared to the pre-construction periods, total annual runoff decreased by 7% in the RSC and increased by 16% in the control catchment. We observed an average recharge of the groundwater system at the RSC site of about 2.5' above that observed at the control site. The increased volume of the groundwater reservoir in the RSC catchment allowed for baseflow even during dry periods. In a pre- and post-construction comparison, area yields of TN, TP and TSS decreased 53, 4 and 12 times more, respectively, in the RSC compared to the control catchment. Results indicate that RSCs positioned in headwater catchments show great promise as an effective means by which excessive nutrient and sediment loads from degraded urban catchments can be curtailed.

Michael Williams is an environmental consultant (Hyla Environmental) and research scientist affiliated with the Smithsonian Environmental Research Center (SERC). His expertise is primarily in the fields of ecohydrology and estuarine ecology. Michael's research commonly focuses on the impacts of human activities on water resources, biogeochemistry and solute dynamics of freshwater and estuarine ecosystems, and the effectiveness of stream restoration and best management practices (BMPs) at decreasing pollutant loads to receiving waters.

THE SMALL SCALE SPATIAL EFFECT OF CONSERVATION AREAS ON WATER QUALITY: IMPLICATIONS FOR CHESAPEAKE BAY AND ITS TRIBUTARIES

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Conservation easements are a land use planning tool used to protect water quality in areas of intense human development. The Gwynn Falls is a 133-mile tributary of Chesapeake Bay that traverse through areas of various human land use. The goal of this experiment was to see the small scale spatial effects of conservation areas on water quality. Water samples were collected from the Gwynn Falls from a point upstream of a conservation easement and every 100 m to a point 2000 m downstream from the easement boundary. Standard indicators of water quality (i.e. dissolved oxygen, nitrate, turbidity) were assessed using ion selective electrodes and colorimetric assays. There was a significant difference between upstream and downstream samples. Dissolved oxygen and pH were higher in downstream samples while nitrate concentrations were lower. Surprisingly, turbidity increased as the water traversed the conservation easement. This study provides important evidence of the benefits and limitations of conservation easements on mitigating the impact of human disturbance on water quality of Chesapeake Bay tributaries. While some water quality parameters improved over short distances, for example nitrate levels, others did not, for example turbidity. Further study is needed to determine if changes to conservation easements would lead to a broader improvement in water quality.

THE TENTH ANNUAL MARYLAND STREAMS ROUNDTABLE

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The MWMC organizes the Maryland Streams Roundtable to foster collaboration and cooperation among the many and varied groups sampling streams throughout Maryland. This gathering provides an excellent opportunity to learn where monitoring is being done and what's being sampled. The Roundtable is intended for professionals, non-profit organizations, and academic institutions monitoring streams. It serves as an opportunity for agencies, academic institutions, and groups to share what and where sampling will be done every year. Forty-one people attended the 9th Annual Maryland Streams Roundtable that was held at the USGS Water Science Center on February 19, 2016. Twenty-three people gave 10-minute presentations on their sampling programs. Included were Federal agencies (2), state agencies (2), local/regional agencies (7), academia (2) consultants (3), and NGOs (6). Fifteen groups submitted 2016 sampling site point data for display on a web-enabled map. This map was used to locate areas of overlap and identify potential opportunities for collaboration.

GHOST STREAMS OF BALTIMORE AND THEIR VALUE AND THEIR VALUE TO SCIENCE, THE SOCIAL FABRIC, AND HISTORY

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Unknown to all but a few, a living aquatic system lives beneath the streets of Baltimore. They are part of a buried network of streams that once provided water, food and habitat to plants, critters and people. Today, most of these streams are known only from old maps and meticulously drawn DPW storm drain construction contracts, due to the paving-over and burial of those aquatic ecosystems. However, there is a building realization of the importance of their many ecosystem and eco-sociological functions (i.e., ecosystem services) especially in current urban water management efforts, where concrete is giving way to green infrastructure and urban landscapes feature "daylighting" of buried streams to create blue-green focal points for public use, education and enjoyment, as well as ecosystem habitat, functions and other services. We discuss what we know about these subterranean networks, their role in the urban watershed continuum (UWC), their potential value to groundwater and urban stream ecology research as well as a historical and educational resource for residents. We wish to initiate a dialogue to propose a collaborative to encourage new science coupled with contributions to a blue-green urban landscape.

USING ENTEROCOCCI TO MONITOR WATER QUALITY OF STREAMS IN HARFORD COUNTY, MARYLAND

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Enterococci are frequently used as indicators of stream health for recreational users. In the summer of 2016, Harford Community College, in partnership with the Chesapeake Bay Foundation, sampled streams in Harford County, Maryland, for Enterococci bacteria. The objective of the project was to determine if Enterococci levels increase following rain events compared to non-rain events. Samples were collected once a week from eight different locations, analyzed, and recorded over the course of twelve weeks. Additional samples were collected after rain events of one-half inch or greater. The compiled results showed evidence of significantly increased levels of Enterococci in relation to rain events. The findings from this research can provide an insight to the public about the increased risk associated with swimming after significant rainfall.

HOW SAFE ARE SAFENERS? A BENTHIC MICROCOSM STUDY

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The herbicides applied to agricultural fields harm crop plants as well as weeds, so specific chemical "safeners" are added as one of several "inert" components of an herbicide mix. Although regulations require the toxicity of the active ingredients of pesticides be studied in controlled experiments, inert ingredients are largely exempt from such scrutiny. We compared the toxicity of the safener benoxacor, with its degradation product (monochloro- benoxacor), an herbicide (S-metolachlor) with which benoxacor is paired, and a mixture of S-metolachlor + benoxacor, to larvae of Chironomus riparius in benthic microcosms. A test sediment containing iron-rich clays was used because degradation of benoxacor under anaerobic conditions in the presence of reduced iron produces a compound also suspected of toxicity. Larval C. riparius were exposed to these four chemical treatments in spiked sediments during chronic 28-day experiments. High concentrations (~100 mg/kg, 200 mg/kg mixture) of all four treatments significantly affected percent adult emergence. Although the levels of Benoxacor at which toxicity was observed are higher than the concentrations of the herbicide S-metolachlor commonly measured in surface waters, no comparable data is available on levels of the safener. Data on the range of Benoxacor concentrations in receiving waters are needed to clarify risk.

THE EFFECT OF DEVELOPMENT ON THE HYDROLOGY OF THE UPPER GWYNNS FALLS

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Increased impervious surfaces in areas surrounding the Chesapeake Bay are a concern because they reduce rainwater infiltration while contaminants, such as motor oil, lawn fertilizer, and pesticides flow into the Bay. In western Baltimore County, Maryland, the Gwynn's Falls receives runoff from the suburban developments in the Owings Mills-Reisterstown corridor. During rainstorms, all of these new impervious surfaces in this region contribute runoff that eventually feeds into the Chesapeake Bay. The aim of this study is to evaluate changes in the amount of impervious surfaces since the opening of the Northwest Expressway (I-795) in the mid 1980's. This event marked the beginning of rapid development in the Owings Mills area. Changes in stream discharge levels between 1982-2014 was evaluated using USGS gauging station data from 3 stations along the upper Gwynn's Falls. Annual flow data of these stations was noted while anomalies such as hurricane activity that may have taken place in the surrounding areas were removed to avoid skewing results. Increased levels of runoff and inflow annually which were correlated to rapid suburban development of the Owings Mills-Reisterstown corridor. This suggests that during rain events there is an increased influx of contaminants flowing into the Gwynn's Falls watershed and ultimately into Chesapeake Bay.

USING LOGGERS TO INCREASE TEMPORAL COVERAGE OF SURFACE WATER-GROUDWATER INTERACTIONS

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Every year millions of tons of road salt are applied to the roads around MD. Overland flow from precipitation events and snowmelt can transport high concentrations of Na to roadside soils, groundwater, and streams. We characterized ground and surface water chemistry to investigate the rates and pathways by which Na+ is transported from impervious surfaces to streams in a suburban watershed. Grab samples, conductivity and pH were collected every two weeks within and downgradient of two storm water management basins (SMBs) near Owings Mills, MD. Continuous measurement of water level and conductivity also were collected with data loggers. Loggers were deployed in wells, SMB, and streams. These measurements allows interactions between surface water and ground water to be observed on the scale of hours to minutes. Loggers recorded pH, temperature, barometric pressure, and conductivity. Conductivity measurements were used as a proxy for Cl and Na concentrations.

BANK-DERIVED SEDIMENT DOMINATES SUSPENDED SEDIMENT FINGERPRINTS IN A SUBURBAN CHESAPEAKE BAY WATERSHED, UPPER DIFFICULT RUN, VIRGINIA, USA

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Excess fine sediment is one of the leading causes of ecological degradation in the Chesapeake Bay. In order to effectively target erosion mitigation measures, it is necessary to identify the source of eroding sediments. Given this, we conducted a sediment fingerprinting study – which tracks sediment chemical signatures – on Upper Difficult Run, an urbanized watershed in Fairfax County, Virginia. In this study, sediment sources were collected from stream banks, forest soils, and road dust, and target sediments were collected from the stream bed and fluvial suspended sediments during 16 storm events from 2008 – 2012. Sediment apportionment was conducted in Sed_SAT, a newly released toolkit for sediment fingerprinting. Most of the fine sediment transported within the watershed originated from stream banks, with minor contributions from forest and roads. Forest and roads only had notable fine sediment contributions during low discharge events (5 – 350 cfs), while material during higher discharge events (350 – 3500 cfs) was almost exclusively bank-derived. This is likely a consequence of increased erosive energy associated with urban storm flows, which contributes to channel instability and bank failure. These results demonstrate that stream bank erosion is responsible for the majority of suspended fine sediment exported from this suburban sub-basin of the Chesapeake Bay.

THE SMALL SCALE EFFECT OF CONSERVATION BUFFERS ON SOIL MICROBE ACTIVITY AND IMPLICATIONS FOR WATER QUALITY

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Soil microbes play a key role in decomposition of soil organic matter, nutrient cycling and pollutant degradation. These functions impact water quality in Chesapeake Bay and its tributaries. The goal of this study was to determine the small scale spatial effect of conservation easements on the soil microbes. Study was conducted within a conservation easement in the Gwynns Falls watershed, Owings Mills, Maryland. Soil samples were taken from flood plains outside of the easement and every 10-15 m downstream of the easement boundary. Microbial activity was assessed using the enzyme indicator phosphatase and soil pH. The resulting microbe activity was higher in areas of conservation compared to those outside conservation. The data suggest that activity decreased in a direct and dependent way as the water came closer to human contact. These results demonstrate that human activity can decrease water quality. Conservation easements can be an effective tool in improving water quality because even narrow conservation buffers bordering waterway can vastly increase soil microbe activity and thus water quality. This study demonstrates the importance of conservation easements as a crucial part of a management plan aimed at improving water quality in areas of intense human activity.

QUANTIFYING CARBON SPECIES FROM A RURAL TO URBAN GRADIENT

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Chemical weathering of soils and rocks and the decay of organic matter are the main sources of dissolved inorganic carbon (DIC) and dissolved organic carbon (DOC) to streams. DIC and DOC play important roles in biogeochemical cycling in stream ecosystems. While the factors that control DIC and DOC inputs to streams have been well studied in undisturbed watersheds, they are not well understood in urban watersheds. To address this question, DOC and DIC concentrations were measured in watersheds across a forested to urban gradient. All of the watersheds have similar bedrock chemistry and thus would have similar DIC and DOC concentrations in the absence of urbanization. We found that concentrations of DIC and DOC increased by a factor of 10 and 3.3, respectively, from the forested watershed to an urban watershed with 0.20-25% impervious surface area respectively. This work is the first Previous work has to shown definitively that concrete and other parts of the urban built environment are the primary a major contributor for elevated DIC in urban streams. Also, preliminary measurements have suggested that not all alkalinity can be contributed to DIC. Work is ongoing to investigate potential contributions from DOC to alkalinity, to characterize the nature of the DOC, and to quantify dissolved carbon exports with implications for downstream receiving waters such as the Chesapeake Bay.

USING QPCR FOR MICROBIAL SOURCE TRACKING OF FREDERICK COUNTY WATERWAYS

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The use of microbial source tracking (MST) allows for insight into the sources of fecal contamination in waterways by measuring the fecal micro-organisms related to a particular host. Due to increasing human populations and growth of urban areas in Frederick County, it is important to monitor the waterways to determine the source of fecal contaminants so that efforts can be made to reduce contamination whenever possible. DNA sequences of Bacteroides that are specific to humans, ruminants and those that are universally-associated with mammalian hosts were used to determine the fecal contamination levels in five Frederick County streams. Samples were collected after at least 72 hours without rain (dry samples) and within 24 hours of 0.5+ inches of rain (wet samples). Quantitative polymerase chain reaction (qPCR) was used to measure the relative level of each source of fecal contamination in each water sample. We determined that each site, under both dry and wet conditions, contained minimal human-specific Bacteroides. We detected a notable increase in ruminant-specific Bacteroides in two of the five wet samples and an increase in the total amount under wet conditions at three sites. Ballenger Creek was dominated (+80%) by ruminant-specific Bacteroides under dry conditions. In most cases, the source(s) of the majority of Bacteroides are neither human- nor ruminant-specific.

FRAMEWORK TO PREDICT TOXICITY OF ION PULSES IN BALTIMORE REGION STREAMS

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A key uncertainty in ecological assessments of anthropogenic chemical stressors is the apparent disconnect between experimental conditions and natural systems. For example, chemicals such as common ions are often tested in a lab at constant concentrations while organisms in the field experience seasonally or event-based pulse exposures. We sought to address this disconnect by conducting a 21 day toxicity test with Daphnia magna exposed to sodium chloride (NaCl) following several pulse exposure patterns. These data were then used to parameterize a General Unified Theory of Survival (GUTS) model to yield a prediction of D. magna survival given a novel NaCl pulse pattern. To test a realistic pulse pattern, we applied the model to chloride ion concentration patterns from USGS gages in streams near Baltimore, MD. The resulting pulse pattern of NaCl was applied to the GUTS model to predict lethal effects for the surrogate invertebrate, D. magna. Model output suggests that individual stream characteristics of NaCl pulse magnitude and frequency produce widely varying organism effects specific to observed pulse patterns. This effort provides a proof of concept for linking laboratory data to realistic environmental exposure scenarios and support for watershed specific seasonal run-off management to limit ion toxicity to invertebrate organisms.

PINNING OUR HOPES ON CITIZEN SCIENCE MONITORING: JOIN THE CHESAPEAKE MONITORING COOPERATIVE TODAY

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The Chesapeake Monitoring Cooperative (CMC) is a new initiative from the EPA's Chesapeake Bay Program (CBP) to incorporate citizen science water quality monitoring data into the health assessments of the Chesapeake Bay Watershed. This project is harnessing the width and breadth of monitoring data that's available throughout the Chesapeake Bay watershed. By working together, we can expand monitoring in the Chesapeake Bay Watershed and improve restoration efforts. In order to increase the visibility and accessibility of data collected by the citizen science and nontraditional monitoring community, CMC is also developing tools such as monitoring protocols, quality assurance project plans, factsheets, a database, and trainings that will be available to all interested groups. If you are part of a volunteer or citizen science organization, or are interested in using data from such groups, please sign up to learn more and become a part of this cooperative. At this interactive poster you can also add a pin to show where your group is monitoring.

INTEGRATED WATER QUALITY MODELING IN TIDAL STREAM: A MARYLAND CASE

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Impairment of water bodies due to wastewater discharge is one of the prioritized issues. In Maryland, it is apparent to look after the Chesapeake Bay and all other streams that flow directly or indirectly. Discharging to impaired water depends on TMDL that the water body can handle. Nitrogen and Phosphorus as cause pollutants, and DO and Chlorophyll a as responsive pollutants were studied. Water quality model was performed to investigate tidal-streams responses when representative Point Source discharged to a stream. The waterbody that was investigated is Little Creek, Caroline County, Maryland. Little Creek is selected because there are considerable failing On Site Disposal Systems (OSDS) near the creek. The failing OSDS were replaced by building Waste Water Treatment Plan. The application of basic water quality models has certain limitations; particularly hydraulic and hydrologic characters in rivers and estuaries are often estimated with assumptions and the calibration take time. HEC-RAS and WASP7 models were integrated to predict and analyze the water quality of the Creek to enhance the efficiency and obtained accurate result.

IMPACT OF CHURCH CREEK'S REGENERATIVE STREAM CONVEYANCE SYSTEM ON WATER QUALITY DURING LARGE RAIN EVENTS

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Church Creek has been identified as one of the most impaired tributaries of the South River. Surrounded by a highly urbanized watershed with 62% impervious surface, this Creek has been the recent focus of the South River Federation's restoration efforts. To reduce the pollution flowing into Church Creek, a Regenerative Stream Conveyance (RSC) system, involving six large step pools, ten coastal plain outfalls, and other restorative structures, was installed just north of tidal waters. The major goal was to reduce stream erosion and sediment loading. To assess the success of this system, a continuous EXO2 water quality monitoring device was deployed at the south end of the project after its August 2014 completion. Preliminary analysis of the data from several major rainfall events reveals a temporary decrease in turbidity (FNU) and increase in dissolved oxygen (mg/L) levels. Low levels of turbidity in such rainfall events indicate a high efficiency in the RSC's ability to reduce sediment pollution. Additionally, the improvement in dissolved oxygen levels suggests that the RSC may also be working to provide better conditions for aquatic life. While further investigation is needed to validate these results, these introductory data help generate a better understanding of RSCs.

FACTORS CONSIDERED FOR CONDUCTING A FISH CROSSING ANALYSIS FOR CULVERT PROJECTS IN MARYLAND

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If not properly designed, man-made structures such as road culverts can block the natural movement patterns of fish. While anadromous species have been a major focus of fish passage restoration efforts in the past, some resource agencies are now requiring fish passage considerations for resident species during the design and maintenance of culverts. In response, the Maryland State Highway Administration (SHA) developed a checklist to determine whether a fish crossing analysis should be conducted prior to the design and maintenance of a culvert. Factors that determine whether an analysis is necessary included the probability of supporting fish, as well as physical characteristics of the existing culvert. The probability of the site to support fish was determined using Maryland Biological Stream Survey data for the different physiographic provinces. Using R software, species-area relationships were developed that account for the variation from anthropogenic impacts using quantile regression. This analysis produced maximum species richness lines that provided an estimate of the watershed size at which no fish would be caught 95% of the time. These data were used in conjunction with the physical characteristics of the culvert to determine whether a fish crossing analysis was warranted.

ESTIMATING THE WHITE-TAILED DEER (ODOCOILEUS VIRGINIANUS) POPULATION IN THE UPPER GWYNNS FALLS WATERSHED AND THE EFFECT OF BROWSING ON FOREST ECOLOGY

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The population of white-tailed deer (Odocoileus virginianus) in central Maryland has increased markedly in the last several decades and browsing rate has risen commensurate with this increase. Deer browsing can reduce vegetation, alter forest structure, and increase nutrient runoff from the soil. The Gywnns Falls watershed within Baltimore County is ideal white-tailed deer habitat because of its mixed land use including extensive residential development. Populations of deer above carrying capacity can have a negative effect on the environment including to water quality. The goal of this study was to determine the population of white-tailed deer in the upper Gwynns Falls watershed and the effect of browsing. To determine the deer density, a fecal pellet survey was conducted periodically since 2013. Deer browse rate was determined using the Phase 2/Phase 3 plot sampling method of the US Forest Service Forest Inventory and Analysis and examining vegetation for evidence of browsing. Deer density in the study area is 0.672 ha-2 (174 mi-2). No sapling trees were present within the study site and 69% of all sprouts were browsed by deer. The white-tailed deer population in the upper Gwynns Falls watershed significantly exceeds environmental carrying capacity and is severely negatively impacting forest regeneration. The implications for forest ecology and water quality are discussed.

INFLUENCE OF WATERSHED-SCALE STORMWATER MANAGEMENT PRACTICES ON SEDIMENT AND NUTRIENT EXPORT

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Stormwater best management practices (BMPs) are becoming increasingly implemented in suburban and urban areas to mitigate the export of nutrient and sediment pollution to aquatic ecosystems. However, there are few studies examining the water quality impacts of installing stormwater BMPs at the watershed scale. We employed a watershed comparison approach to assess the influence of land use and BMP implementation on sediment, phosphorus, and nitrogen concentrations and yields during precipitation events. The study watersheds are located in Clarksburg, MD and Fairfax County, VA and include one forested reference watershed (For-MD), two suburban watersheds with centralized BMPs (Cent-MD and Cent-VA), and one suburban watershed with distributed BMPs (Dist-MD). Stream water samples were collected before, during, and after seven storm events in Cent-MD and For-MD, and five storms in Dist-MD and Cent-VA from 2010-2012. Water samples were analyzed for total suspended sediment (TSS), total phosphorus (TP), soluble reactive phosphorus (SRP), total nitrogen (TN), and nitrate+nitrite. We estimated mean baseflow concentrations for all constituents and event mean concentrations, loads, and yields for each storm event. We then examined relationships between land use, stormwater BMP type, and nutrient and sediment trends among the study watersheds during baseflow and stormflow events.

EFFICACY EVALUATION OF A NOVEL COLD ATMOSPHERIC AIR PLASMA FOR WATER DECONTAMINATION

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In recent years, non-thermal atmospheric plasma has been considered as potential decontamination technology. The plasma can interact with ambient atmosphere and generate a variety of reactive species such as ozone, hydrogen peroxide, radical, atomic and ionic species. Production of ozone in water by cold plasma may have the potential to control aquatic mosquitoes and microorganisms. In this study we used a novel cost effective cold atmospheric air plasma (CAP) system developed by ChiScan LLC. This device is driven by a high voltage at low current to cause dielectric barrier coronal discharge (DBD) without using any kind of noble gas.

We conducted laboratory testing on the effect of this CAP technology as a mosquito control measure on both larvae and eggs living in aqueous environments. In addition, its antimicrobial effect in an aqueous environment was tested against E. coli as an indicator organism.

The testing results demonstrated this novel CAP technology has mosquito larvicidal activity, and is very efficient in inactivating and/or killing mosquito eggs. The antimicrobial effect in an aqueous environment was also observed. There is great promise in application of this novel approach for decontamination of water and improving water quality. This alternative water treatment strategy is ideal for use in resource limited areas and field settings.

PERSISTENTLY ELEVATED CONDUCTANCE IN MATTAWOMAN CREEK AND BIOLOGICAL IMPLICATIONS

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Urbanization degrades aquatic integrity through myriad vectors. Amid the complexity, specific conductance is an easily measured metric that holds potential for signaling the state of urbanizing watersheds. The Maryland Fisheries Service has been exploring possible relationships between conductance and the quality of fish habitat using continuous monitoring in multiple watersheds. To assist the work, volunteers have been performing monthly discrete surveys of conductance in up to 20 sites in the watershed of Mattawoman Creek, a fluvial river and tidal-freshwater estuary entering the Potomac River at Indian Head, MD. Mattawoman's watershed is experiencing rapid development that correlates with declines in usage by river herring of the nontidal river and loss of estuarine-fish diversity. A year of conductance monitoring shows persistently elevated conductance that correlates with catchment road-density both during baseflow conditions and during a May high flow event. Comparing watersheds, a loss of habitat usage by river herring correlates with conductances ~1.6 times background. In addition, analysis of MBSS data for Mattawoman gives evidence of a decline in fish index-of-biotic-integrity for conductances greater than ~200 microSiemens/cm.

POTENTIAL OF INVASIVE CRAYFISH IN GWYNN'S FALLS RIVER

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Several crayfish species inhabit the freshwater watersheds of the Chesapeake. Over the years, and throughout the history of the Bay and Maryland's waterways, the crayfish native to Maryland have been introduced to some alien species that possibly have been causing them harm. In Baltimore County, three crayfish species are commonly found, including two in the Gwynns Falls watershed, the invasive Virile Crayfish (Orconectes virilis) and the native Allegheny Crayfish (Orconectes obscurus). The Allegheny Crayfish were historically a native crayfish that survived lower in the mid-west of Maryland, but now survive in northwest and far west of Maryland. Virile Crayfish were introduced to Maryland in 1885 most likely through fishing exports in Baltimore. This species started in the Patapsco River and expanded rapidly over the years and have taken up most of the Northwest and Mid-West of Maryland. Currently, no management plans are available. In the study, crayfish were identified to see if invasive species inhabited the Gwynn Falls. Traps were set in three different locations in the river to collect crayfish. Traps were checked and crayfish were caught, and identified to be either native or invasive. Their overall length and claw width were recorded to see if being native or invasive affected size. Invasive crayfish were detected during this experiment, being more abundant.

OXYGEN DEPLETION IN A RECENTLY RESTORED STREAM DOMINATED BY AN IRON OXIDIZING BACTERIUM

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A deeply eroded stream reach was recently restored by adding channel fill, pool and riffle systems and floodplain wetlands in order to connect the stream channel to its floodplain and improve stream habitats. Prior to the restoration, we deployed dissolved oxygen (DO) sensors at the upstream and downstream ends of the reach. We found that, as water flowed through the reach, DO concentration and photosynthetic activity decreased. We hypothesized that this was the result of *Leptothrix*, an iron-oxidizing bacterium, which covered the reach where there was low DO and upwelling groundwater rich in iron and dissolved organic carbon. We calculated DO uptake by *Leptothrix* in the restored reach using the closed chamber method with 6 PVC chambers (3 in partial stream flow, 3 in stream stagnation) and 3 controls (no *Leptothrix*). A YSI sensor measured DO depletion in the chambers for 3 minutes after a set DO concentration was reached. DO depletion rates were highest in areas with partial stream flow, followed by the stagnant areas ($p=0.077$), both with *Leptothrix*. The controls had significantly lower DO depletion rates than the partial stream flow and stagnant areas, $p=0.008$ and 0.042, respectively. Because *Leptothrix* has a high DO demand and inhibits algal growth, it likely contributes to low DO in the stream.

FISHERIES RESOURCE INVENTORY NEAR ABERDEEN PROVING GROUND, MARYLAND

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Chesapeake Bay tributaries provide important habitat for fish populations. The U.S. Army base at Aberdeen Proving Ground (APG), Maryland is located in the Upper Chesapeake Bay region and is bordered by the Gunpowder River, the Bush River, and the mainstem Chesapeake Bay. Despite the potential importance of these areas for Chesapeake Bay fish populations and fisheries, few biological surveys have been conducted there. Here we present the results of a fish population survey conducted in May, August, and October of 2015 in the Gunpowder River, Bush River, and mainstem Chesapeake Bay near APG. Fish were collected using bottom trawl and shoreline seine. All fish species were identified and enumerated. The number of individuals per size class was also enumerated for three species of interest: striped bass (Morone saxatilis), yellow perch (Perca flavescens), and white perch (Morone americana). Water quality variables including conductivity, salinity, water clarity, pH, dissolved oxygen, and temperature were also recorded. This poster presents the abundance, distribution, species richness, and species diversity for finfish in this system. Comparisons among season and among waterbody are described as are associations with environmental variables. Fish surveys in the Bay's tributaries can provide insight into the important role that these habitats play for Chesapeake Bay fisheries.

MONITORING NUTRIENTS AND CHLOROPHYLL NEAR A WASTEWATER TREATMENT PLANT OUTFLOW IN THE WESTERN BRANCH, PATUXENT RIVER ESTUARY

Amy Moody; aamoody4321@gmail.com; Friends of Jug Bay

The Western Branch, a tributary of the Patuxent River, has been monitored for water quality near a wastewater treatment plant outflow since January 2008. Nutrient and chlorophyll data collected during a 24-hr cycle each month from 2008 to 2015 was used to determine temporal patterns and trends. During the eight years examined, both nitrate and phosphate had the highest average concentrations in 2009. However, nitrate did not exceed the 1mg/L threshold value; phosphate, on the other hand, exceeded the 0.1 mg/L threshold value from 2008-2010. Peaks above 1mg/L for nitrate were observed from November 2008-March 2009, with a smaller spike occurring in June 2010. Much of the phosphate concentrations were above the 0.1 mg/L threshold value, but exceptionally high levels were observed in September 2010. Chlorophyll-a was consistently higher in August or September than any other month, every year, with values falling within medium (5-20 µg/L) to high (20-60 µg/L) concentration ranges. Overall, we think this area receives excess nutrients from nonpoint sources, including storm drain runoff, urban runoff, and septic tank seepage. Agricultural runoff is not a primary source of nutrient loading. The Western Branch wastewater treatment plant may contribute nutrients above EPA standards during the fall and winter due to seasonal differences in the nutrient levels allowed in the wastewater.

AN ANALYSIS OF THE EFFECTIVENESS OF STREAM CLEANUPS TO IMPROVE FISH HABITAT AND POPULATIONS IN MARYLAND RIVERS

Mark R. Moody; mmoody2@stevenson.edu; Stevenson University

Coauthor: Joseph Matanoski , Stevenson Univerisity

Ever since the environmental movement started in the 1970's, cleaning up polluted landscapes has been a top priority. Stream cleanups of waterways have been conducted by volunteers and organizations to improve the quality of environments affected by the pollution , i.e.; trash, bottles, tires, scrap metal, etc. These cleanups have freed streams and waterways of millions of tons of trash. The pollutants can harm many organisms that live in streams, rivers, wetlands, marshes, etc . Fish, in particular can become trapped in discarded plastics and absorb harmful chemicals emitted by the pollutants. Eventually these pollutants can have a deleterious effect on the Chesapeake Bay. The purpose of this study is to compare fish count data collected by the Maryland Biological Stream Survey to stream cleanup data from Blue Water and Project Clean Stream. The analysis will establish whether or not stream cleanups are helping fish populations in the Jones Falls, Gunpowder, Patapsco, and Gwynns Falls watersheds.

TRACKING METHYLMERCURY PRODUCTION AND EXPORT IN FIRST-ORDER STREAM ECOSYSTEMS

Jacob Oster; joster@umces.edu; Chesapeake Biological Laboratory (CBL), University of Maryland Center for Environmental Science

Coauthors: Andrew Heyes, CBL; Laura Lapham, CBL; William Lamp, UMD, College Park

Methylmercury (MeHg) is a globally distributed neurotoxin with the potential to biomagnify in aquatic ecosystems. While bioaccumulation processes within higher trophic levels have been well documented, processes controlling methylation of inorganic mercury (Hg) and initial steps of accumulation of MeHg into the food web are not well understood. This research seeks to document and compare transfers of MeHg and Hg to the food web of two first order streams with different watershed histories. By measuring spatial and temporal intensities of MeHg exposure (by measuring sediment and stream pore water MeHg concentrations) and MeHg concentrations in benthic macroinvertebrates in two stream ecosystems, we hope to identify benthic macroinvertebrate taxa to serve as bioindicators in MeHg risk assessment. Initial examination of macroinvertebrate species diversity and abundance indicates an anticipated difference between the two watersheds, but with some commonality to explore our question. This difference is likely driven by the differing hydrology between the forested and the agriculturally impacted watersheds. MeHg and Hg analysis is currently underway.

ANACOSTIA RIVER CONTAMINANTS: AN INTERJURISDICTIONAL PROBLEM

Harriette L Phelps; hphelps@hers.com; University of the District of Columbia

The DC Anacostia River food fish are highly contaminated with pesticides (chlordane, DDT) and PCBs. Active biomonitoring with corbicula clams located the great majority of contaminant sources in the (70%) MD watershed and a DC toxic source survey involved contaminated sediment and several fish species. However the funding to plan toxic remediation and control is presently available only for DC. This is a good local example of a severe interjurisdictional river problem. Discussion is invited.

REGENERATIVE STORMWATER CONVEYANCE AND ITS EFFECT ON CARBON LABILITY AND PRIMING

Brendan Player; brendan.player.13@cnu.edu; Christopher Newport University, Smithsonian Environmental Research Center

Coauthors: Dr. Joshua J. D. Thompson, Smithsonian Environmental Research Center; Dr. Thomas E. Jordan, Smithsonian Environmental Research Center

Regenerative Stormwater Conveyance (RSC) has become a commonly used technique to restore the natural functions of degraded streams. This method involves filling eroded channels with gravel, sand, and woodchips, repairing the stream bed and providing a carbon stimulus for denitrification. Although this technique is frequently used, little is understood about its effect on carbon cycling. We studied how this restoration technique affects dissolved organic carbon (DOC) lability and decay rates. We sampled stream water and groundwater from a restored creek located at the Smithsonian Environmental Research Center. The samples were then inoculated with sediment-derived microbes and incubated for five days. Decay rates were calculated from the initial and final DOC concentrations of these samples. These decay rates were then adjusted and compared to decay rates of glucose, a standard labile carbon source. The RSC was shown to increase concentrations of labile DOC, which can accelerate the decay of less labile stream-water carbon. Future research must be done to determine whether this has a significant effect on carbon mineralization and subsequent greenhouse gas emissions.

HART-MILLER ISLAND EXTERIOR MONITORING: EXAMINATION OF SPATIAL AND TEMPORAL TRENDS IN SEDIMENT METALS CHEMISTRY

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Coauthors: Holly Miller, Maryland Port Administration; George Harman, Phoenix Engineering; Amanda Peñafiel, Maryland Environmental Service; Peggy Derrick, EA Engineering, Science, and Technology, Inc., PBC

Located in the upper Chesapeake Bay at the mouth of Back River, the Hart-Miller Island (HMI) Dredged Material Containment Facility (DMCF) is a man-made enclosure constructed during the years 1981 through 1984 to contain sediments dredged from Baltimore Harbor and its approach channels. In accordance with the Clean Water Act and as a special condition of the State Wetlands License [no. 72-127(R)], a long-term monitoring program was implemented in 1981 to assess the effects of HMI on local sediment chemistry and the benthic community. We present results of a statistical analysis to identify significant long-term spatial and temporal trends in the 34 years of sediment metals chemistry collected to date. We also present lessons learned in DMCF exterior monitoring, and suggested improvements for future exterior monitoring programs.

CITIZEN SCIENCE FROM COMMUNITY CLEANUPS

Julia Saintz; Jsaintz@FergusonFoundation.org; Alice Ferguson Foundation Trash Free Potomac Watershed Initiative

Coauthor: Hannah Seligmann, Alice Ferguson Foundation Trash Free Potomac Watershed Initiative

The Alice Ferguson Foundation started doing yearly cleanups on Hard Bargain Farm where it brings youth for nearly 30 years. Since 2007 AFF has collected data on the hundreds of cleanups it sponsors through out the Potomac River Watershed. The site leaders of each cleanup have worked with AFF to collect data on the amount and type of trash they gather. We will present highlights of this citizen science cleanup data to show the value of large scale citizen data even with its shortcomings.

AN INVENTORY OF NATIVE AND NON-NATIVE PLANTS WITHIN A CONSERVATION AREA OF THE GWYNNS FALLS WATERSHED

Lydia Shreeve; lshreeve@stevenson.edu; Stevenson University

Introductions of non-native plants are an increasing and significant threat to water quality in the Chesapeake Bay watershed. Invasive non-native plants are often colonizing species that are shallow rooted and don't stabilize soils. The effect is increased erosion, sedimentation, and nutrient loading into adjacent waterways. Conservation easements are tool used by natural resource managers to reduce the impact of human activity on watersheds. However, it is unclear if these areas act as reserves for native plants. The Gwynns Falls drains a 66 mi2 watershed including parts of Baltimore County and Baltimore City and emptying into the Middle Branch of the Patapsco River. This is one of the major tributaries contributing to the Chesapeake Bay. The purpose of this study is to create an inventory of plants within a conservation easement within the upper Gwynns Falls watershed. A modified US Forest Service inventory and analysis design was used to inventory all plants within a conservation easement and to estimate the areal coverage by non-native plants. It was determined that 80% of the plants in the conservation easement were non-native with similar levels of areal coverage by such plants. It appears that conservation easements may not be effective tool for reducing the negative impact of invasive plants.

BIOENERGETIC ENDPOINTS FOR STREAM ASSESSMENT: LIPID CONTENT IN SURFACE WATER AND CADDISFLY LARVAE VARIES ACROSS AN URBAN TO RURAL GRADIENT

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Coauthors: Andrew East, Towson University; Dr. Christopher Salice, Towson University

Urbanization is a consequence of modern society that can have an array of impacts on ecosystems. Included in these impacts are increased quantities of natural and anthropogenic organic matter due to stormwater runoff; which is especially pronounced in urban environments. Organic matter in aquatic systems can disturb organism physiology and, consequently, stream function. An important objective in stream assessment is to identify metrics that provide useful insights into stream function. We hypothesize that lipid content (and profiles) in surface water and stream organisms provides insight into biological processes within streams. Five streams in the Baltimore region, representing a rural to urban gradient (defined by percent impervious surface), were sampled for surface water and caddisfly larvae. Lipid content of filtered and unfiltered water, as well as larvae, were measured and compared against an urbanization ranking. Preliminary data shows that all samples from the five streams differ in total lipid content and in the ratios between lipid classes (neutral, glyco-, and phospholipids). Of interest is that the expected trend of lipid enrichment in water with decreasing urbanization was not observed. We hypothesize that characteristics other than geochemistry, such as habitat differences, may explain energetic connections between organic matter and benthic invertebrates.

HOWARD COUNTY COMMERCIAL STORMWATER SOLUTIONS WORK GROUP

Mark Southerland; msoutherland@akrf.com; AKRF

Coauthors: Jim Caldwell, Howard County Office of Community Sustainability; Cole Schnorf, Manekin

In April 2016, Howard County convened an 11-member Commercial Stormwater Solutions Work Group to provide recommendations on effective strategies to incentivize commercial property owners to better manage stormwater run-off and assist the County in complying with its MS4 permit. This permit requires that the County treat 20% of its untreated impervious acreage, an action that cannot be accomplished on government property, as approximately 70% of opportunities occur on private land. The work group consisted of 11 commercial business owners, developers, and associated experts. In September, the work group provided recommendations that included (1) focusing outreach on owner-occupied, commercial and industrial properties with significant areas of land not in use, (2) developing standard access and maintenance agreements separately for construction and maintenance phases, (3) streamlining the permitting process by hiring dedicated stormwater permit reviewers, (4) creating a commercial stormwater program that leverages private innovation through turnkey contracts or credit purchases, (5) financing the program through fee waivers and rebates, and (6) recognizing commercial participants with varying levels of certification.

CONCENTRATION OF DISSOLVED METALS IN MINIMALLY DISTURBED STREAMS

Bronson T. Waite; bronson.waite@maryland.gov; Maryland Department of Natural Resources

Coauthors: Matthew J. Ashton, Maryland Department of Natural Resources; Katie M. Kline, Appalachian Laboratory - University of Maryland; Raymond P. Morgan, Appalachian Laboratory - University of Maryland

Annually since 2000, the Maryland Biological Stream Survey, led by the Maryland Department of Natural Resources' Monitoring and Non-tidal Assessment Division, monitors a network of minimally disturbed streams ("Sentinel Sites") to assess variability in stream conditions associated with natural factors. Data are collected on the biology, water chemistry, physical habitat, and temperature at each Sentinel Site. Beginning in 2013, dissolved metals (Magnesium, Calcium, Copper, and Zinc) were added to the panel of analytes tested in spring index-period surface water samples. These metals were included because some (e.g., Cu) are known stressors to aquatic life and elevated concentrations are often associated with emerging environmental issues, such as the salinization of freshwater and natural gas extraction. An understanding of their concentrations at Sentinel Sites is important because concentrations should reflect background conditions. In this poster, we present the first summary of metal concentrations within Sentinel Sites and among regions.

FINGERPRINTING SOURCES OF NITROGEN POLLUTION ON SCHOOLYARDS IN WESTERN MARYLAND

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Fingerprinting nitrogen sources across landscapes is useful for developing science-based management solutions to combat excess nitrogen from anthropogenic sources in the environment. During the past two years, we initiated and developed a unique student-teacher-scientist partnership between (1) high school environmental science classes in western Maryland and (2) scientists and education specialists at the Appalachian Laboratory. The goal of this partnership is to use the concentrations and stable isotopes ($\Delta 17O$ and $\delta 15N$) of nitrate to assess the amounts and sources (i.e. atmospheric vs. terrestrial) of nitrate pollution leaving schoolyards in runoff. In runoff samples collected in fall 2015 at two sites on each of seven schoolyards our team observed large variation in (1) average atmospheric nitrate concentrations (0.009 to 0.17 mg/L), (2) average terrestrial nitrate concentrations (<0.003 to 1.7 mg/L), and (3) nitrate $\delta 15N$ values (-8.7 to 13.9‰). Runoff was dominantly atmospheric nitrate at 6 sites and terrestrial nitrate at the 8 others. High $\delta 15N$ values (and nitrate concentrations) characteristic of animal and/or human waste were consistent with farming and animal husbandry activities at one school. Our results indicate distinct nitrate sources within and across schoolyards, which we are currently attempting to better understand in the context of land use activities.

STREAM HEALTH OF TOWSON UNIVERSITY CAMPUS WATERWAYS

Amy Williams; ajwilliams@towson.edu; Towson University

Coauthors: Seth Dobbis, Towson University; Jeremy Becraft, Towson University; Joel Moore, Towson University

Urban areas are among the fastest growing land cover types. Although research on the geochemistry and ecology of urban streams is growing rapidly, many basic scientific questions regarding urban stream processes remain unanswered. The streams on Towson University's campus represent ideal settings for addressing these questions because the numerous streams and the urban nature of the campus afford the opportunity for detailed investigation of the effects of urbanization on stream ecosystems. Additionally, some campus streams have experienced recent restoration, and another is scheduled for restoration in 2017. This project documents seasonal changes in water quality, including metal, salt, and nutrient loading, and an assessment of ecosystem health through benthic macroinvertebrate (BMI) surveys. Preliminary results suggest that the streams on campus are dominated by mixed cation and Cl-dominated waters. Specific conductivity ranges up to 1755 µS/cm. [Cl] can exceed 930 ppm, exceeding both the chronic (230 ppm) and acute (860 ppm) EPA criteria for aquatic life. Additionally, [Mn] in some locations exceed the 50ppb EPA secondary maximum contamination levels. Preliminary BMI surveys demonstrate low populations and diversity in the stream slated for restoration. Ongoing research will track contributions of salt, nutrients, and metals to campus streams.

SEDIMENT AND CONTAMINANT LOADS IN TRIBUTARIES TO THE ANACOSTIA RIVER

Timothy Wilson; tpwilson@usgs.gov; US Geological Survey Md-DE-DC Water Science Center

Coauthors: Brain Banks, Brenda Majedi, Melanie Mathesz, Charles Walker - US Geological Survey, Maryland-Delaware-DC Water Science Center

This presentation describes an ongoing study by the U.S. Geological Survey to determine sediment and contaminant loads in tributaries contributing to the Anacostia River. Funding for the study is being provided by the Washington D.C. Department of Energy & Environment. Tributaries being sampled include the NE and NW branches of the Anacostia River, Lower Beaverdam Creek, Watt's Creek, and Hickey Run, along with four smaller tributaries (Ft. Stanton, Fort DuPont, Nash Run, and Pope's Branch). The major tributaries will be sampled during 10 storms and once during low-flow conditions, while the smaller tributaries will be sampled during 1 storm and once during low-flow. Large-volume composite samples, containing a minimum of 1 gram of sediment, will be collected during storm events, with the sediment being analyzed for PCBs, PAHs, and organo-chlorine pesticides. Discrete samples collected over each storm will be used to estimate the associated loads of sediment and particulate organic carbon. Results of this project will be used to support a Hydrodynamic model and Fata & transport model under development for the Anacostia River. The study will also provide i much needed information for trackdown of tributary contaminant sources.

HEALTH OF MONTGOMERY COUNTY STREAMS

Cathy Wiss; Cathy.Wiss@anshome.org; Audubon Naturalist Society

The Audubon Naturalist Society (ANS) has sponsored a volunteer water quality monitoring program in Montgomery County, Maryland, and Washington, DC since the early 1900s. Approximately 180-200 volunteers visit permanent stream sites four times a year to collect and identify benthic macroinvertebrates to the taxonomic level of family and to conduct habitat assessments. ANS uses the family-level BIBI calculator developed for the Maryland Stream Waders Program to compute a stream health rating for each monitoring visit. The data collected show decline in water quality in many streams. Better water quality has been maintained in the more forested, less developed areas of the county. Although the County has set aside Special Protection Areas (SPA), not all of the stream reaches in the SPAs exhibit good water quality. Since 2010, stressors to streams throughout the County include excessive stormwater volumes and velocities leading to streambank erosion and channel destabilization; repairs to sanitary sewers embedded in the streams; low baseflows; loss of riparian buffers, especially in powerline cuts; presence of algae; high pH; and invasive plants. Stream restoration has not always led to improved water quality. We recommend protection of existing forests; reforestation projects in uplands and riparian areas; and stormwater retrofits that include trees and native plants.

ROAD SALT (NaCl) INPUTS SIGNIFICANTLY ALTER SOIL PH AND CATION EXCHANGE CHEMISTRY IN SOIL AND AQUIFERS

Gregory Woodward; gwoodward85@gmail.com; Towson University

Coauthor: Joel Moore, Towson University

Since the 1950s, application of road salt has grown due to increases in population and impervious surface area. Road salt impacts on surface and ground water chemistry have been well documented, but few studies have investigated impacts on soils or aquifers. We investigated soil and aquifer chemistry downgradient of two stormwater management basins (SMBs) near Owings Mills, MD. To characterize changes resulting from de-icing salt application, we collected 7 cores ranging from 3.5-7 feet in depth within and downgradient of the SMBs. The soil and aquifer materials are produced from schist weathering and are acidic (pH ~5). We found that soil pH increased to >6 in cores receiving runoff or groundwater flow with high Na concentrations. The exchangeable complex (EC) of unimpacted aquifer soils was dominated by Ca (75-90%) with Mg comprising the bulk of the remaining EC. In contrast, the EC in cores impacted by water with high Na concentrations due to road salt shifted to 20-60% Na with 40-80% Ca and nearly complete depletion of Mg. Our data demonstrate that 15 years of water with high Na concentrations from road salt runoff has dramatically changed soil and aquifer chemistry. As a result, even if road salt application were stopped now, the chemical changes in the aquifer soils would impact groundwater and stream chemistry downgradient of the SMBs for many years.

LAKE LINGANORE WATER QUALITY AND POTENTIAL FOR CYANOBACTERIA BLOOMS

Hannah Zinnert; zinnert@hood.edu; Hood College Center for Coastal and Watershed Studies, Frederick, MD 21701

Lake Linganore is a large lake located near the city of Frederick constructed for water supply and recreation. This lake, along with tributary stormwater management ponds, has xperienced occasional cyanobacteria blooms. Multiple water quality parameters and biological indicators derived from a spring-to-winter monitoring project provide an understanding of why the lake is primed for blooms and what parameters can be used as warning signs for future blooms. Key findings include 1) high chlorophyll levels spring-to-fall; 2) strong P-limitation of planktonic autotrophs ameliorated by P-flux from bottom sediments during summer stratified periods; 3) substantial fall concentrations of filamentous cyanobacteria; and 4) utility of portable fluorometers for monitoring of phycocyanin, the accessory pigment common to freshwater cyanobacteria. Future conditions in the lake remain a concern as a warmer climate favors cyanobacteria growth that will fueled by elevated nutrient loadings from intense agriculture in the lake's upper watershed, dense development in steep topography in the immediate area surrounding the lake, additional housing construction in the watershed, and possible inflow of cyanobacteria from the adjacent management ponds.

Annual Standing Committee Reports

This report summarizes MWMC activities from November, 2015 through November, 2016.

2016 marked the 22nd year for the Council and it was an exciting one. The Board of Directors continued to guide the Council toward its goals and new members provided fresh ideas that helped move the Council forward. The 2015 Annual Conference drew a record 485 attendees. Included were a host of exciting talks and posters and the second post-conference social at the Heavy Seas Brewery. Committee work continued in earnest, including some worthy projects and workshops. The Council will enter 2017 with a renewed commitment to pursue the three Cs – Communication, Coordination and Cooperation - among water monitoring agencies and organizations throughout the State.

Board of Directors

The MWMC Board of Directors went through leadership changes in 2016. Board Chair Clark Howells (Baltimore City) continued to serve with Sandy Hertz (Maryland Department of Transportation) as Co-Chari. The Board welcomed new members Mark Trice (MDNR) and Mindy Ehrich (UMCES). Mindy needed to step down after serving for four months. Board member Chris Swan (UMBC) left the Board early in 2016. Outgoing members were thanked for their service to the Council.

2015 Annual Conference

The 21st Annual Conference was once again held at the Maritime Institute on November 13 and the gathering was bigger and better than ever. With about 485 in attendance, the event's theme was PROTECTING THE SOURCE – SUSTAINING MARYLAND'S WATERS. Protecting high quality surface and ground water was emphasized throughout the day. Rudy Chow (Balto. City DPW) discussed the need to protect Baltimore City's excellent and sustainable drinking water supply. Peter Grevatt (EPA) provided a thoughtful and entertaining overview of EPA's efforts to keep the nation's waters safe for drinking. Frank Dawson (retired MDNR) received the 9th Annual Carl Weber Award for his work with various NGOs in the Annapolis area and as a MDNR leader. Session topics included stream restoration monitoring, emerging stressors, citizen science, the Inter-county Connector, and water quality regulations. Fifty-eight talks, 30 posters (including 7 student posters, 12 vendors or sponsors, and 14 "special interest" exhibits all contributed to a diverse and well-rounded agenda.

Workshops

Stream Monitoring Roundtable

The 9th Annual Maryland Stream Monitoring Roundtable took place on February 19, 2016 at the USGS Water Science Center in Catonsville. There were 46 in attendance. Mary Kay Foley, the Center's Director, kicked off the gathering by welcoming all. During lunch, Steve Harrison and Ian Smith (UMCES) discussed a new effort to monitor the effectiveness of several stream restoration projects and Michael Williams (SERC) focused on a restoration project in the Rock Creek Watershed. There were 24 presentations. Andy Becker (KCI) and Matt Stover (MDE) collaborated to produce an online map of all submitted point data for 2016 monitoring. This map was used to locate areas of overlap and identify potential opportunities for collaboration. The map will be updated annually. For more information about the Roundtable, contact Dan Boward at dan.boward@maryland.gov.

Road Salt

On April 13, 2016, the MWMC sponsored a workshop, Road Salt Usage and Environmental Impacts at the Patuxent Wildlife Visitors Center in Laurel, MD. There were 126 registrants. Topics included Practices and Alternatives, Impacts to Water Resources, Effects on Local Ecology, and Management Planning and Policy.

Workshop Summary - Data collection and analysis across the Mid-Atlantic region has shown in recent years that the increasing usage of road salt during winter months has an impact on our local waterways and groundwater. This all-day conference provided information on current road salt operations, applications, and best management practices within the state and local counties. Presenters discussed current scientific analysis and monitoring efforts, and the effects of elevated chloride levels on surface water, groundwater, and local ecology. Lastly, the workshop provided an overview of management strategies, including regional policies. A panel discussion at the end of the workshop invited attendees to identify additional information and monitoring needs.

Data to Decisions: Making Your Data Matter Workshop

On October 18th, the MWMC sponsored the workshop, Data to Decisions: Making Your Data Matter, at The Watershed Stewards Academy at Arlington Echo Outdoor Education Center in Millersville, MD. This event was at full capacity with 60 registrants. The focus of the workshop was on engaging volunteer/NGO water quality monitors to consider submitting their data for government use.

Workshop Summary - The agenda included a series of presentations from state agencies, the Chesapeake Bay Program, the U.S. Naval Academy, and the Chesapeake Monitoring Cooperative. Presentations provided attendees with information on data quality, data integration guidelines, and available resources and support. The workshop also included a question and answer session designed to address specific questions and/or barriers that the attendees might perceive with working with government staff. The workshop also facilitated networking among volunteer groups, and with government staff. The workshop planning committee is in the process of soliciting evaluations and determining if there is enough interest to hold additional regional workshops on the Eastern Shore and Western Maryland.

Committees (full committee reports can be found elsewhere in this program)

The **Information Management Committee** completed an online mapping tool – the Maryland Water Quality Mapper - that that will be used to track current and past water monitoring activities in Maryland. The tool was posted on the MWMC website in November and an email was sent to potential data submitters in late November. This is a reincarnation of the "clickable map" that MWMC sponsored in the early-mid 2000s. In 2017, the Committee plans to increase the value of the online mapping tool on the MWMC website by expanding the number of collecting organizations and monitoring activities included in the database as well as adding a georeferencing tool for watershed organizations and other NGOs. Another goal is to develop an on-line database that allows users to search past 15 years of MWMC annual conference presentations by keyword.

The **Citizen Science and Community Stewardship Committee** continued to update the MWMC watershed organization contact list that now contains over 250 names. The committee also continues to manage the MWMC Facebook page. Committee goals for 2016 include sponsoring up to two workshops, and completing a 3-year plan that with such activities as a "Volunteer Monitoring for Dummies" user guide, and creating a MWMC Linkedin Account for news content and professional networking within the water monitoring community. The Committee also played a large role in completion of the Data to Decisions Workshop described above. This workshop may be repeated in 2017 – perhaps on MD's eastern shore or elsewhere.

The newly-formed **Student Committee** was busy in 2016. Its overarching goal is to connect students, both high school and undergraduate, with the Council through workshops, projects, and the annual conference. The Committee's first endeavor is to plan and execute the Student Professional Networking Session at the 2016 annual conference. The session will have a diverse set of mentors (e.g., women in science, private consulting) that students can connect to and ask questions of. We hope by engaging more students in the annual conference, we will also build relationships with students throughout the year, providing them with opportunities to attend quarterly Board meetings and work on Board-identified projects. In 2017, the Committee hopes to engage more Board members in the Committee! There will also be an effort to engage students at the annual conference who may want to participate in Board meetings or Board-requested projects

In 2016, the **Monitoring and Assessment Committee** had a busy 2016. The Committee provided planning assistance and support to the Groundwater Committee in planning and organizing the Road Salt Usage and Environmental Impacts workshop. Committee members assisted with the 9th Annual Maryland Stream Monitoring Roundtable. The Committee is planning a Technology Series of workshops for 2017. Topics in the planned three part series may include continuous monitoring techniques, new technologies and methods, field applications, and best practices including calibration, standard operating procedures and quality assurance/quality control measures.The Stream Restoration Monitoring Sub-Committee has been quite active in 2016, holding several meetings and taking on a number of topics – three themed sessions at the December Annual Conference and a very thorough stream restoration literature bibliography to be posted on the MWMC web site. The Sub-Committee also sponsored a very successful forum - Stream Restoration – Science and Regulatory Connections – in June. This event featured presentations from top researchers on the state of stream restoration effectiveness science.

Submitted by Dan Boward
MWMC Executive Secretary
December 2, 2016

Maryland Water Monitoring Council
Information Management and Communication Committee
2016 Annual Report

Co-Chairs

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Committee Goals

The goals of the committee include (1) exploring existing data management procedures employed in Maryland and developing recommendations for data management and quality assurance; (2) creating and maintaining an interactive map of current and past monitoring activities, with appropriate contact information for all data sets and activities; (3) developing an inventory of web links where Maryland-related water-monitoring data, reports, and maps can be easily located online; and (4) encouraging people in the local water resources community to make data and reports available online so they can be easily accessed by the Maryland water-resources community.

2016 Accomplishments

Completed work on an online mapping tool that that will be used to track current and past water monitoring activities in Maryland. The tool is currently available on the MWMC web site.

2017 Goals

Following implementation of the online mapping tool on the MWMC website, increase its value by expanding the number of collecting organizations and monitoring activities included in the database.

Complete an on-line database that allows users to search past 15 years of MWMC annual conference presentations by topic.

Submitted by T. Parham, November 9, 2016

Maryland Water Monitoring Council
Groundwater Committee
2016 Annual Report

Chair

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Committee Members	Organization
David Bolton	Maryland Geological Survey
John Grace	Maryland Department of Environment
Kevin Koepenick	Baltimore Co. Department of Environmental Protection and Sustainability
Tim Goodfellow	Frederick County Department of Planning and Development Review
J. Ellen Lathrop-Davis	Community College of Baltimore County
Joel Moore	Towson University
Jeff Gernand	KCI

Committee Mission Statement

The Committee will promote and facilitate collaboration on issues related to the monitoring and assessment of the quality and available quantity of groundwater in the State. The committee will consider the current state of groundwater monitoring, and will explore the need for documenting and disseminating information on groundwater monitoring activities. The group may promote the sharing and accessibility of groundwater quality data; and may consider and make recommendations on the needs, protocols and quality standards for monitoring in relation to specific threats or stressors to groundwater.

2016 Accomplishments

The Committee planned and held a workshop on the environmental impacts of road salts in April. The workshop was attended by over 120 professionals from local, state and federal agencies, environmental consulting firms, universities, and non-profit organizations. A dozen speakers presented on topics ranging from road salt application processes, to water quality effects in streams and groundwater, to effects on stream biota.

A sub-group of the Committee discussed a list of topics related to groundwater monitoring, as possible issues to focus on in the coming year. In addition to possible follow-up on issues raised at the road salt workshop, other issues identified were:

- The interaction of groundwater and surface water, including water quality and water quantity
- Gaps in existing monitoring networks
- Making ground water level data from various sources/ agencies more accessible.

2017 Goals

1. Follow up on groundwater issues identified at the road salt workshop.
2. Identify contaminants of emerging concern, such as PFOA or PFOS, and explore the need to provide and disseminate relevant information.
3. Look for ways to share groundwater monitoring data.
4. Replace exiting members and expand membership to include representation from the Eastern Shore and southern Maryland.

Submitted by M.G. Pajerowski

November 10, 2016

Maryland Water Monitoring Council
Monitoring and Assessment Committee
2016 Annual Report

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Capt. Diana Muller	South River Federation
Andrew Muller	U.S. Naval Academy
Bryan Perry	Anne Arundel County
Stan Kemp	University of Baltimore
Mike Pieper	KCI Technologies, Inc.
Andy Becker	KCI Technologies, Inc.
Chris Victoria	Anne Arundel County
Ron Klauda	Retired
Jim Cummins	ICPRB
Cherie Miller	USGS
Mark Southerland	AKRF
Doug Redmond	Retired
Clark Howells	Baltimore City RNRS
Sherm Garrison	MD DNR
Alice Volpitta	Blue Water Baltimore
Dr. Hany Sobhi	Coppin State University
Tatiana Roth	Coppin State University
Jai Cole	MNCPPC
Rob Mooney	Triad Engineering, Inc.
Marian Norris	National Park Service

2016 Activities and Accomplishments

The Monitoring and Assessment Committee (MAC) would like to thank Chris Victoria for his service to the committee as co-chair in 2015 and 2016. Mark Southerland will be the new co-chair beginning the end of 2016.

The MAC provided planning assistance and support to the Groundwater Committee and Mat Pajerowski in planning and organizing the Road Salt Usage and Environmental Impacts workshop on April 13, 2016.

The 9th Annual Maryland Stream Monitoring Roundtable took place on February 19, 2016 at the USGS Water Science Center in Catonsville. There were 46 in attendance. Mary Kay Foley, the Center's Director, kicked off the gathering by welcoming all. During lunch, Steve Harrison and Ian Smith (UMCES) discussed a new effort to monitor the effectiveness of several stream restoration projects and Michael Williams (SERC) focused on a restoration project in the Rock Creek Watershed. There were 24 presentations. Andy Becker (KCI) and Matt Stover (MDE) collaborated to produce an online map of all submitted point data for 2016 monitoring. The roundtable was organized by Andy Becker and Dan Boward (DNR).

The MAC is planning a Technology Series of workshops for 2017. Topics in the planned three part series may include continuous monitoring techniques, new technologies and methods, field applications, and best practices including calibration, standard operating procedures and quality assurance / quality control measures.

A sub-committee of the MAC was formed in early 2015 to address monitoring questions related to stream restoration practices. The sub-committee, chaired by Scott Stranko of MD DNR and Scott Lowe of McCormick Taylor, Inc., is titled 'Stream Restoration Monitoring'. The group is comprised of individuals from a variety of organizations and backgrounds. The sub-committee's mission statement is:

The Stream Restoration Monitoring Sub-Committee 1) provide a forum for the exchange of data and information about the effectiveness of stream restoration practices in Maryland, 2) coordinates among those involved with stream restoration monitoring throughout the state, and 3) communicates stream restoration monitoring results. The group is made up of representatives from county and state agencies, environmental consulting firms, practitioners, and academia with diverse experience, knowledge, and expertise in the applying monitoring to stream policy and management.

Sub-committee Members	**Organization**
Chris Victoria	Anne Arundel County
Colin Hill	KCI Technologies, Inc.
Emily Majcher	USGS
Jana Davis	Chesapeake Bay Trust
Jennifer St. John	Montgomery County
Michael Pieper	KCI Technologies, Inc.
Michael Trumbauer	Biohabitats
Michele Dobson	Harford County
Neely Law	Center for Watershed Protection
Robert Shedlock	USGS (retired USGS)
Nancy Roth	Versar
Sadie Drescher	Chesapeake Bay Trust
Sandy Hertz	State Highway Administration
Scott Lowe	McCormick Taylor
Stanley Kemp	University of Baltimore
John Gracie	Brightwater Inc.
Scott Macomber	Maryland Stream Restoration Association
Mark Secrist	U.S. Fish and Wildlife Service
Scott Stranko	Maryland DNR

The Sub-Committee has been quite active in 2016, holding several meetings and taking on a number of topics.

MWMC Annual Conference

The Sub-Committee organized an all-day session at the MWMC conference December 2nd where some of the latest results from stream restoration monitoring will be presented. There is a commitment to organizing a session on stream restoration monitoring at each subsequent MWMC annual meeting for the foreseeable future.

Literature

A very thorough stream restoration literature bibliography is ready for posting on the MWMC web site.

Stream Restoration – Science and Regulatory Connections – Forum (June 8, 2016)

The Sub-Committee teamed up with the Restoration Research ("Pooled Monitoring") group to hold a forum where top researchers presented on the state of stream restoration effectiveness science.

MWMC Citizen Science and Community Stewardship Committee
2016 Annual Committee Report

Committee members and affiliations

Caroline Donovan, UMCES, Chair
Jeff Reagan, Stormwater Consulting, Inc., Board Member
Diana Muller, Anne Arundel County STEM Advisor, Board Member
Marla Duley, Wallace Montgomery & Associates, Community Member

2016 Accomplishments

- Data to Decisions: Why your data matters (workshops)
    - Date of workshop: October 18, 2016
    - The purpose of the workshop was to provide basic information on how volunteer and nontraditional data is incorporated into a variety of state and federal agency work.
    - The workshop included presentations by MWMC Board members (Matt Stover - MDE, Dan Boward - MDNR) as well as other partners (Andrew Muller – USNA, Peter Tango – USGS @ the Bay Program).
    - The workshop also provided a networking opportunity between different groups to share knowledge.
    - The workshop was a big success and we expect to repeat it in different locations around Maryland in 2017. The Committee also continues to get the word out about the Council through its Facebook page.

- Facebook
    - The committee continues to run the MWMC Facebook page, posting at least once a week on a new item or reposting of "reminder" type posts. The page has 293 Likes, and posts with photos as the primary image get the most likes, followed by posts with links. While most people come to the MWMC Facebook page from Facebook, two websites have garnered engagement – the MWMC website and the Google search engine. Demographically, 58% of our audience is women and 40% are men. There is a general bell curve for age, with the majority of our followers falling into the 25-54 year old range. While almost all Likes and People Reached are in the US, there is some international users as well.

2017 Goals

- Repeat Data to Decisions Workshop in two other locations (Eastern Shore and Frederick)
    - The workshop was very successful and although we had participants from a variety of locations, we think providing a locally based workshop will improve the amount of information that is being provided and networks and connections that will be made

- Plan a new workshop
    - We have a list of potential workshops that may be useful to citizen scientists and the community at large. Several workshops are already being planned, such as a general benthic macroinvertebrate workshop (MDNR Explore and Restore) and trainings by the Chesapeake Monitoring Cooperative. Subcommittee members can participate in those workshops or we could plan a new workshop, such as IDDE Rapid Assessment for Citizen Scientists.

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