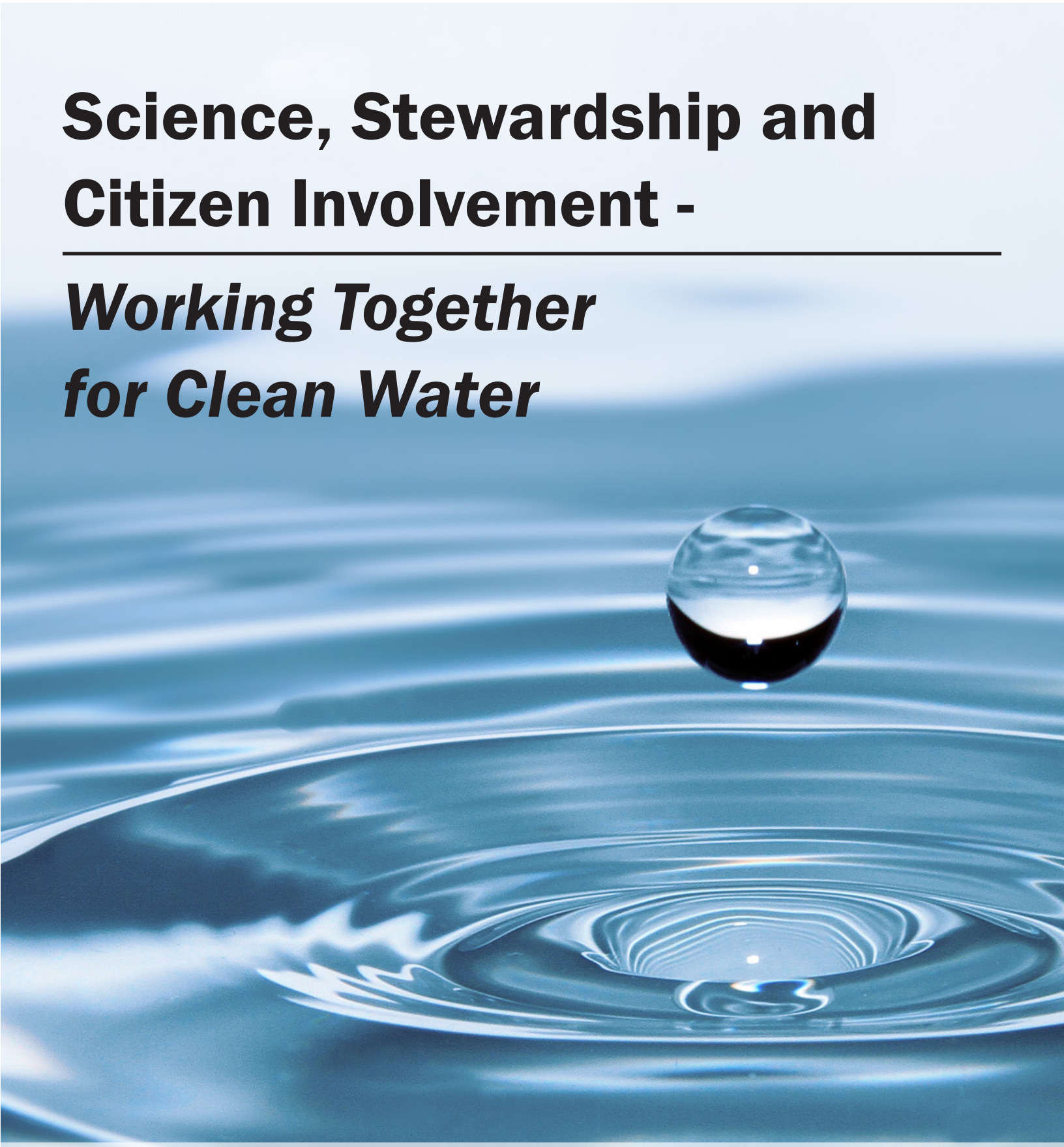
Science, Stewardship and Citizen Involvement -

Working Together for Clean Water



Maryland Water Monitoring Council

24th Annual Conference

Dec. 7, 2018 · Maritime Conference Center · Linthicum

2018 MWMC Annual Conference

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The 24th Annual Conference of the Maryland Water Monitoring Council
Welcome from the Chair of the MWMC Board of Directors

Science, Stewardship, and Citizen Involvement – Working Together for Clean Water

The 2018 MWMC Annual Conference Planning Committee and I would like to welcome you to the 24th 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 "*Science, Stewardship and Citizen Involvement – Working Together for Clean Water"* was selected to highlight the nexus between science, advocacy and a strong monitoring community to achieve the goal of healthy Maryland waters.

In June of this year, the Chesapeake Bay Program (CBP) published an online article which provided highlights from the work being conducted by researchers from the University of Maryland Center for Environmental Science (UMCES), specifically the 2017 Chesapeake Bay Report Card. For the 5th year in a row, the Bay received an overall grade of "C". However, for the first time since 2012, the researchers noted that they are seeing a "statistically significant" positive trend. This significance suggesting that the improvements are the result of real progress rather than chance. The brief article goes on to provide updates on several indicators of Bay health, highlighting the progress made on many fronts while also stressing the importance of the work that still needs to be done. While the article focused on the Chesapeake Bay, it also relayed the importance of building partnerships and continuing to invest in science and monitoring to improve landscape scale management actions and ensure healthy Maryland watersheds for future generations. Today's conference will touch on everything from urban ecology to underwater grasses, emerging toxins of concern to marine debris, and everything in between. We look forward to the varied presentations and hope that they will continue to inspire others to expand our monitoring community.

We are honored to have with us for the morning plenary session two fantastic speakers – Ms. Dominique Lueckenhoff, Senior Advisor to the Regional Administrator, U.S. Environmental Protection Agency Region III and Mr. Will Baker, President and Chief Executive Officer of the Chesapeake Bay Foundation. Ms. Lueckenhoff will be introducing us to the world of Smart Green Corridors and how to leverage innovations to achieve healthy and resilient communities. Mr. Baker will be putting the spotlight on the critical need for citizen monitors to help us save the Bay. These presentations should be a terrific kickoff for the 24th annual conference.

Also continuing this year, we will be awarding the 12th annual 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 second "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. 2018 marks the third year for this award.

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. Sign up to serve on a committee at the MWMC table. 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!

Sandy Hertz

Chair, Maryland Water Monitoring Council

The Carl S. Weber Awards

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

2017 – Dr. Walter Boynton (University of Maryland Center for Environmental Science)

2016 – Bonnie Bick (Mattawoman Watershed Society)

2015 – Frank Dawson (Maryland DNR – retired)

2014 – Jim Long (Mattawoman Watershed Society)

2013 - Paul Kazyak (Maryland DNR)

2012 - Charlie Conklin (Gunpowder Valley Conservancy)

2011 - Bill Stack (Center for Watershed Protection)

2010 - Sally G. Horner (Magothy River Association)

2009 - Peter Bergstrom (NOAA)

2008 - Ron Klauda (Maryland DNR)

2007 - Susan "Abby" Markowitz (Tetra Tech) and Dr. Paul Massicot (Maryland DNR)

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.

Previous Winners

2017 – Rebecca Kenyon-Sisler (Garrett County Educator)

2016 – Ann Strozyk (Howard County Educator)

2018 Annual Conference Planning Committee

Andy Becker	KCI Technologies, Inc.
Dan Boward (Chair)	Maryland Department of Natural Resources
Megan Brosh	Baltimore County Department of Environmental Protection and Sustainability
Kevin Brittingham	Baltimore County Department of Environmental Protection and Sustainability
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Mark Trice	Maryland Department of Natural Resources
Angel Valdez	Maryland Department of the Environment

Additional thanks to:

Katherine Hanna	Maryland Department of Natural Resources (MWMC Webmaster and Graphics Guru)
Jackie Sivalia	Maryland Department of Natural Resources (Conference preparation)
Joanne Alewine	Maryland Department of Natural Resources (Conference preparation and registration table)

MARYLAND WATER MONITORING COUNCIL

24th Annual Conference - Friday, December 7, 2018

Science, Stewardship and Citizen Involvement – Working Together for Clean Water

7:30 **Registration/Poster Set-up/Continental Breakfast –** Registration in Room A-100

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

8:30 ***MWMC Board Chair's Call to Order*** – Sandy Hertz; Maryland Department of Transportation; Chair, MWMC Board of Directors

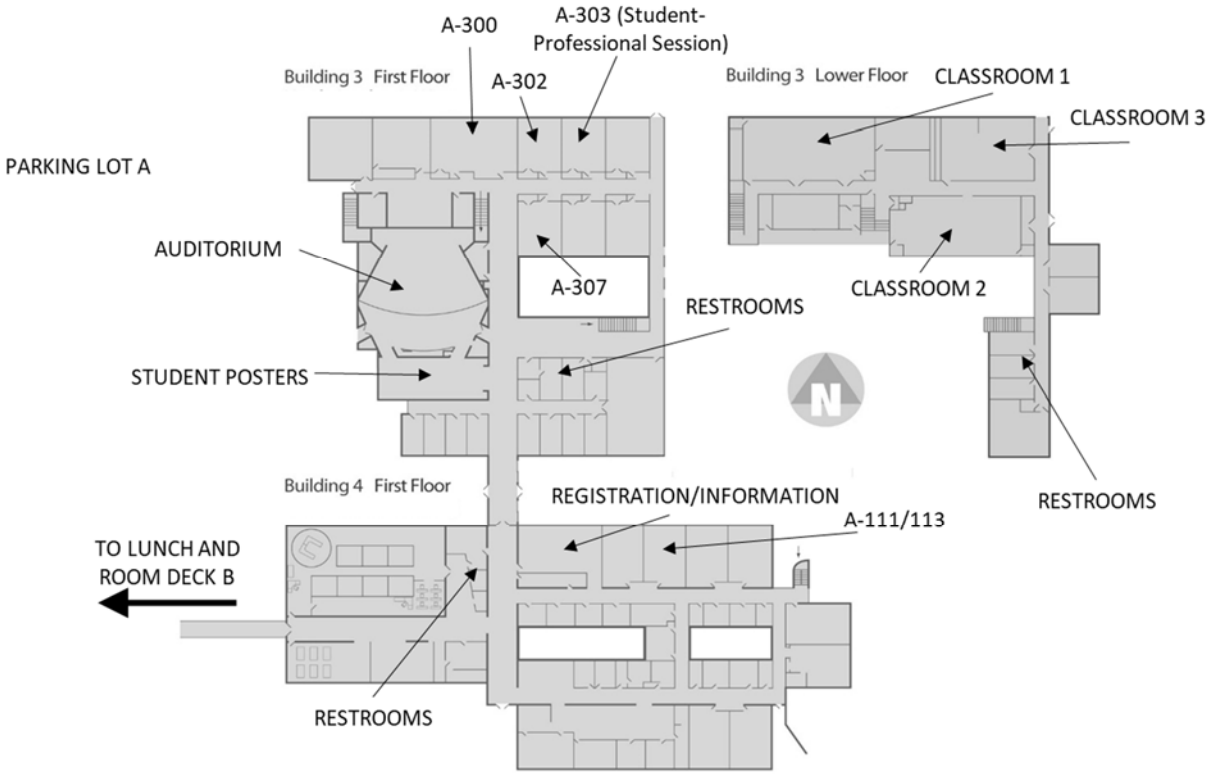
8:45 ***Smart Green Corridors – Using Digital Innovations to Drive Integrated Solutions, Cooperative Stewardship and Increased Accountability for Healthy, Resilient Communities -*** Dominique Lueckenhoff – Senior Advisor to the Regional Administrator, US EPA Region III

9:15 ***Saving the Bay and Making History – The Critical Need For Citizen Monitors*** – Will Baker – President, Chesapeake Bay Foundation

9:45 ***Carl S. Weber Awards*** – Clark Howells; City of Baltimore, and Cathy Weber

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

2018 MWMC Annual Conference Floorplan



Only speakers are listed for oral presentations. The conference program contains the full list of authors, co-authors, contact information, and abstracts. The Program can be downloaded from the MWMC website at www.marylandwatermonitoring.org. Following the conference, this agenda will contain links to presentation files, if available.

The Student-Professional Networking Session will be held in Room A-303 from 10:30 until noon with further discussion in Room Deck B.

Concurrent Sessions - 10:30 – 12:00

AUDITORIUM - FROM RESTORATION TO RECOVERY - STREAM RESTORATION MONITORING I – Moderator, Nancy Roth (Tetra Tech)

- **MONITORING DATA HELPING TO PLAN & EVALUATE FUNCTIONAL UPLIFT** - Chris Ruck (Fairfax County, VA)
- **RIPARIAN FOREST BUFFER FUNCTIONS AFTER 15 YEARS** - Anne Hairston-Strang (MDNR)
- **SETTING TARGETS FOR URBAN STREAM RESTORATION BASED ON BIOLOGICAL** POTENTIAL - Michael Paul (Tetra Tech)
- **WATER QUALITY MONITORING OF LAKE LOUISE** - Bill Buettner (MDOT)

ROOM A-300 - THE JOURNEY FROM SOURCE TO TAP - FORESTS AND WATER QUALITY – Moderator, Clark Howells (Baltimore City DPW)

- **THE NATIONAL FORESTS TO FAUCETS ANALYSIS 2.0** - Sally Claggett (USFS)
- **TAPPING INTO SOURCE WATER** - Eddy Cope (Anne Arundel County DPW)
- **THE IMPACT OF WATER RECLAMATION FACILITIES ON RECEIVING STREAMS** - Rob Kraus (Anne Arundel County DPW)
- **AN EVALUATION OF FOREST IMPACTS AS COMPARED TO BENEFITS ASSOCIATED WITH STREAM RESTORATION** - Ginny Rogers (Versar)

ROOM A-111/113 – WATERSHED STEWARDSHIP – Moderator, Kacey Wetzel (Chesapeake Bay Trust)

- **CITIZEN STEWARDSHIP INDICATOR: BEHAVIORS, TRENDS AND HOW TO USE THEM FOR GOOD** - Kacey Wetzel (Chesapeake Bay Trust) and Suzanne Etgen (Watershed Stewards Academy). Note – this is a 60-minute presentation.
- **USE MY DATA! TOWARDS A MUTUAL UNDERSTANDING BETWEEN DATA COLLECTORS AND THE DATA NEEDS OF DATA USERS ACROSS THE CHESAPEAKE BAY PROGRAM PARTNERSHIP** - Peter Tango (USGS/CBPO)

ROOM A-307 - ENVIRONMENTAL REPORTING AND COMMUNICATION – Moderator, Mark Trice (MDNR)

- **ENVIRONMENTAL REPORTING IN CHALLENGING TIMES** - Rona Kobell (Maryland Sea Grant)
- **CLEAN WATER COMMUNICATIONS** - Chris Trumbauer (The Hatcher Group)
- **"FAKE NEWS": CONFESSIONS OF AN ENDANGERED JOURNALIST –** Tim Wheeler (The Bay Journal)

CLASSROOM 1 - EMERGING TOXICS OF CONCERN – Moderator, Charlie Poukish (MDE)

- **OCCURRENCE OF PHARMACEUTICALS, HORMONES, AND ORGANIC WASTEWATER COMPOUNDS IN PENNSYLVANIA WATERS, 2006–09** - Joseph W. Duris (USGS PA Water Science Center)
- **AN ANALYSIS OF THE CHEMICAL COMPOSITION OF WASTE WATER AND WATER TREATMENT PLANT EFFLUENT** - Timothy Fox (MDE)
- **EMERGING CONTAMINANTS IN PENNSYLVANIA -** Amy Williams (Pennsylvania DEP)

CLASSROOM 2 - URBAN ECOLOGY – Moderator, Angel Valdez (MDE)

- **MAKING URBAN TREES COUNT: A STORMWATER CREDIT FRAMEWORK FOR URBAN TREE PLANTING** - Neely L. Law (Center for Watershed Protection)
- **STREAM TEAM: CITIZEN SCIENTISTS AND URBAN BMPS** - Sarah Giordano (South River Federation)
- **THE PHASE I MS4 MONITORING DATA: PAST, PRESENT, AND FUTURE** - Katherine Slater (MDE)

CLASSROOM 3 - PIPE DREAMS – MANAGING URBAN SEWAGE – Moderator***,*** Megan Brosh (Baltimore County)

- **SANITARY SYSTEM CHALLENGES AND INNOVATION** - Carlos A. Espinosa, P.E (Baltimore City DPW)
- **SEWAGE REDUCTION EFFORTS IN THE ANACOSTIA RIVER** - Jim Foster (Anacostia Watershed Society)
- **THE IMPACTS OF BALTIMORE CITY'S SANITARY SEWER CONSENT DECREE PROJECTS ON WATER QUALITY** - Paul N. De Santis (Baltimore City)

ROOM A-302 - MACHINE LEARNING, MAPS AND PHOTOGRAMMETRY – TECHNOLOGY AT ITS FINEST – Moderator, Alicia Ritzenthaler (LimnoTech)

- **INTEGRATING COLLECTOR FOR ARCGIS AND SURVEY 123 TO CREATE A CUSTOM, MOBILE DATA COLLECTION TOOL** - Alicia Ritzenthaler (Limno Tech)
- **ESRI STORY MAPS: A NEW ALTERNATIVE IN COMMUNICATING WATER-QUALITY RESULTS** - Shannon Jackson (USGS)
- **GLOBAL MONITORING OF FRESH WATER AT HIGH SPATIAL AND TEMPORAL RESOLUTIONS. ASSESSING STREAM AND LAKES HYDROLOGICAL/PHYSICAL FEATURES WITHIN A MACHINE LEARNING FRAMEWORK** - Tushar Sethi (Go Global GIS)
- **USING STRUCTURE FROM MOTION PHOTOGRAMMETRY TO FACILITATE WATERSHED MANAGEMENT DECISIONS AND EVALUATE BEST MANAGEMENT PRACTICES** - Joseph Bell (USGS)

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

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

Concurrent Sessions - 1:30 – 3:00

AUDITORIUM - FROM RESTORATION TO RECOVERY - STREAM RESTORATION MONITORING II – Moderator, Mark Southerland (AKRF)

- **ECOLOGICAL RESTORATION: WHAT HAVE WE LEARNED?** - Dave Penrose (Penrose Environmental)
- **RESTORING WATER QUALITY AND AQUATIC BIOLOGY IN THE CASSELMAN RIVER** - Chris Luckett (MDE)
- **AN EVALUATION OF THE PHYSICOCHEMICAL PROPERTIES OF POOL AND RIFFLE FEATURES CREATED DURING APPLICATION OF REGENERATIVE STREAM RESTORATION APPROACHES IN PERENNIAL STREAM SYSTEMS** - Christopher J. Victoria (Anne Arundel Co.)
- **URBAN STREAM RESTORATION IMPROVES HABITAT BUT NOT WATER QUALITY** - Charles Gowan (Randolph-Macon College)

ROOM A-300 - CITIZEN SCIENTISTS GET THE JOB DONE! – Moderator, Jeff Reagan (Biohabitats)

- **PUTTING THE BAND TOGETHER: CITIZEN SCIENTISTS ARE THE ROCK STARS OF THE MONITORING WORLD** - Beth Wasden (Nanticoke Watershed Alliance)
- **VOLUNTEER MONITORING ON THE OCTORARO** - Rupert Rossetti (Octoraro Watershed Assn.)
- **THE SPA CREEK CONSERVANCY'S VOLUNTEER MONITORING INITIATIVE - FINDING STRENGTHS, MINIMIZING COMPLICATIONS, AND WORKING AROUND OBSTACLES** - Tammy Domanski (Anne Arundel Community College)
- **USING VOLUNTEER MONITORING DATA TO GUIDE MANAGEMENT DECISIONS FOR URBAN STREAMS** - Cathy Wiss (Audubon Naturalist Society)

ROOM A-111/113 – SO MUCH TRASH, SO LITTLE TIME – Moderator, Mark Trice (MDNR)

- **MARINE DEBRIS--PROBLEMS AND SOLUTIONS IN MARYLAND** - Donna Morrow (MDNR)
- **FROM STREETS TO STREAMS TO THE CHESAPEAKE: REDUCING AND TRACKING PLASTIC POLLUTION** - Mark Trice (MDNR) and Julie Lawson (Mayor's Office of the Clean City - District of Columbia)
- **EFFECTS OF PLASTIC POLLUTION ON WILDLIFE** - Laura Bankey (National Aquarium)
- **BALTIMORE'S MR. TRASH WHEEL AND THE FIGHT FOR A SWIMMABLE HARBOR** - Adam Lindquist (Waterfront Partnership of Balt.)

ROOM A-307 – THE YEAR OF THE ANACOSTIA – Moderator, Robinne Gray (Anacostia Watershed Society)

- **MUSSEL POWER, RESTORING FRESHWATER MUSSELS IN THE ANACOSTIA RIVER** - Jorge Bogantes Montero (Anacostia Watershed Soc.)
- **EUTROPHICATION STATUS AND EXPECTATIONS FOR RECOVERY OF THE ANACOSTIA RIVER** - Caroline M. Solomon (Gallaudet University)
- **HELPING THE ANACOSTIA WITH RAINSCAPES** - Ann English (Montgomery Co. DEP)
- **RIVERSMART HOMES** - Andy Oetman (DC Dept. of Energy and Environment)

CLASSROOM 1 - FISH PASSAGE – Moderator, Julie Devers (USFWS)

- **ROAD STREAM CROSSING ASSESSMENTS: IDENTIFYING CULVERTS THAT ARE BARRIERS TO AQUATIC ORGANISM PASSAGE** - Julie Devers (USFWS)
- **FISH FRIENDLY ROAD-STREAM CROSSINGS: RESTORING ECOSYSTEMS FOR FISH AND MAKING INFRASTRUCTURE MORE RESILIENT TO FLOODING** - Julie Devers (USFWS)
- **BLOEDE DAM REMOVAL: INTERSECTION OF SCIENCE AND POLICY IN STREAM RESTORATION** - Serena S. McClain (American Rivers)
- **FISH PASSAGE NO LONGER IMPEDED IN THE LOWER PATAPSCO RIVER AFTER 112 YEARS** - William Harbold (MDNR)

CLASSROOM 2 - MONITORING CHESAPEAKE BAY UNDERWATER GRASSES AND THE ROLE OF CITIZEN SCIENTISTS – Moderator, Brooke Landry (MDNR)

- **BRIEF SESSION INTRODUCTION** - Brooke Landry (MDNR)
- **CREATING THE SAV "NAVY"** - Thomas Guay (Severn River Assn.) Note: this talk begins at 1:40.
- **CITIZEN SCIENCE ON THE SUSQUEHANNA FLATS** - Logan Poore (Havre de Grace Maritime Museum Env. Ctr.)
- **CHESAPEAKE BAY SAV WATCHERS: HIGHLIGHTS FROM THE NEW VOLUNTEER MONITORING PROGRAM** - Suzi Spitzer and Katie May Laumann (UMCES)
- **MAPPING THE REEMERGENCE OF BAY GRASSES** - R. John Dawes (Chesapeake Commons)

CLASSROOM 3 - STORMWATER – Moderator, Mike Pieper (KCI)

- **RESTORING STORM WATER SERVICES TO URBAN SOILS** - Stu Schwartz (UMBC/CUERE)
- **HOW EFFECTIVE ARE BIOSWALES FOR TREATING STORMWATER GENERATED BY MARYLAND HIGHWAYS?** - Keith N. Eshleman (UMCES/AL)
- **TEMPORAL DYNAMICS IN CHLORIDE CONCENTRATIONS VIA HIGH-FREQUENCY CONDUCTIVITY MEASUREMENTS** - Joel Moore (Towson University)
- **IS ROOFTOP RUNOFF SAFE FOR GROWING VEGETABLES? EVALUATING WATER QUALITY AND FOOD SAFETY OF ROOFTOP RUNOFF USING A SUBSURFACE IRRIGATION SYSTEM** - Rachel Rosenberg Goldstein (University of MD) and Claire Hudson (Hood College)

ROOM A-302 – ENGAGING STUDENTS FOR A HEALTHER PLANET – Moderator, Diana Muller (Maritimas)

- **BALTIMORE COUNTY PUBLIC SCHOOLS SALT WATCH** - Joe Davis and Matt Budinger (Baltimore County Public Schools)
- **ENGAGING STUDENTS IN STORMWATER SCIENCE** - Danielle Wynne (Fairfax County, VA Stormwater Mgmt.)
- **WHAT LIVES IN THE HARBOR? BALTIMORE CITY STUDENTS INVESTIGATE BAY WATER QUALITY** - Sarah Haines and Chelsea McClure (Towson University)
- **STUDENT INVOLVEMENT: THE CHALLENGES AND THE BENEFITS** - Lolita Kiorpes (North Point High School /Charles County)

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

Concurrent Sessions - 3:30 – 4:30

AUDITORIUM - FROM RESTORATION TO RECOVERY - STREAM RESTORATION MONITORING III – Moderator, Jim Gracie (Brightwater)

- **IMPLICATIONS OF REMOVED AND EXISTING DAMS ON BENTHIC MACROINVERTEBRATE ASSEMBLAGES IN THE PATAPSCO RIVER, MARYLAND** - Jonathan Watson (MDNR)
- **EFFECTS OF FLOODPLAIN RECONNECTION ON DISSOLVED NITROGEN AND CARBON CONCENTRATIONS IN RESTORED MARYLAND STREAMS** - Virginia Jeppi (Towson University)
- **ARE WE THERE YET? FROM RESTORATION TO RECOVERY** - **STREAM RESTORATION MONITORING III CONCLUDING REMARKS -** Neely L. Law (Center for Watershed Protection)

ROOM A-300 - CITIZEN SCIENTISTS GET THE JOB DONE! (AGAIN) – Moderator, Jai Cole (M-NCPPC)

- **MAGOTHY RIVER ASSOCIATION: A BAND OF CITIZEN SCIENTISTS** - Sally Hornor and Paul Spadaro (Magothy River Assn.)
- **40 YEARS OF CITIZEN SCIENCE MONITORING AT OSBORN COVE: ANALYSIS OF A LOCAL TIDAL TRIBUTARY** - Mackenzie Bodman (UMBC/Chesapeake Bay Program Office)
- **THE MARKETPLACE AS A SOURCE OF CITIZEN SCIENTIST** - Kelton Clark (Open Shell Environmental LLC)

ROOM A-111/113 – LIFE ON THE BOTTOM – BENTHIC MACROINVERTEBRATES – Moderator, Kyle Hodgson (MDNR)

- **ASSESSING THE PRECISION OF MARYLAND'S BENTHIC INDEX OF BIOTIC INTEGRITY** - Tomas Ivasauskas (MDNR)
- **BENTHIC MACROINVERTEBRATE RESPONSES TO A REGENERATIVE STORMWATER CONVEYANCE RESTORATION IN A COASTAL PLAIN STREAM** - Kyle Hodgson (MDNR)
- **BIOENERGETICS: A SUPPLEMENTARY APPROACH TO STANDARD METHODS OF STREAM BIOASSESSMENT** - Madison Smith (Towson University)

ROOM A-307 – NUTRIENTS AND OIL DON'T MIX – Moderator, Drew Budelis (Versar)

- **SIMULATED OIL SPILL SHOWS POTENTIAL IMPACT FOR MICROBIAL COMMUNITY IN JONES FALLS -** Mychala Snead (Stevenson University)
- **BMP IMPLEMENTATION: INTEGRATING COST-EFFECTIVENESS AND CO-BENEFITS WITH NUTRIENT EFFICIENCY -** Olivia H. Devereux (Devereux Environmental Consulting)

CLASSROOM 1 – BETTER HYDROLOGY = HEALTHIER WATERS *– Moderator, Mat Pajerowski (USGS)*

- **RESTORATION OF COASTAL PLAIN HEADWATER HYDROLOGY THROUGH USE OF ARTESIAN GROUNDWATER SOURCES ON A GRID DITCHED SITE IN BELTSVILLE, MD** - Kirk Mantay (GreenTrust Alliance)
- **A MODEL FOR STREAM RESTORATION: ALIGNING TWO-DIMENSIONAL HYDRAULICS WITH FUNCTIONAL OUTCOMES** - Joe Arrowsmith (Straughan Environmental)

CLASSROOM 2 – LOCAL GOVERNMENTS IMPROVE OUR WATERS – Moderator, Brian Smith (MDNR)

- **CEDAR HAVEN LIVING SHORELINE: AN EXAMPLE OF THE BENEFITS OF STABILIZING TIDAL RIVER SHORELINES** - Ingrid Bauer (Straughan Environmental)
- **KEEPING OUR PARKS & STREAMS CLEAN** - Henry Coppola (M-NCPPC)

CLASSROOM 3 – BIG PICTURE PROJECTS FOR THE BAY AND ITS WATERSHED – Moderator, Shannon Lucas (KCI)

- **A NEW APPROACH TO IDENTIFYING DRIVERS OF REGIONAL WATER-QUALITY CHANGE, WITH A PILOT APPLICATION IN THE CHESAPEAKE BAY WATERSHED** - Jeffrey Chanat (USGS)
- **CREDITING LAND CONSERVATION FOR AVOIDING WATER QUALITY DEGRADATION** - Peter R. Claggett (USGS)
- **CLEAN WATER HUB – INNOVATIVE WATER QUALITY DATA SHARING AND VISUALIZATION** - Samantha Briggs (Izaak Walton League of America)

ROOM A-302 – AN APP A DAY KEEPS THE DOCTOR AWAY – Moderator, Byron Madigan (Carroll County)

- **SOUTH RIVER FEDERATION WATER QUALITY MONITORING APP** - Emily Wiggans (Chesapeake Conservancy)
- **TURN OBSERVATIONS INTO ACTION WITH WATER REPORTER** - Erin Hofmann (Chesapeake Commons)

4:30 Adjourn

5:00 – 7:00 Social – Checkerspot Brewing Company CHECKERSPOT BREWING CO.

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

CREATING A SUSTAINABLE VOLUNTEER MONITORING PROGRAM AND INTERPRETING HEALTH RESULTS: AN ANACOSTIA RIVER CASE STUDY - Olivia Anderson, Trey Sherard, Robbie O'Donnell and Ben Turner (Anacostia Riverkeeper)

RE-DISCOVERY OF A POPULATION OF YELLOW LANCE IN THE HAWLINGS RIVER - Matt Ashton (MDNR), Megan Davis (Chesapeake Conservation Corp/MDNR), Jackie Sivalia and James McCann (MDNR)

(Student Poster) VOLUNTEERS WELCOME! MONITORING IRVINE NATURE CENTER'S RESTORED WETLAND - Karleigh Baldwin, Marissa Hoffman, Natalie Johnson, Taylor Long, Gillian Nutter, Julianne Parker and Colby Stein (Stevenson University), Courtney Sagal, Rob Mardiney and Brooks Paternotte (Irvine Nature Center) and Kim Pause Tucker (Stevenson University)

(Student Poster) SUSPENDED AND DISSOLVED NUTRIENT LOAD IN FLOODPLAIN STREAM RESTORATION STREAMS AT BASEFLOW IN BALTIMORE AND HARFORD COUNTY - Luke Barragan (Towson University Geosciences), Patrick McMahon, Virginia Jeppi, Vanessa Beauchamp and Joel Moore (Towson University)

(Student Poster) INCREASING ENVIRONMENTAL REALISM: DAPHNIA MAGNA TOXICITY TESTS WITH LOCALLY RELEVANT STRESSORS AND RESOURCE ENVIRONMENTS - Madelin Barry, Amanda Isabella, Andrew East and Christopher Salice (Towson University)

THE ELEVENTH ANNUAL MARYLAND STREAMS ROUNDTABLE - Andy Becker (KCI Technologies, Inc.)

(Student Poster) LONG TERM MONITORING OF A HOWARD COMMUNITY COLLEGE CAMPUS STREAM - Caitlin Beckjord, Jennifer Kling and Dr. William Straube (Howard Community College)

URBAN STREAM RESTORATION: MATERIAL PROCESSING AND CONVEYANCE CHANNELS - Maddie Berg (James Madison University)

JUG BAY CITIZEN SCIENCE: WATER QUALITY ANALYSIS OF THREE STREAMS - Jeffrey Campbell, Robert Smith, Peter Uimonen, Kim Elliott, David Davis and Patricia Delgado (Jug Bay Wetlands Sanctuary)

ILLICIT DISCHARGE DETECTION AND MONITORING METHODOLOGY - Julie Chang and Paul Sturm (Ridge to Reefs)

ADDRESSING COMPACTED SOILS FOR STORMWATER MANAGEMENT - Kathleen Cullen (US Fish and Wildlife Service/Towson University)

FRESHWATER MUSSEL RESTORATION IN THE PATAPSCO RIVER: EMPLOYING MUSSELS AS BIOFILTERS - Megan Davis (Chesapeake Conservation Corp/MDNR)

BMP IMPLEMENTATION: INTEGRATING COST-EFFECTIVENESS AND CO-BENEFITS WITH NUTRIENT EFFICIENCY - Olivia H. Devereux (Devereux Environmental Consulting, Inc.)

INVESTIGATING BROOK TROUT POPULATIONS ABOVE AND BELOW WATERFALLS - Hannah Eisemann and Dr. Christine May (James Madison University)

QUANTIFYING WATERSHED EXPORT OF ATMOSPHERIC NITRATE ACROSS LAND-USES IN MARYLAND USING TRIPLE OXYGEN ISOTOPES - Keith Eshleman, Joel Bostic and David Nelson (University of Maryland Center for Environmental Science)

EFFECTS OF URBANIZATION AND GREEN INFRASTRUCTURE ON STREAM HABITAT AND BENTHIC COMMUNITY COMPOSITION IN PIEDMONT HEADWATER STREAMS - Rosemary Fanelli (U.S. Geological Survey MD-DE-DC Water Science Center) and Kristina Hopkins (U.S. Geological Survey South Atlantic Water Science Center)

CALCULATING NUTRIENT AND SEDIMENT CONCENTRATIONS BEFORE AND AFTER BMP INSTALLATION IN THE CORSICA RIVER WATERSHED - Brittany Furlong (Chesapeake Conservation Corp/MDNR)

EFFECTS OF NUTRIENT ENRICHMENT ON PHYTOPLANKTON COMMUNITY DYNAMICS IN A CONTROLLED MESOCOSM EXPERIMENT - Samantha Gleich, Patricia Glibert (University of Maryland Center for Environmental Science) and Caroline Solomon (Gallaudet University)

(Student Poster) EVALUATING THE EFFECTS OF SYSTEM MATURATION ON POLLUTANT LOADS FROM STREAM-WETLAND COMPLEXES - Julianna Greenberg, Michael Williams (University of Maryland) and Solange Filoso (University of Maryland Center for Environmental Science)

(Student Poster) HEALTH OF THE ANACOSTIA FROM BEGINNING TO END - Julianna Gross, Claire Moran, Anika Mittu, Sinead Claffey, Fatima Korama, Sofia Grossman and Samantha Suissa (Sherwood High School, SERC)

WHAT'S IN YOUR HERBICIDE? UNREGULATED "SAFENERS" MODIFY EFFECTS OF S-METOLACHLOR ON NON-TARGET ALGAL SPECIES - Sarah Lanasa, Christopher Salice and Andrew East (Towson University)

(Student Poster) EFFECTS OF WETLAND RESTORATION ON STREAM HEALTH: AN ASSESSMENT OF THE WETLAND RESTORATION PROJECT AT IRVINE NATURE CENTER - Crystal Lynn Heintzelman and Wolf T. Pecher, (University of Baltimore)

ILLICIT DISCHARGE DETECTION CASE STUDIES IN PHASE I MS4 JURISDICTIONS - Thomas Jones, Charles Tonkin and Martin Berlett (Versar)

EFFECTS OF PRECIPITATION ON DISSOLVED OXYGEN IN A REGENERATIVE STREAM CONVEYANCE SYSTEM - Shayna Keller, Sarah Giordano and Jesse Iliff (South River Federation)

(Student Poster) ASSESSING THE EFFECTS OF A STREAM RESTORATION ON HYPORHEIC EXCHANGE - Christina (Charli) Klein, Carey E. Pelc and Thomas E. Jordan (Smithsonian Environmental Research Center)

A COLLABORATIVE APPROACH TO ADDRESSING ROADWAY CONGESTION WHILE BALANCING ENVIRONMENTAL IMPACTS AND FISH PASSAGE THROUGH AGENCY COORDINATION AND STREAM RESTORATION IN MONTGOMERY COUNTY, MD - Sarah Koser (EA Engineering, Science, and Technology, Inc., PBC), Jared Paper-Evers (Maryland Department of Transportation/SHA, Matt Harper (Maryland-National Capital Park and Planning Commission) and Mary Matzke (Century Engineering, Inc.)

(Student Poster) CHARACTERIZING STORM EVENT CONCENTRATION-DISCHARGE RELATIONSHIPS IN URBAN WATERSHEDS USING HIGH-FREQUENCY DATA - Melinda Marsh (Towson University), Kyle Bucher (AECOM) and Joel Moore (Towson University)

A COMPARISON OF TWO INDEX OF BIOTIC INTEGRITY (IBI) CALCULATIONS FOR BENTHIC MACROINVERTEBRATES AND FISH AT A MITIGATION SITE - Martha McCauley and Sarah Koser (EA Engineering, Science, and Technology, Inc., PBC), Brian Cox (Maryland SHA), Matt Harper (Maryland-National Capital Park and Planning Commission)

DETECTION OF ESTROGEN IN A BALTIMORE WATERSHED - Aaliyah McCullough and Jasmyn George (Coppin State University)

EXPORT OF NUTRIENTS FOLLOWING LEGACY SEDIMENT REMOVAL AND FLOODPLAIN RECONNECTION RESTORATION PROJECTS - Patrick McMahon (Towson University)

LONG TERM HYDROLOGIC MONITORING OF A SENSITIVE WETLAND HABITAT - Kelley Moxley and Kelly Lennon (WSP) and William Buettner (Maryland Department of Transportation/SHA)

(Student Poster) FOUR YEARS OF STUDENT-TEACHER-AND-RESEACHER (STAR) PROJECT DATA MEASURING SOURCES OF NITROGEN POLLUTION ON SCHOOLYARDS IN WESTERN MARYLAND - Northern Garrett High School, Rebecca Kenyon-Sisler (Northern Garrett High School) and David M. Nelson, Cassie Doty, Andrew J. Elmore, Joel Bostic, and Cathlyn D. Stylinski (UMCES Appalachian Laboratory)

(Student Poster) INFLUENCE OF DIFFERENT N, P AND SI ADDITIONS ON UREA UTILIZATION PATHWAYS IN AN ANACOSTIA RIVER PHYTOPLANKTON COMMUNITY - Mauricio Orozco and Casey Peck (Gallaudet University), Samantha Gleich, Michelle Lin and Patricia Glibert (UMCES/HPL) and Caroline Solomon (Gallaudet University)

ANACOSTIA RIVER (MD/DC) LEGACY CHLORDANE BY ACTIVE BIOMONITORING (CORBICULA) - Harriet Phelps (University of the District of Columbia)

SURVEY OF FRESHWATER ANNELIDS IN THE POTOMAC RIVER BASIN - Corey Rennolds and Alexandra Bely (University of Maryland - College Park)

CHESAPEAKE BAY DERELICT CRAB TRAP REMOVAL IN BALTIMORE COUNTY, MARYLAND FOR TIDAL MITIGATION - Kristen Rigney (EA Engineering, Science, and Technology, Inc. PBC), H. Ward Slacum Jr. (Oyster Recovery Partnership), Todd Nichols (Maryland Department of Transportation), Sarah Koser (EA Engineering, Science, and Technology, Inc. PBC)

COASTAL ATLANTIC OCEAN WATER QUALITY ASSEMENT ALONG THE ASSATEAGUE ISLAND NATIONAL SEASHORE - Morgan Ross and Judith O'Neil (UMCES Horn Point Lab) and Catherine Wazniak (MDNR)

TOPOVAR90M: GLOBAL HIGH-RESOLUTION TOPOGRAPHIC VARIABLES FOR ENVIRONMENTAL MODELING - Tushar Sethi (Go Global GIS LLC), Guseppe Amatulli (School of Forestry & Environmental Studies, Center for Research Computing Yale University), Sami Domisch (Leibniz-Institute of Freshwater Ecology and Inland Fisheries, Berlin, Germany), Tushar Sethi (Spatial-Ecology, Meaderville House, Wheal Buller, Redruth, Cornwall, UK) and Peter Strobl (European Commission, Joint Research Centre, Directorate for Sustainable Resources, Ispra, Italy)

STREAM ASSESSMENT AND SEDIMENT MONITORING FOR TMDL CREDITING - Brennan Smith (Versar), Steven Morsberger and Russell Ewing (McCormick Taylor)

CITIZEN SCIENCE TO SUPPORT INCLUSIVE CHESAPEAKE BAY RESEARCH - Suzi Spitzer, Caroline Donovan, Alexandra Fries, and Bill Dennison (University of Maryland Center for Environmental Science)

(Student Poster) WATER QUALITY ASSESSMENT OF DIVIDING CREEK OUTFALL RETROFIT AND STREAM RESTORATION - Alexander Thompson, April Bothe and Allison Troy (Anne Arundel Community College)

TEMPORAL VARIATIONS IN CHLORIDE CONCENTRATIONS IN GROUNDWATER IN THE PIEDMONT PHYSIOGRAPHIC PROVINCE OF MARYLAND - Tiffany VanDerwerker (Maryland Geological Survey)

(Student Poster) USING THE STREAM FUNCTION PYRAMID TO MEASURE RESTORATION SUCCESS IN DIVIDING CREEK, ARNOLD, MARYLAND - Lucia Villamizar, Katherine Duafala and Dylan Schrader (Anne Arundel Community College)

(Student Poster) COMPARISON OF VIBRIO VULNIFICUS WITH PH, SALINITY, AND TEMPERATURE - Mary Wenzel (Anne Arundel Community College)

A LOOK AT A SEED BANK WITHIN A RIPARIAN WETLAND - Lisa Wheeler and Vanessa Beauchamp (Towson University)

Plenary Talks

SMART GREEN CORRIDORS – USING DIGITAL INNOVATIONS TO DRIVE INTEGRATED SOLUTIONS, COOPERATIVE STEWARDSHIP AND INCREASED ACCOUNTABILITY FOR HEALTHY, RESILIENT COMMUNITIES

Dominique Lueckenhoff, Senior Advisor to the Regional Administrator, U.S. Environmental Protection Agency Region III

SAVING THE BAY AND MAKING HISTORY – THE CRITICAL NEED FOR CITIZEN MONITORS

Will Baker, President, Chesapeake Bay Foundation

Oral Presentation Abstracts

A MODEL FOR STREAM RESTORATION: ALIGNING TWO-DIMENSIONAL HYDRAULICS WITH FUNCTIONAL OUTCOMES

Joe Arrowsmith; jarrowsmith@straughanenvironmental.com; Straughan Environmental, Inc.

Two-dimensional hydraulic modeling offers us the opportunity to unlock relationships between stream restoration design and functional outcomes. In this session, we will provide a primer on two-dimensional modeling aimed at policy makers, regulators, and most importantly, scientists. Topics discussed will be beneficial/accessible for modelers and non-modelers alike. Test cases and video simulations will be shown, along with a discussion on how these results will lead to better project outcomes. We will close the presentation with a discussion on potential research opportunities within our reach. How can model results be used to supplement or replace data that is difficult to measure in the field? Can we use modeling to identify global relationships between different stream design variables (e.g., floodplain connection, surface roughness, slope) and design objectives (lag-time, volume storage, velocity, stability)? With the wide availability of inexpensive, or even free model software, the time is now.

Joe Arrowsmith is a Professional Engineer with Straughan Environmental, Inc., which is located in Columbia, Maryland. He provides leadership and design for Straughan's ecological restoration projects, including stream and wetland restoration and living shoreline design. He holds a Bachelor's Degree in Civil and Environmental Engineering from Virginia Tech, and a Master's Degree in Environmental Engineering and Science from Johns Hopkins University.

EFFECTS OF PLASTIC POLLUTION ON WILDLIFE

Laura Bankey; lbankey@aqua.org; National Aquarium

Marine debris, particularly plastic pollution, has a significant impact on wildlife. With the potential of ingestion, entanglement, transport of invasive species and habitat degradation, plastic pollution adds to the many threats already faced by vulnerable species. Because plastic is persistent in the environment, these threats are ongoing and additive. The tendency of plastics to break down into smaller pieces in the environment also makes their impacts available to all levels of the food chain. While the scale of the plastic pollution problem is beginning to be understood and acute effects on wildlife can often be identified, early science about the chronic impacts of plastic pollution on wildlife and humans is just beginning to be studied. How does long-term exposure to plastics and microplastics effect our aquatic species and how is that translated up food chains? – will be discussed.

Laura currently holds the position of Director of Conservation at the National Aquarium, where she develops and leads field conservation programs in order to advance the Aquarium's mission. She manages staff, volunteers, and interns in field conservation and internal sustainability efforts. Her primary focus is on issues related to climate change resilience, urban conservation and ocean and human health. Particular areas of interest include community-based habitat restoration, marine debris prevention and removal, gardening for wildlife and sustainability. She holds degrees in Chemistry and Biochemistry and Marine Science. Laura has worked at the National Aquarium since 2002.

CEDAR HAVEN LIVING SHORELINE: AN EXAMPLE OF THE BENEFITS OF STABILIZING TIDAL RIVER SHORELINES

Ingrid Bauer; ibauer@straughanenvironmental.com; Straughan Environmental, Inc.

The proposed living shoreline stabilization project at Cedar Haven Fishing Area in Prince George's County showcases an interesting intersection of a local government working towards MS4 goals while also capitalizing on an opportunity to improve a public space for the surrounding community and positively contributing to local habitat and Bay health. Living shorelines earn four times the impervious area equivalent credit as stream restoration projects per linear foot, and with the Prevented Sediment Protocol, the TSS load reductions can be significant. This presentation will discuss the Cedar Haven project as an example of the type of opportunity living shoreline stabilization projects offer for our tidal rivers.

Ingrid Bauer is a Professional Engineer with Straughan Environmental, Inc., which is located in Columbia, MD. She is a designer and project manager focusing on ecological restoration projects, including living shorelines, streams, and wetlands; she is also a project manager for NPDES/TMDL stream and outfall restoration projects with MDOT SHA Office of Environmental Design. Ingrid earned a Bachelor of Civil Engineering degree from the University of Dayton and a Master of Science in Environmental Engineering and Science from Johns Hopkins University.

USING STRUCTURE FROM MOTION PHOTOGRAMMETRY TO FACILITATE WATERSHED MANAGEMENT DECISIONS AND EVALUATE BEST MANAGEMENT PRACTICES

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

Coauthors: Matthew Cashman, Shannon Jackson, Zachary Clifton; U.S. Geological Survey

Structure from Motion (SfM) is a cost-effective means of rendering high-resolution models for evaluating BMP site selection and changes to function and form over time. The USGS in Baltimore MD, in cooperation with MD SHA, is using SfM in a study to evaluate the efficacy of a stream restoration to reduce sediment yields. Aerial and ground-based surveys of the agricultural floodplain and streambanks were collected along a 1km reach of Little Catoctin Creek near Brunswick, MD before and amid restoration construction (March 2017 to present). Collection occurred at rates and extents capable of capturing change for the purpose of rendering elevation models and difference maps. Elevation models, with centimeter resolutions, can be incorporated into flow-forecasting software to aid in BMP selection and improve structural design. Difference maps, derived using USGS-approved SfM workflows, are driving a paradigm shift within the watershed management community by facilitating BMP site selection; identifying erosional "Hot Spots" along stream reaches; and providing accurate rates of streambank erosion at extents previously impractical or impossible to obtain. The USGS is capable of informing cooperators where to install a BMP; at what rate sections are eroding; how well a BMP was constructed with respect to its original design; and the efficacy of an implemented BMP through time.

Joseph is a hydrologist with the USGS Water Science Center located in Baltimore, MD. Joseph's work includes water-quality monitoring and modeling for TMDL compliance as well as using advanced surveying methods to evaluate restoration construction and efficacy evaluation through time.

40 YEARS OF CITIZEN SCIENCE MONITORING AT OSBORN COVE: ANALYSIS OF A LOCAL TIDAL TRIBUTARY

Mackenzie Bodman; mbodman1@umbc.edu; University of Maryland Baltimore County and Chesapeake Bay Program Office

Coauthors: Emily Trentacoste, U.S. Environmental Protection Agency Chesapeake Bay Program Office; Kent Mountford, Chesapeake Bay Program Office; Rebecca Murphy, University of Maryland Center for Environmental Science and Chesapeake Bay Program Office

Restoring water quality in the Chesapeake Bay has been a major focus for Maryland. As scientists and others have sought to explain change, it has become increasingly important to fill data gaps within our understanding of the Bay. One of the main ways the Chesapeake Bay's health is evaluated is through long-term tidal water quality monitoring stations, most of which are in the main stem or large tributaries. Areas such as small tidal tributaries are often not monitored even though they comprise much of the Bay's area. Little is known about how these areas are responding to environmental change such as climate change, restoration efforts, or evolving watershed characteristics. Here we present analysis of a 40-year citizen science water quality monitoring data set collected at Osborn Cove – a small embayment of St. Leonard Creek, a tributary of the Patuxent River. Seasonal and statistical trends analyses on several parameters revealed that many aspects of water quality have been degrading over time, and we can speculate drivers of these changes. This study indicates the need to include small local tributaries in our analyses to fully grasp what is happening in the Bay, and demonstrates the importance of citizen science-monitoring to fill data gaps. By incorporating studies like these, policy-makers should be able to more effectively target issues throughout the Bay.

Mackenzie is a senior at UMBC studying environmental science and geography and German. She has particular interests in combing policy, science and education and hopes to attend graduate school once she has obtained her undergraduate degree. She has a strong background in education and specifically in the development of STEM education curriculum's. These experiences have allowed her to have varied interests and skills that have led her to where she is today.

CLEAN WATER HUB – INNOVATIVE WATER QUALITY DATA SHARING AND VISUALIZATION

Samantha Briggs; sbriggs@iwla.org; Izaak Walton League of America

Coauthors: John Dawes, Erin Hofmann, Brendan McIntyre, Chesapeake Commons

The Izaak Walton League, founded in 1922, has been managing volunteers on the ground using the Save Our Streams (SOS) water quality monitor protocols since its founding in 1969. With pride for the past of SOS, but eyes forward to the future, the League launched a campaign called the Clean Water Challenge, with the lofty goal to monitor 100,000 additional stream sites by the year 2022 (the League's 100th anniversary). The vastness of this goal brought new needs for SOS into the spotlight. The League needed to better manage, publish, and share the water quality data of thousands of volunteers monitoring with SOS. However, with a nationwide scope, the Izaak Walton League noticed that other volunteer groups were having the same problems as SOS. We all needed to better manage, publish, and share our data. From there, the Clean Water Hub came to fruition. Working with Chesapeake Commons and the Water Reporter Platform, the Clean Water Hub is a state of the art data system, designed for volunteers to not only submit their data, but also visualize sites and data through modern automatic mapping and graphing features. Session attendees will be able to see the innovative features of the Hub shortly after launch and learn how to utilize the Hub for their own water quality data storage, sharing, and storytelling.

Sam Briggs is the Save Our Streams Manager for the Izaak Walton League, with the primary role of managing the nationwide network of Save Our Streams monitors, including all aspects of training, mobilization, partnership, and data associated with volunteer groups.

John Dawes is the Executive Director of Chesapeake Commons (CC), Erin Hofmann supports the user's experience of CC's leveraged technologies, Water Reporter and Field Doc, and guides users as they navigate the adoption of these tools, and Brendan McIntyre (software developer and co-founder of CC), builds and maintains systems that power the CC's core products. All have been integral in the development of the Clean Water Hub.

WATER QUALITY MONITORING OF LAKE LOUISE

Bill Buettner; wbuettner@sha.state.md.us; Maryland Department of Transportation State Highway Administration

Coauthors: Robert Hilderbrand, Kathleen Kline, University of Maryland Center for Environmental Science; Ken Pavol, Maryland Department of Natural Resources (Retired)

During the 1991 construction of I-68 in Garrett County, Maryland, material used as the roadways subbase impacted the water quality of tributaries flowing to a privately-owned lake known as Lake Louise. The lake had a population of native brook trout and stocked rainbow trout. The acidic seepage from the fill material resulted in the lowering of pH and affected aluminum, iron and manganese levels with the lake's tributaries. These changes in water quality had negative impacts on the lake's trout populations. In 1995, the MDOT/SHA entered into an agreement with the owners of lake to assess water quality conditions and restore conditions for trout. The use of a passive treatment method known as Successive Alkaline Producing System (SAPS) was implemented in 1997. Following construction, MDOT/SHA contracted with the University of Maryland Center for Environmental Science (UMCES) to monitor water quality and effectiveness of the SAPS. Monitoring indicated water quality improvement but with limited effectiveness. In 2006, the SAPS converted from a "passive" to an "active" system. Over the last ten years, MDOT/SHA along with UMCES have performed chemical and biological monitoring of the lake. Results show the active system is sustaining water quality suitable for trout. Furthermore, native brook and rainbow trout have been successfully reproducing and remain sustainable.

Bill Buettner is a Mitigation Manager at the Maryland State Highway Administration. In last 20 years Mr. Buettner has worked on negotiating permits and subsequent mitigation for highway projects. The last seven years have been primarily focused on the monitoring of mitigation and TMDL sites. Prior to Maryland SHA, Mr. Buettner worked 9 years in the environmental consulting field with focus on wetland delineation and mitigation design. His early career began with employment with Maryland Department of Agriculture as Soil Conservationist implementing Soil and Water Conservation plans. Mr. Buettner is a 1985 graduate of the University of Maryland with a degree in Agricultural Science.

A NEW APPROACH TO IDENTIFYING DRIVERS OF REGIONAL WATER-QUALITY CHANGE, WITH A PILOT APPLICATION IN THE CHESAPEAKE BAY WATERSHED

Jeffrey Chanat; jchanat@usgs.gov; U.S. Geological Survey, Richmond, Virginia

Coauthor: Guoxiang Yang, Natural Systems Analysts, contracted to U.S. Geological Survey, Richmond, Virginia

Large watersheds are a mosaic of differing land types, climate, and human influences, which store and export pollutants over time scales ranging from days to centuries. Long-term monitoring data support the computation of water-quality trends, but attributing these trends to causative factors often requires complex models with many built-in assumptions. This work describes a simpler alternative, designed to link a regional pattern of observed changes in pollutant export to maps of changes in suspected causes, while keeping "rules" to a minimum. We modeled changes in the export of nitrogen, a nutrient whose excess is responsible for decline in Chesapeake Bay fisheries, from 43 bay tributaries between 1990 and 2010. Our model explained 80 percent of the observed changes, linking overall reductions to changes in inputs from point, agricultural, atmospheric, and urban sources, coupled with increases in temperature and precipitation. Delayed export of nitrogen input before 1990 had a smaller influence, indicating that the watershed's "memory" of degradation that occurred long ago, although evident, does not overshadow actions taken to improve regional water quality at the 20-year time scale. By providing "hard evidence" of the effects of past changes, this approach can better inform today's management choices, and help set realistic expectations for their outcomes.

Jeff Chanat is a hydrologist with the U.S. Geological Survey in Richmond Virginia. Since 2010, he has been involved in the interpretation of water-quality monitoring data in non-tidal rivers. Initially, Jeff's focus was on using data collected by multiple agencies and jurisdictions across the Chesapeake Bay watershed to produce regionally consistent estimates of trends in nutrient and sediment fluxes entering the tidal estuary. More recently, he has been responsible for developing methods to attribute those trends to changes occurring across the watershed.

CREDITING LAND CONSERVATION FOR AVOIDING WATER QUALITY DEGRADATION

Peter R. Claggett; pclaggett@usgs.gov; U.S. Geological Survey

Coauthors: Labeeb Ahmed, Attain Corp; Frederick Irani, U.S. Geological Survey

The six states in the Bay watershed and the District of Columbia are responsible for preparing Watershed Implementation Plans (WIPs) to reduce pollution. The Phase III WIPs will outline policies, programs, and Best Management Practices (BMPs) needed to reduce pollution to regulated levels by 2025. Each jurisdiction must account for potential growth in pollution in their WIPs and describe how that growth will be offset. Because future land use change can increase pollution, the Chesapeake Bay Program (CBP) Partners have created a way to credit the role of land conservation and land use planning actions in reducing the future conversion of forests and farms to development. The CBP Partners use a land change model to forecast future development through the year 2025 to serve as a baseline condition for Phase III WIP development. Jurisdictions have the option to develop alternative future scenarios, called "Land Policy BMPs", which can include elements of forest and farmland conservation and land use planning actions. The baseline future land use and all alternative scenarios will be run through the CBP Watershed Model to estimate their effects on pollutant loads to the Bay. If the Land Policy BMPs result in less pollution compared to the 2025 baseline condition, the difference can be credited towards a jurisdiction's required pollutant reductions.

Mr. Peter R. Claggett is a Research Geographer with the U.S. Geological Survey where he characterizes and simulates trends in land conditions. Mr. Claggett received a Bachelor's degree in Environmental Sciences from the University of California at Berkeley, and two Master's degrees from Miami University of Ohio, one in Environmental Science and the other in Geography. He is currently enrolled in the PhD program in Geography and Environmental Systems at the University of Maryland, Baltimore County. He started his career as a US Peace Corps Volunteer followed by work at the U.S. Environmental Protection Agency and the Canaan Valley Institute.

THE NATIONAL FORESTS TO FAUCETS ANALYSIS 2.0

Sally Claggett; sclaggett@fs.fed.us; U.S. Forest Service

The USFS's National Forests to Faucets 2.0 (F2F2) project quantifies, ranks, and illustrates the direct geographic connection between forests (private and public), surface drinking water supplies, and the populations that depend on them–the ecosystem service of water supply. Using data from a variety of existing sources and maps generated through GIS analyses, the project illustrates the relative importance of forests to drinking water supplies across the United States. F2F2 looks specifically at watersheds and water supplies that may be threatened by land use change, wildfire, invasive pests, and future stresses such as climate change induced changes in hydrologic systems. The data produced by this assessment can provide information needed to identify opportunities for water market approaches or schemes based upon payments for environmental services.

Sally Claggett has been the US Forest Service Liaison to the Chesapeake Bay Program since 2002. In this capacity, she works with partners to better integrate and quantify the benefits of forestry practices to water quality and other ecosystem services. Prior to her work at the Chesapeake Bay Program, Sally was a botanist on National Forests in the Pacific Northwest. She is a native of Chesapeake shores.

THE MARKETPLACE AS A SOURCE OF CITIZEN SCIENTISTS

Kelton Clark; kclark@openshellenvironmental.com; Open Shell Environmental LLC.

Typically, we think of citizen scientists as driven by their love for the environment or some other altruistic motivation. We looked at those who were motivated by economic rewards. While fisherman have been used as citizen scientists in a number of systems; we examine the use of oyster farmers in restoration and monitoring. Oysters are an important anchor species that remove nitrogen from the water column and provide habitat for other organisms. Efforts at restoration and monitoring are hindered by resource requirements and issues of scale and methodology. In 2008 MD opened its waters to oyster aquaculture. Local waterman and entrepreneurs, were trained on oyster aquaculture and provided startup materials. Restoration goals are assisted by bottom cage culture that is dependent on building permanent oyster reefs. We compare these plantings to public funded efforts. Monitoring goals are assisted by planting and sales reporting programs which provide a supplemental monitoring program of oyster populations. We compare the efficacy of reporting systems to the state's oyster survey. Standards for nitrogen contents of oysters have been established. Since farmers report oyster sales, these numbers can used to establish amounts of nitrogen removal for use in WIPs and nitrogen trading. Opportunities exist for developing members of other industries into citizen scientists.

Founder and Managing Partner of OpenShell Environmental LLLC. OpenShell is focused on creating sustainable growth in the shellfish aquaculture industry by identifying and implementing market-based solutions to industry challenges. Dr. Clark is the former Director of Morgan State University's Patuxent Environmental and Aquatic Research Laboratory (PEARL). At the PEARL he created an oyster aquaculture program that was built on the question "How can we help". His present appointments include; the Ocean Research Advisory Panel, and the Maryland Oyster Advisory Commission. Dr. Clark received his PhD in Marine Ecology from the University of Maryland.

TAPPING INTO SOURCE WATER

Edward Cope; pwcope43@aacounty.org; Anne Arundel County Department of Public Works

Whether it's surface water or ground water, water treatment systems must supply a safe product to each customer, while meeting regulations mandated by EPA and MDE. This presentation will identify multiple contaminants in source water such as coliforms, nitrates and VOC's and the processes used to make it a viable commodity needed for all people".

I currently work as a Program Manager for Anne Arundel County Department of Public Works and I have been in the Water Treatment Industry for 33 years. I have managed and operated groundwater, surface water and Reverse Osmosis facilities. Programs I manage are Groundwater Appropriation Permitting, Specialized Water Quality Analysis and Water Operation CIP's.

I hold a Maryland Class 4 Water Operators License, Maryland Superintendent License, and I am a Certified Environmental Trainer. I have been a coordinator and instructor at the WWO Short Course and the Maryland Center for Environmental Training (MCET), allowing me to present classes throughout the Country.

KEEPING OUR PARKS & STREAMS CLEAN

Henry Coppola; Henry.Coppola@MontgomeryParks.org; Montgomery Parks, Maryland-National Capital Park and Planning Commission

Every year over 5,000 volunteers join us at 250 cleanup events to remove 70-75 tons of trash from Montgomery County Parks. This presentation will discuss the operational logistics behind organizing individual cleanups projects and running a large-scale volunteer cleanup program; the importance of collaboration and leveraging partnerships, especially with local watershed groups; and how volunteer cleanups fit into the larger realm of water quality issues and stormwater management.

Henry Coppola is the Stream & Park Cleanup Coordinator for Montgomery Parks where he serves on the MS4 Permit Coordination Team. He has a Master of Environmental Management degree with a coastal focus from Duke University's Nicholas School of the Environment and approaches environmental management from a community based perspective.

BALTIMORE COUNTY PUBLIC SCHOOLS PROJECT SALT WATCH

Joe Davis; jdavis3@bcps.org; Baltimore County Public Schools Office of Science

Coauthor: Matt Budinger, Baltimore County Public Schools Office of Science

During the 2016-2017 school year, the Baltimore County Office of Science pitched the idea to a handful of schools to begin monitoring conductivity levels in campus tributaries throughout the year in order to explore the impact that road salt may be having on the aquatic system. Since that first year, participating middle and high schools have successfully collected data throughout the year, conducted comparison studies and used it as a context for learning and as a hands-on citizen science program for students. At the same time, specific curriculum has been designed and implemented in all high schools to investigate local water quality throughout Baltimore County with a focus on stormwater impacts. The goal of Project Salt Watch is to enable students to go beyond the curriculum and to dive deeper into the road salt issue through data analysis and exposure to technical research related to the issue. The ultimate goal of the project is to eventually move students, teachers and local stakeholders towards the development of feasible strategies to mitigate impacts. In this talk, we will discuss the program logistics, data warehousing, success stories, obstacles and strategies moving forward.

Joe Davis has worked in the education field for 25 years. He has been a classroom science teacher, department chair and science resource teacher/naturalist with the Baltimore County Public Schools. In addition, Mr. Davis worked for four years with the Chesapeake Bay Foundation and the Bay Schools Project. Mr. Davis has worked with the scientific community and partners in environmental education to bring local environmental issues to the classroom and curriculum. Currently, Mr. Davis designs and implements environmental programming and curriculum-based Meaningful Watershed Educational Experiences for BCPS while also consulting with schools and teachers to promote environmental literacy.

Matt Budinger is a Science Resource teacher for Baltimore County Public Schools who teaches secondary outdoor education programs. He has been a science teacher for 16 years. He helps coordinate, develop, and teach 6-12th grade outdoor education programs including canoe-based ecology investigations, habitat investigations, and stream studies. He is also a curriculum writer, an instructor for UMBC teaching an Environment course for teachers in a STEM master's program, and helps develop professional development opportunities for teachers. He has a bachelor's degree in biology from Dickinson College and a master's in environmental science and policy from Johns Hopkins University.

MAPPING THE REEMERGENCE OF BAY GRASSES

R. John Dawes; Dawes@chesapeakecommons.org; Chesapeake Commons

Underwater Grasses, commonly referred to as submerged aquatic vegetation (SAV) are a cornerstone indicator of a healthy Chesapeake Bay. By the 1980s, acreage of underwater grasses plummeted below 25% of historic levels across the Bay. To reverse the loss, the Chesapeake Bay Program and partners implemented a SAV Outcome Management Strategy. Beginning in 1978 VIMS documented the presence of SAV in project areas via aerial surveys. Fast-forward to 2017, no full-fledged effort had ground-truthed the aerial work. To rectify this VIMS, MDNR, and local watershed groups organized an effort to crowdsource SAV observations using Water Reporter. Volunteers on boats and from shorelines used the App to report their observations. Researchers used 430 data points provided by 50+ volunteers to ground-truth SAV bed flyovers, provide species information, and build multi-layer data maps, offering groundbreaking level of analysis and confidence in the restoration.

Volunteer networks and the data they collect are invaluable to the continued restoration of the Bay. By appealing to individuals through their love to get out on the Bay, desire to connect with their local watershed group, and providing a clear call to action of what they can share via Water Reporter, the effort to restore bay grasses has a higher level of understanding of the successes and continued needs.

John leads project strategy, system design, and product development for Chesapeake Commons. Originating as a fiscally-sponsored program delivering GIS services and information design to environmental organizations, John grew the Commons into a nonprofit that delivers leveraged products and digital services to organizations working to improve water quality. Prior to founding the Commons, John worked at Environmental Integrity Project as a Research Analyst, mapping public and private drinking water wells and their proximity to coal ash impoundments. John B.A. in Environmental Policy from Juniata College and a M.S. in Geographic Information Systems (GIS) from Johns Hopkins University.

BMP IMPLEMENTATION: INTEGRATING COST-EFFECTIVENESS AND CO-BENEFITS WITH NUTRIENT EFFICIENCY

Olivia H. Devereux; olivia@devereuxconsulting.com; Devereux Environmental Consulting, Inc.

Best management practices (BMPs) must be implemented to reduce nitrogen, phosphorus, and sediment loads in order to meet requirements of MS4 permits, small watershed Total Maximum Daily Loads (TMDLs), and the Chesapeake Bay TMDL. To support these efforts, we developed estimates of nitrogen, phosphorus and sediment reduction effectiveness and cost per unit reduced for each BMP using CAST, a free online decision support tool. Using a series of BMP "isolation" model scenarios, we determined the pounds of nitrogen, phosphorus, and sediment reduced for each BMP. The design of the scenarios isolates the load reduced from each BMP while including the interaction effects of other BMPs, and is useful for assessing relative differences among BMPs. The annualized cost per pound reduced per year may then be calculated using available estimates of unit cost per BMP. This information can enable targeting of the most effective BMPs at the lowest cost. Co-benefits of implemented BMPs were explored using qualitative impact scores. The ability to tie the same action to multiple objectives facilitates program and funding prioritization, and may result in a greater likelihood of implementation and maintenance. Using a small watershed, we illustrate the potential to reduce costs, improve nitrogen and phosphorus reductions, and impact co-benefits.

Olivia Devereux, M.S., is an environmental scientist with expertise in BMP planning and implementation and development of linked watershed and BMP modeling systems. She has performed water quality assessments and facilitated environmental planning efforts. She is the scientific lead in developing the CAST tool and was the scientific lead in developing the first Chesapeake Bay Program Scenario Builder, the system that distributes nutrients to the land and was used to create inputs to the Watershed Model. She also has played a key role in other environmental planning and modeling initiatives.

THE IMPACTS OF BALTIMORE CITY'S SANITARY SEWER CONSENT DECREE PROJECTS ON WATER QUALITY

Paul N. De Santis; paul.desantis@baltimorecity.gov; Baltimore City Department of Public Works

Like many older cities in the U.S. with aging infrastructure, Baltimore City has experienced significant sanitary sewer overflows. In order to address these overflows, Baltimore City originally entered into a consent decree with the U.S. Environmental Protection Agency and Maryland Department of the Environment in 2002. This session will explain the requirements of the consent decree and the effects consent decree projects have had on water quality.

Paul N. De Santis is the Chief of Legal and Regulatory Affairs for Baltimore City Department of Public Works. In this capacity, he is responsible for all environmental compliance issues associated with the Department and is the program manager for Baltimore City's Sanitary Sewer Consent Decree.

FISH FRIENDLY ROAD-STREAM CROSSINGS: RESTORING ECOSYSTEMS FOR FISH AND MAKING INFRASTRUCTURE MORE RESILIENT TO FLOODING

Julie Devers; julie_devers@fws.gov; U.S. Fish and Wildlife Service

Many states and agencies have identified road stream crossings as barriers to aquatic organism passage. Aquatic organisms can be blocked from accessing upstream or downstream habitat by culverts that are undersized, perched, where water is too shallow or there are physical barriers to passage. Some species' migration can be interrupted preventing them from accessing their natural spawning grounds while other species are blocked from moving from one stream to access feeding grounds and exchange genetic material. Some states such as Oregon, Maine, Massachusetts and agencies such as the Forest Service have implemented standards for road stream crossings that allow streams to function more naturally. The National Forest Service technique of replacing culverts includes recreating a natural stream bed through a culvert by simulating conditions in a comparable stream segment. When this technique is implemented with a culvert that spans the bankfull width and the banks of a stream, fish are able to pass freely without interruption to their natural behavior. While larger culverts are more costly, they are much more resilient to flooding and need to be repaired and replaced less frequently. Organizations including state and federal agencies and non-governmental organizations are working in Maryland to get the word out about the benefits of constructing fish friendly culverts.

Julie Devers is a fish biologist with the U.S. Fish and Wildlife Service. She has worked in the Maryland Fish and Wildlife Conservation Office in Annapolis, MD for the past 11 years on freshwater mussel conservation, fish passage, and coastal fish habitat restoration. She previously worked for the Service in West Virginia and Virginia and received her M.S. in fisheries and wildlife management from Virginia Tech.

ROAD STREAM CROSSING ASSESSMENTS: IDENTIFYING CULVERTS THAT ARE BARRIERS TO AQUATIC ORGANISM PASSAGE

Julie Devers; julie_devers@fws.gov; U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service and partners have been working since 2015 to assess road-stream crossings in Maryland. Over 2700 crossings have been assessed for aquatic organism passage and flood resiliency. Assessments were conducted in habitat where priority species have been documented including brook trout, river herring, endangered freshwater mussels (dwarf wedgemussel and yellow lance), bog turtle and Chesapeake log perch. Assessment methods were standardized by the North Atlantic Aquatic Connectivity Collaborative (NAACC) and entered into a regional database. The information collected will help natural resource agencies tasked with managing species determine where spawning habitat is inaccessible and gene flow is being inhibited. The NAACC database is accessible to the public, including department of public works and the State Highway Administration, and can be used to be used to determine where culvert maintenance, culvert replacement or culvert removal could benefit aquatic organisms and reduce road closures due to flooding in the state of Maryland.

Julie Devers is a fish biologist for the U.S. Fish and Wildlife Service. She has worked in the Maryland Fish and Wildlife Conservation Office in Annapolis, MD for 11 years. Her work is focused on freshwater mussel conservation, fish passage and coastal fish habitat restoration.

THE SPA CREEK CONSERVANCY'S VOLUNTEER MONITORING INITIATIVE- FINDING STRENGTHS, MINIMIZING COMPLICATIONS, AND WORKING AROUND OBSTACLES

Tammy Domanski; tldomanski@aacc.edu; Anne Arundel Community College Environmental Center

The Spa Creek Conservancy has a long history of working with local and national organizations, finding ways to improve the quality of water and life on the creek, and contributing to the improvement of the Severn River and Chesapeake Bay. Over the last several years, volunteers working with the SCC have developed a testing protocol that brings multiple individuals together to conduct regular, high quality, data-driven water monitoring. In each of the last three years the group has increased the number of sample sites and frequency of testing. The group also monitors a wide range of parameters including dissolved oxygen, enterococcal levels, clarity, total suspended solids, and levels of nitrogen and phosphorous. The success of the project has relied on a concerted effort by volunteers, training in collaboration with CWMC staff, and enhanced quality assurance and control methods. The presentation will review the development of the SCC volunteer monitoring program, the coordination of effort, training, data verification and reporting, and the challenges involved. Data management, analysis and trends will also be discussed.

Professor in Biology at AACC in Biology and the Environmental Center and has been directing Operation Clearwater for five years. Works with the Spa Creek Conservancy and other local organizations on expanding water quality monitoring capabilities and reporting.

OCCURRENCE OF PHARMACEUTICALS, HORMONES, AND ORGANIC WASTEWATER COMPOUNDS IN PENNSYLVANIA WATERS, 2006–09

Joseph W. Duris; jwduris@usgs.gov; U.S. Geological Survey Pennsylvania Water Science Center

Coauthors: Andrew G. Reif, U.S. Geological Survey Pennsylvania Water Science Center; J. Kent Crawford, U.S. Geological Survey Pennsylvania Water Science Center (Retired)

Concern over the presence of contaminants of emerging concern, such as pharmaceutical compounds, hormones, and organic wastewater compounds (OWCs), in waters of the United States and elsewhere is growing. The U.S. Geological Survey, in cooperation with the Pennsylvania Department of Environmental Protection evaluated the occurrence of contaminants of emerging concern (CECs) in streams, streambed sediment, and groundwater of Pennsylvania. Compounds evaluated in the study were pharmaceuticals (human and veterinary drugs), hormones (natural and synthetic), and OWCs (detergents, fragrances, pesticides, industrial compounds, disinfectants, polycyclic aromatic hydrocarbons, fire retardants and plasticizers). Reconnaissance sampling was conducted from 2006 to 2009 to identify CECs in (1) streamwater upstream and downstream from animal feeding operations, (2) streamwater upstream from and streamwater downstream from municipal wastewater effluent discharges, and (3) streamwater from sites within 5 miles of drinking-water intakes. The number and type of CECs and the concentrations of CECs detected among the different reconnaissance areas was variable. Municipal wastewater generally increased the number and concentrations of various CECs, while samples collected near drinking water intakes had fewer CECs detected and generally small concentrations, less than 50 nanograms per liter.

Joe Duris received his MS in Biological Science from Western Michigan University. He was worked for the U.S. Geological Survey for the past 16 years. In 2016, he became the USGS Pennsylvania Water Science Center's Water-quality Specialist and now oversees study design, data quality, and reporting for USGS water-quality studies around Pennsylvania and northeast region. Joe's research interests include understanding how human practices, including agriculture and urbanization, affect the occurrence, distribution, and transport of nutrients, sediment, trace organic compounds, and pathogenic bacteria in surface water and groundwater.

HELPING THE ANACOSTIA WITH RAINSCAPES

Ann English; ann.english@montgomerycountymd.gov; Montgomery County Maryland Department of Environmental Protection

RainScapes are green infrastructure techniques which provide attractive options for reducing the volume of Stormwater runoff from private properties. Since 2008, the RainScapes program has incentivized the installation of over 400 projects in the Anacostia which manage runoff from 11.36 impervious acres that would otherwise shed all the Stormwater in a storm to a stormdrain. All sizes of parcels are represented in the program projects and while the majority are on private property there is a significant cluster of projects at schools in the watershed. The work to reach people and assist them in planning of a project requires patience and inspiring them to install a project requires creativity and good humor to succeed in making progress. Cash incentives help and as incentive amounts have risen, participation has risen too in key project types which had been relatively more expensive. The RainScapes program professional training and a congregationally focused efforts are two ways we have leveraged a small staff group in order to encourage more participation in actions on private property to work towards the improved health of the watershed while meeting other aesthetic, cultural and environmental goals.. “It's not about what it is, it's about what it can become.” — Dr. Seuss, The Lorax

Ann English, PLA, ASLA, LEED® AP BD+C is the RainScapes Program Manager for the Montgomery County, MD Department of Environmental Protection. Since 2009, Ms. English has led the development of the RainScapes program into a multi-strand program with a wide array of resources online, cash incentives (Rewards Rebates), outreach (workshops and demonstration projects), training (for lay and professional audiences), schools and focused communities (congregations, neighborhoods). She has a reputation as a passionate plantswoman and has degrees in American History, Regional Planning and Landscape Architecture.

HOW EFFECTIVE ARE BIOSWALES FOR TREATING STORMWATER GENERATED BY MARYLAND HIGHWAYS?

Keith N. Eshleman; keshleman@umces.edu; University of Maryland Center for Environmental Science Appalachian Laboratory

Coauthors: Katie Kline, Briana Rice, Ian Smith, Ray Morgan, University of Maryland Center for Environmental Science Appalachian Laboratory

Maryland is leader in urban stormwater management, yet flooding and stormwater pollution continue to plague many developed areas of the state. The dominant feature of Maryland's contemporary approach to stormwater management is an emphasis on low impact development practices such as bioretention that attempt to retain or detain runoff on the watershed by promoting localized infiltration of stormwater. The present study was designed to determine the effectiveness of bioretentive swales ("bioswales") constructed along Maryland highways in achieving three stormwater management objectives: 1) reducing stormwater volumes; 2) attenuating stormwater peaks; and 3) controlling stormwater pollution. Since bioswales along Maryland's existing highway network are almost entirely retrofits, we designed a comparative field study to assess bioswale performance relative to grass swales (i.e., the latter were used as "controls" against which bioswale performance was compared). A related, secondary objective was to quantify differences in flowpaths of water through the bioswales (i.e., surface vs. subsurface) and assess the effects on the concentrations of stormwater pollutants measured at the outlet. A paired experimental design was replicated at sites on U.S. Rt. 40 west of Hagerstown in the Ridge and Valley province and on U.S. Rt. 40 west of Ellicott City in the Piedmont.

Dr. Keith N. Eshleman is Professor at the University of Maryland Center for Environmental Science based at Appalachian Laboratory in Frostburg. Dr. Eshleman's research interests are in the areas of watershed and wetlands hydrology, groundwater/surface water interactions, biogeochemical processes in upland and wetland ecosystems, water quality modeling, and ecosystem responses due to natural disturbances, energy development, and land use change. Recent research projects have focused on the hydrological impacts of acid deposition, forest disturbances, surface mining, shale gas development, and stormwater management.

SANITARY SYSTEM CHALLENGES AND INNOVATION

Carlos A. Espinosa, P.E.; Carlos.Espinosa@baltimorecity.gov; Baltimore City Department of Public Works

The Baltimore Fatberg - In September 2017 the Baltimore City Department of Public Works (DPW) reported a sanitary sewer overflow (SSO). Following a site investigation and condition assessment, DPW determined that the 24" sewer pipe was choked with fats, oils, and grease (FOG). Known as the "Baltimore Fatberg", the 20-foot congealed FOG mass made national news, and caused the release of more than 1 million gallons of sewage into Jones Falls. Removing it was no easy task. The job, estimated at about $60,000, required water jets, a scraper, and a vacuum truck to suck out the fatberg and surrounding debris. Damaged Infrastructure During the 2018 July Storms – During severe storms in July 2018 debris in streams struck and damaged sections of the sanitary sewer infrastructure, causing millions of gallons of diluted sewage to overflow into the Gwynns Falls and Maidens Choice streams. DPW's first priority was to abate the SSOs by setting up bypass pumping. At both locations, setting up bypass was very difficult and expensive. SSO Event Notification System (ENS) – In 2017 Baltimore City DPW installed a network of flow meters capable of alarming the department at the onset of SSOs at selected locations. The locations were identified as chronic SSO sites by means of hydraulic modeling. The ENS network provides more accurate estimation of the SSO Volume.

Carlos Espinosa has 38 years of experience in the design, operation and evaluation of water, storm water, and wastewater systems. He is currently the Chief of the Office of Asset Management for the City of Baltimore Department of Public Works. The Office of Asset Management's mission is to maximize the life of DPW assets by implementing proactive condition assessments and preventive maintenance programs, and applying asset management principles. Mr. Espinosa holds engineering degrees from the United States Naval Academy and from Johns Hopkins University. He is a registered professional engineer in Maryland, Virginia, and Delaware.

SEWAGE REDUCTION EFFORTS IN THE ANACOSTIA RIVER

Jim Foster; jfoster@anacostiaws.org; Anacostia Watershed Society

The Anacostia has been impaired by sewage for hundreds of years. Many sources and unintended consequences have caused this. Today, we are reducing bacteria, nutrients and sediment as well as trash from the Anacostia with major efforts by the water authorities, local leadership, and caring nonprofits. Bacteria is the only impairment separating water quality from meeting swimming standards.

Jim Foster is President of the Anacostia Watershed Society, an organization working to restore the Anacostia River. Their mission is to protect and restore the Anacostia River to fishable and swimmable by 2025. Through education, engagement, and demonstration efforts AWS improves the watershed, the communities, and the habitat. Mr. Foster is presently on the DC Leadership Council for a Cleaner Anacostia River. Additionally, he is a graduate of the Watershed Stewards Academy where he learned about rainwater management solutions and started the National Capital Region Watershed Stewards Academy. Mr. Foster has a B.S. from Penn State University in Environmental Resource Management.

AN ANALYSIS OF THE CHEMICAL COMPOSITION OF WASTE WATER AND WATER TREATMENT PLANT EFFLUENT

Timothy Fox; tim.fox@maryland.gov; Maryland Department of the Environment

From July 2016 to February 2017, the Maryland Department of the Environment sampled the effluent and receiving streams associate with nine waste water treatment facilities and three water treatment facilities. For most facilities, nine sampling events were completed. Each sampling event consisted of sampling directly from the point of discharge and two stations located upstream and downstream of the effluent. Additional effluent samples were taken directly from four ENR facilities. Major ions, nutrients, and six trace metals were measured. Data show that most facilities were in compliance with draft ion criteria and national criteria. Wilcoxon signed-rank tests showed statistically significant difference between downstream and upstream stations for several parameters. Statically significant increases in ion concentrations did not always correspond to statically significant increases in specific conductance. The specific conductance of certain effluent samples was significantly influenced by nutrients. Strong covariance between parameters was observed in the effluent of certain facilities, suggesting that fewer parameters could be sampled without losing large amounts of information.

Timothy Fox has been working for the Maryland Department of the Environment for 9 years where he has been evaluating and developing water quality standards. He graduated from the University of Maine in 1999 with a Bachelor of Science in zoology and minor in chemistry. He also graduated from the University of Rhode Island in 2008 with a Master of Arts in Marine Affairs and Master of Oceanography.

STREAM TEAM: CITIZEN SCIENTISTS AND URBAN BMPS

Sarah Giordano; sarahg@southriverfederation.net; South River Federation

South River Federation's citizen scientists have become an invaluable resource in our evaluation of stormwater best management practices (BMPs). In 2017, South River Federation and Smithsonian Environmental Research Center, joined forces to study Church Creek, an urban tributary previously identified as one of the most polluted creeks in the South River Watershed. Since 2010, Church Creek has been the focus of restoration efforts and now has over 50 BMPs of various type, size, and scale installed within its watershed. Continuous monitoring equipment was placed at key locations to assess the cumulative and individual effectiveness of the BMPs on reducing nutrient and sediment pollution. However, the majority of these devices provide a limited view of the system, collecting weekly flow-based averages that represent the whole of upstream subwatersheds. In order to fine-tune our understanding of the nutrient pollution input to Church Creek, the Federation's volunteers collect synoptic data from all small tributaries within the research area during high flow events. Through the effort of these dedicated citizen scientists, we have been able to identify areas of both release and uptake of nutrients. Ultimately, these efforts will allow for more informed decision making for improving stormwater systems, such as Church Creek.

Sarah Giordano joined South River Federation as a Chesapeake Conservation Corps volunteer after graduating from Washington College with a B.A. in Environmental Studies, a minor in Anthropology, and a concentration in Chesapeake Regional Studies. Afterwards, she was hired to assist the Federation in collecting and analyzing water quality data. Since then she has focused on studying the effect of urban BMPs on water quality. In addition to managing the restoration research project that you will be hearing about shortly, Sarah collects samples, analyzes data, and trains the citizen scientists for this initiative.

URBAN STREAM RESTORATION IMPROVES HABITAT BUT NOT WATER QUALITY

Charles Gowan; cgowan@rmc.edu; Randolph-Macon College

Mechumps Creek in the Town of Ashland, Virginia was damaged from stormwater runoff. To address the problem and to explore methods for fixing urban streams throughout the region, a partnership was formed among the Town, Randolph-Macon College (R-MC), and Stantec (a consulting firm with special expertise in stream restoration). The partnership implemented Phase 1 of a restoration plan in 2010, using natural channel design to restore 1200 feet of 2nd-order stream that runs through a forested riparian zone surrounded by fast-food parking lots associated with an I-95 interchange. Based on annual monitoring conducted by R-MC, the restored reach is 1) stable, 2) supports more fish species than before restoration, and 3) contains insect communities more similar to those typical of undisturbed streams in the region. But, poor water quality due to parking-lot runoff continues to prevent fully-natural populations of fish and aquatic invertebrates from colonizing the restored area. Phase 2 of the project, completed in September, 2018, is meant to address the water quality problem while restoring an additional 1200 feet of creek. The key concept is an experimental approach for treating stormwater runoff called regenerative wetlands.

Charles Gowan is an aquatic ecologist in the Department of Biology and Environmental Studies Program at Randolph-Macon College in Ashland, Virginia where he has taught since 1996. He received his Ph.D. in fisheries biology from Colorado State and a Master's Degree from Michigan State. He is currently the Paul H. Wornom Professor of Biology at R-MC.

CREATING THE SAV "NAVY"

Thomas Guay; ECAlert@gmail.com; Severn River Association

To ground truth aerial surveys of submerged aquatic vegetation (SAV), the Severn River Association recruited a team of citizen scientist volunteers to join our SAV 'Navy' to monitor and identify underwater grasses in the Severn River. We recruited volunteers who live near the river and who had access to kayaks because most of the SAV in the Severn River grows in relatively remote areas and, critically, the grass grows in shallow water, less than 2.5 feet depth. We divided up the areas identified in aerial surveys into nine sectors and assigned members of our SAV 'Navy' to teams based on proximity to where they could access the river and nearby SAV beds. Volunteers welcomed the opportunity to use their kayaks for an on-the-water assignment that benefits scientific understanding of water quality and SAV. Thanks to a grant from the Chesapeake Bay Program, we purchased enough gear to create nine SAV monitoring kits that each team shared in their monitoring sector. On Sept. 27, 2018, SRA organized a single-day monitoring event with 20 volunteers from Crosby Marketing Communications. We had to recruit power boat captains to tow the volunteers isolated areas where we needed SAV monitoring activity. Thanks to the success of the Crosby experiment, SRA will try to repeat a similar one-day event in 2019 to supplement the work of the rest of the SAV 'Navy' on the Severn River.

No biography submitted

WHAT LIVES IN THE HARBOR? BALTIMORE CITY STUDENTS INVESTIGATE BAY WATER QUALITY

Sarah Haines; shaines@towson.edu; Towson University

Coauthor: Chelsea McClure, Towson University

Recent changes to K-12 Maryland public education require an increased need to support school districts in providing meaningful environmental experiences for all students. To address this need we formed a partnership between a university and an informal science education center. Our focus is to engage students in environmental issue investigations relevant to the local community to promote deep, critical thinking. We have four interrelated civic/stewardship goals: (1) To focus on urban youth who may have limited personal experiences with nature and/or have a limited understanding of local natural resources, (2) To assist preservice teachers in becoming confident, competent environmental educators through practical, hands-on professional development, (3) To enact a place-based environmental curriculum that meets both the instructional guidelines of local school districts and State content standards, and (4) To maximize environmental education through repeated interaction with students and educators. We will describe our project methods and partners, then present data that supports our belief that exposing preservice teachers to nonformal educational settings and practices is beneficial to them once they begin their classroom careers. We will also demonstrate that the project is very beneficial to the urban middle school students who are our secondary target audience.

Sarah is a professor of biology and science education at Towson University, where she has been teaching for 19 years. Her interests lie in the areas of science education and environmental education. Her courses for preservice teachers all include outdoor components, and many include service learning. Sarah has built relationships with many local nonformal educational institutions, and she often teaches her classes off campus at these local organizations- she has had her students learning and leading programming at the Maryland Zoo, Irvine Nature Center, Oregon Ridge Nature Center, and the National Aquarium.

RIPARIAN FOREST BUFFER FUNCTIONS AFTER 15 YEARS

Anne Hairston-Strang; Anne.Hairston-Strang@maryland.gov; Maryland Department of Natural Resources Forest Service

Coauthors: Timothy Culbreth, Jerica Miller, Maryland Department of Natural Resources Forest Service

Riparian forest buffers were assessed for vegetation, water quality, and habitat on 30 buffers between 1999 and 2018, located in a focus area in Catoctin, Monocacy, and Antietam watersheds. Most sites (88%) exceeded the target tree stocking of 200 trees per acre, usually a combination of natural regeneration and surviving planted trees, with planted species adding desired native species like oaks. Tree survival stabilized at about 5 years. Native species richness almost doubled over 15 year. Invasive plants remained a minority of species, but number of invasive species tripled over the same time frame as shade-tolerant species expanded and sun-loving species still persisted some. Water quality trends improved, though measures varied among wet and dry years. Turbidity in baseflow was half of the 2001 level by 2017, likely reflecting upstream best management practices in addition to forest buffers. By age 15, most sites had closed canopies producing effective stream shade. Comparing the 13 sites with upstream//downstream temp loggers with no missing data from dry streams for 2002 to 2017, the number of days that downstream stations exceeded the adult trout tolerance of 23.8oC declined from 35% in 2002 to 19% in 2017, despite air temperature averaging 1 C warmer in 2017. Benthic macroinvertebrates varied among sites and years; half of the sites showed improving trends.

Dr. Hairston-Strang is Associate Director with MD DNR Forest Service. She started as the Riparian Forest Buffer Specialist in 1997, following degrees in forest management, forest soils, and forest hydrology.

FISH PASSAGE NO LONGER IMPEDED IN THE LOWER PATAPSCO RIVER AFTER 112 YEARS

William Harbold; william.harbold@maryland.gov; Maryland Department of Natural Resources

Coauthors: Robert Aguilar, Matthew Ogburn, Smithsonian Environmental Research Center

Bloede Dam was breached on September 11th, 2018, marking a substantial improvement for fish passage on the Patapsco River. Fish passage improvement has been a major goal of the dam removal project and two partners, the Maryland Biological Stream Survey (MBSS) and the Smithsonian Environmental Research Center (SERC), have been collecting fish data since 2009. Through electrofishing surveys, DIDSON sonar imaging, and the collection of both icthyoplankton and environmental DNA (eDNA) samples, the MBSS and SERC documented the presence and distribution of Blueback Herring, Alewife, and Hickory Shad in the Patapsco River. They also produced estimated run counts for Blueback Herring and Alewife. Observed abundances of these species varied annually downstream of Bloede Dam, and none of these fish were recorded upstream from Bloede Dam at any point. Benefits of improved fish passage will likely extend to other species as well. There were a total of 14 fewer species collected upstream compared with downstream from Bloede Dam throughout 9 years of electrofishing surveys. Spring 2019 will be the first opportunity in 112 years for all species to move freely through the former impoundment and into the river and tributaries upstream. We anticipate documenting the movement of fishes upstream from the former impoundment as we continue our monitoring efforts into the post-removal period.

William Harbold is a biologist with the Maryland Department of Natural Resources. He has been working with the Maryland Biological Stream Survey to study the impacts of Patapsco River dam removals since 2009.

BENTHIC MACROINVERTEBRATE RESPONSES TO A REGENERATIVE STORMWATER CONVEYANCE RESTORATION IN A COASTAL PLAIN STREAM

Kyle Hodgson; kyle.hodgson@maryland.gov; Maryland Department of Natural Resources

In January 2016, a Regenerative Stormwater Conveyance (RSC) stream restoration project was completed in North Branch Muddy Creek (Muddy Creek) located on the Smithsonian Environmental Research Center property in Edgewater, MD. RSC is a relatively new restoration technique that is gaining popularity in urban Maryland streams, despite sparse evidence of its impacts on resident biota. In 2014, the Maryland Department of Natural Resources established nine benthic macroinvertebrate monitoring sites in the Muddy Creek watershed to document changes in benthic communities pre- (2014-2015) and post-restoration (2016-2018) using Maryland Biological Stream Survey protocols. Average pre-restoration BIBI scores were significantly ($p<0.05$) higher (3.43; fair) compared to first-year (2016) post-restoration (1.57; very poor), adjacent control (2.37; poor), and upstream control (2.62; poor) scores. A significant decrease in taxa richness, Shannon Diversity Index values, and percent non-insect was observed in first-year (2016) post-restoration samples compared to pre-restoration samples. The second and third years after restoration (2017, 2018), sites significantly increased in BIBI scores, taxa richness, and Shannon Diversity Index values compared with first-year post-restoration, suggesting that ecological recovery may be occurring in the restoration reach of Muddy Creek.

Kyle Hodgson is an Aquatic Biologist working for the Maryland Department of Natural Resources - Maryland Biological Stream Survey. His professional interests include monitoring ecological responses to stream restoration and IBI development. Kyle holds a B.S. and an M.S. in Aquatic Ecology from SUNY - Environmental Science and Forestry in Syracuse, New York.

TURN OBSERVATIONS INTO ACTION WITH WATER REPORTER

Erin Hofmann; hofmann@chesapeakecommons.org; Chesapeake Commons

Keeping a pulse on your watershed helps you make better decisions, have a more informed member base, and actualize your mission. Monitoring goes beyond sampling for chemical and bacterial parameters. It ranges from citizen science projects to everyday observation, all to track the ebbs and flows of watershed health. How can groups and volunteers leverage technology to monitor and turn observations into improved water quality?

Comprised of a mobile app and web-based platform, Water Reporter was developed specifically for organizations looking to engage volunteers, collect qualitative and quantitative data, and visualize that data in pragmatic and approachable ways. Participating groups define their own monitoring protocols and the questions that they want to answer. Water Reporter provides features including geo-located reports; data management, analysis, and visualization; embeddable maps; custom form building; status management; and, access to member emails.

Over 20 organizations in Maryland use Water Reporter to conduct everything from daylighting monitoring data, collecting pollution sightings, identifying water quality threats, conducting citizen science studies, planning trash clean-ups, and tracking restoration projects. Presenters will highlight how leveraging Water Reporter helps move the needle towards cleaner water across Maryland.

Erin leads strategy and application for Chesapeake Commons. In this role, Erin supports the user's experience of the Commons' leveraged technologies, Water Reporter and Field Doc, and guides users as they navigate the adoption of these tools. Erin honed her appreciation of the unique needs of environmental organizations while working for various non-profits including the Northern Alaska Environmental Center, The Nature Conservancy, the National Audubon Society, and the National Fish and Wildlife Foundation. Erin holds a B.A. in Environment and Development from McGill University and an M.P.A. in Environmental Science and Policy from Columbia University.

MAGOTHY RIVER ASSOCIATION: A BAND OF CITIZEN SCIENTISTS

Sally Hornor; sally.hornor@gmail.com; Magothy River Association

Coauthor: Paul Spadaro, Magothy River Association

Volunteers with the MRA are actively engaged in environmental monitoring and ecological restoration. Since 1992, volunteers have performed water quality monitoring from both land and boat; currently we monitor 25 stations biweekly from April to October. These data are utilized to determine an annual report on the condition of each creek and of the mainstem based on dissolved oxygen, water clarity measured with Secchi disks and coverage of submerged aquatic vegetation (SAV). SAV data are obtained not only from VIMS and consulting firms, but also by data derived from our volunteer use of cameras on drones. In 2017, our SAV coverage by drone was the first drone data provided by volunteers accepted by VIMS. Each fall, volunteers circumnavigate almost all of the 76 miles of shoreline to ground truth the species of SAV present. For the past 3 years, volunteers have worked with Anne Arundel Community College Environmental Center and MD Department of Natural Resources to determine the viability of spawning yellow perch. We have not only documented the locations of egg chains in February but we have seined for larval yellow perch in March in the headwaters of the mainstem and in some creeks. We also worked with scientists at AACC to develop and implement the concept of floating gardens (floats containing 1-6 emergent wetland plants) which are distributed throughout the watershed.

Sally Hornor attended Goucher College where she received a BA in Biology and then earned an MS in Microbiology and a PhD in Ecology at the University of Connecticut. She has worked as an aquatic ecologist in a variety of ecosystems, including lakes, rivers and the Chesapeake Bay. She taught Microbiology and Ecology at Anne Arundel Community College for 30 years and has been involved in monitoring and ecological research on the Severn and Magothy Rivers during that time. Her primary interests are restoration of streams, oyster communities, submerged aquatic vegetation and water quality monitoring. She serves as a Vice President of the Magothy River Assn.

ASSESSING THE PRECISION OF MARYLAND'S BENTHIC INDEX OF BIOTIC INTEGRITY

Tomas Ivasauskas; tomas.ivasauskas@maryland.gov; Maryland Department of Natural Resources

Coauthors: Ellen Friedman, Jay Kilian, Scott Stranko, Dan Boward, Matthew Ashton, Jason Cessna, William Harbold, Neal Dziepak, and Michael Kashiwagi, Maryland Department of Natural Resources

The Maryland Biologic Stream Survey (MBSS) was established by the Maryland Department of Natural Resources in 1995 to better assess current and future conditions of the State's freshwater streams. Among the protocols set forth by the MBSS, it established the methodology for sampling benthic macroinvertebrate communities, defined community characteristics that were reflective of biotic integrity, and assigned index scores on a scale ranging from 1.0 (most degraded) to 5.0 (least degraded). A common critique of most indices of biotic integrity is the unknown precision of scores. To evaluate the precision of Maryland's benthic index of biotic integrity (BIBI) scores, duplicate benthic samples were taken at 214 sites situated throughout the state. The mean difference in duplicated sample scores was -0.009 (±0.0697), 69.6% of sites had an absolute difference in duplicated BIBI scores ≤ 0.5, and 96.3% of sites had a difference ≤ 1.0. These results demonstrate that the precision of the Maryland BIBI is within an acceptable tolerance for repeatability. These results also underscore the importance of using BIBI scores in conjunction with other relevant data for the purposes of detecting spatial and temporal trends, identifying stressors, and for regulatory and decision-making purposes.

Dr. Tomas Ivasauskas is a biologist with Maryland DNR's Monitoring and Non-Tidal Assessment Division. His primary duties include sampling for the Maryland Biological Stream Survey, database management, and data analysis.

ESRI STORY MAPS: A NEW ALTERNATIVE IN COMMUNICATING WATER-QUALITY RESULTS

Shannon Jackson; sejackson@usgs.gov; U.S. Geological Survey

Traditional presentation methods often fail to fully convey the complexity of water quality results and methods used in data collection. Slideshow presentations are often subject to technical failures, delays, and text-heavy slides. Data presentation requires audience engagement, which is lost with overwhelming tables, graphs, and text. While it is important to promulgate the data itself, the history behind a study, the setting and the methods can help the audience better understand the results. A platform that seamlessly presents dynamic maps, figures, videos, and photos can provide context to the complexity and necessity of a study. In partnership with the Maryland State Highway Administration, the USGS began monitoring a stream restoration of Little Catoctin Creek, in Maryland, and ESRI Story Maps are being to visualize the process. Story Maps are an open source, web-based, user-friendly presentation application that rely on a dynamic, media-driven concept of maps, videos, and other multimedia. Available to the public is an interactive site complete with spatially referenced water quality data, UAV flights, real-time hydrographs, photo and video of sampling methods, and hydraulic modeling. The final product is an effective story-driven presentation with a wide variety of applications in communicating complex water quality data to cooperators and the public.

Shannon Jackson is a Physical Scientist at the United States Geological Survey Maryland Delaware D.C. Water Science Center in Baltimore, Maryland. Her work involves the application of geospatial techniques to model water quality for USGS national and regional programs.

EFFECTS OF FLOODPLAIN RECONNECTION ON DISSOLVED NITROGEN AND CARBON CONCENTRATIONS IN RESTORED MARYLAND STREAMS

Virginia Jeppi; vjeppi1@students.towson.edu; Towson University, Department of Biological Sciences

Coauthors: Vanessa Beauchamp, Department of Biological Sciences, Towson University; Joel Moore, Department of Physics, Astronomy, & Geosciences, Towson University

Legacy sediment removal and floodplain reconnection is a relatively new and unstudied method of restoration that is beginning to be used in the Chesapeake Bay watershed. With this approach, incised streams are reconnected to their floodplains via removal of legacy sediments, which accumulated in ponds behind historic milldams. To study the effectiveness of this method, total dissolved nitrogen (TDN) and dissolved organic carbon (DOC) concentrations were monitored in three streams pre- and post-restoration because TDN contributes to eutrophication and DOC represents a food source for oxygen-depleting microbial activity. The study streams are located in the Maryland Piedmont. The study watersheds are agricultural, suburban, and urban with impervious surface cover (ISC) of 1.54%, 20.5%, and 56.4%, respectively, and drainage areas ranging from 0.96-8.24 sq. km. Water samples were collected at upstream and downstream of the restoration reach under base flow conditions. Preliminary results indicate little change between upstream and downstream after restoration for both TDN and DOC. Land use appears to be the dominant control on these parameters. TDN decreases as ISC increases along the agricultural to urban gradient. By contrast, DOC increases along the gradient.

Virginia (Ginny) Jeppi is an undergraduate at Towson University studying biology and chemistry. For the past two years, she has performed research focusing on evaluating stream restoration effectiveness as part of Dr. Joel Moore's geosciences laboratory and Dr. Vanessa Beauchamp's plant ecology laboratory. Ginny is currently completing an undergraduate honors thesis on the effects of stream restoration on dissolved nitrogen and carbon concentrations in Maryland streams.

STUDENT INVOLVEMENT: THE CHALLENGES AND THE BENEFITS

Lolita Kiorpes; lkiorpes569@gmail.com; North Point High School /Charles County

I have found that given the opportunity to participate in outdoor environmental activities, students rise to the challenges that are presented. Students want the opportunity to be involved. Once they know and understand why we do what we do to help the environment, students want to do their part to help. Hear about activities and projects that give students a chance to take a stand and become knowledgeable on important issues. Students talk about their experiences outside, being involved with hands on activities that can involve canoeing, conducting water quality testing and planting trees. Besides issues facing teachers to get students involved and outside, and blending the opportunity into the curriculum, the risk factor keeps coming up. School systems don't want to face legal pressures as a possible result of a real-world, hands-on experience. Accepting these "new" challenges can be daunting and frustrating. Hear about some ways to navigate these issues.

Lolita Kiorpes is a 2016 Recipient of the Presidential Innovation Award for Environmental Educators. In 2014, Ms. Kiorpes led her school to become the first NOAA Ocean Guardian School in Maryland and received the first of 4 banners. She received grant 5 this year. Students gain a fundamental understanding of different ecosystems and the human interaction component as Kiorpes brings as much of the natural environment into the classroom as possible. She participates with MD DNR programs such as Terrapins in the Classroom and Trout in the Classroom. Understanding water quality is a must and these are a few ways to highlight that challenge.

ENVIRONMENTAL REPORTING IN CHALLENGING TIMES

Rona Kobell; kobell@mdsg.umd.edu; Maryland Sea Grant

What do you do when a reporter calls? How do you handle questions you may not be equipped to answer? When do you need a FOIA or PIA and when is it more trouble than it's worth to go that route? How can you get your own message out the way you see fit? This session will explain how reporters do their jobs, so your interactions with the press will be easier and actually pleasant. (Imagine that.) It will also show you how you can use social media tools to get your own messages out about matters of public safety, public interest, and importance. The session will allow a lot of time for discussion and questions.

Rona Kobell is a science editor and writer with Maryland Sea Grant. Previously, she was a reporter for the Chesapeake Bay Journal, where she co-produced and co-hosted a public affairs radio show on Baltimore's NPR station that ran for more than five years and managed the newspaper's social media presence. A former Baltimore Sun reporter, she has contributed to Grist, Slate, Modern Farmer, Reason, The Atlantic's Citylab, Columbia Journalism Review, The Boston Globe, National Parks, The Washington Post and Chesapeake Bay magazine. She won the 2017 winner of the Lowell Thomas Award for outstanding environmental travel writing. She is a graduate of the University of Michigan.

THE IMPACT OF WATER RECLAMATION FACILITIES ON RECEIVING STREAMS

Rob Kraus; pwkrau18@aacounty.org; Anne Arundel County

Wastewater has been discharged into lakes, streams, and oceans for a very long time. This presentation will take a look at the short history of wastewater treatment in the region, and how far it has come in the last 100 years. There will be a brief look at wastewater handling prior to collections systems and treatment. The talk will progress into a discourse about advancements in collections, processes, equipment, and understanding treatment. It will end with a look at the current state of wastewater treatment.

Rob Kraus is a 20+ year student of wastewater treatment. He currently serves as a wastewater team manager for Anne Arundel County. Prior to being assigned as the superintendent of the Patuxent Water Reclamation Facility in Crofton, Maryland, he maintained and operated water, wastewater, and composting facilities for a small municipality.

CHESAPEAKE BAY SUBMERGED AQUATIC VEGETATION

Brooke Landry; brooke.landry@maryland.gov; Maryland Department of Natural Resources

Submerged aquatic vegetation (SAV) is a vital component of the Chesapeake Bay ecosystem. It provides food and habitat for a number of commercially and ecologically important fish and shellfish. It reduces wave energy which improves water clarity and decreases shoreline erosion. And it acts as a carbon sink, an important role in curbing climate change. Because of its ecological importance, SAV is surveyed annually throughout the Bay by the Virginia Institute of Marine Science (VIMS). The monitoring program includes the collection and interpretation of aerial imagery to determine SAV distribution and acreage, and the accumulation of ad-hoc, in situ SAV observations from academic, local, and government partners to determine species-specific distribution and diversity. Combined, the monitoring data allow for the protection and restoration of SAV throughout the Bay. In 2017, the Bay Program funded a project that incorporated watershed organizations into this SAV monitoring effort. The intent was to supplement the VIMS dataset by increasing the distribution and frequency of in situ SAV observations and to determine the feasibility, practicality, and benefits of engaging citizen scientists in this type of data collection process. In 2018, additional funding was provided to develop an SAV survey protocol, training manual, and certification program for citizen scientists.

Brooke Landry is an SAV biologist with the Maryland Department of Natural Resources and Chair of the Chesapeake Bay Program's SAV Workgroup. Her work is focused on the effects of various anthropogenic stressors on SAV habitat, and on SAV conservation, restoration, and monitoring.

ARE WE THERE YET? FROM RESTORATION TO RECOVERY – STREAM RESTORATION MONITORING III CONCLUDING REMARKS

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

When do we know a stream is restored? What does stream health mean? There is likely no single answer to these questions. A reflection and synthesis of the presentations will note how research and practices related to stream health and restoration help to answer these questions. The breadth of topics reinforces the need to approach restoration recognizing the explicit connections amongst the physical, chemical and biological components of the stream system and the adjacent and upland contributing areas. The continued dialogue to share and discuss our research and projects is also integral to the success of steam restoration.

Neely L. Law is the Director of Education and Training at the Center for Watershed Protection where she coordinates training for working professionals and workforce development programs. Neely is also involved in a number of research-based projects and expert panels to advance stormwater management. She is also Co-Chair of the US EPA Chesapeake Bay Program Stream Health Work Group. Neely has a PhD from the University of North Carolina, Chapel Hill, an MSc from the University of Toronto and a Bachelors in Environmental Studies from the University of Waterloo, Ontario, eh?

MAKING URBAN TREES COUNT: A STORMWATER CREDIT FRAMEWORK FOR URBAN TREE PLANTING

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

Coauthors: Bill Stack, P.E., Karen Cappiella, Deb Caraco, P.E., Center for Watershed Protection, Inc.; Justin Hynicka, Independent Consulting Ecologist

The use of trees for stormwater management is hampered by the uncertainty of how to "credit" trees for runoff and pollutant load reduction and compare their performance with other stormwater practices. While there is extensive research on the environmental benefits of trees and forests, there is limited research and methods to translate these benefits for stormwater management. This presents a challenge to effectively integrate urban tree canopy as part of a stormwater management program for regulatory compliance. The Center for Watershed Protection recently finalized a national crediting system for urban tree planting with funding from the U.S. Forest Service's National Urban and Community Forestry Advisory Council. The crediting approach is based on a literature review, input from experts, and an integrated water balance model using i-Tree Forecast to project key urban tree growth metrics. The crediting approach may be adapted by regional or local regulatory agencies to encourage greater use of trees to meet stormwater requirements, such as stormwater permits, stormwater management regulations, and total maximum daily loads.

Neely L. Law is the Director of Education and Training at the Center for Watershed Protection where she coordinates training for working professionals and workforce development programs. Neely continues to work on a variety of research-based projects with a goal to advance the art and science of watershed and stormwater management to the broadest group of stakeholders. She has participated in a number of Chesapeake Bay Program Expert Panels and most recently as Chair of the Urban Tree Canopy Panel. Neely has a PhD from the University of North Carolina, Chapel Hill, an MSc from the University of Toronto and a Bachelors in Environmental Studies from the University of Waterloo, Ontario, eh?

BALTIMORE'S MR. TRASH WHEEL AND THE FIGHT FOR A SWIMMABLE HARBOR

Adam Lindquist; adam@waterfrontpartnership.org; Waterfront Partnership of Baltimore

Baltimore's Mr. Trash Wheel exists as both an ingenious invention and a viral social media campaign. He has picked up over 1,000 tons of debris and has thousands of followers who recently celebrated his achievements at a Trash Wheel Fan Festival. In this talk you'll learn the secrets to his successes as well as how new media marketing strategies can help keep young people engaged in your work.

Adam Lindquist is the Director of the Healthy Harbor Initiative at the Waterfront Partnership of Baltimore. In 2014, he launched the Mr. Trash wheel campaign, which combined innovative trash interception technology with social media. He directs programs and events that get Baltimore residents to re-engage with the City's marine ecosystem and is currently raising funds for Baltimore's 4th Trash Wheel.

RESTORING WATER QUALITY AND AQUATIC BIOLOGY IN THE CASSELMAN RIVER

Chris Luckett; chris.luckett@maryland.gov; Maryland Department of the Environment

Coauthors: Connie Loucks, Patricia Brady, Maryland Department of the Environment; Alan Klotz, Maryland Department of Natural Resources.

In 1996 the Casselman River was listed on Maryland's 303(d) list for low pH impairment due to acid mine drainage (AMD) from mine lands and episodic acid rain deposition. Low pH values, (less than 6.5) in many tributaries of the Casselman are attributed to a significant impairment of the brook trout and benthic macro-invertebrate populations. The Maryland Abandoned Mine Land Division (AMLD) received funding through Maryland's allocation of the FY2013 EPA 319 (h) program to address the these problems in the Casselman. The funded project used limestone sand dumping sites and limestone leach bed sites in designated TMDL pH and biological impaired headwater streams of the Watershed. The goal was to restore the streams to State pH standards and improve brook trout and benthic populations. AMLD completed construction of eighteen sites on throughout the watershed. Monitoring results showed significant pH improvements. The benthic community was monitored for two years prior to implementation and three years post-implementation. The Benthic Index of Biotic Integrity (B-IBI) has markedly increased at three of the four stations. Fisheries monitoring showed remarkable brook trout population recovery. The project has been very successful and offers a low cost, low maintenance technology for watershed groups to address acidic impairments and improve biological integrity.

Chris received his BS in Marine Biology from Southampton College, Long Island, NY, in 1985. For 15 years, he worked as a coastal ecologist at the Smithsonian Institutions, Marine Systems Laboratory, making living models of various coastal ecosystems and researching the controlled culture of attached algae to remove nutrients and other pollutants from water. In 2000 he came to Maryland Department of the Environment. Chris investigates fish kills and algae blooms, conducts fish and benthic community assessments in fresh and estuarine water, samples fish tissue for contaminants, and is involved in various other special projects involving aquatic biology, ecology, and pollution control.

RESTORATION OF COASTAL PLAIN HEADWATER HYDROLOGY THROUGH USE OF ARTESIAN GROUNDWATER SOURCES ON A GRID DITCHED SITE IN BELTSVILLE, MD

Kirk Mantay; steph@greentrustalliance.org; GreenTrust Alliance, Inc.

Coauthor: Bobby Miller, GreenVest

GreenTrust Alliance, a nonprofit land trust, and GreenVest, an ecoasset development firm, completed a unique 13-acre stream and wetland restoration project at the USDA Beltsville Agricultural Research Center in early 2018. The project was made possible through a diverse public-private partnership. The goal was to restore historic groundwater and surface water flows to a grid ditched wetland and upland site featuring two surface artesian connections to seasonally high groundwater. Target hydrology focused on creating conditions consistent with historic headwater stream and wetland system configurations, fed primarily by shallow groundwater recharged by surface water infiltration from interspersed and nearby wetlands. The constructed stream and wetland system maximizes surface water retention, reestablished groundwater to surface water connections, created a meaningful connection between constructed streams and associated wetlands, and created a stable baseflow stream reach to convey high amounts of flow while vastly reducing the previous field and ditch erosion and associated sediment transport to Little Paint Branch. This presentation will showcase innovative use of exposed groundwater sources for wetland and stream restoration, demonstrating the ability of artesian flows to provide buffering to site hydrology that increases resiliency in low precipitation years.

Kirk Mantay is Director of Operations of GreenTrust Alliance. He is a certified Professional Wetland Scientist who has been restoring and preserving fish and wildlife habitat in the Mid-Atlantic since 1997. Kirk is most excited about protection and enhancement of pre-Columbian ecosystems, including American Chestnuts, pine savannas, bogs, and bald cypress swamps. He has led habitat restoration for the South River Federation, Chesapeake Bay Trust, Ducks Unlimited, and environmental consultants. Kirk serves as a Board Member for the Scenic Rivers Land Trust and as a coach and commissioner for St. Pius X Boys Soccer in Towson, where he lives with his wife and son, in between outdoor adventures.

BLOEDE DAM REMOVAL: INTERSECTION OF SCIENCE AND POLICY IN STREAM RESTORATION

Serena S. McClain; smcclain@amrivers.org; Director, River Restoration, American Rivers

Coauthors: Jessie Thomas-Blate, American Rivers; Mary Andrews, National Oceanic and Atmospheric Administration

Dam removal is one of the fastest, most effective ways to restore a river. However, for natural resource managers, watershed organizations and others, determining how to remove a dam and navigate things like the regulatory process can seem daunting. One of the more challenging issues that can define a project's level of complexity is the manner in which sediment must be managed. Sediment is one of nature's building blocks, moving and shaping the earth as it weathers and erodes rocks. Yet, as it becomes trapped behind dams, we struggle with the question of how to re-establish the beautiful, chaotic function of rivers in a way that avoids unacceptable degradation. Federal and state regulatory processes can have significant influence over sediment management options through the varied application of regulations tied to Clean Water Act 404 permitting and 401 water quality certifications. Navigating these processes can be challenging from both a practical and a scientific perspective. During this talk, we will discuss dam removal on Maryland's Patapsco River and use it to explore how the intersection of sediment science and policy have influenced the practice of dam removal. The presentation will also touch on relatively new federal regulatory guidance and how rollout of these guidelines will contribute to and influence the management of sediment at future dam removal sites.

Serena has worked in the river restoration field for 17 years, focusing largely on dam removal planning. As Director of River Restoration at American Rivers (AR), McClain works with regional and national stakeholders to demonstrate how to enhance safety, quality of life and economic development by restoring the natural function of rivers and utilizes her communications and policy expertise to ensure that local communities and key decision-makers are aware of the opportunities available to them and are equipped with the tools necessary to aid them in those decisions. Prior to joining AR, she worked as a consultant developing media and marketing strategies for issue-oriented campaigns.

MUSSEL POWER, RESTORING FRESHWATER MUSSELS IN THE ANACOSTIA RIVER

Jorge Bogantes Montero; jmontero@anacostiaws.org; Anacostia Watershed Society

The Anacostia Watershed Society's (AWS) freshwater mussel restoration project is a pioneer effort to help increase the biofiltration capacity of the aquatic ecosystems in the tidal Anacostia River. This project is laying the groundwork for future mussel restoration efforts by determining the most suitable habitats and the feasibility of scaling up further mussel propagation efforts in the river. With the "Mussels in the Classroom" pilot project, AWS will engage 250 school students in a hands-on education experience during which students will learn the significant role of freshwater mussels in improving water quality and will take action to restore the mussel communities in the Anacostia River. Because mussels filter sediments and nutrients from the water column, the resulting improved water clarity will enhance submerged aquatic vegetation beds, providing habitat for other bottom dwelling invertebrates, which can support fish populations, including migratory fish species. This project is helping improve the Anacostia River's water quality by deploying more than 5,600 mussels in the river, and educating students and the general public about the larger river's restoration efforts.

Jorge Bogantes Montero is a Natural Resources Specialist at the Anacostia Watershed Society in Bladensburg, MD. He leads ecological restoration efforts on public parklands in the Anacostia River watershed, including wetland restoration, tree plantings, meadow creation, SAV propagation, mussel propagation, wildlife monitoring, and invasive plant management. Mr. Bogantes Montero has a Bachelor's degree in Natural Resource Management and Protection from the Universidad Estatal a Distancia in San Jose, Costa Rica, his native country. Before moving to the U.S., Jorge worked in Costa Rica on tropical biodiversity conservation.

TEMPORAL DYNAMICS IN CHLORIDE CONCENTRATIONS VIA HIGH-FREQUENCY CONDUCTIVITY MEASUREMENTS

Joel Moore; joelmoore6@gmail.com; Department of Physics, Astronomy, and Geosciences, Towson University

Coauthor: Rosemary Fanelli, U.S. Geological Survey, Catonsville, Maryland

Increasing chloride concentrations ([Cl]), primarily driven by the deicing salt NaCl, are observed in streams across the northern US, raising concerns about effects on stream ecosystems. Most previous [Cl] studies relied on discrete samples collected on a weekly to yearly basis to quantify long-term [Cl] changes. However, these sampling intervals are insufficient for accurately characterizing exceedences of US EPA aquatic life criteria: a chronic criterion of 230 mg/L based on a 4-day average and an acute criterion of 860 mg/L based on a 1-hour average concentration, neither of which should be exceeded more than once every 3 years. To fill this research gap, we used discrete [Cl] samples and high-frequency (5–15 minute intervals) specific conductivity (SC) data collected at over 20 USGS gaging stations to 1) predict high-frequency [Cl] using SC as a surrogate and 2) quantify patterns in high-frequency [Cl] dynamics with a focus on the mid-Atlantic. Preliminary results indicate the number and duration of events exceeding EPA criteria varied annually but occurred in most years with more frequent and longer duration events in smaller and/or more urban streams. These results improve our understanding of the ecological impacts of deicer applications and will assist managers with designing sampling strategies to quantify [Cl] impacts.

Joel Moore is an Associate 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.

MARINE DEBRIS--PROBLEMS AND SOLUTIONS IN MARYLAND

Donna Morrow; donna.morrow@maryland.gov; Maryland Department of Natural Resources

Coauthor: Kimberly Hernandez, Maryland Department of Natural Resources

This presentation will describe the marine debris crisis from a large scale perspective, down to a Maryland focused perspective. This includes problems ranging from the "great pacific garbage patch" as well as the presence of micro-plastics in the Chesapeake tributaries. After an overview of the scope of the global problem, staff will outline some work currently underway in the mid-Atlantic to address the problem through Maryland DNR (Chesapeake and Coastal Service) and its many partners. The presentation will close with a mention of research needs and a look forward.

Donna is a 20 year veteran of the Department of Natural Resources having led programs related to marinas and the recreational boating industry. Her responsibilities include the Maryland Clean Marina Initiative and the Clean Vessel Act grant program. Most recently she has helped lead the agency's efforts in marine debris reduction strategies in the mid-Atlantic. Donna holds a Bachelor of Arts in Sociology, concentrating in Environmental Studies, and a US Coast Guard captain's license. Her personal love of the water, sailing, and wildlife fuel her passion for implementing strategies for eliminating marine debris.

DC'S RIVERSMART HOMES PROGRAM

Andy Oetman; andrew.oetman@dc.gov; DC Department of Energy and Environment

Washington, D.C.'s RiverSmart Homes program is one of the largest residential green infrastructure programs in the United States. This program provides technical and financial support for District homeowners to install stormwater mitigation features like rain barrels, trees, rain gardens, native plant landscaping, permeable pavement, and green roofs. Since 2009, we have had over 12,000 participants.

How does the program work? Why does the program work? How can this program work in my community?

This presentation will dig into the program details, order of operations, successes, failures, trends, and the future for urban implementation of green infrastructure in DC and beyond.

Andy Oetman has been working in the world of stream restoration and stormwater mitigation since 2008. He is originally from Michigan where he started his career working on Great Lakes issues. He has spent the last 7 years working with DC's Department of Energy and Environment to implement green infrastructure by managing various stormwater incentive programs including the RiverSmart Communities and RiverSmart Homes programs.

SETTING TARGETS FOR URBAN STREAM RESTORATION BASED ON BIOLOGICAL POTENTIAL

Michael Paul; michael.paul@tetratech.com; Tetra Tech Inc., Ecological Sciences

Restoration requires intent. Intent to restore from some current condition to some other condition. Traditional goals include minimally disturbed reference conditions. But is that appropriate for urban streams? If not, what is an appropriate biological condition target and how do we define it? This talk focuses on the theory and application behind the concept of biological potential to define interim targets for the adaptive management of urban stream protection and recovery using existing biological assessment tools. We used a gradient of urbanization in North Carolina to identify biological potential targets for streams and we discuss how that can be used in assessment and restoration. We also developed and applied methods to investigate watershed and reach scale features associated with better than and worse than expected biological conditions in different urban settings that can be used to guide restoration measures for managing urban watersheds to maximize biological potential. The management implications of the biological potential concept beyond restoration will also be discussed.

Dr. Paul is an aquatic ecosystem ecologist with 24 years' experience in the research and management of aquatic ecosystems, especially urban streams. He has provided technical support in assessment and criteria development for more than 35 states, tribes, and federal agencies, has developed instructional materials for and led workshops on assessment, analysis, and criteria development across the nation, and has co-authored EPA guidance on the statistical analysis of bioassessment data, the design, sampling and analysis of bioassessment for large rivers, and the application of stressor-response analysis for nutrient criteria development. He lives with his family in North Carolina.

ECOLOGICAL RESTORATION: WHAT HAVE WE LEARNED?

Dave Penrose; dave@penrose.consulting; Penrose Environmental

Stream ecologists have been collecting data from restoration projects for two decades and as yet the linkages between restoration planning, engineering and ecology is poorly established. In addition, many regulatory agencies and watershed managers have clearly noted that the river's ecological condition must show measurable improvement to be a successful restoration and obtain the maximum number of mitigation credits. How can stream restoration practitioners bridge this gap and improve the ecological functions of stream restoration projects? Can ecological functions such as organic matter retention, or the removal of excessive nutrients and/or sediment improve ecological condition and should these functions be included in the project design or intended goals? Stream ecologists have noted the value of recognizing micro-habitats in streams. Are these concepts being considered in design? We will present some observations and data that should help with guidelines to accomplish this.

Dave retired from the WQ Group at NCSU in 2008. Much of his work there was to assess the ecological recovery of stream restoration projects in NC. Prior to working with NCSU Dave was with the NC Division of Water Quality. He worked with the DWQ as an Environmental Biologist specializing in assessing streams and rivers using aquatic insects as indicators of water quality. Dave has given numerous workshops that deal with the ecology and taxonomy of aquatic insects and intends to remain active in this area. He was elected president of the Society for Freshwater Science (formerly the North American Benthological Society) in 2012.

CITIZEN SCIENCE ON THE SUSQUEHANNA FLATS

Logan Poore; lpoore1994@gmail.com; Havre de Grace Maritime Museum's Environmental Center

The Havre de Grace Environmental Center is located in Havre de Grace, MD, where the Susquehanna River enters the Chesapeake Bay and forms one of the Bay's most valuable resources, the Susquehanna Flats. We believe the Flats is one the most important resources of our region, so when the Bay Program's SAV Workgroup solicited watershed organizations for participation in a citizen-science based SAV monitoring pilot study, we volunteered immediately. The goal of the pilot study was to 1) collect SAV data, 2) determine the practicality of volunteers collecting this type of data, and 3) use the data and experience as a tool for outreach and education. We structured the program to allow our volunteers the ability to collect data at their leisure, which made the study feel less like work. Our volunteers were particularly excited to collect data in the field rather than help with office work and over the course of the study, they gained a real interest in SAV. They began questioning patterns they saw in the data, such as why certain species would dominate specific areas, and it was fascinating to see the project evolve into a real passion for some. Citizen science is becoming recognized as a legitimate form of data collection and in turn, citizen science is changing the way people view volunteering. We look forward to continuing our SAV monitoring program in the Susquehanna Flats.

Logan Poore is a recent graduate of Salisbury University, where he completed his BA in Environmental Science with a minor in GIS. Currently, Logan is employed as the Director of the Havre de Grace Maritime Museum's Environmental Center in Havre de Grace, Maryland. Here, Logan is working to push the Environmental Center forward, through the guidance of their mission statement, which is to: "Inspire and educate residents of, and visitors to, the Lower Susquehanna River and Upper Chesapeake Bay region to appreciate, understand, and protect their natural environment through outdoor, onsite, and online experience, education, exhibits, and support of scientific research."

INTEGRATING COLLECTOR FOR ARCGIS AND SURVEY 123 TO CREATE A CUSTOM, MOBILE DATA COLLECTION TOOL

Alicia Ritzenthaler; aritzenthaler@limno.com; LimnoTech

Coauthors: Heather Bourne, Brad Udvardy, LimnoTech

Imagine your team is conducting a comprehensive assessment of one or more water resources in your jurisdiction. Perhaps you are undertaking stream condition assessments, conducting BMP inventories, or leading a citizen monitoring program. To accomplish this, a robust mobile data collection tool is needed to ensure seamless data integration and uphold the highest standard of QA/QC measures. For one such effort, LimnoTech found that existing 'off the shelf' tools could not address all needs including: interacting with custom map layers, creating new features, conditional programming for attribute collection, the ability to set unique permissions, and integration with existing GIS resources. Pushing the boundaries of existing mobile data collection, LimnoTech customized a mobile data collection tool integrating Collector for ArcGIS and Survey 123 using a URL scheme. This tool allows users to interact with the powerful mapping of Collector while leveraging Survey 123's strong, conditional programming capabilities to populate attributes of new or existing features. Using this tool streamlines effort in the field, reduces post-collection data processing, and drastically improves QA/QC. This presentation will discuss what lead LimnoTech to develop this tool, the advantages it has over existing 'off the shelf' tools, demos the tool, and discuss the variety of possible applications.

Alicia Ritzenthaler joins us from LimnoTech's Mid-Atlantic office in Washington, DC. Her expertise in environmental sampling, monitoring program design, water resource planning, and data management and visualization have been developed working for academic, government, and private stakeholders in the US and abroad. Lending years of field monitoring experience to the task, Alicia is excited to share with us a custom GIS-based, mobile, data collection tool to improve field data collection by streamlining effort in the field and ensuring QAQC measures are upheld.

AN EVALUATION OF FOREST IMPACTS AS COMPARED TO BENEFITS ASSOCIATED WITH STREAM RESTORATION

Ginny Rogers; grogers@versar.com; Versar Inc.

Coauthors: Kevin McGuckin, Martin Berlett, Versar, Inc.; Charles Tonkin, Environmental Research Group; Jennifer Saville, Coastal Resources (formerly Versar Inc.)

While most stream restoration activities in Maryland currently focus on redefining the stream channel and restoring the connection to the floodplain, little attention has been paid to the effects of stream restoration to vegetation communities in the floodplains themselves. Over the past two summers, we have investigated four sites in the Coastal Plain and Piedmont of Maryland to examine the effects of stream restoration on forest community structure and function. At each site, measurements were taken at three different treatments: restoration, reference (as pristine as conditions allow), and control (degraded). Differences in a variety of variables such as diversity, evenness, and richness were examined both amongst sites and amongst treatments. In addition, using functional groups as described in literature, changes in plant community function were also examined. Preliminary results indicate that across location, reference sites do contain more functional groups than either control or restoration sites. Results like these can be used by managers to evaluate whether restoring a stream itself is worth the potential changes to its riparian forest community due to alterations in hydrological regime.

Ms. Rogers received her Bachelor's Degree in Biology from The College of William and Mary in 1996 and her Master's Degree from the Duke University School of the Environment in 1998. She has been involved in the environmental field in Maryland for more than 20 years and is currently a Project Manager at Versar Inc., located in Columbia. She has a diverse background in the environmental field, from all aspects of the Maryland Biological Stream Survey to municipal stormwater (MS4) support. She also supports the Power Plant Research Program in facilitating environmental reviews for the licensing of transmission lines and solar generation facilities.

IS ROOFTOP RUNOFF SAFE FOR GROWING VEGETABLES? EVALUATING WATER QUALITY AND FOOD SAFETY OF ROOFTOP RUNOFF USING A SUBSURFACE IRRIGATION SYSTEM

Rachel Rosenberg Goldstein; rerosenb@umd.edu; University of Maryland - College Park

Coauthor: Claire Hudson, Hood College

Harvested rainwater and rooftop runoff have many benefits as irrigation sources for vegetable gardens, but the quality of these water sources is largely unknown. These water sources are attractive options to reduce water costs and mitigate stormwater runoff. The few studies that exist on harvested rooftop water quality raise concerns about heavy metal contamination. Our pilot study sought to determine the efficiency of garden beds designed to receive rooftop runoff and act a reservoir for sub-irrigation. We explored the system's ability to improve and maintain water quality. The study site is located at a non-profit in Frederick, MD and consists of six vegetable rain garden (VRG) beds: four sub-irrigated from rooftop runoff, and two control raised beds. We evaluated ambient rainwater, first-flush rooftop runoff, sub-irrigation water, soil, and Swiss chard grown in VRG's for total coliforms, E. coli, Enterococcus spp., lead, copper, aluminum, cadmium and zinc. All heavy metals levels were below EPA's recommended water quality criteria for irrigation on all sampling dates. Presumptive E. coli exceeded FSMA standards from first-flush samples on one date. E. coli was detected once on chard. The VRG system has possible environmental and community stewardship benefits: stormwater mitigation, water conservation, and providing community members in food deserts with fresh produce.

Dr. Rachel Goldstein is an Assistant Research Professor at the University of Maryland's College of Agriculture & Natural Resources and the School of Public Health. She is the Extension and outreach co-project director for CONSERVE focused on water reuse in agriculture. She has a PhD and MPH in Environmental Health Sciences from the University of Maryland. Claire Hudson is an instructor in Hood College's biology department and coordinator of the Coastal Studies Program. She is co-founder of the non-profit, The Society for Ocean Sciences. Her passion is for aquatic organisms. Her current research interests include the analysis of cyanotoxins found throughout the food chain of aquatic organisms

VOLUNTEER MONITORING ON THE OCTORARO

Rupert Rossetti; rupertrossetti@gmail.com; Octoraro Watershed Association

The Octoraro is a Piedmont watershed in Lancaster & Chester Counties, PA and Cecil County, MD. The Octoraro Watershed Association and its partners have been conducting monitoring programs for over a decade. The results are being used to identify priority subwatersheds and implement agricultural and urban stormwater projects to improve local water quality. After many years operating with a shoestring budget, coaching and training by the Lancaster Water Quality Volunteer Coalition in 2017 and a recent equipment grant from Lancaster Water Week have enabled the formation of a new volunteer monitoring program in the Octoraro to measure the impact of the installed BMPs.

Rupert Rossetti has a BS in Geology from the University of London. He spent 20 years as an oilfield geologist with Conoco, then 10 years with DuPont as an internal business process consultant. Upon retirement in 2004, he has spent the last 14 years volunteering to protect water quality. Rupert and his wife live on a small farm outside Port Deposit. He is Secretary of the Octoraro Watershed Association and a Volunteer Stream Monitor.

MONITORING DATA HELPING TO PLAN & EVALUATE FUNCTIONAL UPLIFT

Chris Ruck; christopher.ruck@fairfaxcounty.gov; Fairfax County (Virginia) Stormwater Planning Division, Watershed Assessment Branch

Coauthors: LeAnne Astin, Fairfax County Stormwater Planning Division Watershed Assessment Branch; Meghan Fellows, Fairfax County Stormwater Planning Division Watershed Implementation Branch – South; Jonathan Witt, Fairfax County Stormwater Planning Division Watershed Assessment Branch

Data from Fairfax County's (VA) biological monitoring program 2004-2017 are used to evaluate the in-stream community as surrogates for water quality through a locally-derived Benthic Index of Biotic Integrity (B-IBI). Understanding the natural variability of ecological communities helps restoration practitioners and natural resource managers set realistic goals for recovery. An examination of benthic communities related to local landscape and habitat variability is highly influential in benthic community structure and function. As Fairfax County continues to spend over $20 million, annually, on stream restoration project implementation many external factors will hamper the ability to achieve regulatory goals for ecological recovery. In an effort to improve the biological outcomes of stream restorations, County ecologists and urban foresters are consulted regarding community habitat requirements, are incorporated into project teams, and assist with the implementation and monitoring of stream restorations. This discussion summarizes the above factors using Fairfax County stream monitoring data and highlights lessons learned through the incorporation of ecologists and new experimental designs in the stream restoration process.

Chris Ruck is currently the Section Chief for the Stream Monitoring Section of Fairfax County's Watershed Assessment Branch. Chris has a Master's in Environmental Science and Policy from George Mason University. He has monitored and evaluated freshwater ecosystems in the private sector, academia and now in local governmental (at Fairfax County). Since he's no longer chasing kids' soccer balls in the evenings, he has more time to turn rocks in streams and walk past nearby stream restoration projects. Even so, he still enjoys relaxing with a cup of coffee and multivariate statistical analyses.

RESTORING STORM WATER SERVICES TO URBAN SOILS

Stu Schwartz; stu_schwartz@umbc.edu; University of Maryland Baltimore County - Center for Urban Environmental Research and Education

Standard grading and landscaping practices produce an anthropogenic landscape characterized by disturbed compacted soils that limit vegetation success and amplify stormwater runoff. Urban hydrologic response is widely viewed and managed as the product of impervious surface runoff, moderated by infiltration services from the pervious landscape. Yet the hydrologic legacy of modern mass grading and standard construction practices commonly decouples the form and function of urban pervious landscapes. We describe the prevalence of soil compaction in the Baltimore metropolitan area along with field-scale results from compacted urban sites that were renovated with soil decompaction and amendment practices. Vegetation success and hydrologic services can be purposefully restored using sustainable grading practices that integrate urban soil husbandry with mass grading and land transformation. Dramatic (order of magnitude) increases in infiltration rates on urban pervious landuses reflect the dramatic loss of hydrologic function accompanying traditional land transformation practices. Disturbed compacted soil profiles represent a significant overlooked hydrologic legacy in the urban pervious landscape, and a significant opportunity to improve hydrologic design, stormwater management, and restore urban hydrologic function, through the purposeful design of sustainable landscapes.

Stu Schwartz is a Senior Research Scientist at CUERE at UMBC. His research focuses on water resources management, green infrastructure, and urban hydrologic science. Before joining UMBC, he directed the Center for Environmental Science Technology and Policy at Cleveland State University; was Associate Director of the Water Resources Research Institute at the University of North Carolina, and Directed the Section for Cooperative Water Supply Operations (COOP) at the Interstate Commission on the Potomac River Basin.

GLOBAL MONITORING OF FRESH WATER AT HIGH SPATIAL AND TEMPORAL RESOLUTIONS. ASSESSING STREAM AND LAKES HYDROLOGICAL/PHYSICAL FEATURES WITHIN A MACHINE LEARNING FRAMEWORK

Tushar Sethi; tsethi@gmail.com; Go Global GIS LLC

Coauthor: Giuseppe Amatulli, Research Scientist at Yale School of Forestry & Environmental Studies and Yale Center for Research Computing

Lakes and rivers process a significant quantity of freshwater, which is among the most vulnerable resources in nature. The physico-chemical characteristics of each watershed or stream are the result of complex interactions among several environmental variables. These variables regulate discharge regimes and stream profiles, such as rainfall, evapotranspiration, soil infiltration and retention, geomorphology, land use, and snow cover, among others. Current knowledge of stream flow trends in rural areas and developing countries is limited and fragmented, and small streams are often not represented. A full geo-analysis is needed to capture these stream features. Freshwater quantification at high spatial resolution is therefore essential to this aim, and also the first step towards a comprehensive assessment of the global water cycle. The project captures the multi-dimensional aspects of the flow regimes (monthly discharge) and model hydraulics worldwide, using a broad range of 90m geo-datasets and gauging station data in a machine learning framework. This work will be the most comprehensive hydrological model based on a high dimensional data-driven approach able to assess stream network location, width, depth and water flow. The overarching goal of this research is to revolutionize our understanding of the fundamental principles that govern freshwater discharge regimes worldwide.

Tushar Sethi is an environmental technologist with Go Global GIS LLC. His wide-ranging coverage of environmental infrastructure includes water management, waste treatment and materials recovery, and energy from waste and other renewable sources. His expertise ranges from project-specific technology appraisal to high-level policy research for public and private sector stakeholders in energy and natural resource management. Mr. Sethi holds an MSc DIC in Environmental Technology from Imperial College London.

THE PHASE I MS4 MONITORING DATA: PAST, PRESENT, AND FUTURE

Katherine Slater; katherine.slater@maryland.gov; Maryland Department of the Environment

Coauthor: Jeff White, Maryland Department of the Environment

Phase I MS4 counties have been monitoring chemical, physical, habitat and biological conditions at both in-stream and outfall locations since the 1990s. With more than 20 years of monitoring, the MS4 dataset contains more than 97,500 records. The MDE is compiling data and conducting QA/QC. The preliminary results indicate some chemical concentrations have declined over-time in certain watersheds; however, more standardized protocols are required for applying advanced statistics analysis. The counties also have been conducting random biological monitoring since the 2000s. Each county has their unique strengths in the aspects of map scale, site selection methods, revisitation ratio, stratification and rotation strategies. Based on what the State has learned from the permit required monitoring and recognizing the increasing data needs for delisting the biological impaired watersheds, a comparable monitoring design followed by a defensible analysis plan is critical for transforming data into information. MDE is researching the latest survey design and analysis methods while also coordinating with the counties and DNR to enhance cross-pollination. MDE aims to build an MS4 database which allows cross-county evaluation of TMDL progress and informs future Integrated Report assessments, ultimately facilitating data-driven, scientific-based watershed management.

Wencheng (Katherine) Slater is a research statistician working in the Integrated Water Planning Program at the MDE since Nov 2017. Her work focuses on bridging science and policy with latest literature and defensible analysis. She is a PhD candidate in Oceanography at the University of Maryland Collage Park. Her doctorate research is about hypoxia and foodweb interactions in the Chesapeake Bay. Before coming to the MDE, She worked on ecosystem-based fishery management at NOAA as a Knauss Sea Grant Fellow and later as a research associate. She lives with her husband and their 2 years old boy in the Ellicott City.

BIOENERGETICS: A SUPPLEMENTARY APPROACH TO STANDARD METHODS OF STREAM BIOASSESSMENT

Madison Smith; msmith99@students.towson.edu; Towson University

Coauthor: Christopher Salice, Towson University

Urbanization is a prevalent feature of our modern environments, altering stream hydrology via increased stormwater runoff, thus impacting imbedded ecosystems. In the Mid-Atlantic, two key stormwater inputs to streams are organic matter and salt ions, which can lead to disturbances in organism physiology and, ultimately, stream function. A challenge lies in characterizing these disturbances. We are exploring how proportions of macromolecules (lipids, carbohydrates, proteins) may be used to quantify the connection between stressors and disruption of bioenergetic processes. Lipid, protein, and carbohydrate content of Trichoptera hydropsychidae were measured in animals collected from four streams in Baltimore City and County, across an urbanization gradient (0, 1.1, 17.3 & 24.9% impervious surface). Water chemistry data were collected, including conductivity, dissolved organic carbon, total suspended solids, and sediment lipid concentrations. As a comparison, a community assessment was performed according to the EPA rapid bioassessment protocol. Preliminary organismal bioenergetic data show temporal patterns, but clear differences among sites are lacking. Differences in organic matter fluxes during storm events, however, were observed. Ongoing analyses suggest that organismal (and stream) energetic data may provide useful insights into anthropogenic impacts to freshwater streams.

Madison is a graduate research assistant in Dr. Salice's ecotoxicology lab. She plans to complete her master's thesis this spring, after which she hopes to find work as an analytical chemist.

SIMULATED OIL SPILL SHOWS POTENTIAL IMPACT FOR MICROBIAL COMMUNITY IN JONES FALLS

Mychala Snead; msnead2@stevenson.edu; Stevenson University, Department of Biological Sciences

Coauthors: Karleigh Baldwin, Xena Sorto, Sergut Admasu, Madison Socks, and Kim Pause Tucker, Stevenson University, Department of Biological Sciences

In December 2017, a heating oil spill of over 3000 gallons resulted in contamination of soil and water in the Jones Falls (Baltimore City). Similar events involving oil are becoming more common and show a need to research the effects of hydrocarbon pollution. Prior research demonstrated that bacterial communities from the Jones Falls exhibited enhanced growth and metabolic response after exposure to used motor oil. We simulated an oil spill by growing sediment bacteria from the Jones Falls on oil-enriched agar. After incubation, colonies that grew on the enriched agar were isolated and characterized. Through 16s rDNA sequencing, three different bacterial genera (Pseudomonas, Acinetobacter, Bacillus) had been isolated. We observed the growth and metabolism of three Pseudomonas species in response to oil, and observed no distinct differences in their growth and metabolism. Pseudomonas species also represented a majority of the microbial community from the simulation. The recent winter oil spill presented an opportunity to examine the impacts of a real oil spill. Current research is focusing on culture-independent analysis through metagenomic sequencing of the surface water at 1 mile downstream of the oil spill location for the day of the spill and subsequent months. These data will provide insight into the ecological impacts of oil pollution on an impacted urban stream.

Mychala Snead is a senior biology major and English minor at Stevenson University. As a December graduate, she looks forward to completing this two-year project on the effects of oil on microbial communities with her mentor Dr. Kimberly Tucker. Mychala was the 2017 MWMC student poster first prize winner. After graduating, she hopes to continue researching the effects of pollution on microbial communities.

EUTROPHICATION STATUS AND EXPECTATIONS FOR RECOVERY OF THE ANACOSTIA RIVER

Caroline M. Solomon; caroline.solomon@gallaudet.edu; Gallaudet University

Coauthors: Melanie Jackson, Patricia M. Glibert, University of Maryland Center for Environmental Science

The Anacostia River is among the most polluted tributaries in Chesapeake Bay. However, there have been concerted efforts to improve the ecosystem health of the river in the past few years. One such effort has been the implementation of the first phase of a series of tunnels in March 2018 that will retain and divert sewage and storm water effluent. In order to better understand the potential impact of such restoration efforts, we present data from five years prior to implementation that show distribution patterns in both phytoplankton communities and nutrient (nitrogen & phosphorus) concentrations and relationships to amount of flow into the Anacostia River. The change in composition of the nitrogen pool from mostly nitrate at the upper sites to ammonium at the confluence of the Anacostia and Potomac Rivers is associated with a shift of diatoms to chlorophytes and cyanobacteria as indicated by both pigment and 16/18S analyses. Based on these patterns, it is predicted that diversion of water and its associated nutrients will lead to an improvement in water quality leading to a change in the community composition of phytoplankton species.

Both a faculty member at Gallaudet University and an adjunct at the University of Maryland Center for Environmental Science, Dr. Caroline Solomon serves on masters and doctoral committees for research on increasing participation of deaf and hard of hearing people in STEM and estuarine science especially in the areas of nutrient and microbial dynamics. Her current research focus is on the Anacostia River, but she has studied urea dynamics in other parts of the Chesapeake Bay. She is also very active in initiatives that promote participation of deaf and hard of hearing people including sign language science lexicon, workshops, and involving students in her research projects.

CHESAPEAKE BAY SAV WATCHERS: HIGHLIGHTS FROM THE NEW VOLUNTEER MONITORING PROGRAM

Suzi Spitzer; sspitzer@umces.edu; University of Maryland Center for Environmental Science- Integration & Application Network

Coauthor: Katie May Laumann, University of Maryland Center for Environmental Science- Integration & Application Network

Submerged aquatic vegetation (SAV) provides many essential ecosystem services in the Chesapeake Bay and serves as an indicator for environmental change and overall ecosystem health. Currently, SAV monitoring data helps to inform Bay policy and management decisions, but there is a persistent need for additional SAV monitoring in order to ground-truth annual aerial surveys of seagrass meadows and collect other important data related to seagrass growth and species distribution. We worked with Chesapeake SAV experts and volunteer monitoring coordinators to co-develop a two-tiered standardized monitoring protocol and training program for citizen scientists that is designed to generate maximally useful data for professional scientists while also providing an engaging and educational experience for volunteers with varying interests and abilities. This session will unveil features of the new monitoring protocol for citizen scientists and will highlight several resources offered through the training and certification program, such as the methods manual, sampling guidebook, and training videos. The new program will provide an avenue for citizen scientists to engage with their environment and with a broader community of SAV volunteer monitors, and will support collaborative efforts to monitor and protect seagrass growth and contribute towards improving overall Bay health.

Both of the speakers work at the Integration & Application Network in Annapolis, within the University of Maryland Center for Environmental Science. Suzi Spitzer is a PhD student in the Marine Estuarine Environmental Sciences Graduate Program. Her dissertation research investigates how community engagement and science communication can facilitate collaborative learning between scientists and the public within the context of citizen science. Katie May Laumann is a Science Integrator. She has a PhD from the College of William and Mary, where she researched biodiversity in the Chesapeake Bay and fish phylogenetics. She previously worked as a fisheries manager for the state of Virginia.

USE MY DATA! TOWARDS A MUTUAL UNDERSTANDING BETWEEN DATA COLLECTORS AND THE DATA NEEDS OF DATA USERS ACROSS THE CHESAPEAKE BAY PROGRAM PARTNERSHIP

Peter Tango; ptango@chesapeakebay.net; U.S. Geological Survey Chesapeake Bay Program Office

There are hundreds of volunteer groups, in addition to academic institutions, local, state and federal agencies, interstate agencies and non-governmental organizations that are active in environmental monitoring across the Chesapeake Bay watershed. Regionally, groups, agencies and institutions are frequently interested in seeing their water quality data collections further used in research or regulatory assessments. Misaligned protocols and sampling procedures, insufficient documentation of activities or lack of quality assurance rigor are examples of historical hurdles the groups have encountered in having their data used for analysis and decision-support. The USEPA supported Chesapeake Bay Monitoring Cooperative (CMC) was established to provide support to volunteer and nontraditional monitoring partner community efforts by creating a platform for data collection and delivery with established levels of integrity. Further, groups organizing data collections may use project outlines to help guide their efforts so that sampling approach, sampling efforts, and the level of analysis needed for certain applications are better aligned with expectations of the data collector and the targeted data user. Examples will be provided as well as opportunities for volunteer programs to consider in extending the use of their data by the Chesapeake Bay Program partnership.

Peter was hooked on science since a 5th grade teacher inspired him to start a birding life list (1976). A passion for science work, and maintaining the birding life list, continue through today. Peter's degree work in forest biology (BS), wildlife science (MS) and fisheries management (PhD) supports his position with USGS as Chesapeake Bay Monitoring Coordinator. Serving the Chesapeake Bay Program partnership (CBP), Peter's position also involves serving additional coordinator and workgroup roles for CBP. Running, fishing, hunting, hiking and biking can all help round out the hours in a day and keep life full of good health and fitness, lots of wonder, and plenty of outdoor adventures.

FROM STREETS TO STREAMS TO THE CHESAPEAKE: REDUCING AND TRACKING PLASTIC POLLUTION

Mark Trice; mark.trice@maryland.gov; Maryland Department of Natural Resources

Coauthors: Julie Lawson, Mayor's Office of the Clean City - District of Columbia; Chelsea Rochman, University of Toronto

Evidence is a powerful policy driver. Preliminary results of a 2015 Chesapeake Bay microplastics study will be presented. Water samples were collected from wastewater outflows, tributaries with a high density of plasticulture farming, stormwater runoff and ambient conditions to determine the concentration and types of microplastics from each regime. Oysters were also collected to determine if microplastics are assimilating into bay organisms. Results will be used to determine the extent of aquatic microplastic pollution in the bay and guide future management decisions. The Chesapeake Bay Trash Trawl and data from Anacostia River trash traps have led to significant legislative victories in Maryland and DC in recent years, and prompted greater public awareness of the environmental impact of plastics and litter. Nonprofits and government are now using social science to drive further policy and program changes to bring these benefits to neighborhoods, improving quality of life and environmental outcomes.

This talk will be a dual presentation by Mark Trice and Julie Lawson.

Mark Trice directs the Maryland Department of Natural Resources Water Quality Informatics (WQI) program which oversees tidal monitoring programs, water quality data management/QA, and the Eyes on the Bay (www.eyesonthebay.net) website.

Julie Lawson is an environmental professional and education advocate in Washington, DC, currently serving as Director of the Office of the Clean City under Mayor Muriel Bowser.

Dr. Chelsea Rochman is an Assistant Professor in the Department of Ecology and Evolutionary Biology at the University of Toronto whose research investigates the sources, fate and ecological implications of anthropogenic pollutants in aquatic ecosystems.

CLEAN WATER COMMUNICATIONS

Chris Trumbauer; chris@thehatchergroup.com; The Hatcher Group

Coauthor: Rona Kobell, Maryland Sea Grant

Science and data isn't enough to make policy change. This talk will discuss how to develop campaigns, strategic communications and policymaker outreach efforts around clean water topics.

Chris Trumbauer is a Vice President at The Hatcher Group and works with a diverse range of nonprofit organizations and coalitions working on sustainability, clean water and conservation issues. Before joining The Hatcher Group, Chris was the executive director of West/Rhode Riverkeeper, Inc., where he developed new public outreach initiatives and began producing and publicizing annual river report cards. Chris served on the Anne Arundel Council Council from 2010-2018 and on the Maryland Critical Areas Commission and Smart Growth America's Maryland Local Leaders Advisory Board. He is a graduate of the University of Maryland, College Park.

AN EVALUATION OF THE PHYSICOCHEMICAL PROPERTIES OF POOL AND RIFFLE FEATURES CREATED DURING APPLICATION OF REGENERATIVE STREAM RESTORATION APPROACHES IN PERENNIAL STREAM SYSTEMS

Christopher J. Victoria; pwvict16@aacounty.org; Anne Arundel County Watershed Protection and Restoration Program

Coauthors: Rachel Denby, Bryan Perry, Anne Arundel County Watershed Protection and Restoration Program

Regenerative stream restoration is one watershed restoration technique extensively employed by the County. This approach typically results in large pool areas created within the reach of interest, with the overall character of the stream reach changed from an entrenched, free flowing single thread system to more of a wetland complex with little or no entrenchment and enhanced connection with surrounding floodplain areas. However, some potential drawbacks with this practice have been anecdotally identified. These include depressed dissolved oxygen levels and elevated stream temperatures, particularly in the summer months. Measurements of pH (SU), specific conductance (µS/cm), dissolved oxygen (mg/L), and temperature (°C) were performed in randomly selected riffles and pools at six restored stream reaches and at one unrestored reference stream weekly for one year. Excluding seasonal variability, little difference was observed in stream temperature over the study period among, but some differences in dissolved oxygen, specific conductance, and pH were observed. In particular, specific conductance was elevated in all restored sites compared with the unrestored reference reach. Additional assessment work may be necessary to determine the underlying causes of the observed differences.

Chris is an Environmental Scientist with Anne Arundel County's Watershed Protection and Restoration Program. His interests include riparian area ecology and the relationships between biological health and stream channel physical conditions. He has a B.S. degree in Biological Sciences from Florida State University and has worked in the Chesapeake Bay watershed for both government agencies and in the private sector over his 25 year career.

PUTTING THE BAND TOGETHER: CITIZEN SCIENTISTS ARE THE ROCK STARS OF THE MONITORING WORLD

Beth Wasden; bethwasden@nanticokeriver.org; Nanticoke Watershed Alliance

With staff support, program partners, and adequate resources, well-trained citizen scientists like the Nanticoke Creekwatchers provide high-quality, long-term data and increase the capacity of organizations and staff and the work that they do. Go behind the citizen science, and learn how to create and manage a long-term, stadium-worthy water monitoring program.

Beth Wasden isn't a rock star but played one in Rock Band a few years ago. However, she's been managing the Nanticoke Watershed Alliance's Nanticoke Creekwatchers Program for eight years. During that time, the program has won both Delaware and Maryland Governor's Volunteer Awards and has received Tier 3 status under the Chesapeake Bay Program through the Chesapeake Monitoring Cooperative. Before that, she worked as a Volunteer Coordinator at Pickering Creek Audubon Center and at Delaware State Parks.

IMPACTS OF DAM REMOVALS ON BENTHIC MACROINVERTEBRATE ASSEMBLAGES IN THE PATAPSCO RIVER, MARYLAND

Jonathan Watson; jonathan.watson@maryland.gov; Maryland Department of Natural Resources

Coauthors: William Harbold, Scott Stranko, Maryland Department of Natural Resources

Dam removal is becoming an increasingly common approach to address issues of aquatic connectivity and dam safety. In many cases, the responses of benthic macroinvertebrate assemblages are dictated by factors specific to the study system (e.g., stream order). Dam removal in the Patapsco River began in 2010 with the removal of Simkins Dam, which resulted in mobilization of sediment to downstream areas and uncovering natural river bottom substrates upstream. In 2018, the removal of Bloede Dam was initiated and subsequent sediment mobilization has been observed. Maryland DNR has used D-nets to collect benthic macroinvertebrates from productive substrates (e.g., riffles) at > 15 sites in the mainstem river from 2009 – 2018. After Simkins Dam was removed, EPT taxa richness increased in the former impoundment while the percent of burrowing taxa exhibited various peaks downstream. In 2016, we also began collecting samples at a subset of six transects using a Hess sampler placed in habitats that were representative of the dominant substrate in each respective site. These data suggest that benthic macroinvertebrate assemblages at sites with faster flows exhibited higher organism density and lower inter-annual variability. Overall, these data provide valuable insight to longer-term (> 5 years) responses of benthic macroinvertebrates to dam removal in this river and in other systems.

Jonathan is a biologist with the Maryland Department of Natural Resources where, among other things, he studies the effects of dam removal and stream restoration projects on aquatic biota.

CITIZEN STEWARDSHIP INDICATOR: BEHAVIORS, TRENDS AND HOW TO USE THEM FOR GOOD.

Kacey Wetzel; kwetzel@cbtrust.org; Chesapeake Bay Trust

Coauthor: Suzanne Etgen, Watershed Stewards Academy

18 million people live in the Bay watershed. 18 million people take actions each day that positively and negatively affect the health of the Bay. To reach our Bay restoration goals, we MUST obtain the partnership of the residents of the watershed. The Chesapeake Bay Program has responded to that need by creating the Citizen Stewardship Indicator, which measures individual stewardship behaviors of residents across the Bay Watershed. This data set not only tracks and measures progress toward increasing the positive actions of individuals, it can also help us to create more effective outreach programs that really do change polluting behaviors. Citizen Stewardship Goal Team co-chairs, Kacey Wetzel and Suzanne Etgen will unpack this tremendous body of research and explore the social science implications of using it to target and change behaviors.

Suzanne Kilby Etgen is the founding Executive Director of the Anne Arundel County Watershed Stewards Academy (WSA) . Suzanne holds a BS in Environmental Science and a MA in Religion and Ecology. Suzanne is also a trained Community Based Social Marketing Technical Assistance Provider, assisting Stewards and organizations in the development of campaigns to change polluting behaviors. Suzanne has participated in water quality monitoring efforts (chemical and macro invertebrate surveys), instructed restoration education programs, directed environmental summer camps, served as Arlington Echo's apiarist (bee keeper) and instructed low ropes team building instructor certification course.

"FAKE NEWS": CONFESSIONS OF AN ENDANGERED JOURNALIST

Tim Wheeler; twheeler@bayjournal.com; The Bay Journal

Is the Chesapeake really getting better? What will a restored Bay look like? Can it stay that way? Tim Wheeler has wrestled with those questions and many more over 44 years as a journalist, the better part of it spent reporting on and editing news and features on environmental topics. And it all began because of two words: "plastics" and "oysters." To him, what we're doing to the Earth – including the Bay -- is the biggest story any journalist could hope to cover, one that spans every facet of public policy and private life. It's also one of the most challenging stories possible – on the environment beat, news oozes rather than breaks or bleeds. And it's gotten harder to cover, as newsrooms shrink, and as manipulation of the media and public mistrust of journalists grows. But it's essential that someone stay on the story and demand answers to those and other tough questions – because the answers will determine what kind of world our children and grandchildren will inherit.

Tim Wheeler has covered the Chesapeake Bay and other environmental issues for most of his career, including nearly 32 years with the Baltimore Sun and Evening Sun. He's a former president of the Society of Environmental Journalists and has won numerous awards, including the 2010 Excellence in Journalism Award from the Renewable Natural Resources Foundation. A native of West Virginia, he grew up eating oysters and followed his taste buds to the Bay. He began his career at the Richmond Times-Dispatch, then worked for a regional news service in Washington, D.C. After that, he moved still closer to the Bay, reporting for the Norfolk Virginian-Pilot and Ledger-Star, and finally to Maryland. He earned a B.A from the University of Virginia and a master's in journalism from Columbia University.

EMERGING CONTAMINANTS IN PENNSYLVANIA

Amy Williams; amywilli@pa.gov; Pennsylvania Department of Environmental Protection

Pennsylvania Department of Environmental Protection (DEP) has undertaken sampling of many emerging contaminants, including endocrine disrupting compounds (EDCs), throughout the state. Sampling began in 2012 with four sites of total estrogenicity samples and continued from 2013 to present, expanding through the years to 27 sites per season in 2018. These 27 sites are sampled with passive water samplers called polar organic chemical integrative samplers (POCIS) and semipermeable membrane devices (SPMDs). Compounds sampled include hormones, total estrogenicity, pharmaceuticals, pesticides, wastewater compounds, polycyclic aromatic hydrocarbons (PAHs), and poly-brominated diphenyl ethers (PBDEs). In addition, sediment has been tested at many sites for hormones, wastewater compounds, and pesticides. Water grab samples are analyzed for pesticides and total estrogenicity, or compounds likely to act as hormones and affect estrogen-receptors. Approximately 70 sites have been tested for one or more of the chemical suites and matrices listed above. Compounds are ubiquitous throughout the state. The hope is that the extensive sampling with years of data will help explain patterns at sites, upstream versus downstream targeted areas, and overall presence and concentrations of these compounds.

Amy Williams is a Water Program Specialist with the Department of Environmental Protection in the Bureau of Clean Water, Division of Water Quality, Assessment Section. She is involved with Pennsylvania's biannual 303(d)/305(b) report, emerging contaminant sampling, data analysis, protocol development, and a host of other activities. Amy interned at the Department on two separate occasions, working with Vector Management and wetlands. She became employed by the Department full time in 2007 after graduating from Shippensburg University with a B.S. in Geoenvironmental Studies and an M.S. in Biology.

SOUTH RIVER FEDERATION WATER QUALITY MONITORING APP

Emily Wiggans; ewiggans@chesapeakeconservancy.org; Chesapeake Conservancy

Coauthors: Michael Norton, Colin Steif, Chesapeake Conservancy

In the past year, the Chesapeake Conservancy's Conservation Innovation Center developed a web-based Data Map in partnership with the South River Federation (SRF). The SRF is an alliance of individuals and civic and community associations dedicated to protect, preserve, restore and celebrate the South River Watershed. As part of SRF's efforts to monitor water quality within the South River, they have prepared almost 10 years of water monitoring data for public consumption in the Data Map. Available data includes water clarity, dissolved oxygen, and bacterial readings from over 20 sampling points dating back to 2010. The Data Map helps translate quantitative scientific measurements of water quality to relatable questions about the health of the South River: Is it safe to swim in? Can fish breathe? How clear is it? The Data Map illustrates the health of the river by indicating the sampling location and color-coding the site's condition so that residents can be advised as to the health of sites throughout the watershed. The Data Map highlights restoration projects in the South River catchment, ranging from tiny rain gardens to multi-million dollar stream restorations. The SRF's Data Map will be regularly updated into the future, and is one piece of the Conservancy's ongoing commitment to improving the access and usability of citizen water monitoring data. https://southriverdata.net

Emily Wiggans is a Geospatial Analyst at the Chesapeake Conservancy. As part of the Conservancy's Conservation Innovation Center, she is working to make citizen-science water quality data more impactful and readily available by leveraging the Conservancy's land cover data and web development tools. She utilizes her remote sensing skills to enable partners to work more cost-effectively to protect and restore land and water resources throughout the Chesapeake Bay Watershed. She holds a Bachelor's Degree in Environmental Science, with a concentration in Water Resources, from the University of Vermont.

USING VOLUNTEER MONITORING DATA TO GUIDE MANAGEMENT DECISIONS FOR URBAN STREAMS

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

Coauthor: Mike Kolian, Audubon Naturalist Society

Since the early 1990s, the Audubon Naturalist Society has sponsored a volunteer monitoring program in Washington, DC, and its Maryland suburbs. Monitors collect and identify benthic macroinvertebrates to the taxonomic level of family, then enter their data into the Maryland Stream Waders family-level benthic index of biotic integrity (BIBI) to calculate stream health scores. They also conduct habitat assessment surveys and record narrative observations. Although many urban streams rate "poor", trends can be discerned by looking more closely at taxa richness, appearance or disappearance of aquatic families, presence or absence of intolerant taxa, and proportionate changes in the benthic community over time. A study of three small tributaries of Rock Creek in Washington, DC, shows that family-level monitoring data, coupled with information from habitat assessment surveys and monitors' observations, can be used to guide stream management decisions.

Cathy Wiss is the coordinator of the Audubon Naturalist Society's Water Quality Monitoring Program. She has monitored with the program since 1997. Cathy holds a JD from Catholic University Law School, a BA from Smith College, and a certificate in Natural History Field Studies from the Graduate School USA.

Mike Kolian has been a volunteer with the ANS monitoring program since 1999. During this time he has monitored two streams in Washington, DC, including Normanstone Run, where he is the current team leader. When not monitoring, Mike is an environmental scientist at the US Environmental Protection Agency's Office of Atmospheric Programs, where he has worked for over 17 years.

ENGAGING STUDENTS IN STORMWATER SCIENCE

Danielle Wynne; danielle.wynne@fairfaxcounty.gov; Fairfax County, Virginia Stormwater Management

This presentation will focus on creating and growing meaningful partnerships between local government and local school systems. Through examples of successful programs and overcoming some roadblocks along the way, attendees will be introduced to more than a decade's worth of award-winning partnership programs between Fairfax County, VA Stormwater scientists and Fairfax County Public School.

Danielle Wynne has been an ecologist with Fairfax County, VA Stormwater Management since 2002. Ms. Wynne has an undergraduate degree in Biology and Master's degree in Environmental Science and Public Policy from George Mason University. Her duties include stream insect and fish surveys, bacteria sampling and field assessments of habitat and water quality. Ms. Wynne has a passion for working with students and teachers to help promote the importance of stormwater management and clean water. Ms. Wynne has worked with thousands of students and looks forward to educating many thousands more.

Poster Abstracts

CREATING A SUSTAINABLE VOLUNTEER MONITORING PROGRAM AND INTERPRETING HEALTH RESULTS: AN ANACOSTIA RIVER CASE STUDY

Olivia Anderson; olivia@anacostiariverkeeper.org; Anacostia Riverkeeper

Coauthors: Trey Sherard, Robbie O'Donnell, Ben Turner, Anacostia Riverkeeper

Citizen monitoring has become increasingly important for community engagement and sampling over a wide area in a limited amount of time. Anacostia Riverkeeper and partners have been navigating the route to develop a sustainable citizen monitoring program on the Anacostia River and across the District of Columbia for E. coli and other primary contact standards criteria. Assessing community resources and other well-run citizen monitoring program are key to help recognize community partners, volunteer bases, and best practices for communication and constructing quality assurance plans. In addition to building the program, interpreting the health information with geospatial variations of data through visual displays of data and multiple public websites is crucial for delivering accessible public information effectively. This is necessary to efficiently communicate scientific findings and engage community members. Community engagement leads to community investment, which is increasingly important for urban and historically neglected waterways. These skills can be taken and applied in multiple watershed areas, facilitating a large impact monitoring multiple sites, even if with a small staff team. The growing importance of community involvement tied with widespread monitoring is a crucial skill to be able to expand citizens science.

RE-DISCOVERY OF A POPULATION OF YELLOW LANCE IN THE HAWLINGS RIVER

Matt Ashton; matthew.ashton@maryland.gov; Maryland Department of Natural Resources

Coauthors: Megan Davis, Chesapeake Conservation Corps; Jackie Sivalia, James McCann, Maryland Department of Natural Resources

The Yellow Lance (*Elliptio lanceolata*) was listed by the U.S. Fish and Wildlife Service as federally threatened under the Endangered Species Act in April of 2018. In Maryland, the species was historically known from a handful of locations, including the Hawlings River, Patuxent River, and Potomac River, although the validity of some records had been questioned due to taxonomic ambiguity. In 2015, a specimen that was confirmed by independent authorities as Yellow Lance was found in the Hawlings River by Montgomery County Department of Environmental Protection Biologists. During a federal assessment of the species' status, we confirmed the validity of natural history museum specimens of Yellow Lance that were collected from the Hawlings and Patuxent rivers between 1908 and 1952. In 2018, surveys to assess the species' abundance and range in Maryland were funded by USFWS. We sampled 32 sites in the Hawlings River within habitat visually assessed to be suitable. We detected 23 Yellow Lance at 14 sites over 6.15 river kilometers. Additionally, we found other rare mussels to be relatively abundant in the middle portion of the watershed. Currently, the Yellow Lance population is known from the confluence with the Patuxent River to upstream of Brighton Dam Road. Additional surveys are needed to refine the upstream extent of distribution and population size in the Hawlings River and its status in the Patuxent River. Coordination with state and local partners will be key to the conservation of Yellow Lance and mussel populations as a whole in the Hawlings River since a majority of the riparian and stream habitat is publically owned.

<STUDENT POSTER> VOLUNTEERS WELCOME! MONITORING IRVINE NATURE CENTER'S RESTORED WETLAND

Karleigh Baldwin; kbaldwin3@stevenson.edu; Stevenson University

Coauthors: Marissa Hoffman, Natalie Johnson, Taylor Long, Gillian Nutter, Julianne Parker, Colby Stein, Stevenson University; Courtney Sagal, Rob Mardiney, Brooks Paternotte, Irvine Nature Center; and Kim Pause Tucker, Stevenson University

Irvine Nature Center, a private not-for-profit nature reserve in Baltimore County, recently restored approximately 60 acres of wetlands on their property near the headwaters of the Jones Falls. The restored streams and wetland hydrology facilitated diverting stormflow and reducing sediment and nutrient loading. In addition, more than 2,100 species were planted and seeded to reestablish a diverse wetland. Efforts to monitor these wetlands over time will be conducted by Irvine's staff, volunteers, and citizen scientists. To facilitate these continued monitoring efforts, Stevenson University students have developed and tested volunteer-friendly monitoring protocols specific to the sites as part of a Service-Learning course. An initial survey of the biodiversity found that many organisms are utilizing the restored habitat including bluegills, tadpoles and frogs, damselflies, dragonflies, and other various aquatic insects. In addition to the biodiversity survey, the products of the course included an interactive field guide on iNaturalist, a printed field guide, and protocols for volunteers.

<STUDENT POSTER> SUSPENDED AND DISSOLVED NUTRIENT LOAD IN FLOODPLAIN STREAM RESTORATION STREAMS AT BASEFLOW IN BALTIMORE AND HARFORD COUNTY

Luke Barragan; lbarra2@students.towson.edu; Towson University Geosciences

Coauthors: Patrick McMahon, Virginia Jeppi, Vanessa Beauchamp, Joel Moore, Towson University

A portion of sediment load is bound to nutrients, sediment and nutrient abundance impact the viability of fluvial and estuarine ecosystems. Agricultural land use and construction can overload streams with sediment. The relationship between suspended and dissolved nutrient load was studied following floodplain reconnection stream restoration. The effectiveness of floodplain reconnection projects is determined by their ability to reduce the export of sediment and nutrients, mostly nitrogen and phosphorus. From 2016-2018, monthly samples were collected for analysis of dissolved concentrations and total suspended sediments (TSS) at points upstream and downstream of floodplain reconnection restoration projects at three streams in Baltimore and Harford counties. The impervious surface cover of watersheds varied from 1.3% to 56.4% along a rural to urban gradient. Nitrogen (N) and carbon (C) concentrations in TSS was measured using an Elementar Vario EL III CHNOS Elemental Analyzer. Based on preliminary results, N and C concentrations were less than 0.3% and 5%, respectively. N and C varied somewhat between sites with lower concentrations for the suburban site than the agricultural and more urban sites. These results indicate that both the concentration and flux of TSS will play a role in export of nutrients in particulate form.

<STUDENT POSTER> INCREASING ENVIRONMENTAL REALISM: *DAPHNIA MAGNA* TOXICITY TESTS WITH LOCALLY RELEVANT STRESSORS AND RESOURCE ENVIRONMENTS

Madelin Barry; mbarry7@students.towson.edu; Towson University

Coauthors: Amanda Isabella, Andrew East, Christopher Salice, Towson University

Test species like *Daphnia magna* are used to assess ecological effects of chemicals in freshwater systems. Standard toxicity protocols for *D. magna* evaluate one stressor at a time with unfed animals. These conditions, however, are ecologically unrealistic and, therefore, lack environmental relevance. Resources, for example, are generally available in many freshwater systems and are likely to drastically alter toxicity. Additionally, organisms are more likely to be exposed to chemical mixtures as opposed to a single stressor in isolation. Pyraclostrobin and sodium chloride are important anthropogenic chemical stressors because pyraclostrobin is a fungicide commonly found in agricultural runoff and rising salinity is an increasing issue statewide. The goal of the current study was to explore the combined impacts of these chemical stressors using a full factorial design, in which *D. magna* were exposed to binary mixtures under differing resource levels. The toxic effects of pyraclostrobin were increased in the presence of sodium chloride. Interestingly, for both chemicals toxicity was substantially decreased when food was available. The results indicate that the ecological complexities common to actual habitats should be taken into account when assessing chemical impacts to Maryland waterways.

THE ELEVENTH ANNUAL MARYLAND STREAMS ROUNDTABLE

Andy Becker; andy.becker@kci.com; KCI Technologies, Inc.

Coauthor: Dan Boward; Maryland Department of Natural Resources

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. Fifty-eight people attended the 11th Annual Maryland Streams Roundtable that was held at the USGS Water Science Center on February 23, 2018. Twenty people gave 10-minute presentations on their sampling programs. Included were Federal agencies, state agencies, local/regional agencies, academia, consultants, and NGOs. Eleven groups submitted 2018 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.

<STUDENT POSTER> LONG TERM MONITORING OF A HOWARD COMMUNITY COLLEGE CAMPUS STREAM

Caitlin Beckjord; cbeckjord@howardcc.edu; Howard Community College

Coauthors: Jennifer Kling, Dr. William Straube, Howard Community College.

Streams located on Howard Community College campus (HCC) were monitored during the Fall 2017 and Spring 2018 semesters. The purpose of this study was to better understand the impacts of anthropogenic activities on the health of fresh water streams in Howard County. Turbidity, dissolved oxygen, pH, conductivity, nitrate, phosphate, air and water temperatures were tested in the field weekly. The data collected were compared to previous Maryland Stream Waders and Department of Natural Resources data, all of which had been collected near HCC and elsewhere in Howard County. Nitrate and phosphate were slightly elevated upstream, but lower downstream. Conductivity levels in campus streams, which are mainly fed by parking lot runoff, were found to be extremely elevated, with a yearly average of 2268 μS/cm. Additionally, all measured conductivity levels were higher than sites previously tested by the Stream Waders. This suggests high levels of local anthropogenic inputs, possibly due to road salt use or calcium dissolved from concrete surfaces. Overall, Howard County streams have been rated as "very poor" by the Department of Natural Resources Stream Waders program, but are now trending towards being rated as "poor." Research is ongoing to identify the polluting ions and their source.

URBAN STREAM RESTORATION: MATERIAL PROCESSING AND CONVEYANCE CHANNELS

Maddie Berg; bergmr@jmu.edu; James Madison University

Stream restoration is gaining popularity in the Mid - Atlantic region to offset impacts from urbanization, such as increased levels of impervious surfaces and decreased vegetation along stream banks, changing the flow patterns of the water. Due to these changes urban stream systems have high erosion rates resulting in increased nutrients into the Chesapeake Bay. Different restoration practices such as conveyance and material processing channels can play a role in the amount of nutrients leaving streams. Conveyance channels are constructed to protect existing utility and infrastructure placed adjacent streams from erosion. This practice prioritizes channel stability and may result in reduced other stream functions (e.g., nutrient uptake). Material processing channel design techniques developed after the use of wood in Pacific Northwest restoration. These streams work to meet the Total Maximum Daily Load levels while providing fish and wildlife habitat and supporting a reduction of instream energy and associated erosion. They work to retain nutrients, sediment, and organic matter raising the water level, connecting it with the floodplain. This study evaluated these two restoration practices in terms of macroinvertebrate diversity and abundance as well as organic retention to help professionals and citizens gain awareness for the different restoration practices.

JUG BAY CITIZEN SCIENCE: WATER QUALITY ANALYIS OF THREE STREAMS

Jeffrey Campbell; jcampbell@environmentalinformatics.com; Jug Bay Wetlands Sanctuary

Coauthors: Robert Smith, Peter Uimonen, Kim Elliott, David Davis, Patricia Delgado, Jug Bay Wetlands Sanctuary

Citizen scientists collected water quality and nutrient data in the three streams that flow through Jug Bay Wetlands Sanctuary (JBWS) into the tidal freshwater estuary on the Patuxent River in southern Anne Arundel County. Long-term monitoring of stream water quality started in the mid 1980s, but the current monitoring protocol, and the source of this analysis, was implemented in 2010. This protocol collects samples at two main points along the stream: (1) where the streams enter JBWS (upstream), which represents water quality from the watershed; and (2) downstream above the head of tide, which represents the water quality after the natural processes occurring within the Sanctuary. Observations were made monthly and include dissolved oxygen, pH, conductivity, turbidity, phosphorus, and nitrogen. The results of this preliminary analysis of 2010-2017 data identify trends and potential changes in the water quality in the watersheds upstream and within the natural area, as well as differences among the streams.

ILLICIT DISCHARGE DETECTION AND MONITORING METHODOLOGY

Julie Chang; julie@ridgetoreefs.org; Ridge to Reefs

Coauthor: Paul Sturm, Ridge to Reefs

This poster displays a project about the survey and detection of illicit discharge in Ft. Belvoir, Virginia, under their MS4 permit. Regional nonprofit Ridge to Reefs has worked with Ft. Belvoir's Directorate of Public Works (DPW) to survey existing outfalls that led to waterways and then assess collected field data, nearby land uses, and mapped drainage areas to determine the potential of illicit discharge from each outfall. The army base includes 4 major watersheds in northern Virginia, all of which direct water into the Chesapeake Bay through the Potomac River: Accotink Creek, Pohick Creek, Dogue Creek, and Little Hunting Creek. As a restoration ecologist at Ridge to Reefs, I will explain the methodology and parameters to surveying and assessing these outfalls as well as the effects of illicit discharge monitoring in an area that connects urbanized land to the Chesapeake Bay.

ADDRESSING COMPACTED SOILS FOR STORMWATER MANAGEMENT

Kathleen Cullen; kathleen_cullen@fws.gov; U.S. Fish and Wildlife Service/Towson University

The only sector of nutrient and sediment pollution that is still increasing in the Chesapeake Bay watershed is urban stormwater runoff. Innovative techniques are needed to successfully reduce the amount of stormwater coming from developed areas. Compacted soils have a detrimental effect on the hydrologic cycle, and are an often overlooked factor in stormwater runoff. Techniques for preventing and mitigating soil compaction in developed areas can provide benefits to water quality and quantity, and should be widely implemented throughout the Chesapeake Bay watershed.

FRESHWATER MUSSEL RESTORATION IN THE PATAPSCO RIVER: EMPLOYING MUSSELS AS BIOFILTERS

Megan Davis; megan.davis@maryland.gov; Maryland Department of Natural Resources

In some freshwater systems, filter feeding bivalve molluscs are the dominant benthic biomass and can influence ecosystem structure and function. They provide food for other organisms, support habitat modification, aid in streambed stabilization, and affect nutrient dynamics. Moreover, freshwater mussels are among the most imperiled of all fauna across North America. This reduced diversity and abundance has been attributed to habitat loss, water quality degradation, invasive species, and host-fish deficiency. Recently, these factors in the Patapsco River have improved to levels which may support populations of *Elliptio complanata* (Eastern Elliptio). Restoration via propagation and reintroduction are important tools in mussel conservation. Tam and Ashton (2017) provided a plan for implementing the restoration of *E. complanata* in the Patapsco River via reintroduction, propagation, and monitoring. In this project, we will begin monitoring the 2017 introduction of *E. complanata* into the Patapsco River, consider expanding restoration efforts by introducing *Utterbackinaia implicata* (Alewife Floater) into tidal-freshwater habitat, and complete a second reintroduction of *E. complanata*. In addition, we propose several pilot studies to investigate the use of mussels to sequester nutrients and bacteria through our ongoing hatchery culture activities.

INVESTIGATING BROOK TROUT POPULATIONS ABOVE AND BELOW WATERFALLS

Hannah Eisemann; eisemahk@dukes.jmu.edu; James Madison University

Coauthor: Dr. Christine May; James Madison University

Anthropogenically driven factors-increasing temperature and sediment in valley streams, acidification of mountain streams, and the introduction of non-native/ hatchery trout- are restricting habitat suitable for healthy populations of eastern brook trout (*Salvelinus fontinalis*). These salmonids are important top predators in mountain streams and a favorite of anglers throughout their native Appalachian range. Waterfalls geologically create unique landscapes above them that may alleviate the temperature-productivity "habitat squeeze" for brook trout, potentially ideal targets for conservation efforts despite being isolated above a barrier. This would challenge the conservation paradigm that isolated populations are inherently prone to extirpation. This study investigates many Virginia waterfalls and compares brook trout populations above and below seven of them in George Washington and Jefferson National Forest by measures of 1) population biomass, 2) population density, and 3) length-weight index. One-hundred meter reaches were sampled for brook trout via 3-pass block-netted electroshock depletions. All trout were counted, weighed, and measured for fork length. We highlight the similarities and differences between sites and between above and below populations overall.

QUANTIFYING WATERSHED EXPORT OF ATMOSPHERIC NITRATE ACROSS LAND-USES IN MARYLAND USING TRIPLE OXYGEN ISOTOPES

Keith Eshleman; keshleman@umces.edu; University of Maryland Center for Environmental Science

Coauthors: Joel Bostic, David Nelson, University of Maryland Center for Environmental Science

Excess nitrogen (N) inputs to the Chesapeake Bay (CB) have impaired water quality for decades. Atmospheric N deposition represents the only input that affects the entire CB watershed irrespective of land-use. Thus, quantifying its export and relationship to land-use is critical for understanding and mitigating the effects of N pollution. Triple oxygen isotopes of nitrate (NO3) provide a tracer of atmospheric NO3, allowing for quantification of "unprocessed" NO3 exported to streams. To quantify watershed export of atmospheric NO3 and understand its relationship with land-use, stream samples (n = 832) from 14 sub-watersheds of the Chesapeake Bay watershed were collected regularly from October 2015-September 2017 and analyzed for NO3 concentrations and oxygen isotope ratios. Annual flow-weighted concentrations of unprocessed atmospheric NO3 ranged from 0.02 – 0.18 mg N L-1 and loads ranged from 0.02 – 0.59 kg N ha-1 yr-1. Annual retention of deposited NO3 ranged from 90 – 99 % and was negatively correlated with percent agricultural land ($r2 = 0.62$, $p < 0.005$). These results indicate high rates of processing of atmospheric nitrate and reveal that land surface processes modulate transport and transformation of NO3 from deposition to stream export, with agricultural land retaining less atmospheric NO3 likely due to additional N inputs (i.e. fertilizer, manure).

EFFECTS OF URBANIZATION AND GREEN INFRASTRUCTURE ON STREAM HABITAT AND BENTHIC COMMUNITY COMPOSITION IN PIEDMONT HEADWATER STREAMS

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Coauthor: Kristina Hopkins, U.S. Geological Survey South Atlantic Water Science Center

Green infrastructure (GI) is increasingly implemented to mitigate the effects of urbanization on stream ecosystems. This type of stormwater management, which focuses on distributed infiltration of stormwater runoff, was implemented in Clarksburg, MD as it underwent urban development over the past 20 years. To understand the ecological effects of urbanization and GI implementation, five headwater streams were intensively monitoring during the same 20-year period, including three watersheds that underwent suburban development and GI implementation and two control watersheds with limited land use change (one forested watershed and one urban watershed). Stream health was assessed by monitoring streamflow, sampling water quality, and annual measurements of benthic macroinvertebrate and fish communities. Preliminary results show declines in stream benthic or fish index of biological integrity (IBI) scores and increases in specific conductivity in all three watersheds that underwent development. While IBI scores declined during development in the three GI watersheds, these IBI scores were typically greater than those in the urban control watershed. Future analyses will explore changes in benthic and fish community composition across sites and over time and relate community metrics to abiotic conditions in the stream ecosystems (e.g., physical habitat, water quality, and hydrology).

CALCULATING NUTRIENT AND SEDIMENT CONCENTRATIONS BEFORE AND AFTER BMP INSTALLATION IN THE CORSICA RIVER WATERSHED

Brittany Furlong; brittany.furlong@maryland.gov; Maryland Department of Natural Resources

Approximately 65% of estuaries and coastal bodies in the U.S. are degraded by nutrient overloading, which can lead to harmful algal blooms, degraded water quality, and species and habitat loss. The Corsica River watershed was identified as an impaired waterbody in 1996 due to excessive nutrients and suspended solids, signs of eutrophication, and fecal coliform. This watershed is dominated by agricultural land use (60%) mostly for crop production. The leading source of nitrogen and phosphorus inputs to the watershed are from agricultural sources. A Watershed Restoration Action Strategies (WRAS) plan for the watershed was initiated in 2005 and aimed to improve water quality and enhance ecosystems. Water quality data of TN, TP, and TSS was collected in three tributaries that feed into the Corsica River from 2005 to 2016. Load calculations are typically used to assess BMP effectiveness, however, available data may not accurately represent the relationship between load and flow due to tidal influences. This project will therefore focus on calculating seasonal trends of nitrogen, phosphorus, and TSS concentrations to assess the effectiveness of potential nutrient and sediment reductions before and after BMP installation.

EFFECTS OF NUTRIENT ENRICHMENT ON PHYTOPLANKTON COMMUNITY DYNAMICS IN A CONTROLLED MESOCOSM EXPERIMENT

Samantha Gleich; sgleich@umces.edu; University of Maryland Center for Environmental Science

Coauthors: Patricia Glibert, University of Maryland Center for Environmental Science; Caroline Solomon, Gallaudet University

The Anacostia River Tunnel is a large-scale engineering project that was designed to divert sewage and stormwater effluent to the Blue Plains Wastewater Treat Plant. By diverting this effluent, nutrient loads reaching the Anacostia River should be reduced, in turn reducing the magnitude of algal blooms in this system. The proportions of different nutrients and the forms of those nutrients may also change, which could affect the species composition of these blooms. Previous work on the Anacostia River revealed that the concentration and form of nutrients in the water alters the relative abundance of phytoplankton groups; however, improvements in water quality that follow the implementation of the Tunnel may affect these community-level responses. To further investigate these possible changes, nutrient enrichment experiments were conducted in which the effects of changes in nutrient level, proportion and form on algal community composition were measured. Preliminary results reveal that the form of nitrogen in the water alters the photosynthetic efficiency of phytoplankton communities and may in turn lead to shifts in species composition. These data, together with ongoing monitoring of the water quality in the river will provide insight as to how nutrient reductions will influence phytoplankton community dynamics in the River following the implementation of the Tunnel Project.

<STUDENT POSTER> EVALUATING THE EFFECTS OF SYSTEM MATURATION ON POLLUTANT LOADS FROM STREAM-WETLAND COMPLEXES

Julianna Greenberg; jgreenb6@terpmail.umd.edu; University of Maryland

Coauthors: Michael Williams, University of Maryland; Solange Filoso, University of Maryland Center for Environmental Science

Stream restoration has become an increasingly common way for states in the Chesapeake Bay watershed to obtain credits to meet their Total Maximum Daily Load (TMDL) requirements, and stream-wetland complexes (SWCs) are a relatively novel restoration design that is gaining popularity. Located in Anne Arundel County, Cypress and Church creeks are SWCs that include engineered wetlands and step-pool conveyances extending to the estuarine interface. Solute concentrations and discharge were monitored at the outflows of Cypress and Church creeks for 4 and 2 years prior to restoration in 2012 and 2014, respectively, and for another 1 to 2 years following construction. Monitoring occurred throughout the pre- and post-construction phases to estimate the changes in loads of total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) from the restoration reaches. Preliminary results indicated that there were moderate reductions in nutrient and sediment loads after restoration. However, since this monitoring was completed, there has been an apparent reduction in the residual disturbance effects of construction suggesting that the initial load estimates may have substantially changed. Accordingly, we present the preliminary results of an ongoing study to evaluate the effects of SWC maturation by comparing TN, TP, and TSS loads in the pre- and post-restoration periods.

<STUDENT POSTER> HEALTH OF THE ANACOSTIA FROM BEGINNING TO END

Julianna Gross; jhawleyg@gmail.com; Sherwood High School, Smithsonian Environmental Research Center

Coauthors: Claire Moran, Anika Mittu, Sinead Claffey, Fatima Korama, Sofia Grossman, Samantha Suissa, Sherwood High School, Smithsonian Environmental Research Center

As the Anacostia river flows, road salt in runoff from a neighborhood upstream can stress fish populations twenty miles downstream in Washington DC. Our study site in Sandy Spring, Maryland represents the most upstream point of the Northwest Branch of the Anacostia River. Interested in how the health of the pure beginning of the river deteriorates as the water flows downstream, we collected data for multiple water quality indicators, including dissolved oxygen, conductivity, and turbidity. By comparing stream health of the most upstream point to a point almost directly at the confluence of the Anacostia and Potomac Rivers, the South Capitol site of the Anacostia River and Potomac River Monitoring Program of the Washington DC Department of Energy and Environment, our data shows the striking difference in the health of the Anacostia River. For example, fluctuations of percent saturation of dissolved oxygen all the way up to 208.6% oxygen saturation at Sandy Spring decline to a maximum of 110.7% oxygen saturation in Washington D.C. the same week in April, this trend continuing throughout our year of data collection and indicating potential decline in water quality. The trends in our data represent the importance of combining data from multiple sites to study the health of the Anacostia as a whole, from beginning to end.

<STUDENT POSTER> EFFECTS OF WETLAND RESTORATION ON STREAM HEALTH: AN ASSESSMENT OF THE WETLAND RESTORATION PROJECT AT IRVINE NATURE CENTER

Crystal Lynn Heintzelman; crystal.heintzelman@ubalt.edu; University of Baltimore

Coauthor: Wolf T. Pecher, University of Baltimore

Wetland restoration has been proven to assist in improving water quality because wetlands act as sinks for pollutants such as excess nutrients and heavy metals. Irvine Nature Center in Owings Mills, MD resides 116 acres within the Jones Falls watershed of which leads into the Chesapeake Bay. The wetland restoration project at Irvine includes the construction of vernal pools, the planting of many different native species, and the placement of woody debris and rock channels along already present stream beds. Wetland restoration has occurred here in hopes of: restoring and repairing degraded sections of the stream, divert storm flow, restore/enhance riparian wetland hydrology, reduce sediment and nutrient loading, and reestablish mosaic of native plant communities. This experiment is designed to test whether the wetland restoration project is successful in reducing nitrates, phosphates, sediments, and improving water quality. Sample sites were selected before and after areas of wetland restoration that were constructed with the following parameters tested: temperature, dissolved oxygen, pH, phosphorus, nitrates, turbidity, total dissolved solids, and conductivity. Sediment samples were also collected at the beginning and end of the sample time-frame to discover microbial differences among the sites using DGGE.

ILLICIT DISCHARGE DETECTION CASE STUDIES IN PHASE I MS4 JURISDICTIONS

Thomas Jones; tjones@versar.com; Versar

Coauthors: Charles Tonkin, Martin Berlett, Versar

From 2006 to present, Versar has provided Illicit Discharge Detection and Elimination (IDDE) services to Phase I jurisdictions in Maryland and Virginia as part of multidisciplinary, municipal separate storm sewer (MS4) support contracts. Field staff have identified and reported potential illicit discharges in a variety of land uses (e.g., commercial, industrial, residential) from a variety of causes (e.g., cross-connection, washing). Staff provide the results of field screening, digital photos, maps, and source tracking information to enable permit holders to conduct confirmatory follow-up and remediation to eliminate confirmed illicit discharges. We present case studies from IDDE support efforts to illustrate the types, causes, and methods of elimination of illicit discharges.

EFFECTS OF PRECIPITATION ON DISSOLVED OXYGEN IN A REGENERATIVE STREAM CONVEYANCE SYSTEM

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In 2010, South River Federation (SRF) deemed Church Creek a highly impaired tributary of the South River. As a part of the restoration efforts to reduce stream erosion and sediment loading into Church Creek, SRF installed structures to create a Regenerative Stream Conveyance (RSC) system. In 2014, SRF installed an EXO2 continuous water quality monitoring device just downstream of the restoration project to assess the performance of the system. After analysis of the 2017 data indicated a potential link between Dissolved Oxygen (DO) and rainfall events, further investigation reveals that Dissolved Oxygen's diurnal cycle changes after the majority of rainstorm events and displays a temporarily higher trough average. An increase in DO after a rainstorm event may indicate that the cobblestone structures in the RSC system effectively disturbs the flow of water, producing an aeration effect that could provide a more productive environment for aquatic life. Ongoing research will further investigate the level of impact the RSC structures have on the aeration of the water after rainstorms of various intensities.

<STUDENT POSTER> FOUR YEARS OF STUDENT-TEACHER-AND-RESEACHER (STAR) PROJECT DATA MEASURING 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 anthropogenic nitrogen pollution in the environment. Over the past four years, we have 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 draining a variety of land-uses. Students have discovered great variability in the amount of atmospheric and terrestrial nitrate in runoff from schoolyards in Garrett, Allegany and Washington Counties. However, their combined results suggest that impervious surfaces across western Maryland schoolyards reduce the uptake and/or processing of atmospheric nitrate. In addition, students at Northern Garrett High School have found seasonal impacts on the function of their school's wetland, which effectively reduces terrestrial nitrate in runoff in the late summer/early fall, but not in the late winter/early spring.

<STUDENT POSTER> ASSESSING THE EFFECTS OF A STREAM RESTORATION ON HYPORHEIC EXCHANGE

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Coauthors: Carey E. Pelc, Thomas E. Jordan, Smithsonian Environmental Research Center

A reach of Muddy Creek, located on the property of the Smithsonian Environmental Research Center (Edgewater, MD), was deeply incised by a culvert and was restored in 2016. The restoration filled the streambed with gravel, sand and wood chips in order to reconnect the stream with its floodplain and raise the area's water table. Because Muddy Creek is a tributary of the Chesapeake Bay, one purpose was to trap nutrients from local runoff in the stream before they reach the Bay. Understanding hyporheic exchange is vital to understanding nutrient trapping. This exploratory study assessed hydraulic pressure gradients in and around the stream to better understand surface-groundwater exchange and groundwater flow. Water level measurements of over 100 wells and piezometers, distributed in transects of the restored reach and in the streambed, were taken between May and July, 2018. Hydraulic gradients during the study period were spatially and temporally variable but predominantly indicated flow of surface water into and away from the stream bed, suggesting that the stream may be losing water. However, the formation of iron oxide precipitates in some sections of the stream suggested that groundwater rich in dissolved iron had emerged from the stream bed in places. In general, the restoration seems to have increased the spatial variability of hyporheic exchanges along the stream.

A COLLABORATIVE APPROACH TO ADDRESSING ROADWAY CONGESTION WHILE BALANCING ENVIRONMENTAL IMPACTS AND FISH PASSAGE THROUGH AGENCY COORDINATION AND STREAM RESTORATION IN MONTGOMERY COUNTY, MD

Sarah Koser; skoser@eaest.com; EA Engineering, Science, and Technology, Inc., PBC

Coauthors: Jared Paper-Evers, Maryland Department of Transportation, State Highway Administration, Office of Highway Development; Matt Harper, Maryland-National Capital Park and Planning Commission; Mary Matzke, Century Engineering, Inc.

A collaborative approach was undertaken to address roadway congestion and safety concerns in Montgomery County, MD while minimizing impacts to natural resources. The purpose of this project was to improve safety and traffic operations along MD 355 and West Old Baltimore Road and upgrade an existing, undersized culvert. The culvert is along on a Use IV-P stream (recreational trout waters) and required fish passage by USFWS. The project is located on land owned by M-NCPPC, charged with protecting natural resources in Montgomery County. The existing culvert only passes the 5-year storm event. The new culvert would: pass the 50-year storm event; provide passage for fish and aquatic organisms; provide natural substrate within the culvert; address the long-term bed degradation that may affect fish passage through the structure in the near future; mitigate for any significant increases in channel boundary stress upstream or downstream of the structure; incorporate a deep pool stream habitat feature to replace existing lost features. It was proposed to restore and relocate the channel downstream of the proposed culvert to increase sinuosity (reduce channel slope) as well as to reduce bank height and sediment mobility to minimize further bed degradation, and to compensate for increased shear stress.

<STUDENT POSTER> WHAT'S IN YOUR HERBICIDE? UNREGULATED "SAFENERS" MODIFY EFFECTS OF S-METOLACHLOR ON NON-TARGET ALGAL SPECIES

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Dual II Magnum (DUAL) is an herbicide formulation that is applied to a wide variety of crops including corn which is a critical Maryland crop. When applied before germination, the active ingredient, S-Metolachlor (S-MET), kills unwanted plants. Interestingly, to protect crop species from the herbicide the "safener", Benoxacor (BEN), is added. BEN and other safeners are considered inert and, therefore, are not regulated nor tested for toxicity. Runoff from agricultural fields where DUAL has been applied can lead to measurable concentrations of S-MET and BEN in freshwater systems. While the effects of S-MET on aquatic organisms have been studied, less is known about the effects of DUAL and BEN. We conducted a series of 72-hour algae toxicity tests to establish the EC50 (the concentration causing 50% growth inhibition) of the non-target algae, Raphidocelis subcapitata, for S-MET, BEN, and DUAL. S-MET was the most toxic followed by DUAL while BEN was less toxic by an order of magnitude. These data suggest that BEN may provide a "safening" effect to algae similar to what occurs in terrestrial crop species. We are now exploring how a model consumer, Daphnia magna, may further modify effects of the S-MET, DUAL and BEN. Results from these studies provide insights into potential environmental effects of agrochemicals that can enter freshwater systems.

<STUDENT POSTER> CHARACTERIZING STORM EVENT CONCENTRATION-DISCHARGE RELATIONSHIPS IN URBAN WATERSHEDS USING HIGH-FREQUENCY DATA

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Concentration-discharge (C-Q) relationships offer valuable insight into solute mobilization and transport in watersheds, in part, by highlighting the relative contributions of event water, soil water, and groundwater. More C-Q studies have been performed on forested and agricultural watersheds than urban watersheds even though stormwater infrastructure and impervious cover increase hydrologic connectivity. We examined storm event C-Q relationships for two small urban watersheds (<6.5 sq km) in the Baltimore, MD region: West Branch Herring Run (HERR), a partially-channelized stream, and Plumtree Run (PTR), an unchannelized stream. C-Q relationships were evaluated based on rotational direction and slope for specific conductance (SC) and concentrations of dissolved silica and major ions using a combination of high-frequency data and discrete sampling. Clockwise hysteresis patterns were observed at HERR while PTR predominantly exhibited anticlockwise patterns, which implies that solute transport occurs more rapidly at HERR and may be attributable to differences in stormwater drainage infrastructure and/or basin morphology. SC and solutes generally exhibited flushing patterns (i.e., an initial concentration rise) during smaller magnitude storm events (Q < 1.42 cubic meters per sec) in both watersheds; dilution patterns were observed during larger magnitude events.

A COMPARISON OF TWO INDEX OF BIOTIC INTEGRITY (IBI) CALCULATIONS FOR BENTHIC MACROINVERTEBRATES AND FISH AT A MITIGATION SITE

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Coauthors: Sarah Koser, EA Engineering, Science, and Technology, Inc., PBC; Brian Cox, Maryland State Highway Administration; Matt Harper, Maryland-National Capital Park and Planning Commission

EA Engineering, Science, and Technology, Inc., PBC (EA) was tasked by the Maryland State Highway Administration (SHA) to perform pre-construction monitoring as required by the Maryland Department of the Environment (MDE) and U.S. Army Corp of Engineers, Baltimore District for the MD 97 Bypass Site and Mitigation Site in Brookeville, Montgomery County, Maryland. Benthic macroinvertebrate and fish in-stream assessments were performed in 2016 and 2017 at both the Bypass and Mitigation Sites using the Maryland Biological Stream Survey (MBSS) methodology. To determine the index of biotic integrity (IBI) for benthic macroinvertebrates and fish at these sites, metrics for both the MBSS-based IBI calculation and the Montgomery County Department of Environmental Protection IBI calculation were used. Both calculations use unique metrics for both benthic macroinvertebrates and fish to determine the IBI for the site. This study investigates the different metrics used for the two methods and evaluates stations sampled at Brookeville using both IBI methods.

DETECTION OF ESTROGEN IN BALTIMORE WATERSHED

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This paper focuses on the detection and quantitation of estrogen hormone in Baltimore's watersheds. Baltimore's drinking water primarily comes from three watersheds (Loch Raven, Prettyboy, and Liberty). Between 1999 and 2000, the U.S. Geological Survey sampled 139 surface waters throughout the U.S and they discovered that 80% of these waters contained endocrine disrupting chemicals (mostly estrogens). Fish, in the very waters we end up drinking, are changing sex due to exposure to excess estrogen. To detect estrogen in water we used an enzyme-linked immunosorbent assay (ELISA) kit and to quantify the concentration of estrogen in water, a microplate reader was used. Data analyses revealed no significant difference in the estrogen levels between the different test sites nor seasonally (fall 2017 & winter 2018). Based on the measured optical density, there are traces of estrogen in Baltimore watersheds during the fall season. The average estrogen levels in the Loch Raven sub-sheds was 0.074 ppb (Fall 2017) and 0.048 (Winter 2018) and for Liberty sub-sheds it was 0.046 ppb (Fall 2017) and 0.040 ppb (Winter 2018). In Prettyboy sub-sheds the level was 0.067 ppb (Fall 2017) and 0.042 ppb (Winter 2018). Overall, Loch Raven watershed has slightly higher levels of estrogen than the other two watersheds, both in the Fall and Winter seasons.

EXPORT OF NUTRIENTS FOLLOWING LEGACY SEDIMENT REMOVAL AND FLOODPLAIN RECONNECTION RESTORATION PROJECTS

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The Mid-Atlantic Piedmont was altered by deforestation, conversion to agricultural lands, and mill dams during European settlement. Land use changes led to the aggregation of fine-grained (legacy) sediments, burying pre-settlement wetlands, behind successive mill dams in Piedmont streams. Mill dams were abandoned and breached in the 19th and 20th centuries. Streams eroded legacy sediments at the point of breach leading to the incision of many streams in the present Mid-Atlantic region.

Legacy sediment removal (LSR) and floodplain reconnection (FR) techniques were developed to address the conditions caused by historic mill dams, yet little is known about their functionality. We compared baseflow nitrogen concentrations and total suspended solids (TSS) between upstream and restored downstream conditions of six different LSR and FR projects in the Maryland Piedmont region. Initial results indicate nitrogen reductions are not significant during baseflow, except at the most urbanized site (high ISC), which shows a decrease in nitrogen. Low discharge conditions at this site may facilitate denitrification. TSS comparisons between up-downstream reaches reveal reductions in sediments are not significantly different in sites restored more than two years ago. Conversely, sites restored during the study exhibit elevated TSS transport relative to their upstream control.

LONG TERM HYDROLOGIC MONITORING OF A SENSITIVE WETLAND HABITAT

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The Hampstead Bypass, located in Carroll County, was constructed in 2009 by the Maryland Department of Transportation, State Highway Administration (MDOT SHA). The bypass navigates near federally threatened sensitive wetland habitats. An extensive hydrologic monitoring network was installed in 1999 with extensive agency coordination to determine the pre-construction water budgets associated with the key wetland areas. Monitoring continued throughout the design process, during construction and was recently completed in 2018. The monitoring was required by the MDE/USACE Permits and the Department of Natural Resources. A Sensitive Species Habitat Management Plan was developed to ensure that roadway construction caused no net changes to wetland hydrology. Pre-construction monitoring included installation of streamflow gauges, monitoring wells, piezometers, and precipitation gauges. During the post-construction phase, streamflow gauges, monitoring wells, and piezometers were again monitored. Yearly cross-sectional surveys were completed at three culverts on either side of the Bypass. Pre- and post-construction data analysis were completed to document no changes hydrology of the sensitive wetland sites. WSP has assisted MDOT SHA with various phases of monitoring. This poster will highlight key components of the sites 20 year monitoring history.

<STUDENT POSTER> INFLUENCE OF DIFFERENT N, P AND SI ADDITIONS ON UREA UTILIZATION PATHWAYS IN AN ANACOSTIA RIVER PHYTOPLANKTON COMMUNITY

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The Anacostia River, "the forgotten river," has an overall poor quality caused by several anthropogenic sources including sewage, excess nutrients from runoff, and combined sewer overflows (CSOs). To assess the impact of changing nutrient concentrations and forms on the bacterial and phytoplankton community composition and productivity, samples were collected from the Anacostia River into fifteen cubitainers with different nutrient additions (different combinations of +N, +P, +Si). Our project focused on one aspect: the influence of different nutrient additions on urease activity, an enzyme responsible for the breakdown of urea to ammonium. We hypothesized that there would be more urease activity in the +NO3- and +urea additions because NH4+ suppresses urease activity and there will be no difference in +P treatments because urease activity does not require ATP.

ANACOSTIA RIVER (MD/DC) LEGACY CHLORDANE BY ACTIVE BIOMONITORING (*CORBICULA*)

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This study of chlordane in Anacostia fish tracked Chlordane from MD sources to DC fish via contaminated sediment and the migratory DC River Shad that feeds on sediment invertebrates and is a favorite food of DC food fish.

SURVEY OF FRESHWATER ANNELIDS IN THE POTOMAC RIVER BASIN

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Annelids are widespread and abundant components of freshwater ecosystems. They comprise an important food source for higher trophic levels and can affect physical and chemical properties of aquatic substrates through their burrowing and feeding. Despite their abundance and ecological importance, freshwater annelids remain poorly studied, in part because they tend to be challenging to collect and identify. We are currently surveying the freshwater annelid communities in wadeable streams of the Potomac River Basin. We target the full size range of annelids, thus collecting macroannelids as well as the significant but often ignored microannelids. We sampled 18 streams across three ecoregions of the watershed, including in areas of high and low urbanization, in spring, summer, and fall of 2018. Sample processing is ongoing but available data provide preliminary results. "Tubificids" are particularly abundant in the spring and asexual naids (especially *Pristina*) are particular abundant in the summer. Microannelids represent a numerically very important fraction of the annelid community. Peak annelid densities are high, reaching ~400 individuals per liter of sediment. To catalyze future work on this important component of the freshwater biota, we will generate DNA barcodes for species in the Potomac River Basin and deposit a large collection of reference specimens at NMNH.

CITIZEN SCIENCE TO SUPPORT INCLUSIVE CHESAPEAKE BAY RESEARCH

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In 2017, Maryland Department of Transportation - State Highway Administration (MDOT-SHA) partnered with the Oyster Recovery Partnership (ORP) and EA Engineering, Science, and Technology, Inc. PBC to satisfy compensatory tidal mitigation required by MDE and USACE via an off-site and out-of-kind tidal enhancement project. The project included the enhancement of existing tidal waters by removing lost or abandoned (derelict) crab traps. Approximately 3,000 acres within the Chesapeake Bay (the Bay) northeast of Hart-Miller Island was identified by ORP as a priority area for derelict crab trap removal. Yearly estimates indicate that 3.3 million blue crabs, or approximately 4.5 percent of the annual harvest, are trapped in derelict crab traps within the Chesapeake Bay. Similar removal projects have been implemented by Virginia Institute of Marine Science (VIMS), NOAA, and ORP in the Chesapeake Bay and have shown that the removal of derelict crab traps can have a positive impact on blue crab populations. The project satisfied mitigation goals by reducing trash and debris, providing ecological uplift through reduced mortality of species trapped in derelict crab traps, stimulating the local economy by employing local watermen during the off season, and increasing economic productivity of blue crabs. During the removal effort, over 1,100 pieces of derelict gear were removed.

COASTAL ATLANTIC OCEAN WATER QUALITY ASSEMENT ALONG THE ASSATEAGUE ISLAND NATIONAL SEASHORE

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Water quality is more routinely assessed in estuarine environments and embayments than offshore; however, the coastal ocean offshore Maryland is important both ecologically and economically as well. Therefore, maintaining a healthy ocean environment is imperative. The Maryland Coastal Bays (MCB) and waterways which surround the Assateague Island National Seashore, are influenced by both land sources as well as tides and currents from the Atlantic Ocean. The inlet at Ocean City provides important tidal exchange into the MCB. Studies within the MCB have identified a general increase in nutrients and widespread degradation in water quality The results of two previous offshore water quality surveys in 2011 and 2012 revealed elevated chlorophyll and nutrients and potentially harmful algae detected (i.e. genera *Dinophysis*, *Karenia*, and *Psuedo-nitzschia*). There is a need to better understand the linkages between the coastal ocean and the MCB, ecosystem changes and impacts of human activity. A project funded by the National Park Service is currently underway to assess ocean water quality conditions in the nearshore environment off of Assateague Island. Three cruises were completed in the summer of 2018. Continued monitoring will help determine nutrient dynamics, phytoplankton species abundances that can be potentially be used to model bloom development and interactions with the MCB.

TOPOVAR90M: GLOBAL HIGH-RESOLUTION TOPOGRAPHIC VARIABLES FOR ENVIRONMENTAL MODELING

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Topographical relief involves the vertical and horizontal variation of the Earth's terrain and it drives processes in hydrology, climatology, geography and ecology. Its assessment and characterization is fundamental for various types of modeling and simulation analysis. In this regard, the Multi-Error-Removed Improved Terrain (MERIT) Digital Elevation Model (DEM) currently provides the best high-resolution DEM globally available, at a 3 arc-second resolution (90m), due to the removal of multiple error components from the underlying SRTM3 and AW3D30 DEMs. To depict topographical variations worldwide, we developed a new dataset comprising different terrain features derived from the MERIT-DEM. The fully standardized geomorphometry variables consist of slope, aspect, eastness, northness, roughness, terrain roughness index, vector ruggedness measure, topographic position index, stream power index, convergence, profile/tangential curvature, first/second order partial derivative and 10 geomorphological landform classes with their parameters features (intensity, exposition, range, variance, elongation, azimuth, extend and width). All newly-created geomorphometry variables are readily available at a 3 arc-second resolution, for use as input data in various environmental models and analyses in the field of geography, geology, hydrology, ecology and biogeography.

STREAM ASSESSMENT AND SEDIMENT MONITORING FOR TMDL CREDITING

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Stream restoration has been widely adopted in Maryland to meet nutrient and sediment reduction targets for the Chesapeake Bay TMDL. The Expert Panel has provided a protocol (Protocol 1) to define project specific sediment and nutrient reduction credits for certain stream restoration practices. Maryland Department of Transportation State Highway Administration (MDOT SHA) collects data to implement this protocol and define site-specific crediting. This poster details the stream assessment and sampling efforts for several upcoming MDOT SHA restoration projects.

CITIZEN SCIENCE TO SUPPORT INCLUSIVE CHESAPEAKE BAY RESEARCH

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Collaboration between professional and citizen scientists has demonstrated potential to support environmental research that is not only more comprehensive and thus better able to inform environmental policy and management decisions, but also more inclusive and useful for the public. Chesapeake scientists recognize that collaborations with citizen groups are instrumental in understanding complex socioecological systems, and have invited volunteers to contribute data towards comprehensive Bay health assessments. However, research goals of professional and citizen scientists often differ, and this perceived misalignment of priorities can discourage citizens from engaging and sharing data with professional scientists, stifling knowledge production. This poster shares results from two comparison analyses used to investigate the monitoring goals of both professional and citizen scientists in the Chesapeake Bay watershed, and highlights areas of consensus where the two groups can work together to answer research questions and simultaneously fulfill scientific and community needs. To effectively collaborate, scientists should make efforts to understand and legitimize citizen monitoring objectives, facilitate collaborative dialogue, and actively create opportunities that empower citizen scientists to contribute to the development of a new, more integrative understanding of the Bay.

<STUDENT POSTER> WATER QUALITY ASSESSMENT OF DIVIDING CREEK OUTFALL RETROFIT AND STREAM RESTORATION

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In 2010, the Magothy River Watershed Assessment identified Dividing Creek as a medium-high priority for restoration. The headwaters of Dividing Creek originate as stormwater runoff from the Severna Park Golf Center, and also receive stormwater via outfalls from the Arnold campus of Anne Arundel Community College. The Anne Arundel County Watershed Protection & Restoration Program completed three projects along the portion of Dividing Creek that runs through the AACC campus in order to combat channel erosion and treat stormwater. Project A replaced an existing outfall that originated from a stormwater management pond outfall with a SPSC system. Project B retrofitted an additional downstream stormwater outfall with an SPSC system. Project C restored the eroded stream channel, and installed a series of shallow pools and riffle weir grade controls to stabilize the channel and improve water quality. To assess the successfulness of these projects in improving water quality, we will test dissolved oxygen, nutrient, and sediment levels following rainfall events at several points along the creek. We will run tests at the headwaters, downstream of the restoration, at each outfall, as well as two additional points along the riffle-pool sequence. Preliminary findings indicate that sediment levels are highest downstream of the restoration.

TEMPORAL VARIATIONS IN CHLORIDE CONCENTRATIONS IN GROUNDWATER IN THE PIEDMONT PHYSIOGRAPHIC PROVINCE OF MARYLAND

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The use of road deicing salts has been shown to have significant impacts on groundwater, which may threaten drinking water sources. In the Maryland Piedmont Physiographic Province, unconfined aquifers are the primary water source for people on private water wells, and these aquifers are susceptible to surface-based contamination. High-chloride water from deicing salt can damage plumbing fixtures, appliances, and pipes. Removal of chloride from domestic well-water systems requires the installation of relatively expensive reverse-osmosis systems. Additionally, the impacts of these salts on the mobilization of trace elements, heavy metals, and adsorbed contaminants have not been adequately evaluated. In the late 1980s and 1990s, the Maryland Geological Survey (MGS) sampled many wells in the Maryland Piedmont region, testing the water samples for chloride and other major ions and constituents. Because of increased growth, there is an increased risk of rising chloride concentrations in this region. These data provide a valuable baseline against which future water-quality samples can be compared to monitor changes in groundwater chemistry. MGS will resample approximately 50 wells over the next two years and analyze these samples for similar constituents as previous samples. Targeted groups of wells will be evaluated for temporal changes in chloride concentrations.

<STUDENT POSTER> USING THE STREAM FUNCTION PYRAMID TO MEASURE RESTORATION SUCCESS IN DIVIDING CREEK, ARNOLD, MARYLAND

Lucia Villamizar; lfvillamizar91@gmail.com; Anne Arundel Community College

Coauthors: Katherine Duafala, Dylan Schrader, Anne Arundel Community College.

The Stream Functions Pyramid, developed by Fischenich, provides a framework that organizes stream functions into a hierarchy of categories, illustrating that higher-level functions are supported by lower-level functions. It highlights the connection between stream functions and riparian systems and helps to identify which functions are more vital to restoration of stream and riparian functions. The Pyramid is also a useful tool in goal setting, developing and reviewing stream assessment methodologies, and creating standard operating procedures for regulatory and non-regulatory stream restoration programs. The purpose of our study is to test the success of the Dividing Creek restoration project, located on the Arnold campus of Anne Arundel Community College, using The Stream Function Pyramid. We are going to analyze elements of the hydrology, hydraulics, geomorphology, physicochemical, and biological features of the Diving Creek and compare results to those collected before the restoration. Preliminary data shows that macroinvertebrates biodiversity has increased since the restoration project, but we suspect that suspended solids downstream of the project may have increased as well.

<STUDENT POSTER> COMPARISON OF *VIBRIO VULNIFICUS* WITH PH, SALINITY, AND TEMPERATURE

Mary Wenzel; mary.e.wenzel@gmail.com; Anne Arundel Community College

The Chesapeake Bay is an important part of the Maryland way of life. Hundreds of thousands of people every spring, summer and fall enjoy all of its amazing aspects like fishing, swimming, boating and other recreational activities. A lot of those activities came to a halt in the summer of 2014 when there was an outbreak of *Vibrio vulnificus*, a flesh-eating bacteria. What caused an outbreak of this species that is most likely present at low levels year-round? The most common hypotheses include rising water temperature, lowered pH or decreases in salinity. The purpose of this project is to test the impact of temperature, pH, and salinity on levels of *Vibrio vulnificus*. The bacterium will be collected from five different locations around the Annapolis area, including Thomas Point Park, Sandy Point State Park, Matapeake State Park, Beverly Triton Beach Park, and Tilghman Island Marina. All of these locations have water/beach access throughout the year and are popular recreational areas.

<STUDENT POSTER> A LOOK AT A SEED BANK WITHIN A RIPARIAN WETLAND

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Coauthor: Vanessa Beauchamp, Towson University

Seed banks contain propagules which are dispersed from the surrounding vegetation community. Riparian areas often have species rich seed banks that can be used for a propagule source of restoration. In the Eastern US piedmont many wetlands have been buried by legacy sediment accumulated over centuries behind historic mill dams. A recently developed restoration technique is to remove portions of these sediments, reconnecting the streams to the flood plain and exposing the buried wetlands. Our seed bank project took place at Bear Cabin Branch in Fallston, MD. We were interested in the viability of the seed bank contained within the legacy sediment and buried historic wetland. Random soil samples were taken at the bank edge from the floodplain surface to the buried wetland. Typical riparian seed banks are dominated by Juncus, and most seeds tend to be found within the top 2cm of soil. Juncus was also the dominant species in our seed bank but we found viable seeds from the floodplain surface to 135cm below the surface. We were not able to germinate any seeds from the sediments collected from the buried historic wetland soil layers.

Annual Standing Committee Reports

Maryland Water Monitoring Council

2017-2018 Annual Report

This report summarizes MWMC activities from November, 2017 through November, 2018.

2018 marked the 24th 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 2017 Annual Conference drew a record 600 attendees. Included were a host of exciting talks and posters and the fourth post-conference social at the nearby Marriot Hotel. Committee work continued in earnest, including some worthy projects and workshops. The Council entered 2018 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 changed leadership in 2017 with Sandy Hertz (MDOT) and Mat Pajerowski (USGS) taking the helm as Chair and Vice-Chair, respectively. The Board welcomed new members Megan Brosh (Baltimore County; replacing Kevin Brittingham) and Bill Stack (Center for Watershed Protection; replacing Carolyn Donovan). All 2018 Board members will remain going into 2019. MWMC Board of Directors information can be found at http://dnr.maryland.gov/streams/Pages/MWMC/BoardofDirectors.aspx .

2017 Annual Conference

The 23rd Annual Conference was once again held at the Maritime Institute on December 8 and the gathering was bigger and better than ever. With a record 600 in attendance, the event's theme was MANAGING WATER QUALITY IN A CHANGING WORLD. An informative plenary session started with a talk by Jim Caldwell (Howard County) who described the 2016 Ellicott City flood and plans for prevention going forward. Dr. Grace Brush (Johns Hopkins University) presented her work on Chesapeake Bay sediments and trends over thousands of years. Walter Boynton (Chesapeake Biological Lab) received the 11th Annual Carl Weber Award for his four decades of work on Bay and Patuxent River research. And Rebecca Kenyon-Sisler (Northern Garrett High School) won the second annual Above and Beyond Award for her work with students in Garrett County. Session topics included stream restoration monitoring, farming and water quality, climate resiliency, Maryland lakes, trout and citizen science. Seventy talks, 41 posters (including 15 student posters), 21 vendors or sponsors, and 14 "special interest" exhibits all contributed to a diverse and well-rounded agenda.

Workshops

Stream Monitoring Roundtable

The 11th Annual Stream Monitoring Roundtable was held at the USGS Water Science Center on February 23, 2018. About 58 people attended and there were 20 presentations by staff from agencies, consulting firms, academic institutions and NGOs. Mary Kay Foley, the Center's Director, kicked off the gathering by welcoming all. Mike Galvin (SavATree) gave a lunchtime presentation on the Baltimore Urban Waters Partnership. Andy Becker (KCI) and Shirley Kirby (MDE) collaborated to produce an online map of all submitted point data for 2018 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 Andy Becker at andy.becker@kci.com.

Stream Habitat Assessment Workshop for Citizen Monitors

On April 14, 2018, the MWMC's Citizen Science and Community Stewardship Committee held a workshop on freshwater stream habitat assessment at the Howard Co. Conservancy Center in Woodstock. About 60 folks participated. Jeff Reagan (Biohabitats) took the lead in organizing the workshop. Presentations included 1) MBSS protocols (Dan Boward – Maryland DNR); 2) Protocols for use by teachers (Amanda Sullivan – Howard Co. Conservancy); and 3) EPA Rapid Bioassessment Protocols (Jeff Reagan – Biohabitats). The indoor session ended with an overview of the Davis Branch restoration project by Mike Trumbauer (Biohabitats). Following the indoor presentations, registrants split into groups, hiked to Davis Branch and practiced their newfound skills. The Committee is planning a second habitat workshop for some time in 2019. For more information, contact Jeff Reagan at JReagan@biohabitats.com.

What's in store for 2019?

Since 2019 will be the 25th year for the Council, the annual conference may be expanded to multiple days at a different venue. The Conference Planning Committee will commence its 2019 activities in April. The Monitoring and Assessment Committee plans to hold a workshop on the MBSS IBIs in February. The workshop will be open to representatives of the MS4 jurisdictions and select contractors. There may be a more expanded workshop later in the year. As mentioned above, the Citizen Science and Community Stewardship Committee is planning a second habitat workshop geared toward volunteer monitors. Full committee reports can be found elsewhere in this program.

Submitted by Dan Boward
MWMC Executive Secretary
December 7, 2018

Maryland Water Monitoring Council Groundwater Committee

2018 Annual Committee Report

Chair

Mat Pajerowski
U.S. Geological Survey
MD-DE-DC Water Science Center
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Committee Members	Organization
John Grace	Maryland Department of Environment
Kevin Koepenick	Baltimore Co. Dept. of Environmental Protection and Sustainability
Steve Sherrard	Garrett County Environmental Health
Bill Ensor	Baltimore Co. Dept. of Environmental Protection and Sustainability
Joel Moore	Towson University
Brandon Fleming	U.S. Geological Survey
David Andreasen	Maryland Geological Survey

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.

2018 Accomplishments

The Committee focused on the issue of water quality in individual homeowner wells.

The committee reviewed previous information collected by MGS via a survey of some Maryland counties on their water-quality testing requirements. A student intern was enlisted by the committee, who adapted the previous MGS survey with new questions. The intern met with the committee input and approval of survey questions, and identified appropriate agencies at the county level who would have relevant information. The survey was sent to the appropriate agency in each county, and responses have been compiled. The committee is expected to continue its assessment of county requirements for water-quality testing and availability of data.

2019 Goals

1. Review results of the survey of County requirements for water-quality testing of individual wells and data availability, and discern possible next steps in assessing its utility for a state-wide assessment.
2. Follow up on groundwater issues related to the application of salt as a deicer.
3. Expand membership to include representation from the Eastern Shore and southern Maryland.

Submitted by M.G. Pajerowski

Maryland Water Monitoring Council Monitoring and Assessment Committee

2018 Annual Committee Report

Co-Chairs

Andy Becker	Michael Williams
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Committee Members (from 2017)	Organization
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

2018 Activities and Accomplishments

The MAC completed an analysis of the 2017 MWMC Annual Conference Survey and presented the results at the MWMC Board Meeting on January 16, 2018. The MWMC Board and the Annual Conference Planning Committee use the results of the analysis each year to strengthen the conference program to best meet the needs of the council. The 2017 analysis focused on the following:

- Conference attendee make-up – e.g. affiliation, volunteer based, background
- Reviews of conference presenters, posters, and topics
- Reviews to enhance the conference experience – e.g. overall program, conference layout
- Solicitation of speakers and topics for future workshops and annual conferences

Detailed results were also presented to the Annual Conference Planning Committee in early 2018 to facilitate discussion of conference themes and session topics for the 24th Annual Conference.

The 11th Annual Maryland Stream Monitoring Roundtable took place on February 23rd, 2018 at the USGS Water Science Center in Catonsville. There were 58 in attendance. Mary Kay Foley, the Center's Director, kicked off the gathering by welcoming all. During lunch, Mike Galvin (Baltimore Urban Waters Partnership/SavATree) discussed work on urban regreening, urban canopy improvements, and social investment for environmental benefit. There were 20 presentations. Andy Becker (KCI), Shirley Kirby, and Matt Stover (MDE) collaborated to produce an online map of all submitted point data for 2018 monitoring. The roundtable was organized by Andy Becker and Dan Boward (DNR).

The MAC organized a steering committee for a MD DNR MBSS IBI calculation workshop. The steering committee met on August 2nd at the MGS headquarters building in Baltimore, MD. Committee discussion topics included the need for an IBI workshop, MBSS IBI calculations in R statistical packages, surveying MWMC email list on the use of MBSS IBIs, development of a step-by-step IBI calculation document, workshop planning. A survey was distributed to the MWMC email list on August 15. Survey responses were received from 126 people and are helping inform the workshop planning and document development. A steering committee meeting is scheduled for early 2019 with the workshop anticipated in mid-2019.

Stream Restoration Monitoring Subcommittee

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
Michael Pieper	KCI Technologies, Inc.
Michael Trumbauer	Biohabitats
Michele Dobson	Harford County
Neely Law	Center for Watershed Protection
Robert Shedlock	USGS (retired)
Nancy Roth	Tetra Tech
Sadie Drescher	Chesapeake Bay Trust
Sandy Hertz	MDOT
Scott Lowe (Co-Chair)	McCormick Taylor
Stanley Kemp	University of Baltimore
Jim Gracie	Brightwater Inc.
Scott Macomber	Stormwater Maintenance & Consulting
Mark Secrist	U.S. Fish and Wildlife Service
Mark Southerland	AKRF
Scott Stranko (Co-Chair)	Maryland DNR
Shannon Lucas	Stormwater Maintenance & Consulting
Alison Armocida	Maryland DNR
Greg Golden	Maryland DNR
Ed Doheny	USGS
Dave Ivy	CEM Science
Rich Starr	Ecosystem Planning and Restoration
Kevin Smith	Maryland DNR
Claudia Donegan	Maryland DNR
Christ Aadland	Maryland DNR
Shirley Kirby	MDE

During 2018, the sub-committee planned and organized the all-day session at the MWMC conference, 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.

2019 Goals

The MAC is planning several activities for 2019:

1. Reconvene regular quarterly meetings starting in early 2019.
2. Assist with the development of a workshop and instructional guide to provide details on calculation of the MBSS Benthic and Fish Index of Biotic Integrity (BIBI and FIBI). MBSS provides excellent instruction on the field techniques for sample collection and preservation; however the committee sees a need for more detailed instruction on the laboratory and data analysis phases of the process. A documented approach will provide better accuracy and consistency and will provide solutions to common issues with sample size, taxonomic identification levels, metric calculation, and quality control.

Maryland Water Monitoring Council Citizen Science and Community Stewardship Committee

2018 Annual Committee Report

Committee members and affiliations
Jeff Reagan, Biohabitats Inc., Board Member, Chair
Diana Muller, Board Member, Co-Chair
Karen Wiggen, Charles County Dept. of Planning and Growth Management, Board Member
Marla Duley, Community Member

2018 Goals

- The committee is currently planning a Habitat Assessment workshop for volunteer monitoring groups and practitioners looking to hone their skills. We are currently in discussion with the Howard County Nature Conservancy to host the workshop and use Davis Branch for the field component of training. We will provide instruction on using DNR Habitat Assessment Protocols, EPA Rapid Bioassessment Protocols, Stream Corridor Assessment Protocols, and introduce the USFWS Function-Based Framework for Stream Assessment.
- The committee is committed to organizing at least 2 events per year, and will schedule a face-to-face "Happy Hour" committee meeting in early January as a follow-up to the Annual Conference.
- Increase Facebook engagement with consistent and relevant content.

2018 Accomplishments

- Habitat Assessment Workshop
    - Workshop was hosted in April at the Howard County Conservancy
    - The purpose of the workshop was to hands on experience conducting MBSS Habitat Assessment protocols and EPA Rapid Bioassessment protocols
    - The workshop included presentations and training by MWMC Board members (Jeff Reagan - Biohabitats, Dan Boward - MDNR) as well as other partners (Mike Thompson - Biohabitats, Dave Sigrist– MNCPPC, Mike Trumbauer- Biohabitats, Lori Lilly – Howard EcoWorks, Sara Weglein- MDDNR, Greg Zuknick- Biohabitats, and Sarah Roberts- Biohabitats).
    - The workshop also provided a beneficial networking opportunity between different groups of people from various backgrounds to share knowledge.
    - The workshop was a great success with almost 80 attendees.
- Facebook
    - The committee continues to run the MWMC Facebook page, posting on average once a week on a new item or reposting of "reminder" type posts. The page has grown to 440 Likes and continues to be a good resource for sharing events and job announcements.

Current News

- Despite the departure of our wonderful previous Chair, Caroline Donovan, the committee is remaining active and planning future events.

2019 Goals

- The committee is currently planning another Habitat Assessment workshop in the spring at the Charles County Soil Conservation District facility for volunteer monitoring groups and practitioners looking to hone their skills training. We will provide instruction on using DNR Habitat Assessment Protocols and EPA Rapid Bioassessment Protocols, with some discussion on Stream Corridor Assessment Protocols, and USFWS Function-Based Framework for Stream Assessments.
- The committee is committed to organizing at least 2 events per year, and will schedule a face-to-face "Happy Hour" committee meeting in early January as a follow-up to the Annual Conference.
- Increase Facebook engagement with consistent and relevant content.

Maryland Water Monitoring Council Student Committee

2018 Annual Committee Report

Committee members and affiliations

Joel Moore, Towson University, Chair, Board Member
Dan Boward, MDNR, Board Member
Karin Olsen, Anchor QEA, Inc., Community Member
Tami Imbierowicz, Harford Community College, Community Member
John Munro, UMUC, Community Member
Dot Lundberg, Rowan University, Community Member (through 2017 MWMC meeting)

The Student Committee's goals are to connect students, both high school and undergraduate, with the Council through workshops, projects, and the annual conference.

2018 Accomplishments

- Our main endeavor was to plan and execute the Student Professional Networking Session at the 2017 annual conference. The session had a diverse set of mentors that included women and other underrepresented groups in science, private consultants, K–12 science educators etc.
    - The mentors served on a panel that had 6 participants from government, industry, and education. The format was that each participant introduced themselves and talked a little about their career path. Students then could ask the panelists questions.
    - The session was perhaps more sparsely attended than the session in 2016 but seemed be a better format. The session was 60 minutes during the last slot of the day, and the weather was bad (snow starting), which likely contributed to sparser attendance.
    - Dot Lundberg was the key organizer and leader of the session with assistance from Carolyn Donovan (co-chair of committee through December 2017) and Joel Moore.
- The 2018 Student Professional Networking Session will take place at the 2018 conference.
    - The style of the session will be tweaked. The panel will remain the same but the session will be held earlier in the day in a 1.5 hour time slot to give the students more time to interact with the mentors on a more individual level. Also, we hope to give students and mentors the option to eat their lunch in the room and have more opportunities to talk.
    - Student interest has been high with 35 currently signed up for the session through early November 2018.

- The Student committee continued work to facilitate student internships for two MWMC committees. One way that we tried to engage students more in the Council was through setting up unpaid (but credited) internships with MWMC committee members (or subcommittees). The internships have the goal of helping accomplish the goals of the MWMC and at the same time fulfilling the needs that many undergraduate students have for industry-relevant experience and/or academic credit.
    - In 2017, two internships were advertised – one for a GIS specialist to help with the online Stream Mapper (MDNR and MDOT, Information and Management Committee) and one for a data analyst to help with groundwater water quality information on domestic service wells (USGS, Groundwater Committee).

- An intern was not selected for the mapping project due to time constraints on the individuals overseeing that project.
- An intern was selected for the Groundwater Committee and successfully completed their project during the spring of 2018.
- We decided not to pursue more internships for the 2018-19 academic year.

2019 Goals

- Evaluate the success of the Student Professional Networking session that will take place at the 2018 annual conference
- Consider one or two more internship opportunities if well-defined projects with well-established timelines are proposed.
- Consider inviting a graduate (Masters or PhD) student to attend and participate in the quarterly MWMC meetings (continuing from 2018)

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