2014

9th Susquehanna River Symposium Program with Abstracts

Bucknell Center for Sustainability and the Environment

9TH ANNUAL

SUSQUEHANNA RIVER SYMPOSIUM

NOVEMBER 21 & 22, 2014

Science & the River

Ongoing projects and research in the Susquehanna watershed

PROGRAM WITH ABSTRACTS

9th Annual SUSQUEHANNA River Symposium

November 21-22, 2014

Elaine Langone Center
Bucknell University

This symposium brings the public together with scientists, engineers, consultants, watershed groups, and state and federal agencies to share some of the findings of our research within the watershed and discuss the long-term health and sustainability of the Susquehanna River and Chesapeake Bay.

CONTRIBUTORS

Bucknell University Watershed Sciences and Engineering Program

Susquehanna River Heartland Coalition for Environmental Studies

U.S. Fish and Wildlife Service

Pennsylvania Department of Environmental Protection

Chesapeake Bay Foundation

Cover photo: View north up the West Branch Susquehanna River at Lewisburg, PA, June 2014.
Provided by B. Hayes

Welcome!

The Watershed Sciences and Engineering Program of the Bucknell Center for Sustainability and the Environment and the Susquehanna River Heartland Coalition for Environmental Science welcomes you to the 9th Annual Susquehanna River Symposium.

All events will be held in the Elaine Langone Center on the campus of Bucknell University and are free and open to the public. Parking is available on Moore Avenue and 7th Street. Maps and lodging information can be found online at:

www.bucknell.edu/riversymposium.

PRESENTATIONS, STUDENT RESEARCH POSTERS AND EXHIBITS

Research posters and interactive displays by students and faculty working on projects throughout the Susquehanna watershed will be featured, as well as exhibits and representatives from a number of organizations devoted to conserving and protecting the Susquehanna's many natural resources.

Visit the symposium website for updates and to download more information

November 21, 2014

Terrace Room, Elaine Langone Center
Bucknell University

FRIDAY

Welcome

7:00 PM

Dr. John C. Bravman
President
Bucknell University

Studying the Watershed Through University Research and Collaborative Partnerships

7:15 PM

H. W. “Skip” Wieder
Executive Director
Susquehanna River Heartland Coalition for Environmental Studies

Keynote Address

Sustainable Susquehanna: A Habitat Conservation Vision for the Region's Fish and Wildlife

7:30 PM

Michael Slattery
Coordinator, Chesapeake Bay Program
U.S. Fish and Wildlife Service
Annapolis, Maryland

Student Research Posters, Agency Exhibits, and Evening Social

8:15 - 10:00 PM

Research posters from faculty and students.

Displays from watershed groups, conservancies, consulting firms, and other organizations.

SUSQUEHANNA RIVER SYMPOSIUM

Bucknell UNIVERSITY
WATERSHED SCIENCES AND ENGINEERING PROGRAM

SATURDAY

November 22, 2014

Terrace Room, Elaine Langone Center
Bucknell University

8:00 - 8:50 AM

Student Research Posters and Agency Exhibits

Enjoy coffee and refreshments to get your day started!

8:50 AM

Welcome and Announcements

Benjamin R. Hayes
Chairman, 2014 Susquehanna River Symposium

Session No. 1

AQUATIC AND TERRESTRIAL ECOLOGY AND THE CHESAPEAKE BAY

Steven Jordan*, Moderator

9:00 AM

Economic Value of Implementing the Chesapeake Bay Cleanup Plan

Beth McGee
Chesapeake Bay Foundation, Annapolis, Maryland

Spencer R. Phillips
Key-Log Economics, Charlottesville, Virginia

9:15 AM

Impacts of Japanese knotweed (*Polygonum cuspidatum*) on Native Plant Diversity in Riparian Communities along the Susquehanna River

Chris Martine
Department of Biology, Bucknell University

Anna Freundlich
BLM Conservation and Land Management Program

Matt Wilson
Department of Forest and Conservation Sciences
University of British Columbia, Vancouver, BC

9:30 AM

Algal Phosphorus Storage During Storm Runoff Events in Streams

Steven Rier, Sarah Hay, and Keith C. Kinek
Department of Biology, Bloomsburg University

November 22, 2014

Terrace Room, Elaine Langone Center
Bucknell University

SATURDAY

9:45 AM

Biological Studies of American Eel at the Conowingo Project

Chris Avalos and Ray Bleistine
Normandeau Associates, Drumore, PA

Kimberly Long
Exelon Power Corporation, Kennett Square, PA

Tom Sullivan
Gomez and Sullivan Engineers, Heneker, NH

10:00 AM

Angler Use Survey of the Lower Susquehanna River Downstream of Conowingo Dam

Michael D. Martinek
Normandeau Associates, Drumore, PA

10:15 AM

Unassessed Waters Initiative: What We Have Learned in 4 Years of Sampling and Over 500 Streams

Jonathan Niles
Fresh Water Sciences Initiative, Susquehanna University

10:30 AM

Break

10:45 AM

Examination of American Shad Restoration Efforts: Susquehanna River Example

Ray Bleistine
Normandeau Associates, Drumore, PA

11:00 AM

Monitoring Eastern Hellbender Populations in the Susquehanna River Basin: Evidence for Population Stability and Massive Declines

Peter J. Petokas
Department of Biology, Lycoming College

SATURDAY

November 22, 2014

Terrace Room, Elaine Langone Center
Bucknell University

11:15 AM

Crayfish in the Susquehanna River — 2008 to 2013: Rust(ies) Never Sleep(s)

Brian P. Mangan
Environmental Program, King's College, Wilkes-Barre, PA

11:30 AM

Using 20 Years of Benthic Invertebrate Surveys by Multiple Agencies to Reveal Patterns of Community Structure Over Space and Time

Matthew E. McTammany
Department of Biology, Bucknell University

Matt Wilson
Department of Forest and Conservation Sciences
University of British Columbia, Vancouver, BC

Sean P. Reese and Benjamin R. Hayes
Center for Sustainability and the Environment, Bucknell University

Michael D. Bilger
Freshwater Research Initiative, Susquehanna University

11:45 AM

Interpreting Diatom Communities in the Upper Main Stem of the Susquehanna River

Jack R. Holt
Department of Biology, Susquehanna University

12:00 - 12:45 PM

Lunch

Walls Lounge, Elaine Langone Center

12:30 PM

Experimental Stocking of American Eels in the Susquehanna River Watershed and Implications for Eastern Elliptio Populations

Julie Devers
U.S. Fish and Wildlife Service, Annapolis, MD

Steve Minkkinen and Ian Park
U.S. Fish and Wildlife Service, Annapolis, MD

Heather Galbraith
U.S. Geological Survey, Northern Appalachian Research Laboratory

November 22, 2014

Terrace Room, Elaine Langone Center
Bucknell University

SATURDAY

Session No. 2

WATERSHED HYDROLOGY AND RIVER HYDRAULICS

Jessica T. Newlin, Moderator

Retrospective Case Study of the Impact of Rain Gage Network Reductions on National Weather Service River Forecasts in the Susquehanna River Basin

1:00 PM

Peter, R, Ahnert, Kevin P. Hlywiak, and Seann M. Reed
National Weather Service
Middle Atlantic River Forecast Center, State College PA

Characterization of Water Quality of a Pumped-Storage Facility

1:15 PM

Steven W. Adams
Normandeau Associates, Drumore, PA

Consumptive Use Modeling to Optimize Surface Water Withdrawal Sustainability

1:30 PM

Kevin L. Hoover
Water and Wetlands.com, Ortanna, PA

Jeremy V. Manno
State College, PA

Application of a Simplified Dam Failure Analysis on the Susquehanna River Valley

1:45 PM

Mark Schwartz, Jeff Oskamp, and Jemie Dababneh
Rizzo Associates, Pittsburgh, PA

Break

2:00 - 2:15 PM

SATURDAY

November 22, 2014

Terrace Room, Elaine Langone Center
Bucknell University

Session No. 3

WATER QUALITY ASSESSMENTS AND TREATMENT TECHNOLOGIES

Sean P. Reese, Moderator

2:15 PM

Multidisciplinary Surface Water Monitoring And Assessment of the Susquehanna River

Michael (Josh) Lookenbill
Division of Water Quality Standards
PA Department of Environmental Protection

Amy Williams and Dustin Shull
Division of Water Quality Standards
PA Department of Environmental Protection

2:30 PM

Community-based Water Quality Monitoring Projects in Marcellus Shale Gas Drilling Regions in Centre, Clearfield, and Clinton Counties, PA

Md. Khalequzzaman
Dept. of Geology & Physics, Lock Haven University

2:45 PM

Acid Mine Drainage Research-Service-Learning in the Laurel Highlands

William Strosnider
Environmental Engineering Program, Saint Francis University

3:00 PM

Pharmaceutical Disposal: Assessing the Flows and Impacts on Your Community

James Maneval and Ryan C. Snyder
Department of Chemical Engineering, Bucknell University

November 22, 2014

Terrace Room, Elaine Langone Center
Bucknell University

SATURDAY

Session No. 4

CONSERVATION, PLANNING, AND RIVER TOWNS

Ben Marsh*, Moderator

Reflection on the 2004 Rivers Conservation Plan for the Lower West Branch of the Susquehanna River —The Good, the Bad, and the Ugly

3:15 PM

Mel Zimmerman
Department of Biology, Lycoming College

Floods on the Susquehanna: Small River Towns' Flood Mitigation and Response Strategies Reshape their Land Uses and Urban Centers

3:30 PM

L. D. Duke
Department of Marine and Ecological Sciences
Florida Gulf Coast University

Seamus McLaughlin
Department of Environmental Studies
Bucknell University

Attitudes about Land Conservation in Counties Contiguous with the Susquehanna River

3:45 PM

Brandn Green
Place Studies Program, Center for Sustainability and the Environment
Bucknell University

Adjourn

4:00 PM

*not confirmed

SESSION NO. 1, 9:00 AM

Terrace Room, Elaine Langone Center

Steve Jordan*, Session Moderator

Aquatic and Terrestrial Ecology and the Chesapeake Bay

1.1 **9:00 AM** McGee, Beth

ECONOMIC VALUE OF IMPLEMENTING THE CHESAPEAKE BAY CLEANUP PLAN

Beth L. MCGEE, Chesapeake Bay Foundation, 6 Herndon Avenue, Annapolis, MD 21403, BMcgee@cbf.org, Spencer R. PHILLIPS, Key-Log Economics, 100 Christa Court, Charlottesville, VA 22903

In response to continuing water quality issues in the Chesapeake Bay, the U.S. Environmental Protection Agency (EPA) in collaboration with the six watershed states and the District of Columbia has finalized the Chesapeake Bay Total Maximum Daily Load (TMDL) for nitrogen, phosphorus and sediment and the jurisdiction-specific clean up plans to attain these limits. The present study evaluates the ecosystem service benefits that would accrue in the Chesapeake Watershed as a result of implementing these clean up plans.

We focus on the dollar value of eight ecosystem services originating, and largely enjoyed, in the Chesapeake Bay watershed region: food production (crops, livestock, and fish), climate stability, gas regulation, water supply, water regulation, waste treatment, aesthetics, and recreation. These we evaluated for baseline, TMDL, and business-as-usual scenarios. Ecosystem service benefits accrue in the TMDL scenario in two complementary ways. First, land use shift from less to more ecosystem-service-productive uses. Second, land in any land use can become more productive as a result of management actions designed to reduce nutrient and sediment pollution.

We employed a four-step process to estimate these benefits: 1) Assign land and water in the Chesapeake Bay watershed to one of seven land uses (forest, wetlands, open water, urban open space, other urban land, agriculture, and other) based on EPA Chesapeake Bay Program data and remotely sensed land cover data. Land use was estimated for each of the three scenarios. 2) Adjust baseline (2009) health / productivity for land use based on a spatially explicit index derived from pollution, population density and other indicators of human impacts on ecosystems. 3) Estimate changes from baseline ecosystem health for the TMDL and BAU scenarios, using projected changes in total suspended solids loads as a proxy for improvement/degradation for the non-tidal portion of the watershed. For the Tidal portion, improvement in attainment of dissolved oxygen standards serves as the proxy. 4) Calculate the dollar value of eight ecosystem services in each scenario using the benefits transfer met hod with region-specific values drawn from thousands of possible source studies.

Relative to both the baseline and business-as-usual scenario, estimated benefits of full implementation of the TMDL is approximately $20 billion per year, beginning in 2025 (2013 dollars). Detailed estimates by land use, state and ecosystem service will be publicly released in the fall and presented at the conference, but in general, the majority of benefits involve the water supply and regulation, and aesthetic services. For land uses, forests, open water and lands supply the majority of these benefits. Relative to the size of the region economy, the magnitude of these estimates compares well with previous studies. And relative to the projected cost of TMDL implementation, these estimates suggest that complete implementation is a worthwhile financial investment.

*not confirmed

1.2 **9:15 AM** Martine, Chris

IMPACTS OF JAPANESE KNOTWEED (POLYGONUM CUSPIDATUM) ON NATIVE PLANT DIVERSITY IN RIPARIAN COMMUNITIES ALONG THE SUSQUEHANNA RIVER

Chris MARTINE, Department of Biology, Bucknell University, Lewisburg, PA 17837, ctm015@bucknell.edu; Anna FREUNDLICH , BLM Conservation and Land Management Program; Matt WILSON, Department of Forest and Conservation Sciences, University of British Columbia, Vancouver, BC V6T 1Z4 Canada

Invasive species can alter natural communities and out-compete native plants, reducing densities of natives or replacing them completely. This study sought to quantify the impact of Japanese Knotweed (*Polygonum cuspidatum*) on riparian plant communities along the Susquehanna River in central Pennsylvania. Two study communities, one relatively intact and one invaded by Japanese knotweed, were surveyed. Both areas were sampled across the herbaceous, understory, and canopy layers. Densities and presence/absence were recorded for 30 x 12m plots within each study area. Although a small group of native species appear to be tolerant, results indicate that plots in sites invaded by *P. cuspidatum* are significantly less diverse than those in intact plots. Species recorded within both communities, such as the common blue violet (*Viola cucullata*), smooth Solomon's seal (*Polygonum biflorum*), and green dragon (Arisaema dracontium), had significantly reduced densities in the invaded plots compared to the intact plots. Recruitment of native tree seedlings appears to be impaired by incursions of P. cuspidata and surveys of mature tree dbh in each site allows us to infer that this has been the case for some time in our study area.

1.3 **9:30 AM** Rier, Steven

ALGAL PHOSPHORUS STORAGE DURING STORM RUNOFF EVENTS IN STEAMS

Steven T. RIER, Department of Biology, Bloomsburg University, Bloomsburg, PA 17815, srier@bloomu.edu; Sarah E. HAY, Department of Biology, Bloomsburg University, Bloomsburg, PA 17815, Keith C. KINEK, Department of Biology, Bloomsburg University, Bloomsburg, PA 17815

Rapid phosphorus (P) fluctuations in streams coupled with the potential for microorganisms to store P as polyphosphate suggests that P pulses during storm runoff are important drivers of stream nutrient dynamics. We used a recently-developed 4',6-diamidino-2-phenylindole (DAPI)-based approach for quantifying polyphosphates in microbial assemblages to compare the response of stream algae to natural runoff events in a small headwater tributary to Fishing Creek, a larger fifth order section of Fishing Creek near Bloomsburg, PA and in twelve 15 L recirculating stream mesocosms.

Increases in polyphosphate storage following P pulses appear to be a function of pulse concentrations and duration with algae in the mid order section displaying substantial increases in polyphosphate concentrations following storm events, while the headwater reach did not display detectable increases. These results were confirmed by two laboratory mesocosm experiments and suggest that under certain conditions P- pulses may significantly affect lotic ecosystem functional processes, such as primary productivity, nutrient spiraling and organic matter processing, which could persist long after the pulse has subsided.

1.4 **9:45 AM** Avalos, Chris

BIOLOGICAL STUDIES OF AMERICAN EEL AT THE CONOWINGO PROJECT

Chris AVALOS, Normandeau Associates, Inc., 1921 River Road PO Box 10, Drumore PA 17518, cavalos@normandeau.com; Ray BLEISTINE, Normandeau Associates, Inc., 1921 River Road PO Box 10, Drumore PA 17518; Kimberly L. LONG, Exelon Power Corporation, Exelon Way, Kennett Square, A 19348; Tom SULLIVAN, Gomez and Sullivan Engineers, P.C., 41 Liberty Road, Heneker, NH 03242

As part of a broad bio-engineering investigation at Conowingo Hydroelectric Dam, MD we studied the distribution and abundance of juvenile American eel, Anguilla rostrata, downstream of the dam for two years. Results of our study were expected to provide potential location(s) for an eel fish way when and if deemed desirable for the migrating population.

Elvers and yellow eels were sampled between 24 June and 6 September 2011 using elver ramps (with Enka Mat and Akwa Drain substrates) and eel pots (for yellow eels). A total of 1,159 eels (1,100 elvers collected from the elver ramps and 59 yellow eels in pots) were collected in the spillway side downstream of Conowingo Dam compared to 166 elvers and 92 yellow eels collected in 2010. Capture of elvers differed between substrate type and location of ramps. The East ramps (located farther from the powerhouse), collected 539 elvers, with 133 collected in the Enka Mat substrate, with 406 elvers collected in the Akwa Drain substrate. The West ramps (location near the powerhouse) collected 561 elvers, with 405 collected in the Enka Mat substrate, with 156 elvers collected in the Akwa Drain substrate. High elver collections on both sides were ramps parallel to walls suggesting elvers orient themselves upstream to structure. The collection locations of elvers were subject to spill age which caused extensive damage to the collection gear. It was observed that the integrity of any structure below the spillway could be at risk during spillage.

Elver lengths ranged from 87 to 188 mm TL, with an average size of 124.9 mm. Yellow eels harvested from the eel pots totaled 151 for both study years; with the exception of one, all yellow eels were collected near the powerhouse location. The length range of eels collected in pots ranged from 300 to 689 mm TL, with an average length of 515.4 mm. Most elvers were split at age 1 or 2, and 3 to 5 years of age at 30%, respectively. A large gap in age at year 6 to 8 was apparent; larger eels were aged 9 to 17, plus one at 19 years of age.

The study period encompassed three new moon periods and two full moon periods; a strong relationship was not observed between the number of elvers captured and lunar phase. Elvers were observed in abundance below crest gate 30.

Elvers climbing to base of Conowingo Dam on the Susquehanna River. Elvers are juvenile eels that migrate to brackish waters and begin to develop gray to greenish-brown pigmentation. Credit: Maryland Fisheries Resources Office, USFWS

1.5 **10:00 AM** Martinek, Michael

ANGLER USE SURVEY OF THE LOWER SUSQUEHANNA RIVER DOWNSTREAM OF CONOWINGO DAM

Michael D. MARTINEK, Normandeau Associates, Inc., 1921 River Rd., Drumore, PA 17518, mmartinek@normandeau.com

An angler use survey of the lower Susquehanna River was conducted as part of the relicensing for Conowingo Dam. This particular survey targeted recreational anglers fishing downstream of the dam in spring through fall months in 2010. We conducted roving on-site interviews of shoreline and boat-based anglers at several access points along the east and west shorelines of the river. Weekly, low altitude aerial observations via helicopter were used to count anglers and determine fishing location preferences. Anglers were asked to answer questions regarding fish target species, time duration of trip, number and species of fish caught, kept, and released, and home zip code. The data collected was used to estimate total catch per effort, catch per unit effort for individual fish species and overall catch per unit effort. A total of 1,047 angler interviews were conducted; more than 20 species were caught. The common species targeted by anglers included: striped bass, largemouth bass, hickory shad, and white perch.

1.6 **10:15 AM** Niles, Jonathan

UNASSESSED WATERS INITIATIVE: WHAT WE HAVE LEARNED IN 4 YEARS OF SAMPLING AND OVER 500 STREAMS

Jonathan NILES, Department of Biology, Susquehanna University, 514 University Avenue, Selinsgrove, PA 17870, niles@susqu.edu

Since 2011 Susquehanna University has participated in the Pennsylvania Fish and Boat Commission's Unassessed Waters Initiative. As part of this Initiative we have surveyed over 500 previously Unassessed Waters throughout central Pennsylvania to determine their status as possible Wild Trout streams. We found brook trout in greater than 50% of these streams. Many streams supported robust populations of brook trout.

10:30 BREAK

1.7 **10:45 AM** Bleistine, Ray

EXAMINATION OF AMERICAN SHAD RESTORATION EFFORTS: SUSQUEHANNA RIVER EXAMPLE

Ray A. BLEISTINE, Normandeau Associates, Inc. 1921 River Road, Drumore, PA 17518, Rbleistine@normandeau.com.

Efforts to restore American shad to multiple river systems on the Atlantic coast have been ongoing in various forms since the mid-1800s. The Susquehanna River has been the site of multiple forms of restoration and this makes it an ideal system to study the various efforts and level of success. In the early 1900's the construction of four major dams permanently changed the structure of the Susquehanna River. Modern restoration efforts began in the 1950's and are ongoing. These efforts have included trap and transport, installation of fish passage facilities, fishing moratorium, and hatchery operations. Using published data, this examination looks at the restoration goals, various restoration efforts, and the success of these efforts.

1.8 **11:00 AM** Petokas, Peter

MONITORING EASTERN HELLBENDER POPULATIONS IN THE SUSQUEHANNA RIVER BASIN: EVIDENCE FOR POPULATION STABILITY AND MASSIVE DECLINES

Peter J. PETOKAS, Department of Biology, Lycoming College, Williamsport, PA 17701, petokas@lycoming.edu

Over the course of nine consecutive field seasons, we have monitored multiple populations of the eastern hellbender (*Cryptobranchus alleganiensis*) in multiple tributaries of the Susquehanna River. Although once widespread throughout the river basin, this research has revealed that the eastern hellbender is now restricted to several tributaries of the West Branch watershed. Population monitoring has shown that some populations are stable and self-sustaining throughout a particular watershed, while significant population declines have taken place in other watersheds. In cooperation with Cornell University, we have determined that 40% of hellbenders in the river basin are infected with chytrid fungus (*Batrachochytrium dendrobatidis*), yet there is no direct evidence that chytrid is the underlying cause of observed population declines. Necropsies of hellbender carcasses collected from a decline location have revealed no indicators of morbidity or mortality, and all appeared healthy in gross dissection. To augment declining hellbender populations, we have begun a cooperative effort with zoological facilities in New York to raise hellbenders to an age (3-5 years) and size that will not be subject to predation when the salamanders are released into Susquehanna River tributaries.

1.9 **11:15 AM** Mangan, Brian

CRAYFISH IN THE SUSQUEHANNA RIVER--2008 TO 2013: RUST(IES) NEVER SLEEP(S)

Brian P. MANGAN, Environmental Program, King's College, Wilkes-Barre, PA, 18711 , brianmangan@kings.edu

Crayfish were surveyed in the Susquehanna River in 2008 and 2013. During each survey 100 baited wire traps were deployed in 10X10 grids at each of 11 sampling sites along 400 km of the river. Rusty crayfish were collected at five of the 11 sites in 2008, and at two additional sites in 2013. The numbers of Rusty Crayfish collected at most sites were similar to 2008. However, at one downriver site in 2013 the number of crayfish collected were astonishing. The high densities of crayfish in this section of the river coincide with reported declines of smallmouth bass.

1.10 **11:30 AM** McTammany, Matthew

USING 20 YEARS OF BENTHIC INVERTEBRATE SURVEYS BY MULTIPLE AGENCIES TO REVEAL PATTERNS OF COMMUNITY STRUCTURE OVER SPACE AND TIME

Matthew E. MCTAMMANY, Biology Department, Bucknell University, Lewisburg, PA 17837 , mmctamma@bucknell.edu; Matthew J. WILSON, Department of Forest and Conservation Sciences, University of British Columbia, Vancouver, BC V6T 1Z4 Canada; Sean P REESE, Center for Sustainability and the Environment, Bucknell University, Lewisburg, PA 17837; Benjamin R. HAYES Center for Sustainability and the Environment, Bucknell University, Lewisburg, PA 17837; Michael D. BILGER, Freshwater Research Initiative, Susquehanna University, Selinsgrove, PA 17870.

State and federal agencies frequently conduct benthic macroinvertebrate surveys for bioassessment across large spatiotemporal scales. However, these data are rarely used outside specific regulatory agencies to address ecological questions. We assembled a dataset of benthic community information from 10 locations in the Susquehanna River and major tributaries collected by four federal and state agencies from 1991-2011. To account for differences in sampling, processing, and identification methods among agencies, we standardized sample size and resolved taxonomic ambiguities of 150 samples. Invertebrate communities were dominated by mayflies and caddisflies (45.6 to 83.2%) across all locations, and spatial patterns in certain invertebrate taxa were detected among major sub-basins of the Susquehanna River drainage.

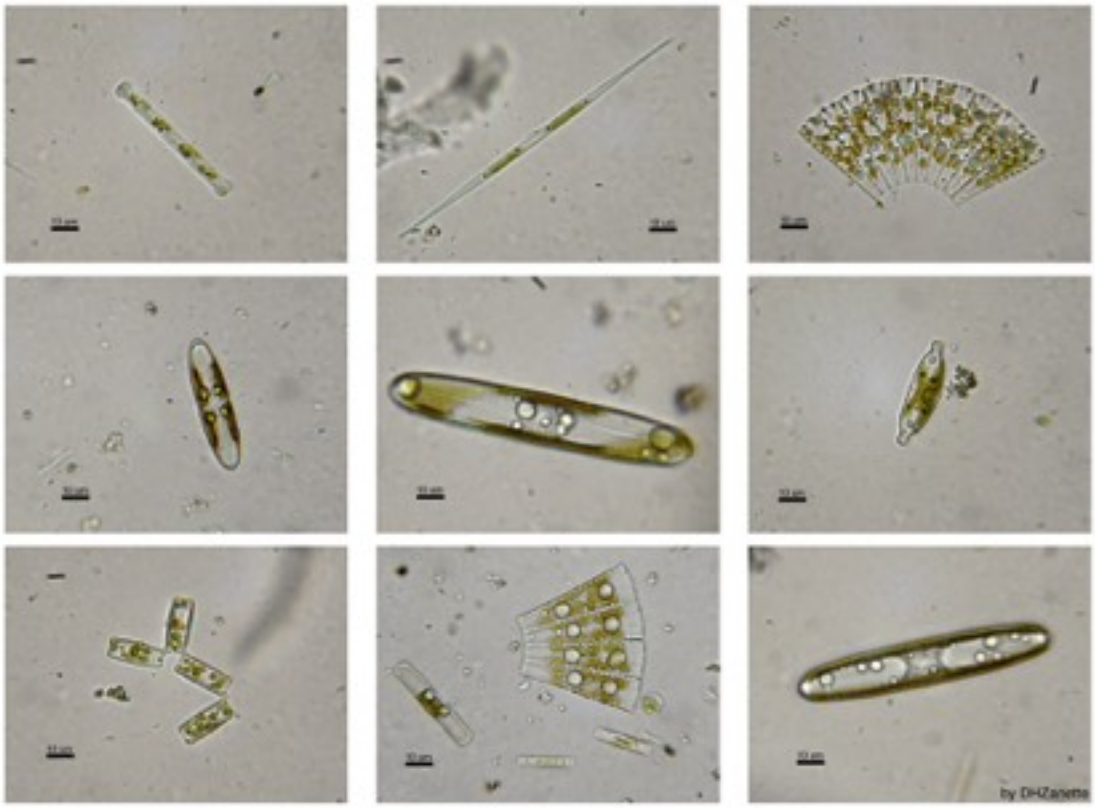
In addition, the dataset also documents the spread of Asian clams (*Corbicula*) and the impact of black fly (*Simuliidae*) management in the Susquehanna River. Percent EPT and community diversity measures were inversely correlated, indicating that traditional macroinvertebrate IBI approaches might not be applicable to large rivers. Large river invertebrates are understudied and, even with challenges of compiling multi-agency datasets, we show the value of applying these data to large river systems. Our analysis also suggests changes to future biomonitoring protocols to improve their effectiveness in bioassessment and ecological applications.

1.11 **11:45 AM** Holt, Jack

INTERPRETING DIATOM COMMUNITIES IN THE UPPER MAIN STEM OF THE SUSQUEHANNA RIVER

Jack R. HOLT, Biology Department, Susquehanna University, Selinsgrove, PA 17870, holt@susqu.edu

From 2009 to the present, diatom periphyton communities have been collected as part of a long-term monitoring program summer and fall between Sunbury and Selinsgrove on a transect near Shady Nook, Byers Island on the Susquehanna River. The overall purpose of the monitoring program was to establish a baseline together with benthic invertebrate communities to help understand changes in the Susquehanna River. Throughout the study, diatom communities were collected passively by periphytometers, artificial substrates using glass microscope slides which were immersed in the river for 3-4 week intervals. In 2012, we began to supplement the passive samples with diatom communities collected actively from stones, sediment, and plants (when present). Overall, species richness for the sites was relatively low and rarely exceeded 15 species when collections were made by periphytometers, but more than doubled (26-56) when collections were made by active means. Furthermore, from 2012 to the present Cocconeis placentula dominated the passive collections ($\bar{x}$ = 81.7%), but were much less common in diatom communities on stone ($\bar{x}$ = 7.8%) and sediment ($\bar{x}$ = 6.0%). This difference was seen in common metrics like Shannon Diversity Index (SDI) in which SDI for diatom communities on glass slides was 0.5 to 0.8 while SDI values for communities on stone and sediment ranged from 2.5 to 3.0. The Byers Island transect lies below the confluence of the West Branch and North Branch of the Susquehanna River, each of which shows signature values of turbidity, pH, conductivity, and alkalinity. Because of the dominance of C. placentula on the periphytometer slides, diatom communities on them showed high similarity between the two plumes. Communities collected by active means, however, did show differences. For example, of the 146 species collected between samples taken actively in 2013 from the North Branch Plume and West Branch Plume, only 20 species were shared between them. That the level of homogeneity between samples may be a consequence of the homogeneity or orientation of the substrates will be discussed.



12:00 - 12:45 PM - LUNCH
(Walls Lounge, Elaine Langone Center)

12:30 PM LUNCHEON ADDRESS

EXPERIMENTAL STOCKING OF AMERICAN EELS IN THE SUSQUEHANNA RIVER WATERSHED AND IMPLICATIONS FOR EASTERN ELLIPTIO POPULATIONS

Julie DEVERS, U.S. Fish and Wildlife Service, 177 Admiral Cochrane Dr., Annapolis, MD 21401, julie_devers@fws.gov; Steve MINKKINEN and Ian PARK, U.S. Fish and Wildlife Service, 177 Admiral Cochrane Dr., Annapolis, MD 21401; Heather GALBRAITH, U.S. Geological Survey, Leetown Science Center, Northern Appalachian Research Laboratory, 176 Straight Run Road, Wellsboro, PA 16901

American eel populations have been declining along the Atlantic coast. Conowingo Dam, at mile 10 of the Susquehanna River, blocks American eels from accessing 43% of previously available habitat in the Chesapeake Bay watershed. Following the construction of large mainstem dams in the Susquehanna River, eels were stocked sporadically until 1980. In addition to very low abundance of eels found in the Susquehanna River watershed the freshwater mussel *Eastern Elliptio*, common in most mid-Atlantic streams and rivers, is relatively low in abundance. Laboratory tests conducted by USGS, Northern Appalachian Research Laboratory and USFWS, Maryland Fishery Resources Office (MFRO) suggest that American eels could provide an important link to *Eastern Elliptio* reproduction in the Susquehanna River. *Eastern Elliptio* larvae use American Eels as a host during this parasitic life stage. One reason for the low abundance in *Eastern Elliptio* in the Susquehanna River may be the low number of eels. MFRO has been working since 2006 to assess the best methods for capturing eels below Conowingo Dam and transporting them to upstream tributaries in the Susquehanna River Basin. Following baseline fish and mussel surveys, experimental eel stockings in two tributaries were conducted from 2010 to 2012 . Fish and mussel populations will be monitored until 2019 to assess the impacts of American Eel reintroduction on fish populations and Eastern Elliptio reproduction and recruitment.

SESSION NO. 2, 1:00 PM

Terrace Room, Elaine Langone Center
Jessica T. Newlin, Ph.D., P.E., Session Moderator

Watershed Hydrology and River Hydraulics

2.1 **1:00 PM** Anhert, Peter

RETROSPECTIVE CASE STUDY OF THE IMPACT OF RAIN GAGE NETWORK REDUCTIONS ON NATIONAL WEATHER SERVICE RIVER FORECASTS IN THE SUSQUEHANNA RIVER BASIN

Peter, R, AHNERT, NWS, Middle Atlantic River Forecast Center, 328 Innovation Blvd (STE 330), State College, PA, 16870, peter.ahnert@noaa.gov; Kevin P. HLYWIAK, Middle Atlantic River Forecast Center, State College, PA, 16870; Cody L. Moser, AMEC, Boulder, CO, 80302; Seann M. REED, Middle Atlantic River Forecast Center, State College, PA, 16870

Funding cuts in 2013 resulted in the loss of 63 United States Geological Survey rain gages in the Susquehanna River basin. For this study, the impact of gage reductions on gage network density and on calculations of Mean Areal Precipitation (MAP) for the sub-basins used for Middle Atlantic River Forecast Center modeling and forecasting is examined. In addition, to further examine the impacts on operational river forecasts, sets of retrospective hydrologic forecast model simulations are made with and without the removed gages for several significant flood events that occurred prior to the loss of these gages. The loss of gages leads to an increase in MAP uncertainty during high impact events. While changes in river crest flows are small most of the time, in about 10% of the cases the crest flow accuracy was degraded by more than 20%. In a few cases, this increased forecast error and/or uncertainty could make it more difficult to make timely river flood warning and evacuation decisions. The study demonstrates the value of retrospective simulations and flood crest analyses in quantifying the potential impacts of gage network reductions on river forecast accuracy.

2.2 **1:15 PM** Adams, Steven

CHARACTERIZATION OF WATER QUALITY OF A PUMPED-STORAGE FACILITY

Steven W. ADAMS, Normandeau Associates, Inc., 1921 River Rd., Drumore, PA 17518, sadams@normandeau.com

We characterized the water quality (water temperature, dissolved oxygen (DO), pH, chlorophyll a, specific conductivity, and turbidity) of the Muddy Run Pumped Storage Facility located on the lower Susquehanna River in 2010 and 2011 and analyzed the effects of project operations on these parameters, particularly during summer low flow period. We systematically sampled depth profiles in April through October and took continuous measurements (except for chlorophyll a) in the immediate forebay and the tailrace of the project. The water quality of the upper storage reservoir, to a large extent, is reflective of prevailing conditions in the lower reservoir (Conowingo Pond, source water) due to daily exchange of water between the two bodies of water though some differences occur in vertical distribution of DO. As in the past, some deep areas in the upper storage reservoir showed vertical stratification (mostly in late July through August). No thermal stratification was observed.

Relative to the historical records, little changes were observed in water quality characteristics of the reservoir. Although substandard DO values (daily average ≤ 5.0 mg/L and instantaneous value ≤ 4.0 mg/L) were recorded at both continuous monitors; mainly during July-August period their occurrences could not be conclusively correlated with project operations. However, an increase in DO at the continuous monitor in the immediate forebay area during pumping mode was noted, perhaps a reflection of withdrawal of high DO water from the lower reservoir. The influence of substandard DO was limited to the turbine discharge area during generation. Even though the upper reservoir exhibits DO stratification, the tailrace instantaneous DO measurements of <4.0 mg/L occurred only once (0.2%) and no daily average DO values were less than 5.0 mg/L meeting the PA DEP standard. Simultaneous measurements of water temperature taken at different operational modes did not show discernible effects of project operations. Both the turbidity and pH values met the PA DEP water quality standards and were within the historical range.

2.3 **1:30 PM** Hoover, Kevin

CONSUMPTIVE USE MODELING TO OPTIMIZE SURFACE WATER WITHDRAWAL SUSTAINABILITY

Kevin L. HOOVER, 1109 Buchanan Valley Road, Orrtanna, PA, 17353, khoover@waterandwetlands.com; Jeremy V. MANNO, 2634 Sleepy Hollow Road, State College, PA, 16803

Development of a natural gas well by hydraulic fracturing requires several million gallons of water over a period of days or weeks. Options available to supply this water include surface water take points (with or without storage impoundments), off-site haulage (trucking), or, more rarely, wells. The Susquehanna River Basin Commission (SRBC) establishes restrictions on the amount of water that may be withdrawn from the Susquehanna River or its tributaries by setting a minimum allowable flow that must remain in the channel (passby), and newer permits have been based on a monthly flow frequency distribution for the stream. Conventional statistical methods can provide an estimate of the probability that a surface water take point will provide sufficient water to meet a fracturing project's needs; however, this does not address the behavior of a stream over time with regards to water availability. A new method of visualizing water use planning is presented based on comparing the projected daily project use requirements to the modeled daily regulatory availability over the historic record for the stream source in association with an existing or constructed storage impoundment.

This approach allows better visualization of the behavior of a water supply (i.e. identification of flashy streams and situations where a water supply has a non-normal statistical behavior) to give greater confidence in the sizing of storage impoundments to meet a supply goal of surface withdrawal only. Hydraulic fracturing schedules can then be manipulated within the model to make use of excess flows above passby and avoid periods where direct surface withdrawal is not sustainable. The goal of this modeling is to reduce or eliminate truck hauling requirements for water and its impacts to the local community, carbon emissions, and unbalanced withdrawals from other watersheds.

2.4 **1:45 PM** Schwartz, Mark

APPLICATION OF A SIMPLIFIED DAM FAILURE ANALYSIS ON THE SUSQUEHANNA RIVER VALLEY

Mark SCHWARTZ, Rizzo Associates, Inc., 500 Penn Center Blvd, Pittsburgh, PA 15235, Mark.Schwartz@RizzoAssoc.com; Jeff OSKAMP, Rizzo Associates, Inc., 500 Penn Center Blvd, Pittsburgh, PA 15235 and Jemie DABABNEH, Ph.D., Rizzo Associates, Inc., 500 Penn Center Blvd, Pittsburgh, PA 15235.

A simple, conservative dam failure analysis methodology is applied to the Susquehanna River Valley. This method, the Volume Method, is a screening tool that allows a desktop study (i.e., with spreadsheets and GIS) to produce a conservative dam failure analysis, providing a low-cost alternative to detailed modeling studies for delineating dam failure flood hazards at vital structures. Detailed dam failure analysis can be very costly for large watersheds that contain numerous dams. While this level of detailed analysis is necessary for evaluating the safety of some structures, a simplified, conservative screening method could reduce engineering costs for some sites by eliminating the need for costly detailed analysis.

The Volume Method compares the total volume of water storage contained in upstream dams (i.e., the volume of water impounded if all upstream reservoirs were full) to the volume of storage in the watershed upstream of a site / structure. The volume of storage in upstream dams is obtained from databases such as the National Inventory of Dams, which provides comprehensive information for most dams in the United States. The volume of storage available upstream of the site / structure is determined using topographic data for the watershed and GIS tools.

A case study of this method will be presented, demonstrating the safety of an important structure.

2:00 - 2:15 PM - BREAK

SESSION NO. 3, 2:15 PM

Terrace Room, Elaine Langone Center

Sean P. Reese, Session Moderator

Water Quality Assessments and Treatment Technologies

3.1 **2:15 PM** Lookenbill, Michael

MULTIDISCIPLINARY SURFACE WATER MONITORING AND ASSESSMENT OF THE SUSQUEHANNA RIVER

Michael (Josh) LOOKENBILL, PA DEP Division of Water Quality Standards, Harrisburg, PA 17015, mlookenbil@pa.gov; Amy WILLIAMS, PA DEP Division of Water Quality Standards, Harrisburg, PA 17015 Dustin SHULL, PA DEP Division of Water Quality Standards, Harrisburg, PA 17015.

Wide-scale, disease-related mortality of young-of-year (YOY) smallmouth bass (SMB) was first documented in 2005 and again annually at varying degrees between 2006 and 2013 at West Branch Susquehanna, Susquehanna, and Juniata River locations. Since 2010, bacterial infections resulting in lesions have also been documented in a number of other warm-water streams in the Susquehanna River Basin. Also, fish pathology studies conducted by the US Geological Survey (USGS) detected intersex conditions among SMB in the Susquehanna River Basin. In order to investigate and associate potential sources and causes of the observed SMB population conditions, staff from the Department of Environmental Protection's Division of Water Quality Standards (DWQS) implemented a complex, multi-year survey using a wide array of methods to examine both natural and anthropogenic stressors and possible causal links to the diseased fish. The study design incorporates sampling multiple stations on the Susquehanna and Juniata mainstems, critical tributaries, and several other locations across the state and the collection of inorganic water chemistry; continuous instream monitoring (CIM) for physical chemistry; biology (benthic macroinvertebrates, fish, mollusks, and periphyton); nutrients and fatty acid analysis (algae and SMB); fish histo-pathology; storm event sampling; sediment and organic water (grab and passive sampling) for pharmaceuticals, antibiotics, hormones, organic wastewater compounds, and pesticides; and flow. This study began in 2012 by piloting some of the protocols and river station/reach reconnaissance. In addition to DWQS staff, USGS, Susquehanna River Basin Commission, and Pennsylvania Fish & Boat Commission are assisting with field data collection. The full-fledged study continued through the spring and summer of 2014 and will continue through 2015. This presentation will summarize t he findings of the 2012 and 2013 sampling seasons and progress made in 2014.

3.2 **2:30 PM** Khalequzzaan, Md.

COMMUNITY-BASED WATER QUALITY MONITORING PROJECTS IN MARCELLUS SHALE GAS DRILLING REGIONS IN CENTRE, CLEARFIELD, AND CLINTON COUNTIES, PA

Md. KHALEQUZZAMAN , Dept. of Geology & Physics, Lock Haven University, Lock Haven, PA 17745, mkhalequ@lhup.edu

In the wake of the Marcellus Shale gas drilling surge in central Pennsylvania, Lock Haven University's Water and Environmental lab forged partnerships with several community organizations to monitor surface water sediment quality in the vicinity Marcellus activity. These organizations include the Clearfield and Centre County chapters of the Pennsylvania Senior Environmental Corps, Centre County Conservation District, Beech Creek Watershed Association, and the South Renovo Borough Water Supply System. With the cooperation of our partners, several sub-watersheds of the West Branch Susquehanna River, including the Hall Run, Beech Creek, and various other small watersheds in Clearfield County, have been selected for assessment. The field parameters included temperature, pH, DO, TDS, conductance, ORP, and stream flow. Additional lab analyses yielded cation and anion values, including total iron, aluminum, manganese, barium, copper, calcium, magnesium, zinc, arsenic, bromide, sulfate, nitrate, phosphate, and chloride. Based on the field and lab results, the following conclusions have been reached: 1. The water quality in the Hall Run watershed is pristine and meets drinking water standards for all tested parameters; 2. Although seasonal variations of several parameters were recorded in the Beech Creek watershed, none of the levels were of high enough values to warrant concern; 3. Not enough data has been collected in the small watersheds in Clearfield County to reach any firm conclusions about the possible seasonal and temporal variations in the measured parameters; and 4. Based on current data, no evidence of direct impact from Marcellus Shale gas-well drilling on surface water and sediment quality has been detected. In addition, these projects have provided invaluable hands-on experiences for LHU students, while assisting surrounding counties by partnering with several community-based volunteer programs that are active with environmental and ecological impacts of human activities on natural resources.

3.3 **2:45 PM** Strosnider, William

ACID MINE DRAINAGE RESEARCH-SERVICE-LEARNING IN THE LAUREL HIGHLANDS

William STROSNIDER, Environmental Engineering Program, Saint Francis University, Loretto, PA 15940, WStrosnider@francis.edu.

Acid mine drainage is the greatest water quality issue facing Pennsylvania. Since its founding in 2012, the Saint Francis University Center for Watershed Research & Service has been deeply involved in a multitude of research and service projects related to the characterization and treatment of acid mine drainage. On the research side, the Center has helped to advance the simultaneous and passive co-treatment of acid mine drainage and sewage as well as acid mine drainage treatment with open limestone channels. Serving our surrounding communities, the Center has assisted nonprofit and governmental organizations on projects ranging from characterizing acid mine drainage impacts, determining treatment system performance, and troubleshooting treatment systems. In addition, the Center is leading an effort to transfer sustainable acid mine drainage treatment technology developed in our region to severely impacted mining regions in the Bolivian Altiplano.

3.4 **3:00 PM** Tankersley, Rennie

PHARMACEUTICAL DISPOSAL: ASSESSING THE FLOWS AND IMPACTS ON YOUR COMMUNITY

Rennie M. TANKERSLEY, Bucknell University, 701 Moore Ave. C0845 Lewisburg PA 17837, rmt016@bucknell.edu, Ryan C. SNYDER; James MANEVAL, Department of Chemical Engineering, Bucknell University, Lewisburg, PA 17837

Active pharmaceutical ingredients (APIs) are the portion of a drug product that is used to treat and prevent disease. While a fraction of the chemicals are consumed and transformed by the patient's body, significant amounts of APIs either remain untaken or pass through the body unchanged. As a result, both the drug APIs that pass through the body unchanged and those that are untaken are disposed of through flushing, treated by the wastewater system, directed to the rivers, and contaminate the natural waterways. Concerns have become more prevalent since intersex and mutated bass were first discovered in the Susquehanna River Watershed. Just as society recognizes insecticides and herbicides as major pollutants in the environment, pharmaceuticals are becoming known as a similar harm.

This project concentrates on mathematically modeling the mass flows of pharmaceutical waste, which is based on data from literature as well as information gathered from local law enforcement, healthcare professionals, and wastewater specialists. With the flow information in hand, we use the model to compute potential costs based on the impact to the human body, river, landfill, agricultural farmland, and atmosphere. Using these cost assessments, our clients in the community can look to drive change through legislation and education. These changes could lead to better disposal methods and improved surface water quality.

SESSION NO. 43, 3:15 PM

Terrace Room, Elaine Langone Center

Ben Marsh*, Session Moderator

Conservation, Planning and River Towns

4.1 **3:15 PM** Zimmerman, Mel

REFLECTION ON THE 2004 RIVERS CONSERVATION PLAN FOR THE LOWER WEST BRANCH OF THE SUSQUEHANNA RIVER- THE GOOD, THE BAD, AND THE UGLY

Mel ZIMMERMAN, Biology Department, Lycoming College, Williamsport, PA 17701, zimmer@lycoming.edu

Draining nearly 7,000 square miles, the West Branch of the Susquehanna River is the largest of the Susquehanna River sub-basins. Between 1996 and 2004 the West Branch of the Susquehanna was divided into upper, middle, and lower sections for the purpose of development of River conservation Plans through a program developed by PA DCNR. Lycoming College Clean Water Institute (CWI) was one of several partners when the North Central Pennsylvania Conservancy (NPC) led a multi-year effort to develop a Rivers Conservation Plan for the lower 75 mile portion of the West Branch Susquehanna River. Beginning at Farrandsville (Clinton County) and ending in Northumberland (Northumberland County) at the confluence between the West Branch Susquehanna River and the North Branch, this report attempted to pull together the "state" of water, wildlife, landscape and development for this section of the watershed. Using this decade old report as a benchmark I will attempt to summarize the many changes to the river that have occurred during this busy 10 years while focusing specifically on the overall water quality observed during the river monitoring projects completed by CWI. CWI has been actively monitoring 12 sites along this section focusing on water chemistry, macroinvertebrates and issues such as the impact of sewage treatment plant upgrades.

4.2 **3:30 PM** Duke, L. D.

FLOODS ON THE SUSQUEHANNA: SMALL RIVER TOWNS' FLOOD MITIGATION AND RESPONSE STRATEGIES RESHAPE THEIR LAND USES AND URBAN CENTERS

L. D. DUKE, Department of Marine and Ecological Sciences, Florida Gulf Coast University, 10501 FGCU Blvd South, Fort Myers FL 33967, ldduke@fgcu.edu; Seamus MCLAUGHLIN, Department of Environmental Studies, Bucknell University, Lewisburg PA 17837

In much of the U.S., planning, policies, actions, and decisions for flood mitigation, damage reduction, and public safety are made by municipal governments. Federal and State guidelines, incentives, grants, restrictions and regulations have developed to guide municipalities; and also have planned, funded, and constructed many large-scale systems. As a result the actual actions and decisions for flood management – and their effectiveness – vary enormously from one location to another. This research investigates the local flood strategies for a case study of two small municipalities: Milton and Lewisburg, PA. The two boroughs have similar social history, economic development, and local government structure; and share a single hydrologic unit of a river with a well-documented history of high-flow events. The research objective was to characterize flood mitigation strategies in the two boroughs, including current policy approaches; actions and policy decisions from previous decades; and land use changes from flood mitigation efforts. Research methods included interviews with municipal personnel; local archives and records; State and Federal archives; and GIS land-use data. Findings show a surprising degree of differences. Lewisburg has promoted acquisition of certain properties flood-prone areas, in successive small actions over decades, using Federal and State funding in pulses after disaster events. Milton accepted massive Federal funding after 1972 Agnes flooding, spurring profound land-use changes, and does not partake of further property acquisitions. Instead Milton applies building-code procedures that encourage "smart flood-proofing" (water-resistant building materials, specified elevation of occupied stories, elevation of utilities and furnaces, etc). Future research will use these results to analyze ways in which Federal and State programs and policies influence local programs; ways in which local policies and decisions conform to, promote, or conflict with priorities of Federal and State policies for flood mitigation; and ways in which Federal and State programs and restrictions promote, or conflict with, local preferences and policies not only for flood mitigation but also for economic development, preservation of historic districts, recreational land use, and others.

4.3 **3:45 PM** Green, Brandn

ATTITUDES ABOUT LAND CONSERVATION IN COUNTIES CONTIGUOUS WITH THE SUSQUEHANNA RIVER

Brandn GREEN, Place Studies Program of BSCE, Lewisburg, PA 17837, bgreen@bucknell.edu

This presentation provides an overview of the assets, attitudes, challenges, and opportunities associated with and for land conservation throughout selected counties in the Susquehanna River watershed. Qualitative data was gathered through interviews with key informants from land conservation organizations in counties contiguous to the river throughout New York, Pennsylvania and Maryland. Interviews were carried out in 19 of the 22 river counties. Interviewees were recruited from a list of conservation officials and leaders put together by the principal investigator. In total, fifty-eight interviews were completed. These interviews provide a rich and contextualized understanding of how land use and land conservation practices vary across these counties. Findings of this research have been shared with the Chesapeake Conservancy as they develop their Envision the Susquehanna project. Funding for the research was provided by the Chesapeake Conservancy.

4:00 PM - ADJOURN

**moderator not confirmed*

POSTER PRESENTATIONS

8:00-10:00 PM Friday, November 21, 2014
8:00- AM - 4:00 PM Saturday, November 22, 2014
Terrace Room, Elaine Langone Center

INVESTIGATION OF FLUVIAL MIXING ZONES IN THE MARSH-BEECH-BALD EAGLE CREEK SYSTEM IN CENTRE AND CLINTON COUNTIES, PA

Eric J. PIRRONE, Dept. of Geology and Physics, Lock Haven University, Lock Haven, PA 17745, epirrone@lhup.edu; Alex NEIDIG; Brandin MANN; Philip GRIFFITH; Thomas KEANE; Md. KHALEQUZZAMAN, Dept. of Geology and Physics, Lock Haven University, Lock Haven, PA 17745.

The AMD-impacted Beech Creek and nutrient-rich Marsh Creek join the net-alkaline Bald Eagle Creek before it empties into the West Branch of Susquehanna (WBS) River. The goal of this project was to observe the behavior of mixing zones as they relate to geochemical processes within the Bald Eagle Creek system.

Water quality data was assessed for a 6.2-mile stretch during the summer of 2014, starting below the Foster Joseph Sawyer dam and ending at Mill Hall, PA. The field data were collected using two Hydrolab Sondes (MS-5) that recorded temperature, pH, DO, conductance, TDS, salinity, chlorophyll-a, and ORP at one-minute intervals. In addition, 8 water samples and 4 soil samples were collected. These samples were analyzed in the lab for additional geochemical parameters, including acidity, alkalinity, metals and nutrients. The results of the field and lab data were visualized using ArcGIS software and analyzed using statistical methods. The data provided insights into the impact that various physical, hydrologic, geological, anthropogenic, and chemical processes have on the water quality in the studied system.

The following trends were observed in the downstream direction: a decline in chlorophyll-a, specific conductance and DO concentrations, and an overall increase in pH. This study warrants further investigation to better understand the role of geochemical processes on the water quality of this tri-creek system.

IMPACT OF AMD AND MARCELLUS SHALE GAS-WELL DRILLING ON SURFACE WATER QUALITY IN CENTRE, CLEARFIELD, AND CLINTON COUNTIES, PA

Eric J. PIRRONE, Dept. of Geology and Physics, Lock Haven University, Lock Haven, PA 17745, epirrone@lhup.edu; Brandin MANN; Alex NEIDIG; Philip GRIFFITH; Thomas KEANE; Md. KHALEQUZZAMAN, Dept. of Geology and Physics, Lock Haven University, Lock Haven, PA 17745.

With the sustained Marcellus Shale gas-well drilling in central Pennsylvania, Lock Haven University Water and Environmental Lab continues its ongoing relationships with several community-based organizations to monitor the quality of surface water in the proximity of various Marcellus Shale drilling locations. Participating organizations include the Clearfield and Centre County chapters of the Pennsylvania Senior Environmental Corps, Beech Creek Watershed Association, and the Centre County Conservation District. Numerous sub-watersheds of the West Branch Susquehanna River, including Beech Creek, and various small watersheds in Clearfield County, have been selected to provide baseline water testing as a service to the surrounding communities. The study was intended to monitor potential areas for contamination due to natural gas extraction. Measured field parameters included temperature, pH, DO, TDS, conductance, ORP, and surface discharge in the monitored streams. Additional lab analyses yielded parameters, including net acidity and alkalinity, along with several cations and anions, such as total iron, aluminum, manganese, copper, calcium, magnesium, barium, sulfate, and chloride concentrations.

Multiple conclusions have been reached regarding the water quality of the monitored watersheds. Samples collected from the Beech Creek and Clearfield sub-watersheds typically exhibit values below the established MCLs of drinking water standards for various chemical parameters, which are related to natural gas extraction. However, multiple study locations exhibit pervasive AMD impairment, which is a direct result of legacy coal mining. Through active collaboration with community-based organizations, students have the opportunity to garner research experience, while providing a valuable service to the greater community. This study has far-reaching implications for policy-making in regards to the development of Marcellus Shale as a resource while protecting the environment and preserving human health.

THE MISSING LEGACY OF MIDDLE CREEK LAKE: IMPLICATIONS OF LEGACY SEDIMENT EROSION

Jennifer M. ELICK, Earth and Environmental Sciences, Susquehanna University, Selinsgrove, PA 17870, elick@susqu.edu; Kyle Seaman., Earth and Environmental Sciences, Susquehanna University, Selinsgrove, PA 17870

Erosion of legacy sediments from Middle Creek Lake, south of Selinsgrove, PA, contribute to pollution in the Susquehanna River and Chesapeake Bay. In the last two centuries, at least 4 different dams have operated on Middle Creek. Two adjacent grist mills, operating simultaneously, were located on the creek throughout the 19th century, and later, in the 20th century, two small wooden hydroelectric power plants: one in 1906 and a larger, replacement dam in 1936, operated until 1992, when it was removed. Each of these dams allowed sediment to accumulate in the lake as legacy sediment.

Recently, the Middle Creek Lake Basin was examined to better understand the anthropogenic legacy sediment record. Though the lake underwent nearly 163 years of sediment deposition, much of this record is now believed to have been removed by erosion. In 1992, the PA Fish and Boat Commission (PAFBC) estimated 760,000 m^3 of total sediment within the lake. With the breach of the dam in 1992, they also estimated a potential loss of 57,000 m^3 of silt to be transported away, to the Susquehanna River and beyond. Based on recent examination of the lake sediments, we estimate a total of 789,000 m^3 of sediment was deposited in the lake basin, with 436,000 m^3 representing actual legacy deposits. Artifacts exposed at the surface of legacy sediment today, range in age from the 1940's to the 1970's, suggesting that much of the sediment deposited from 1936 to 1992 has been eroded. Additionally, the silty loam representing this time interval (56 years) is very thin throughout the basin, averaging 0.15 m. We approximate that nearly 3 to 4 times as much sediment estimated by the PAFBC has been lost from the lake basin due to erosion since 1992. This study suggests earlier estimations of sediment volume were imprecise and too low, and a greater amount of sediment likely made its way into the Susquehanna River and to the Chesapeake Bay.

PRESENCE OF TROUT POPULATIONS IN UNASSESSED STREAMS OF NORTH CENTRAL PENNSYLVANIA

Dan ISENBERG, Susquehanna University, Selinsgrove, PA 17870, isenberg@susqu.edu; John Panas, Susquehanna University, Selinsgrove, PA, 17870, Desmond Edwards; Jeremy Gurbatow; Erin McKeown; Mike Bilger; and Jonathan Niles, Susquehanna University, Selinsgrove, PA 17870.

While Pennsylvania has over 64,000 waterways, the Pennsylvania Fish and Boat Commission only has data on approximately 7,000 of these waters. Created in 2010, The Unassessed Waters Initiative is a collaboration between the Pennsylvania Fish and Boat Commission and Pennsylvania colleges to visit headwater tributaries that have never been assessed to determine the presence and status of wild trout populations. Data collected from the Unassessed Waters Initiative is used by the Fish and Boat Commission to help correctly classify and protect high quality streams from environmental alterations and degradation. Streams classified as wild trout waters receive greater protection under PA Code and wetlands of wild trout streams protected as Exceptional Value Wetlands. Since 2011, Susquehanna University has assessed 500 streams for the Initiative. During summer 2014 we surveyed over 170 previously unassessed tributary streams throughout north central Pennsylvania looking for the presence of trout populations via backpack electrofishing. Historical data indicates that approximately 50% of unassessed waters in North Central Pennsylvania are found to have trout species present. Efforts in 2014 were focused on the assessment of un-named tributary streams. In addition to sampling these streams for fish species according to PFBC protocols, we collected water quality and benthic macroinvertebrate data at study sites.

LANDSCAPE CHARACTERISTICS OF UNNAMED TRIBUTARIES ON WHITE DEER CREEK

Daniel E. RESSLER, Earth and Environmental Sciences, Susquehanna University, Selinsgrove, PA 17870, resslerd@susqu.edu; John Niles Department of Biology, Susquehanna University, Selinsgrove, PA 17870

Wild trout (brook trout, *Salvelinus fontinalis*) are native in Pennsylvania waters and are considered an important species in forested watersheds. Their populations are an important asset in Pennsylvania's managed recreational fisheries. Populations in unnamed tributaries to White Deer Creek were measured in 2013. The coordinates of sampling locations were used to construct sub-watershed boundaries in ArcMap 10.2 using USGS digital elevation models. Land use, soils, water quality, and terrain datasets were analyzed to determine whether these traits could predict wild trout populations. Results indicate that watershed size, channel slope, soil parent material, and channel width are significant predictors of trout populations. As more watersheds are analyzed, these watershed characteristics may be valuable for predicting trout populations in other un-assessed waters.

USE OF ARTIFICIAL NEST BOXES TO FACILITATE EGG COLLECTION FOR AN THE EASTERN HELLBENDER HEAD-STARTING PROGRAM

Samuel E. WANNER, Department of Biology, Lycoming College, Williamsport, PA 17701, wansamu@lycoming.edu; Sarah D. Pedrick, and Peter J. Petokas, Department of Biology, Lycoming College, Williamsport, PA 17701

Population declines have been taking place throughout the entire geographic range of the eastern hellbender (*Cryptobranchus alleganiensis*) in North America. The declines and local extinctions have led to multiple head-starting programs to augment or restore hellbender populations. Once widespread throughout the Susquehanna River basin, the eastern hellbender is now restricted to several tributaries of the West Branch watershed. In order to establish a head-starting program for the Susquehanna River basin, we are collecting fertilized eggs to be transported to zoological facilities that are prepared to raise larval and juvenile hellbenders until they are of a size where they are unlikely to be subject to predation (3-5 years of age). To facilitate the collection of fertilized eggs, we installed 17 artificial nest boxes in the late summer of 2014. The boxes are distributed across three stream reaches occupied by hellbenders and within a single tributary of the West Branch watershed. The boxes are made of concrete and weigh 27 kg. By mid-September, no adult hellbenders had taken up residence in, nor had nested within, the concrete boxes. We now believe that the nest boxes should have been installed several months in advance of the nesting season so that adult hellbenders would have had more opportunities to find the boxes and take up residence. We plan to leave the boxes in place until the next nesting season, but will modify the boxes to darken the chamber, making it more suitable for permanent residency and egg deposition. In lieu of collecting eggs from the artificial nest chambers, we are currently searching for natural nests from which we hope to collect eggs to be transported to the head-start facility.

DENTIFICATION OF BACTERIA ISOLATED FROM LESIONS ON YOUNG OF YEAR SMALLMOUTH BASS

Miranda GIRALDO, Department of Biology, Lycoming College, Williamsport PA 17701, girmira@lycoming.edu; Hannah MORRISSETTE, Joseph DINSMORE; Sydney BLOSSER; Jeffrey D NEWMAN, Department of Department, Lycoming College, Williamsport PA 17701.

Bacteria were cultured on Tryptic Soy or R2A agar after collection from lesions on six diseased Young of the Year (YOY) Smallmouth Bass from the West Branch Susquehanna River at Watsontown. These six fish sampled were of ten fish that had symptoms of clinical disease, a disease which has been studied for more than ten years without a known causative agent. The nearly complete 16s rRNA gene was amplified from isolates and the 5' half was sequenced via conventional Sanger methods. Identifications were made by comparison of the quality-trimmed sequence to the EZTaxon type strain database. The most commonly isolated organisms were *Plesiomonas shigelloides*, *Chryseobacterium gambrini*, and a variety of *Aeromonas* species, including *A. australiensis*, *A. veroni*i, and *A. taiwanensis*. Other less frequently isolated organisms were *Acinetobacter gyllenbergii, Flavobacterium johnsonii, Exiguobacterium acetylicum, Pseudomonas mos selii*, and a novel *Chryseobacterium* species. Additional testing must be conducted to determine whether any of these organisms is the causative agent for Smallmouth disease.

HABITAT PREFERENCES, AND POPULATION STRUCTURE AND STABILITY, IN AN EASTERN HELLBENDER POPULATION IN THE WEST BRANCH OF THE SUSQUEHANNA RIVER

Sarah D. PEDRICK, Department of Biology, Lycoming College, Williamsport, PA 17701, pedsara@lycoming.edu; Samuel E. WANNER, and Peter J. PETOKAS, Department of Biology, Lycoming College, Williamsport, PA 17701.

We collected habitat and population data over two field seasons (2012 and 2014) for an eastern hellbender (*Cryptobranchus alleganiensis*) population in a tributary of the West Branch of the Susquehanna River. Analyses of population data show that the population has been stable across the sample years, with no significant change in linear density. Analyses of habitat use show that hellbenders take up residency in or near the thalweg, where the majority of cover rocks are located. Peripheral cover rocks are only rarely used by hellbenders. We found a positive relationship between the size (total body length) of hellbenders and the size (length) of the cover rock. Population size/age structure and sex ratios were similar between the two sample years. During the second field season (2014), we observed American eels (*Anguilla rostrata*) beneath cover rocks, but in no case did we find eels and hellbenders beneath the same cover rock. We observed no eels in the study area in 2012. Recent eel introductions in the watershed likely explain the sudden appearance of eels in the study reach. The precipitous co-occurrence of eels and hellbenders raises the concern that eels may compete with hellbenders for rock cover and for a limited food resource that consists mainly of Allegheny crayfish (*Orconectes obscurus*). Significant competition for food and cover, and eel predation on hellbender eggs, larvae and juveniles, could potentially initiate a decline in an otherwise stable hellbender population.

IRIVER BED CHARACTERIZATION ON THE WEST BRANCH OF THE SUSQUEHANNA RIVER WITH SIDE SCAN SONAR

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Channel formation and maintenance processes for river form and habitat creation depend greatly on the ability of discharges to transport and distribute sediments of particular sizes. Commonly-used methods for sediment size determination (e.g. pebble counts and sample collection with a dredge device) have limitations for use in large river environments with substantial gravel- and cobble-sized bed sediment such as the West Branch of the Susquehanna River. Side scan sonar and photogrammetry methods are being used to conduct a large-scale characterization of bed material size and spatial distribution of sediments on the bed of the river. A 5-km reach of the West Branch of the Susquehanna River is identified as a test section for the application of the side scan sonar. A Lowrance® HDS-10 Gen2 system with StructureScan® is used to collect extensive sonar imagery of the bed of the river. The collected data are processed with the SonarTRX and ArcGIS software to develop a complete sonar image of the river bed. The characterization of river bed sediments and distribution patterns on a section of the West Branch of the Susquehanna River provides necessary data for the interpretation of channel formation due to modern floods and paleofloods in the region and for aquatic ecologists interested evaluating benthic habitat within the river.

COMPETITIVE EFFECT AND MECHANISMS OF AN INVASIVE SPECIES, JAPANESE KNOTWEED (POLYGONUM CUSPIDATUM) IN THE RIPARIAN PLANT COMMUNITY OF THE SUSQUEHANNA RIVER

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Polygonum cuspidatum, Japanese knotweed, is an invasive exotic species from Asia. Originally introduced to North America as an ornamental plant, it has caused significant disruption to the native riparian plant communities of Pennsylvania. In the summer of 2014 we carried out field research in the riparian zone of the Susquehanna River adjacent to Bucknell University to identify native plants that are highly susceptible to competition from *P. cuspidatum*. Our current research is investigating the mechanism of this competition with a focus on the role of allelopathy, the release of chemicals that inhibit the growth of other plants. Allelopathy is thought to be one of the main mechanisms that allows *P. cuspidatum* to

successfully compete with native plants. In the field study, several 2.5m by 0.5m plots were set up on both the upstream and downstream sides of patches of *P. cuspidatum* encountered along the river and divided into five 0.5m by 0.5m plots. In each plot, frequency of each species was recorded and a photo was taken from above. *Impatiens pallida* and *Verbesina alternifolia* may be highly susceptible to *P. cuspidatum* and are candidates for further study. We are conducting controlled studies in the lab that measure the effect on germination and growth of applying extracts from leaves and rhizomes of *P. cuspidatum* to the seeds of *I. pallida* and *V. alternifolia*. An additional study will be conducted in the field that measures the effect of either the full plant, only the below ground parts, or only the aboveground parts of Japanese knotweed on the other species in its community with a specific focus on the plants that were found to be highly susceptible to its presence.

COMPARISON OF THE WATER QUALITY, FISH AND MACROINVERTEBRATE CHARACTERISTICS OF TWO CLASS A TROUT WATERS WITH OTHER IMPAIRED STREAMS

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Two class A trout streams, both named Hagerman's Run (one a tributary of Lycoming Creek; the other a tributary of West Branch Susquehanna River) in Lycoming County were sampled for the last 5 years and will be compared to seven other streams from impaired sites. The Hagerman streams show high species diversity when it comes to the macroinvertebrates but low diversity of fish. In addition, one of these creeks is also showing some impairment due to erosion from gravel roads which may threaten its classification. The seven other streams are tributaries to or part of the Sugar Creek watershed which is a tributary to the North Branch of the Susquehanna River. All 7 of these streams had no trout, and showed low macroinvertebrate diversity. All of these streams were located near, or next to farms, and there is a high possibility that a lot of run off is occurring from these farms not using Best Management Practices. The fish diversity was higher compared to the two Hagerman's Run streams. The water chemistry also showed higher concentrations of Phosphorous and Nitrogen. An attempt will be made to find correlations between the influence of chemistry, habitat and biota on these creeks.

ASSESSMENT OF PASSIVE AND ACTIVE MACROINVERTEBRATE COLLECTION METHODS IN ADJACENT REACHES ON THE UPPER MAIN STEM OF THE SUSQUEHANNA RIVER 2012-2014

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Macroinvertebrates are functional indicators of stream health based upon their sensitivity to pollution. Our study utilized different passive and active benthic macroinvertebrate collection methods (D-net, Surber sampler, rock baskets, and Hester-Dendy multiplate samplers) during the summer 2012 - 2014. Collections were taken on both sides of the west channel in the west channel of the upper main stem of the Susquehanna River near Shamokin Dam, PA. Sampling sites each included seven locations, one for passive sampling and six longitudinal locations for active sampling. During previous sampling periods during summer and fall 2012 - 2013, we collected 50 taxa of macroinvertebrates identified to family-level, which allowed us to calculate pollution tolerance values and other comparative metrics. The Proportional Bray-Curtis Similarity Index analysis describes a very low to moderate overlap between benthic macroinvertebrate communities collected by active and passive methods (2% - 43%). Furthermore, other metrics including the Shannon Diversity and Hilsenhoff Biotic Indices reflected the variability in occurrence of pollution intolerant taxa according to method and location. The greatest variation occurred in percent EPT which showed a range of 0% to 56% in a single sample period using different methods. Passive sampling methods selectively collected colonizers and omitted other taxa (e.g. burrowers and mollusks) illustrating their bias in sampling. Overall, the metrics did not support the use of one technique over another. Rather, they supported the practice of using both passive and active collection methods in order to use macroinvertebrate community estimates to assess water quality in large rivers that have a wetted channel of cobble, silt, and sand like the upper main stem of the Susquehanna River. We concluded that active samplers which target different habitats together with passive samplers which allow comparisons from one site to another would be the most appropriate methods to use in the upper main stem of the Susquehanna River.

WATER QUALITY STATUS OF BLACK HOLE CREEK, LYCOMING COUNTY, PA

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Black Hole Creek is a tributary of the West Branch Susquehanna River near Montgomery, in Lycoming County, Pennsylvania. It is approximately 8 miles (13 km) long. Black Hole Creek starts near U.S. Route 15. The first one third of the creek flows through forests. The second one third of the creek flows through a golf course. The final one third of the creek flows through residential areas and farmland. The stream contains trout. It also is subject to significant increases in temperature downstream of a pond on the grounds of the Allenwood Federal Prison. In 2003 an assessment of erosion along Black Hole Creek was completed by Lycoming College Clean Water Institute Interns. This information was used by the local watershed group to projects that decreased bank erosion and improved fish habitat. The 2003 study also included water chemistry, macroinvertebrate and fish (electrofishing) surveys. During the summer of 2014 a similar study was repeated at three sites to evaluate and update water quality and aquatic life above and below the White Deer Golf course and federal lands. The upper one third of the stream has developed into a class A brook trout stream while the warm waters created by the pond still hinder the trout population downstream even though some restoration projects have been completed. Recommendations for future projects will be presented.

PRELIMINARY REPORT ON DIATOM COMMUNITIES IN THE UPPER MAIN STEM OF THE SUSQUEHANNA RIVER IN 2013-2014

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The upper main stem of the Susquehanna River is formed by the confluence of the West and North Branches, each of which is chemically and physically distinctive. The upper main stem retains the signatures of the two branches due to weak lateral mixing, and we refer to them as the North Branch plume (NBP) and West Branch plume (WBP). Thus, characterization of the diatom communities required samples taken from sites that occur in the plumes of both branches. We sampled sites at a transect that straddles Byers Island near Shamokin Dam, PA and below the Adam T. Bower inflatable dam at Sunbury, PA. Samples were taken in the summer and fall of 2013 and the summer of 2014 and prepared for examination by light and electron microscopy. Within the plumes of the two branches, we identified four particular habitats inhabited by diatom communities: sediment, stone, plant and plankton. We eliminated epiphytes from this analysis because beds of submerged and emergent plants occurred only in WBP. Samples from WBP had 36, 28 and 4 species in the stone, sediment and plankton communities, respectively. Similar samples from NBP had 22 (stone), 51 (sediment) and 5 (plankton) species. Of the diatom communities on stone surfaces, there were only 9 species in common to NBP and WBP. Similarly, sediment samples from both plumes had only 11 species in common. No diatom species were common to the plankton of both plumes. Habitats of the NBP were dominated by small centric species (e.g. *Stephanodiscus parvus, Cyclotella atomus, Stephanocyclus meneghiniana*, and *Discostella pseudostelligera*), all taxa that were absent from the WBP.

BATHYMETRY AND SEDIMENT ACCUMULATION OF WALKER LAKE, PA USING TWO GPR ANTENNAS

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Silting within all man-made reservoirs can be a major problem. Exploring a lake's bathymetry with Ground-Penetrating Radar (GPR) techniques is one way to identify the magnitude of sediment accumulation in these reservoirs. In this study, the bathymetry and sediment accumulation of Walker Lake, PA were explored with two frequency GPR Antennas. The apparatus developed in this study included two antennas placed on an inflatable boat towed by a 14 feet Jon Boat powered by a 55 lbs. thrust electric trolling motor.

Depending on the depth of the lake, either a 400 or 100 MHz antenna was applied to identify the bathymetry, the amount of sediments deposited, and its distribution. A total of eighteen transects were taken along the entire length of the lake. Using multiple processing software including RADAN 7, GPR Viewer, SAS 9.1.3 and MATLAB three-dimensional and contour surfaces of the pre-1971 topography and bathymetry of Walker Lake were developed. The bathymetry, the volume of sediment and its accumulation rate were successfully estimated. The lake was found to vary between few cm to 9 m in depth. Deposition of sediment takes place mainly near the inlet of the lake and gradually decreases toward the dam while the depth of the water increases. The depth of sediment deposit ranges between few centimeters and 1.85 ± 0.15meter.

WATER QUALITY OF THE WEST BRANCH SUSQUEHANNA RIVER AT WATSONTOWN

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The Susquehanna River has faced many changes and challenges in recent years, from flooding, the effects of acid mine drainage, non-point source run-off and point sources such as sewage treatment systems with discharges from combined sewage overflows. This study compares chemical and biological data collected on the river at the Watsontown site from 2009 and 2014 to document any changes to the “health” of the river. The Hilsenhoff Biotic Index was used to calculate benthic macroinvertabrate biodiversity and species tolerance, as insect population and abundance are key to understanding the health of the river. The EPT index was also used to calculate water quality, as were food-web charts of the benthic macroinvertabrates. Water chemistry was also taken and analyzed at the two sites. Since September of 2013, sewage discharge from the primary sewage treatment facility at Watsontown has been eliminated since the plant was removed and replaced by a holding facility which sends the sewage to be treated by the advanced treatment system in Milton. Effects of this change are also included in the study.

ASSESSING THE TROPHIC STATE OF ROSE VALLEY LAKE

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Rose Valley Lake is a 369 acre man-made reservoir located in Lycoming County and managed by the PA Fish and Boat Commission for recreational fishing and boating. Since 2000, the Lycoming College Clean Water Institute (CWI) has been a partner with the Rose Valley/Mill Creek Watershed Association to complete the chemical and biological assessment of the lake and Mill Creek watershed. A major part of this assessment is the determination of the trophic state of the reservoir. This involves measurement of chemical and biological parameters following the protocols of Carlson’s Tropic State Index as outlined in the Secchi Dip-In. The first North American Secchi Dip-In started in 1994 and now thanks to the support of volunteer programs and volunteers, the North American Lake Management Society, and the Environmental Protection Agency, the Dip-In database has grown to more than 41,000 records on more than 7,000 separate water bodies (not including different sites, such as along rivers and estuaries). Macroinvertebrate, macrophyte, phytoplankton , zooplankton, and fish counts were completed in order to compare to historical data. Trends found in the data suggest an appropriate amount of aging in the lake environment, but also a negative trend in ecological health. Several threatening factors are present in the area, including nearby Marcellus gas drilling, erosion, and other factors related to increasing amount of human occupation/visitation

CONTRIBUTION OF LYCOMING COLLEGE CWI TO THE PFBC UNASSESSED WATERS PROJECT (2010-2014)

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This is the fifth year that Lycoming College CWI has participated with PA Fish and Boat Commission in the Unassessed Waters Project. To date the team from CWI has completed a total of 361 streams in the Loyalsock, Lycoming , and Pine Creek Watersheds. In the past two years streams in the Genesee , Allegheny , White Deer Hole Creek, Black Hole Creek, Quenshukeny, Pine Run and Antes Creeks watersheds as well as unnamed tributaries in Tioga County have been completed. Data for this project has been logged into the PFBC Unassessed Waters Data set for consideration of trout stream protection. The number of class A, B, C, D and E streams in each watershed will be presented. On average 50% of the streams sampled support wild trout and near 20% are considered class A or B trout streams. A breakdown of the benefits and limitations of this program will be presented.

THE LYCOMING COUNTY FARM PROJECT – 4TH YEAR UPDATE OF WATER QUALITY MONITORING

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In August 2011, a long term project started to monitor the water quality of three sites along an unnamed tributary to White Deer Hole Creek (Lycoming County). This project involved the cooperation of 4 farms (3 Amish), the Lycoming County Conservation District, the Lycoming County Planning Commission, and Lycoming College Clean Water Institute. After one year of preliminary water quality monitoring, the Lycoming County Conservation District worked with farms to implement best management practices (BMPs), consisting of riparian buffer construction, manure management, and no-till farming. Clean Water Institute interns began a pre and post evaluation along three sections of the tributary (upstream middle and downstream of project), collecting monthly chemical and physical data. Yearly sampling included macroinvertebrate and fish (electrofishing) density and diversity. Data loggers documenting flow have been used to calculate nitrogen, phosphorus, and sediment loads. Data will be presented that document some improvement to nutrient and sediment loads, as well as an effect on the biota present. Specific evidence pointing to this observation includes the reappearance of brown trout at two of the sites.

LATERAL MIXING OF THE NORTH AND WEST BRANCHES OF SUSQUEHANNA RIVER AT HUMMELS WHARF, PA

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The mixing zone of the north and west branches of the Susquehanna River at a site downstream from the merging point (Sunbury, PA) was studied to understand how these two streams and the rain events, associated with their corresponding watersheds are affecting this lateral mixing. Continuous data sampling from the Shady Nook site was used to collect multiple transects from August 2009 to August 2013 to identify the transition zone between the west and north branches. The specific conductivity of the water yielded the strongest correlation to the two branches' mixing zone and provided accurately tracking of the lateral shifting during both wet and dry conditions. Based on this correlation, predictions can be made to explain movement of pollutants and their mixing. Precipitation and discharge data was examined to study the influence of rain events on the location of the mixing zone. Results have shown that as the discharge of the mainstem increases, the mixing zone shifts lateral away from the Shady Nook shoreline until it reaches a threshold discharge of 12300 ft^3/s, and then the mixing zone shifts backward as the discharge increases beyond this threshold discharge.

THE RIPARIAN CONTINUUM CONCEPT: SPIDERS AND CROSS ECOSYSTEM SUBSIDIES ALONG A STREAM SIZE GRADIENT

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Emerging aquatic insects provide important subsidies to consumers in terrestrial ecosystems and elicit a variety of responses in riparian predator populations. Flux of aquatic insects into the riparian zone is determined by both secondary production per unit stream area and stream width, while particular insect taxa emerging are dependent on location within the river continuum as described by the river continuum concept. Riparian spider communities appear to be particularly influenced by emergence events due to their various feeding strategies and ability to track preferred prey. However, little work has been conducted on the relationship between spider groups and aquatic insect emergence patterns. We hypothesized 1) spiders using different hunting strategies will be distributed in a predictable manner along the river continuum and 2) spider biomass will correlate with aquatic insect emergence. We collected riparian spiders and emerging insects from 1st-7th order streams in central Pennsylvania during a one month period in summer 2014. Preliminary results indicate riparian predator abundance increases with aquatic insect flux; however, further data analysis is required to examine patterns in spider feeding group distributions.

STREAM SIZE DETERMINES THE RESPONSE OF MICROBIAL COMMUNITIES TO PHOSPHORUS PULSES DURING STORM RUNOFF

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Brief phosphorus (P) pulses associated with storm runoff have the potential to be important drivers of microbial community growth in stream ecosystems. We measured the capacity of stream microbial communities to respond to brief P pulse during natural storm events in a small headwater tributary of Fishing Creek and a larger fifth order section near Bloomsburg, PA. Storm runoff in the fifth order section of Fishing Creek resulted in substantial increases in algal polyphosphate, the primary P storage structure for microorganisms. P storage in this reach appeared to be followed by a period of rapid growth. In contrast, we did not observe such an increase in polyphosphates in the headwater section of Fishing Creek for natural storm runoff events or after we performed an artificial P release. Our results indicate that the combination algae domination of the microbial community and P pulses that are higher in concentration and duration might allow P delivered during storm runoff to have greater ecosystem-level effects in larger streams and rivers.

WATER TEMPERATURE VARIABILITY IN THE WEST BRANCH OF THE SUSQUEHANNA RIVER AND ITS TRIBUTARIES

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The water temperature and hydraulic characteristics of a river create environments that support complex habitats within the river and its tributaries. Measurements of water temperature are collected using a network of over fifty HOBO Pendant® data loggers placed in the West Branch of the Susquehanna River (WBSR) and its tributaries. Analyses of water temperature variations achieve several goals, including (1) mapping of the spatial variability in water temperature in the West Branch of the Susquehanna River, (2) identification of primary groundwater inflow sources to the WBSR, and (3) general characterization of hydraulic mixing where smaller tributaries enter the main river. A broadly-spaced network of water temperature data loggers in the WBSR is being used to better characterize general longitudinal and cross-channel temperature variability. Methods are developed for mapping of longitudinal transects of the WBSR from Muncy, PA to Winfield, PA using a SonTek RiverSurveyor® M9 system in combination with In-Situ and Solinst data loggers. In combination with geologic data and field observation, analyzing near- bed temperature, water-surface temperature, water conductivity levels, and general temperature mapping identifies potential groundwater inflow sources to the river. A detailed network with data loggers more

closely spaced is installed at major tributary confluences with the main river to allow for the characterization of hydraulic mixing at these locations. Overall, this collection of water temperature variability and velocity data on the West Branch of the Susquehanna River and its tributaries serves as an initial step in understanding the hydraulic dynamics necessary for proper river and stream management decisions that consider the long-term sustainability of the river's ecosystem processes.

WATERSHED MONITORING NETWORK USING SENSOR NODES IN A MESH TOPOLOGY

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A hydroclimatic monitoring network was installed in the Miller Run watershed, a tributary to the Susquehanna River. The goal of this project is to develop and test state-of-the-art methods for collecting and displaying weather and streamflow data from a network of remote monitoring stations in real-time. The monitoring network is currently comprised of three stations. Each station is solar powered and able to communicate using a private wireless network. One station is also equipped with a cellular data modem and routes data between the Internet the other monitoring stations using the private wireless network. A server at Bucknell University periodically records weather and streamflow data from each station into a distributed time-series database. A separate server queries this database to provide real-time interactive visualizations and a user-friendly dashboard accessible to researchers. This project demonstrates the feasibility of providing real-time hydroclimatic information using modern wireless communication, database, and web technologies. In the future, we plan to grow our system by adding more stations and integrating data from other providers (e.g., USGS) to create a unified platform for hydroclimatic research.

IMPORTANCE OF AQUATIC PREY SUBSIDIES AND HABITAT STRUCTURE TO RIPARIAN SPIDER COMMUNITIES ALONG A STREAM SIZE GRADIENT

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Abundance and distribution of riparian predators are strongly affected by trophic subsidies from aquatic ecosystems (prey availability) and habitat structure within the riparian zone. As suggested by the river continuum concept (RCC), biological communities change as river size increases from small headwater streams to large rivers due to differences in river size and food resources. During the summer of 2014, we investigated how changes in aquatic communities affected riparian predators, specifically orb-weaving spiders, preying on emerging aquatic insects along river size gradients. We deployed standardized wooden tree structures to control for varying habitats in order to focus solely on the influence of trophic subsidies. These structures (catering to both horizontal and vertical orb-weaving spiders) were placed along riparian zones of 1st, 3rd, 5th, and 7th order sites of three local rivers (the North and West Branches of the Susquehanna River and the Juniata River). We hypothesized that if trophic subsidies are more influential than habitat structure, then riparian predator communities on standardized habitats will be similar to natural habitats but will vary along stream size gradients. Conversely, if physical habitat structure has more influence, then riparian predator communities will be similar on standardized habitats regardless of stream size but different from surveys of predators in natural riparian zones. Additionally, we hypothesized that, as stream order increases, spider abundance, biomass, and diversity will increase due to higher aquatic insect availability. Preliminary data show that tree structures attracted fewer and smaller spiders than adjacent riparian plots, which could be caused by limited exposure time for colonization or colonization by younger spiders avoiding competition with larger spiders for prime web sites. As a result, our results are inconclusive at this point regarding the relative importance of habitat structure to riparian spider communities.

THE 2014 ACADIAN PROGRAM IN REGIONAL CONSERVATION AND STEWARDSHIP- REPORT FROM THE PA TEAM OF SRHCES.

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The goal of this program is to educate students on the importance of conservation, especially in regards to large landscape-scale conservation. Students are brought from all over the world to participate in this week long course. This year's participants were from Massachusetts, Chile, Argentina, Belize, Vietnam and Pennsylvania. Prior to the workshop, each team was directed to prepare a 3 hour presentation on a large conservation initiative in their country/state. The Pennsylvania team included two students from Lycoming College Clean Water Institute and one from Bloomsburg University. Pennsylvania's team, under the direction of Dr. Zimmerman, delivered an elaborate presentation on the issues, clean-up efforts, and economic effects of the Susquehanna River watershed and Chesapeake Bay. Groups collaborated together after each presentation to come up with a consensus of possible solutions for each group. After introducing specific conservation efforts being made around the world, the student's attention was then brought to a current project that is underway in Maine. The "Bay to Baxter" initiative entitles the efforts being made to connect parcels of land that currently represent a long corridor from the Penobscot Bay to Baxter State Park. Teams from each region were mixed and assembled into new teams according to specialties; this allowed for each group to concentrate on a specific task. Each team was provided with a challenge to solve regarding the "Bay to Baxter" initiative, and as a whole, aid in organizing the next efforts to be made. Aside from the presentations and initiatives, the course also included trips to several locations along the Penobscot River and Acadia National Park. The top of Cadillac Mountain provided a fantastic view that captured nearly the entire stretch of the "Bay to Baxter" initiative, and was a good representation of the sheer size of land this initiative is aiming to protect.

AN ENVIRONMENTAL DNA SURVEY OF EASTERN HELLBENDER (*CRYPTOBRANCHUS A. ALLEGANIENSIS*) POPULATIONS IN THE CENTRAL PENNSYLVANIA

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Eastern hellbender (*Cryptobranchus a. alleganiensis)* is one of many amphibian species that have been experiencing population decline in recent years. Because of its secretive nature in aquatic habitats, it is difficult to grasp the distribution range at a regional scale. The conventional survey can be invasive as it often involves physical handling and alteration of micro-habitats. We used a non-invasive environmental DNA (eDNA) analysis, which is an analysis of genetic materials left in organism's habitats, to survey the hellbender populations in the Susquehanna River Basin. We tested three hypotheses: 1) eDNA would detect previously unknown hellbender populations; 2) water samples from night collections would have higher eDNA concentrations than day samples because hellbenders are nocturnal; and 3) hellbender eDNA concentration would be higher during their breeding season (i.e., the end of August and September) than that during the non-breeding season. We conducted monthly water sampling from eight tributaries of the West Branch Susquehanna River between June and October 2014. Each tributary was sampled twice (day and night) every month. These tributaries are Penns Creek, Buffalo Creek, White Deer Creek, White Deer Hole Creek, Muncy Creek, Loyalsock Creek, Lycoming Creek, and Pine Creek, among which the latter four creeks contain known hellbender populations. The water samples were filtered and DNA was extracted. Quantitative PCR was used to not only detect but also obtain concentration of hellbender DNA in the samples. The preliminary data from the June samples suggest the presence of hellbender populations only in the tributaries previously known to contain its populations.

FEASIBILITY OF USING FRESHWATER MUSSELS TO MONITOR BA AND SR CONTAMINATIONS IN PENNSYLVANIA STREAMS

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With the extensive Marcellus Shale natural gas development, horizontal drilling, combined with hydraulic fracturing, produces a large quantity of saline flowback water high in Ba and Sr contents, raising health and ecological concerns in case of spills or leaks.

Freshwater mussels, as sedentary filter feeders, could potentially take up Ba and Sr in the growth rings of their shells, reflecting the chemistry of the aquatic environment over time. The experimental site mussels (*E. complanata* and *L. cariosa*) were obtained from the West Branch Susquehanna River near Williamsport PA; the control site is on Buffalo Creek, Union County. From 2010 to 2014, PA Department of Environmental Protection data, at two monitoring points near West Branch sample sites, showed that the river water Ba concentrations (± 1σ) were 30 (5) and 34 (13) µg/L, Sr 100 (44) and 98 (50) µg/L. In two tributaries, Ba concentrations were 19 (6) and 26 (6) µg/L, Sr 23 (8) and 32 (8) µg/L. X-ray diffraction confirmed that the mineralogy of the shell is mostly aragonite (CaCO3). Cross-sectional thin sections (0.5 mm) were observed under transmitted light microscope and environmental scanning electron microscope back-scattered electron mode to identify possible growth rings. Major (Ca) and trace elements (Ba, Sr) were analyzed along transects in shell layers using electron probe micro-analysis (EPMA). Results were reported as molar ratios of [X/Ca]shell (X Ba, Sr). Correlating [X/Ca]shell and historical [X/Ca] in the water was challenging, because of the uncertainty in the shell layer ages and the scarcity of data. If shell and water chemistry data had sufficiently high spatial and temporal resolutions, freshwater mussel shell layers could potentially be interpreted as water chemistry records.

2014 STATE OF THE LITTLE JUNIATA RIVER

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The Little Juniata River is a seventh order stream located in Blair and Huntingdon Counties of Pennsylvania. The headwaters of this watershed cre ate the western boundary of the Susquehanna River Basin. Throughout much of the twentieth century, the Little Juniata River was a target for industrial and domestic discharges, severely degrading its water quality. With the establishment of water quality regulations and enforcement by state agencies, the stream was able to support game fish by 1971, and by 1980 the health of the Little Juniata River had improved dramatically. However, there were still several point and non-point source pollution issues that continued to plague the river. The most significant issues include: nutrients from agricultural runoff, illegal roadside and sinkhole dumping, stream bank erosion, storm runoff, contamination from industrial, domestic and agricultural sites, and discharges of raw or improperly treated sewage from domestic or municipal sources. As a result, there has been a concerted effort by many interested parties, both state and local, to restore the integrity of the stream since the mid to late 1990's. A key component of this effort has been the collection of biological and physiochemical data to monitor the river's health. Therefore, in an effort to determine the current status of the Little Juniata River; data from previous and current studies (ranging from 1998 to 2014) under taken by multiple collaborators were complied to create a GIS database. Key indicators of stream health used in the "2014 State of the Little Juniata River" include: Index of Biological Integrity (IBI) scores for macro-invertebrates, maximum water temperatures, E. coli counts, nitrate levels, dissolved oxygen levels and pH. Data for each of the five main reaches of the Little Juniata River was analyzed. Any data of the same type within a particular reach was averaged together. Each indicator of stream health was given a distinct symbol, and a colored scaling system was used to indicate whether a parameter was in good, intermediate, or poor condit ion. Overall, the data suggested that water quality in the Little Juniata River is of intermediate condition; and shows signs of slight improvement from its headwaters to its confluence with the Juniata River.

RAYSTOWN LAKE CHANNEL CATFISH SPAWNING STUDY (2013-14)

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During the summers of 2013 and 2014, Juniata College and Pennsylvania Fish and Boat Commission (PFBC) partnered to perform Channel Catfish, *Ictalurus punctatus*, spawning studies on Raystown Lake in Huntingdon County, Pennsylvania. Past fingerling stocking programs in Pennsylvania have been unsuccessful in sustaining Channel Catfish populations, which has been attributed to an absence of preferred spawning microhabitats. Therefore, PFBC devised a protocol that relies on the introduction of man-made spawning structures, catfish boxes, designed to replicate optimal nesting sites. They believe the boxes could become an important management tool to enhance young-of-the-year (YOY) survivorship in lakes lacking suitable nesting habitats. To test this theory, catfish boxes were deployed into Raystown Lake and checked for occupancy from May to August of 2013, with the goal of determining if Channel Catfish in Raystown Lake would actively utilize these artificial man-made structures. Observations from 2013 found evidence of continuous spawning for six straight weeks, confirming that the boxes provide Channel Catfish with acceptable reproductive and grow-out microhabitats in this environment. Following the 2013 study, researchers questioned fry survival rate after they leave the catfish boxes due to the lack of cover in which fry could hide. A 2014 study was designed to test if adult Channel Catfish would selectively choose boxes that provided protective cover for fry once leaving the artificial structure. Catfish boxes were again deployed into Raystown Lake and checked for occupancy from May-July of 2014. This study differed in that boxes were place near different structure types. Observations from 2014 suggested that Channel Catfish appeared to prefer catfish boxes with stone structure on top as documented by higher occupancy rates than in boxes with no cover and boxes near submerged woody debris. We speculate this observation occurred because fry, upon leaving the catfish box, could hid e in the cervices created by the stone pile to avoid predation. As a result, we were able to provide PFBC with information on how to improve the placement of catfish boxes for future catfish restoration and management projects across the state.

STORIES OF THE SUSQUEHANNA

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This summer we analyzed both primary documents and secondary literature to compile a database of significant Native American locations with a five mile corridor of the Susquehanna River's West Branch. We then created a Geographic Information System (GIS) interactive map layer of these sites. In this, clicking each point location will give you a description and the sources used. This layer we created will be added to a larger map which details the North Branch and the Main Stem of the Susquehanna River. This research helps us better understand the story of the past: settlement patterns, tensions and conflict, relationships between different groups of people and of people with their environment. This research was on behalf of the Chesapeake Bay Conservancy, who aim to update the John Smith National Historic Trail with the history of the Susquehanna River. There were limitations to this research , as it is difficult to find written history from so long ago, in addition to a general lack of recorded information from the Native Americans. However, we found old county histories, the works of JF Meginness, and Moravian Church's diaries written in German (translated by Katherine Faull) to be very valuable resources. We hope to continue mapping locations, chronologically, to produce a time lapse map of the area.

In addition to mapping, we are developing a self-tour app. This uses your phones GPS and speakers to talk when you are near an important site. Although there are many uses around Bucknell for such an app in the future, the current one is dedicated to people who kayak on the Susquehanna River. It provides a tour based on the information we have collected this summer and that has been collected in years past.

MARCELLUS SHALE DEVELOPMENT, AIR POLLUTION, AND ASTHMA EXACERBATIONS

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Unconventional natural gas development (UNGD), the extraction of natural gas from shale, has rapidly grown in Pennsylvania since 2005. Shale gas extraction is a major industrial undertaking with the potential to affect air, water, and soil. Much of the concern over UNGD has centered on water, but air pollution may be of greater concern. There has been little research on the health concerns of the potential air impacts of UNGD. We are engaged in a study to evaluate associations between UNGD and asthma exacerbations. We began by creating a complete database of wells. Starting with data on well location; dates of drilling, perforation, and stimulation; well depth, and production from the Pennsylvania Department of Environmental Protection (DEP), we filled in missing data using the Pennsylvania Internet Record Im aging System/Wells Information System, and then imputed values that were still missing. Our final population includes 6,915 drilled wells by June 2013. Using remote sensing and crowdsourcing technologies, we collected the dates of well flaring and locations of ponds associated with UNGD. Information on compressor stations, which data suggest are an important source of UNGD-related air emissions, is not currently electronically available. We started with a list of compressor stations related to UNGD from DEP (nP6) and made a total of 17 visits to 4 DEP offices, scanning 6,007 documents. These documents were data abstracted into an electronic database. The source of our health data is the Geisinger Health System, which has used electronic health records (EHR) since 2001. These records include information on diagnoses, vital signs, medications, procedures, laboratory tests, tobacco use, and sociodemographics. Using EHR data, we identified 38,646 asthma patients in Pennsylvania and New York. Between 2005 and 2013, we identified the following asthma exacerbations: 446 primary asthma hospitalizations, 4,833 primary or secondary asthma hospitalizations, 1,896 asthma emergency department visits, and 30,516 new oral corticosteroid medication orders. We are assigning patients exposure estimates based on the different phases of UNGD, ponds, and compressor stations. We are using a nested case-control study design to evaluate associations between exposure to UNGD and asthma exacerbations in this cohort of patients.

OPEN LIMESTONE CHANNELS FOR ACID MINE DRAINAGE TREATMENT: PERFORMANCE AND DESIGN GUIDANCE

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The Swank open limestone channel has been treating Al-dominated acid mine drainage in the upper reaches of the Clearfield Creek watershed. The channel has been functioning since 2011 and is located in the village of Frugality. This channel is used to counter the effect of ac id mine drainage that averages an acidity of 83 mg/L $CaCO_3$ and Fe, Mn and Al concentrations of 0.6, 0.9, and 9.2 mg/L respectively. The channel is 275 m long with slope of 6 to 9%. Treatment performance has been monitored over the life of the channel. In addition, rhodamine tracer tests were used to develop a reliable relationship between flow rate and residence time. As expected, increased residence time led to increased pH. However, the pH levels off at approximately 40 min of residence time once it reaches pH of around 4.4 due to the release of hydrogen ions from the formation of $Al(OH)_3$. Acidity removal is directly proportional to residence time; the higher the residence time is the more acidity is removed. Using this information, a simple model has been created to predict treatment performance of this channel in order to guide the design of future channels treating similar waters.

THE EFFECT OF SODIUM CHLORIDE ON THE RATE OF CALCITE DISSOLUTION AND ACID MINE DRAINAGE

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Open limestone channels are a common method for treating acid mine drainage. The Swank open limestone channel in Reade Township, Cambria County has been monitored over the past 3 years, measuring pH, alkalinity, dissolved oxygen, and conductivity. In 2011, the inflow of the channel had an average pH of 3.3 and an outflow average pH of 4.4. Currently, there is less pH increase than when the channel was originally installed. This is due to the buildup of precipitates on the limestone rocks which slows dissolution rates. In order to fix this problem, a new method of regeneration needs to be discovered. The purpose of this experiment was to observe the effect of salt (sodium chloride) on the speed of calcite dissolution and acid mine drainage by testing the pH, conductivity, and alkalinity every 3 hours for 2 days under controlled laboratory conditions. Based on the data collected, the pH increased faster with salt than without. By adding salt, the conductivity raised drastically, allowing the pH to change faster. Future treatment plans could include adding salt to increase calcite dissolution rates and possibly regenerate channel performance.

PASSIVE CO-TREATMENT OF ACID MINE DRAINAGE AND MUNICIPAL WASTEWATER: SIMPLE ANAEROBIC TRIALS

Jacob MCCLOSKEY, Rebecca PEER, Emily BACH, Evan ANTHONY, Jeffrey CHASTEL, Peter SMYNTEK, Rachel WAGNER, Joel BANDSTRA, William STROSNIDER, Environmental Engineering Program, Saint Francis University, Loretto, PA 15940

The passive co-treatment of municipal wastewater (MWW) and acid mine drainage (AMD) is an emerging treatment approach that has shown recent promise. The approach involves allowing a self-designed microbial ecosystem to synergistically improve these waters by passively manipulating redox conditions. To investigate the efficiency and rates of reactions of anaerobic co-treatment, 24 replicate anaerobic 1L-cubitainers containing a 5:2 MWW:AMD mixture and inert Kaldnes plastic media were sealed and incubated for 30 days. The AMD had 37 mg/L aluminum, 20 mg/L iron, 2.6 mg/L manganese, and 670 mg/L sulfate with a pH of 2.7. The MWW had 1200 mg/L of chemical oxygen demand, 7.4 mg/L phosphate as P, pH of 6.9, and 375 mg/L of alkalinity as calcite equivalent. After a sharp decrease from the initial mix pH of 6.9 to 6.3, the pH increased linearly back to 6.9. Following pH, alkalinity also dipped from the initial mix of 153 to 128, but then increased linearly to 249 mg/L as calcite equivalent due to bacterial sulfate reduction. Sulfate decreased from 230 to 149 mg/L. Iron decreased to 0.05 mg/L upon mixing due to the effect of increased pH on trivalent iron. Iron later increased near the midpoint of the incubation, likely from the activity of iron reducing bacteria acting on iron oxyhydroxides. However, the iron released into solution subsequently precipitated via iron-sulfide formation. Hydrogen sulfide concentrations increased dramatically over time, supporting sulfate reduction and iron-sulfide precipitation as treatment mechanisms. Phosphate decreased to below detection limits (< 0.5 mg/L as P) immediately upon mixing. Chemical oxygen demand decreased from 389 in the influent mix to 242 mg/L. Overall, results revealed interesting iron treatment dynamics and provided reaction rates central to expanding this technology to field-scale application.

DRINKING BEFORE THE DRILLS: A STUDY OF THREE PRISTINE WATER SITES IN SULLIVAN COUNTY

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During the last decade, technologies have improved allowing for extraction of natural gas from the Marcellus shale at depths of eight to ten thousand feet, opening Pennsylvania for drilling and fracking. Economic reality, however, has caused oil and gas companies to delay drilling at many of the sites for which they have obtained drilling permits. This affords us the opportunity to measure natural non-impacted chemical quantities (aka baseline data) at several ponds in Sullivan County, specifically Sones Pond, Beech Lake, and Shumans Lake. Sones Pond is located in the Loyalsock State Forest, Forks, PA and was sampled on June 6. Beech Lake is located in Laporte, PA and was sampled on June 11. Shumans Lake is located in Lopez, PA and was sampled on June 20. Samples from each site were strategically taken to gain knowledge of the entire body of water, including any obvious inflows and outflows. Data collected in situ included pH, dissolved oxygen, conductivity, and turbidity. Conductivity values averaged 12 μS/cm (Beech) and 14 μS/cm (Sones), but ranged from 61 to 204 μS/cm at Shumans Pond. pH at all the ponds was slightly acidic to neutral, with the lowest pH at Beech Lake (5.2 to 5.6). Alkalinity was low at all sites sampled, ranging from 1.1 to 1.6 mg/L as $CaCO_3$ at Beech Lake to 2.4 to 9.6 mg/L as $CaCO_3$ at Shumans Pond. Acidities were also low ranging from 2.1 to 6.0 mg/L as $CaCO_3$ at Beech Lake to 4.6 to 13.6 mg/L as $CaCO_3$ at Shumans Pond. Samples were analyzed for aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, nickel, and zinc using ICP-OES, with all metals except barium, iron, and manganese being below detectable limits. Both fracking and produced water from Marcellus production can be traced using conductivity, chloride, strontium, barium, and some heavy metals making pollution from Marcellus production easily detectable in these ponds should it occur – all via a sonde placed at the inflow.

ANALYSIS OF DNA SEQUENCES FROM LARGEMOUTH BASS VIRUS ISOLATES FROM SMALLMOUTH BASS

Shannon PIPES and Jeffrey D NEWMAN, Department of Biology, Lycoming College, Williamsport PA 17701.

The viral pathogen, Largemouth Bass Virus (LMBV), is a member of the family Iridoviridae and has been known to cause large fish kills among Largemouth Bass, *Micropterus salmoides*. The viral pathogen is also consistently isolated from other species where diseased fish are found. Throughout the Susquehanna River Basin since 2005, Smallmouth Bass, *Micropterus dolomieu*, have been suffering from wide-spread disease related deaths. Even though LMBV is not clinically known to affect Smallmouth Bass, this virus is prevalent among diseased fish infected with other pathogens such as *Pseudomonas aeruginosa*. The question we seek to address is whether there are significant genetic differences between LMBV isolates from smallmouth bass and largemouth bass. Total DNA was isolated from preparations of LMBV derived from smallmouth bass and largemouth bass isolates. Five LMBV-specific primer sets were used to amplify fragments from each preparation for conventional Sanger sequencing and the total DNA preparations are also being analyzed using MiSeq NextGen sequence analysis. After we receive the sequence data, further assembly, annotation, and analysis will be conducted to identify any host-specific variations.

EVALUATION OF METALS AND ORGANIC COMPOUNDS IN WATER SAMPLES FROM SEVEN LOCATIONS ACROSS THE UPPER MAIN STEM OF THE SUSQUEHANNA RIVER NEAR SUNBURY, PA

Kristen M. BENITEZ, Chemistry Department, Susquehanna University, Selinsgrove, PA 17870, benitez@susqu.edu; Amir Y. ALWALI, and Lou Ann TOM, Chemistry Department, Susquehanna University, Selinsgrove, PA 17870.

River water samples from seven locations across the upper main stem of the Susquehanna River near Sunbury, PA were analyzed for the presence of metals and organic compounds. A Perkin Elmer Analyst 800 Atomic Absorption Spectrometer was used to analyze the water for presence of the following metals in suspension using external standard methods: manganese, iron, aluminum, antimony, arsenic, mercury, tin, chromium, lead, nickel, cadmium, selenium, molybdenum, copper, strontium, calcium, magnesium and zinc. Control spike samples were also analyzed to determine if the metals may absorb onto the sediment found in several of the sample locations. The concentrations of metals varied from non-detectable using flame atomization to concentrations over 100 ug/mL. Those metals which could not be detected will be re-evaluated using the more sensitive graphite furnace methods for lower concentrations. The results are considered preliminary because digestion of the samples before analysis was not performed, but if the spiked samples suggest that metals may absorb onto the sediment particles, this will be pursued as part of the sample preparation. Samples are also being analyzed using a Thermo Trace 1300 Gas Chromatograph with an ISQ Single Quadrapole Mass Spectrometer for the presence of organic compounds.

PRE-CONSTRUCTION ASSESSMENT OF TURTLE CREEK AND UNNAMED TRIBUTARIES (TURTLE CREEK, UNION COUNTY)

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DEP biologists and interns collected D-frame kick-net samples, basic water chemistry, and deployed temperature sondes in May 2014 on six farms along Turtle Creek in Union County. The work was done to provide baseline conditions prior to implementing Growing Greener Grant funded stream bank stabilization work and installation of agricultural best management practices. Data was collected both on the main stem and on two unnamed tributaries. On the main stem, the 3 sites represent a farm where cows have active access to the stream, a farm where the cows were fenced out of the stream approximately 5 years ago, and a farm that has not had any cows in the stream area for over 20 years. The unnamed tributaries were on 2 separate farms. At both farms an upstream reference site was selected as well as a site where stream improvement or agricultural best management practices were to be implemented. The reference sites on both unnamed tributaries were closer to the source and represent a more unaltered stream ecosystem than the sites selected for stream improvement work.

TEMPORAL VARIATION IN BLACK SPOT DISEASE IN THREE COMMON SPECIES OF CYPRINIDS FROM THE SUSQUEHANNA RIVER

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We examined spotfin shiner (Cyprinella spiloptera), spottail shiner (Notropis hudsonius), and bluntnose minnow (Pimephales notatus) for black spot disease. These fishes were collected from seven years of seine samples from the Upper Susquehanna River. Our goals were to assess variation in the prevalence (=Nhost/Nfish), mean intensity (=Nspots/Nhost), and abundance (=Nspots/Nfish) of disease among the years sampled.

BLACK SPOT DISEASE IN A LARGE DISCRETE SAMPLE OF SPOTFIN SHINERS FROM THE UPPER SUSQUEHANNA RIVER

Chad K. KATRA, Environmental Program, King's College, Wilkes-Barre, PA, 18711; Thomas P. MANGAN and Brian P. MANGAN, Environmental Program, King's College, Wilkes-Barre, PA, 18711

We examined 3500 spotfin shiners (Cyprinella spiloptera) for black spot disease. These fish represented a single haul of a 7.6 m bank seine along the shoreline of the Upper Susquehanna River. This sample presented an opportunity to assess black spot in a large, discrete sample of a common minnow at a single point in time. Our specific goals were to assess the prevalence (=Nhost/Nfish), mean intensity (=Nspots/Nhost), and abundance (=Nspots/Nfish) of disease in these fish.

PASSIVE CO-TREATMENT OF ACID MINE DRAINAGE AND MUNICIPAL WASTEWATER: SIMPLE ANAEROBIC TRIALS

Jeffrey CHASTEL, Environmental Engineering Program, Saint Francis University, Loretto, PA 15940, jac101@francis.edu; William STROSNIDER, Environmental Engineering Program, Saint Francis University, Loretto, PA 15940

The passive co-treatment of municipal wastewater (MWW) and acid mine drainage (AMD) is an emerging treatment approach that has shown recent promise. The approach involves allowing a self-designed microbial ecosystem to synergistically improve these waters by passively manipulating redox conditions. To investigate the efficiency and rates of reactions of anaerobic co-treatment, 24 replicate anaerobic 1L-cubitainers containing a 5:2 MWW:AMD mixture and inert Kaldnes plastic media were sealed and incubated for 30 days. The AMD had 37 mg/L aluminum, 20 mg/L iron, 2.6 mg/L manganese, and 670 mg/L sulfate with a pH of 2.7. The MWW had 1200 mg/L of chemical oxygen demand, 7.4 mg/L phosphate as P, pH of 6.9, and 375 mg/L of alkalinity as calcite equivalent. After a sharp decrease from the initial mix pH of 6.9 to 6.3, the pH increased linearly back to 6.9. Following pH, alkalinity also dipped from the initial mix of 153 to 128, but then increased linearly to 249 mg/L as calcite equivalent due to bacterial sulfate reduction. Sulfate decreased from 230 to 149 mg/L. Iron decreased to 0.05 mg/L upon mixing due to the effect of increased pH on trivalent iron. Iron later increased near the midpoint of the incubation, likely from the activity of iron reducing bacteria acting on iron oxyhydroxides. However, the iron released into solution subsequently precipitated via iron-sulfide formation. Hydrogen sulfide concentrations increased dramatically over time, supporting sulfate reduction and iron-sulfide precipitation as treatment mechanisms. Phosphate decreased to below detection limits (< 0.5 mg/L as P) immediately upon mixing. Chemical oxygen demand decreased from 389 in the influent mix to 242 mg/L. Overall, results revealed interesting iron treatment dynamics and provided reaction rates central to expanding this technology to field-scale application.

Susquehanna River Heartland Coalition for Environmental Studies

A unique collaboration of faculty and students working together to:

Mission

- Conduct research on hydrologic, geologic, and ecologic processes in the Susquehanna watershed.
- Create field-intensive educational opportunities for students.
- Bring together faculty and students from surrounding universities and connect them with local, state, and federal environmental agencies and organizations
- Present their findings at the annual Susquehanna River Symposium

Participating Universities

- Bloomsburg University
- Bucknell University
- Juniata College
- Kings College
- Lock Haven University
- Lycoming College
- St. Francis University
- Susquehanna University

Summer interns and faculty gather with Heartland Coalition leaders at Lycoming College, July 2014.

EXHIBITORS

- Merrill Linn Conservancy for Land and Water
- Buffalo Creek Watershed Association
- Susquehanna Greenway Partnership
- US Fish and Wildlife Foundation
- PA Department of Environmental Protection
- Normandeau Associates
- Chesapeake Bay Foundation
- Susquehanna River Heartland Coalition for Environmental Studies
- Bucknell University Watershed Sciences and Engineering Program

Notes

Envision the Susquehanna

Mission Statement: Envision the Susquehanna is a collaborative initiative that invites communities , businesses and individuals to become involved in creating a common vision for the Susquehanna River that focuses on environmental integrity through habitat conservation, restoration and vigilance; economic development; appreciation for the watershed's rich history and culture; and the outdoor experience through recreational trails and river access.

This project, led by the Chesapeake Conservancy in partnership with the Susquehanna River Heartland Coalition for Environmental Studies, Wildlife Management Institute, Pennsylvania DCNR, Foundation for Pennsylvania Watersheds, Susquehanna Greenway Partnership, and Chesapeake Bay Commission intends to sustain and enhance the Susquehanna River's position as a major economic, recreational, wildlife and tourism asset for the nation.

Key potential deliverables of the project include:

- a Vision for the Susquehanna focused on environmental integrity (habitat conservation and restoration), economic development (heritage and river-based tourism), cultural engagement (online and community-based education and art), and outdoor experience (recreational trails and river access), and large landscape conservation projects,
- a coordinated list of implementation actions to achieve this Vision,
- implementation of the Susquehanna River Connecting River Trail as a historic component of the Captain John Smith Chesapeake National Historic Trail, and
- a significant increase in public engagement with the River and its history.

Key Goals & Objectives:

Preservation/Conservation

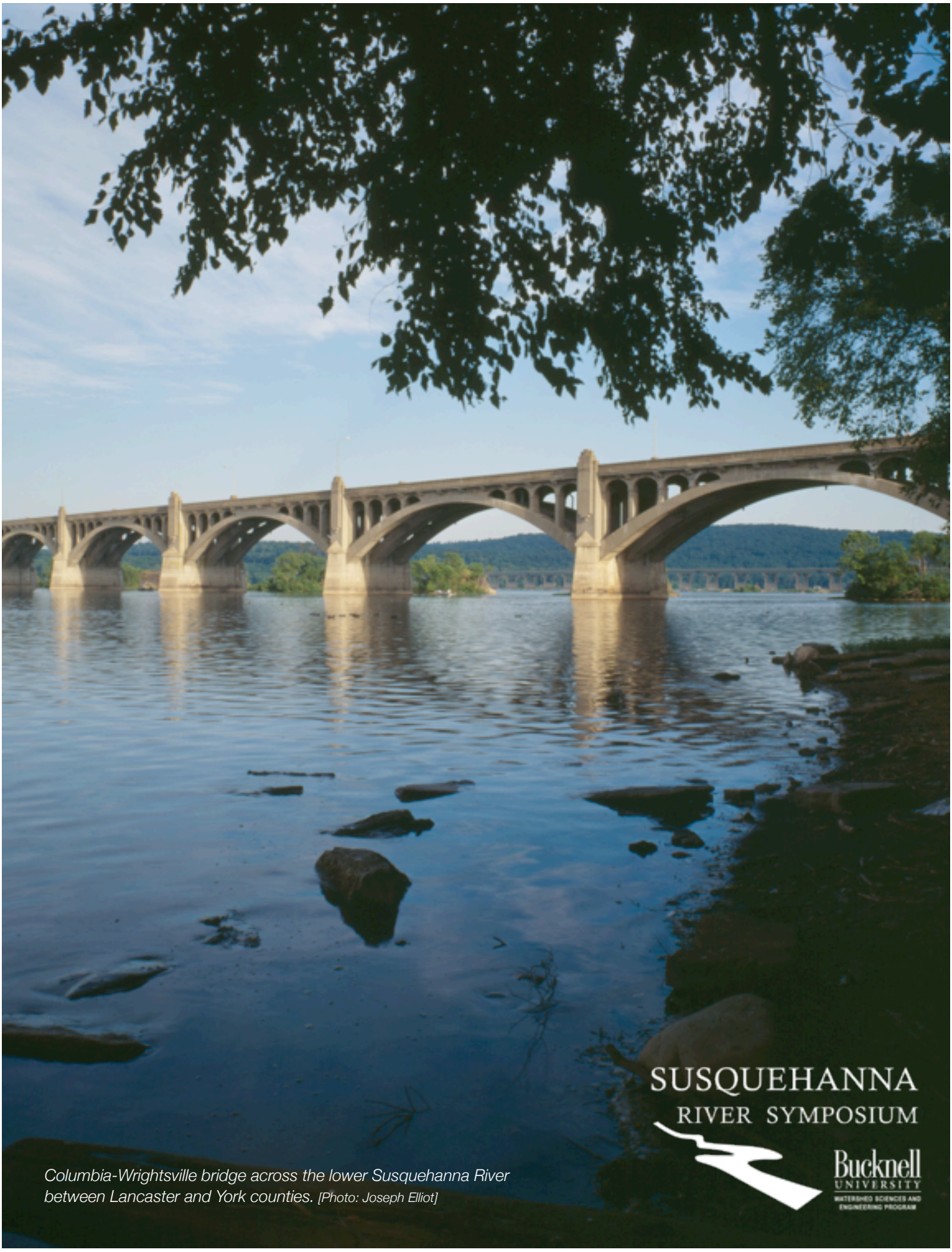
- Wildlife refuge areas
- Scenic & natural interpretive areas
- Cultural heritage
- Recreation, landscape conservation projects

Sustainability

- Environmental integrity
- Vigilance

Economic Viability

- River town development
- Economic impacts
- Geotourism
- Legislative and stakeholder ownership



Columbia-Wrightsville bridge across the lower Susquehanna River between Lancaster and York counties. *[Photo: Joseph Elliot]*