



Presented by the

SRHCES

Susquehanna River
Heartland Coalition for
Environmental Studies

Pulse of the Heartland

2014 ANNUAL REPORT

The Susquehanna River, and its watershed, define the quality of life for all who live, work and play within its boundaries. Arguably this region's most important asset it provides half of the fresh water that reaches the Chesapeake Bay. Its influence extends beyond Pennsylvania to the lives of many within the Chesapeake Bay area.

In recognition of this tremendous asset, six regional colleges and universities joined other partners, including Geisinger Health System, Northcentral Pennsylvania Conservancy, the Forum for Pennsylvania's Heartland and SEDA-COG, to work with state agencies and Chesapeake Bay affiliates to form the Susquehanna River Heartland Coalition for Environmental Studies (SRHCES). Through the Coalition, the faculty, students and staff's impressive talents are engaged to study and monitor environmental issues within the watershed. Additional promotion and support for this effort have come from sponsors such as Sunbury Broadcasting Co., The Daily Item, the Foundation for Pennsylvania Watersheds and the Degenstein Foundation.

SRHCES's members meet monthly to discuss individual research projects, opportunities for



For more information about SRHCES, please visit www.SRHCES.org.

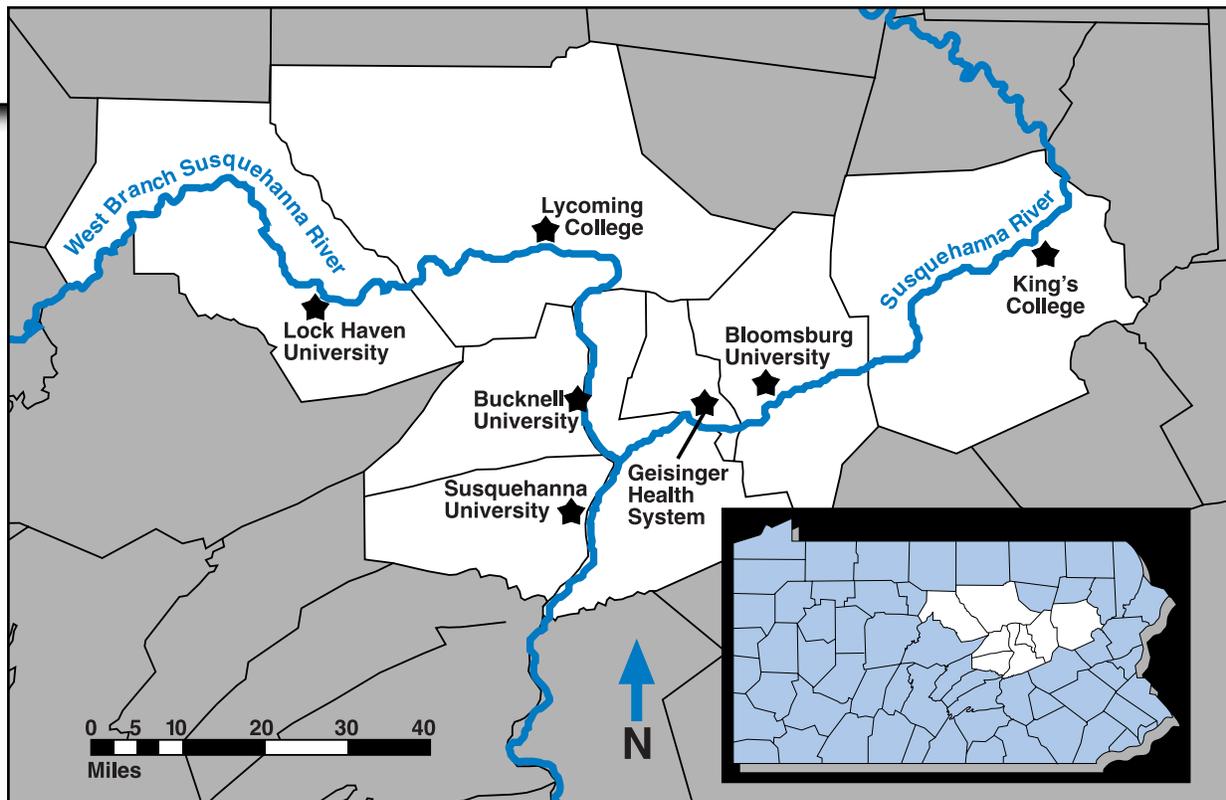
collaboration, and the issues faced in their research. These meetings provide a forum to not only share information, but to also discuss partnerships.

SRHCES has been meeting for a number of years now. The summer work with interns from the various member colleges and universities has allowed the man-power necessary for the SRHCES members to take on a variety of research projects, as well as provided those students with invaluable field experience.

One thing we did this year was contact some of the interns from the past to find out what they're doing now, and how their internship with a SRHCES member helped prepare them for their career. Some of these former students are working for consulting firms, others have gone on to pursue advanced degrees, while others are now working for state agencies and commissions to study water quality.

We hope you enjoy the updates on the scientists' work and research related to the Susquehanna River and the terrestrial habitat along its banks.

We've also included updates from our partners at Geisinger Environmental Health Institute and Sunbury Broadcasting.



MAP COURTESY OF JEFF BRUNSKILL, DEPARTMENT OF GEOGRAPHY & GEOSCIENCES, BLOOMSBURG UNIVERSITY

Monitoring the Susquehanna

Dr. Jonathan Niles

Director

Mike Bilger

Aquatic Research Assistant

Susquehanna University's
RK Mellon, Freshwater
Research Initiative



Dr. Niles has four projects this summer. He and other researchers at Susquehanna University are working to start the three year Freshwater Research Initiative funded by a \$2.25 million dollar grant from the RK Mellon Foundation.

The first project Dr. Niles and his lab are continuing is their work with the Pennsylvania Fish and Boat Commission on the Unassessed Waters Initiative. Since beginning on the project in 2011, Dr. Niles and his team have assessed 340 total streams and documented the presence of trout in 205 of the previously unassessed streams. This year, they plan to assess another 150 named and un-named tributaries for brook and brown trout this summer. Dr. Niles is focusing on un-named tributaries in Schrader Creek in Bradford County, and Loyalsock Creek in Sullivan and Lycoming Counties as previous research has shown 50% of the un-named tributaries contain trout. Dr. Niles is also studying how Marcellus shale geological formation may affect trout streams in Pennsylvania highlands.

Dr. Niles is also working with Mike Bilger in stream assessments. Mike Bilger was recently named a full-time researcher at Susquehanna University and is working in cooperation with Dr. Niles under the RK Mellon Foundation. His project involves deploying rock baskets in the Susquehanna River Basin to look at water quality, algae populations, and macroinvertebrates. Mike Bilger is also continuing his work with the Snyder County Conservation District to put together an Ecology Day for local citizens which allows the general public to collect their own water samples, macroinvertebrates, and fish from demonstration tanks. He is also continuing his investigation into the spread and importance of crayfish in the river systems.

Another project Dr. Niles' lab is working on is in cooperation with Loyalsock Creek Watershed Association, Trout Unlimited, and Loyalsock State Forest to examine how sedimentation from culvert replacement and road reconstruction on gravel roads following flooding devastation caused by Hurricane Irene and Tropical Storm Lee may be impacting



Dr. Niles' student interns electro-fishing in a stream for wild trout populations.

recovery of trout populations in Loyalsock Creek. Once problem locations have been determined, Dr. Niles will work with stakeholder groups to best determine restoration efforts that might be possible and most cost effective. Through this process they will leverage available restoration funds to begin implementation of targeted restoration efforts of gravel roadways and culverts within the watershed.

The third project Dr. Niles is working on is a long-term headwater stream assessment of brook trout populations and benthic macroinvertebrates. The project assesses the regional food web and biotic response to flooding and suggests ways biotic communities recover and restructure themselves to pre-flooding conditions. Data about benthic macroinvertebrates, fish populations, and diet was collected from 30 streams within Loyalsock Creek in 2012 and 2013. Data collected shows stabilization of benthic communities approximately 1 year post flood. Data collected from 2014 on brook trout populations shows that streams are recovering back to pre-flood population levels, but there are still differences in the age structure.

The final project Dr. Niles is involved with this summer is a study of smallmouth bass movement dynamics. Partnered with Penn State and the Pennsylvania Fish and Boat Commission, the goal of the study is to quantify seasonal movement and thermal habitat use of smallmouth bass in the West Branch Susquehanna. They are evaluating movement in conjunction with water quality to inform future fish health and disease work on the Susquehanna.

Jeff Newman

Associate Professor of Biology
Lycoming College



Dr. Jeff Newman is one of the collaborators working with Geoff Smith (PFBC) and Vicki Blazer (USGS) on the health issues of smallmouth bass. Dr. Newman and his students are studying viruses and bacteria that may be the cause.

Often in DNA work, researchers will look just at specific genes. For this project, however, the researchers want to sequence the whole genome. Dr. Newman explained that the whole genome would be somewhere between 100,000 and 150,000 letters (G, A, T, and C) long. This requires more DNA which is part of the reason for allowing the viruses to grow and reproduce.

Lycoming College students Shannon Pipes and Samantha Stropko are working with Dr. Newman on the project. The students are continuing to work on preparing the samples for sequencing.

The bacterial samples Dr. Newman is processing are collected from live fish. Smith transported the fish to

The DNA sequencing is being done through GCAT-SEEK (gcat-seek.org). This is a National Science Foundation funded research collaboration network that allows researchers to share technology and knowledge.

Lycoming College in water filled coolers. Dr. Newman and his students then swabbed the lesions on the fish to collect bacteria. The matter collected by the swabs were transferred to petri dishes and allowed to grow.

Where viruses have the G, A, T, and C in 100,000 to 150,000 letter long sequences, bacteria sequences are

3,000,000 to 6,000,000 letters long. Every type of organism has a specific gene called 16S rRNA and the sequence of that gene alone often is sufficient to identify that organism. For the bacterial side of the project, Dr. Newman and the students isolate the unique gene sequence and analyze it to identify the specific bacteria.

Lycoming College students Hannah Morrisette and Miranda Giraldo are working with Dr. Newman on the bacterial research along with high school students Joe Dinsmore and Sydney Blosser.

The crews are still working to prepare samples, and Dr. Newman is confident analysis will be completed this Fall.

Dr. Benjamin Hayes

Director, Susquehanna River Initiative
Bucknell University



Dr. Benjamin Hayes directs the Watershed Sciences and Engineering (WSE) program at Bucknell University and helps faculty and students on a number of projects in the Susquehanna watershed. He continues to work closely with Bucknell aquatic ecologist Sean Reese to oversee a network of instruments used to monitor flow and water quality conditions in the River and several tributaries. He continues to organize the annual Susquehanna River Symposium, which this year is entitled "Science and the River" and will be held November 21 and 22 at the Elaine Langone Center.

Ben provides fluvial geomorphology expertise to the University's stream restoration project on Miller Run, and spent several weeks in May and June drilling test borings and installing a network of monitoring wells, stream gages, and weather station. The rest of the summer he helped various WSE students and faculty with their field work, including Erin Cox and Tucker Cottrell, both Civil and Environmental Engineering students under the direction Dr. Jessica T. Newlin who are studying river temperature and bedforms, and Madeline Dulac, a geology student under the direction of Dr. R. Craig Kochel, who is developing a stream restoration and conservation plan for the middle and lower reaches of Miller Run.

Ben also helps the Merrill W. Linn Land and Waterways Conservancy monitor a large palustrine wetland near Montandon, PA and serves as Vice President of the north-central region of Pennsylvania Trout Unlimited, where he works with 13 TU chapters actively involved in conservation and restoration efforts throughout central Pennsylvania.

Dr. Chris Hallen

Professor, Department of Chemistry
and Biochemistry
Bloomsburg University



Dr. Hallen has two student projects this summer. The first project is headed by student Chris, who is taking water chemistry from headwater streams in Fishing Creek and comparing them to baseline data from 2008 to detect any impacts that may be a results from the natural gas pads created in the area for Marcellus shale drilling. The water samples are taken back to the lab and tested for different ion content. The samples are usually tested for 13 different types of metals; cations such as sodium, lithium, and ammonia and anions such as sulfates and phosphates. This research is important in understanding the impacts, if any, of Marcellus shale drilling on headwater streams for future management practices.

Shelby, Dr. Hallen's second intern, is working on taking creating baseline data sets for Shumann's, Beech, and Soan's ponds in Sullivan County by taking water chemistry at each site. These ponds are in locations close to future gas pads; by creating the baseline data, researchers will be able to detect impacts, if any, from gas pads by looking at changes in water chemistry before and after installation.



Dr. Hallen and Dr. Rier setting up an effluence recorder in a headwater stream.



Dr. Rier and his summer intern processing biofilm collected from rocks in a headwater stream.

Dr. Steven Rier
Associate Professor of
Biology
Bloomsburg University



Dr. Rier is continuing his research on how phosphorus pulses impact algae growth. Last year, Dr. Rier and his intern created artificial stream channels and manipulated the amount of phosphorus in the water to see how the algae reacted to different phosphorus pulses. This year, Dr. Rier is interested in looking at how algae stores phosphorus after storms and how much is needed before an algae bloom. He is also interested in why and how fast an algae bloom spreads and what other nutrients are being taken in by the algae.

Dr. Rier has been sampling pristine headwaters in State Game Land 13 and Fishing Creek to determine phosphorus levels before and after storms. Rocks in assessed streams were scraped, and their contents were taken back to the lab for further testing. He is also taking water chemistry at sampling sites to determine if any other chemicals affect algae blooms. By identifying how much phosphorus is stored prior to a bloom, Dr. Rier hopes to be able to identify streams susceptible to algae blooms before the event occurs.

Why is phosphorous is bad for streams?

High phosphorous concentrations in streams lead to algae blooms. Algae blooms are bad for stream health because they cover the surface of the water, preventing light from penetration to the river beds. This event also lowers the dissolved oxygen (DO) in the stream leading to the mortality of fish and other organisms.

Dr. Jack Holt
Professor of Biology
Susquehanna University



Dr. Holt is again working with algae and diatoms. Previously, Dr. Holt has collected and identified over 80 species of diatoms through his data collection. However, this year Dr. Holt plans to collect nearly 180 different species by targeting particular habitats. To do this, he has added extra collection sites in the center of the River. He has also found that what he previously thought were plates of clay in his samples were actually crumbles of diatoms.

He and his team collected data by transect lines along the shores of the Susquehanna River below the confluence of the Susquehanna River and Shamokin Creek. His student Ian Murray is helping with diatom collection along Byer's Island while Amir Awali is looking at the translateral mixing of the acid mine drainage and agricultural runoff about three kilometers below the confluence of the west branch and the headwaters.

Another aspect of Dr. Holt's research that is new is his recording of data. Since March, Dr. Holt has been identifying individual diatoms found in the Susquehanna River and taking their measurements. He then inputs this data into a comprehensive spreadsheet, measuring his data against previously recorded data. So far, he has found that the diatom species found in the Susquehanna River do not fit exactly with other research recorded for the same species. This comprehensive data sheet will show a list of species and their measurements characteristic of the Susquehanna River.



Dr. Holt's student researcher, Amir, running lab tests on samples collected in the river.



*A smallmouth bass with black spots, part of Dr. Mangan's research.
NOTE: Picture from bassresource.com*

Dr. Brian Mangan
Professor of Environmental
Science and Biology
King's College



Dr. Brian Mangan is continuing to assess mercury concentrations in organisms collected from samples sites on the Susquehanna River that range from the New York border to Harrisburg, PA. The main organisms of focus at this time are macroinvertebrates.

In addition, Dr. Mangan and his team are looking for patterns of the black spot parasite in cyprinids. The black spot parasite has been documented in Pennsylvania since 1980. While the black, splotchy patches affected the appearance of the fish, it has not yet been reported as life-threatening. However, if juvenile fish contract large amounts of the parasite, it can cause mortality. Black spot occurs on bass, pike, perch, minnows, and other small fishes. Dr. Mangan is primarily looking at three minnow species for black spot: spotfish shiners, spottail shiners, and bluntnose minnows. He wants to try and answer questions related to the parasite's incidence, prevalence, distribution of the fishes, and environmental cues associated with these.

Dr. Mangan also spent a portion of the summer writing a grant to further his research on crayfish in the River. Along with Mike Bilger (Susquehanna University), Sean Reese (Bucknell University), and Robert Michener (Boston University), Dr. Mangan hopes to receive funding that will allow them and their students to delve into the diet of crayfish in the river, as well as design a method for measuring crayfish density.

Dr. Mel Zimmerman
Professor of Biology
Director, Clean Water Institute
Lycoming College



Dr. Zimmerman is continuing into his fifth year working with the Unassessed Waters Initiative with Pennsylvania Fish and Boat Commission. This year, his team continued assessing Lycoming Creek and Pine Creek watersheds and began assessing the headwaters of the Allegheny and Genessee watersheds. Since beginning their work with the Program in 2010, Dr. Zimmerman's team has completed 307 unassessed streams; this year they plan to complete an additional 40 streams.

He is also in his fourth year of monitoring best management practices (BMP's) applied to four farms within the White Deer Hole Creek Watershed. The purpose of this project is to collect water quality samples at monthly intervals and compare those results to the baseline data which was collected a year before BMP's were applied. By doing this, Dr. Zimmerman will be able to observe trends and potential impacts created by applying BMP's. Future BMP's will garner more support if it can be proven that they work effectively.

He has carried over his work with CromaFlow, previously known as Cromaglass, by monitoring water quality and looking at the effectiveness of microbes in degrading wastewater in saltwater environments. Dr. Zimmerman has also continued monitoring the West Branch of the Susquehanna from Lock Haven to Sunbury, with concentrations in Watsontown and the Williamsport Hiawatha dock sites for benthic macroinvertebrates, water chemistry, and periphyton algae. In addition, his team has continued to monitor Lycoming Creek and Mill Creek for water chemistry and has followed up with their previous assessment of Hagerman's Run. Dr. Zimmerman has also begun monitoring seven sites around Rose Valley Lake for



Zimmerman's field crew assessing unassessed waters by electro-shocking the streams for wild trout populations.

macroinvertebrates, water chemistry, and zooplankton. This year, three students, Emily Vebrosky and Trent Lee from Lycoming and Haley Giannone from Bloomsburg, were asked to join the Acadian Program in Regional Conservation and Stewardship in Winter Harbor, Maine. Dr.

For more information on the Acadian Program, see page 13.

Zimmerman was also invited to sit on the panel. The purpose of the conference was to assess watersheds around the world for ideas on how to improve the Penobscot River in Maine. Four teams were invited to the conference; Pennsylvania, Belize, Vietnam, and Chile.

Ahmed Lachhab
Professor of Earth and Environmental Sciences
Susquehanna University



Dr. Lachhab has an ongoing project using the Water Quality Index (WQI) as a method to assess water quality in the Beech Creek watershed. A student intern, Tyler Shields, is looking to measure eleven different components to calculate the WQI to assess water quality of the Susquehanna River. Additional sites in Clearfield County have been added this year.

He is also placing long term monitoring sondes on four sites near Hummels Wharf. He and his team took sondes down Beech Creek, above and below its confluence points, to compare to spring numbers. In addition, he received equipment to build two stations to track several water quality parameters remotely.

In addition to the two new water quality stations, Dr. Lachhab has also started collaborating with other scientists in Morocco to measure bathymetry and sediment deposit that results from hydraulic mining.

Dr. Mizuki Takahashi
Assistant Professor of Biology & Animal Behavior
Bucknell University



Dr. Takahashi has two student projects this summer.

Dr. Takahashi and one of his two student researchers, Mayu Uemura, are working on developing a way to detect the presence of Hellbenders in streams using environmental DNA (eDNA). To do this, they've collected water samples from streams known to contain populations of Hellbenders and from unassessed streams. The water is hand-pumped through a thin



Dr. Takahashi and intern Mayu collect water samples to capture eDNA to take back to the lab and run for Hellbender DNA.

filter that catches all the eDNA from the stream much like a coffee filter catches coffee grinds. Then, they conduct polymerase chain reactions (PCR's) by applying primers specific to Hellbender DNA to isolate it from any other DNA that may have been collected on the filter. The primer acts somewhat like a dye that can only combine with Hellbender DNA, making that DNA stand out from the rest of the DNA that may have been collected. Agarose gel electrophoresis, which acts as a type of scale, is applied to each sample to determine whether or not it contains Hellbender DNA. The purpose of this project is to see if eDNA is a viable way to monitor Hellbender populations without actually having to find and handle the animals. This project would also have the capability for not only assessing streams for Hellbender populations, but also for individual Hellbender specimens.

The second project Dr. Takahashi is involved with this summer is the predation cycle of eastern newts and frogs. His second research student, Carolyn McPhee, has set up an experiment using aquatic mesocosms.

A mesocosm is a tool used by researchers that allows them to create a mini-environment that mirrors the natural environment they are studying. By using a mesocosm, researchers are able to manipulate their mini-environment and observe the effects of the manipulation without harming the actual landscape.

Each mesocosm, basically a covered baby pool, is loaded with ten eastern newts and an array of tadpoles. By using the mesocosms, Carolyn is able to observe the natural predator-prey cycle of newts and frogs and how that relationship changes due to different environmental manipulations such as faster water evaporation, higher tadpole quantities, and varying water temperatures. The lab

is interested in how the presence of tadpoles, a food source for the eastern newts, can affect their growth and reproduction and even become a predator of the newts once that growth and reproduction cycle is disturbed.

Dr. L. Donald Duke Visiting Professor of Civil & Environmental Engineering Bucknell University



Dr. Duke studies planning and management actions for flood mitigation, and this summer is evaluating a few Susquehanna River Valley municipalities in detail that can inform our understanding of what approaches are effective throughout the U.S. His SRHCES-funded research for Summer 2014 is designed to identifying strategies employed by Susquehanna Valley boroughs as they work to comply with requirements, contain costs for citizens, sustain aging town centers, and reduce flood damages and potential safety hazards. This year, Dr. Duke and his intern, Seamus McLaughlin, are focusing on how the boroughs of Lewisburg and Milton municipalities have responded to damages and risks from flooding in their historic downtowns and at-risk residential neighborhoods. The research analyzed Federal and State official policies; information from State agencies on flood-response applications from the boroughs; interviews with municipal personnel about current practices and future plans; and archival data including deeds held in County assessors' offices, some hundreds of years old.

Findings show disparate strategies, each with their advantages and disadvantages, even in these two boroughs that are very near one another and have experienced similar flood damages for their 200-year histories. Lewisburg has acquired flood-prone properties, converting them from residential and commercial land uses where people and property are at risk into parks and open space that can accommodate periodic flooding without damage. Lewisburg's strategy has been incremental and strategic, acquiring properties over time using a range of funding from State and Federal programs for urban development, recovery after specific disasters, and ongoing non-disaster funding such as FEMA's Repetitive Loss Program. Conversely, Milton has declined to convert properties to avoid losing the commercial and residential vitality of its historic core. Partly that stems from the borough's response to the damages of the 1972 flooding associated with hurricane Agnes, when multi-million-dollar redevelopment programs redesigned the historic town center. Today's attitude is that remaining historic buildings are too precious to lose, and future losses are mitigated instead with requirements for "flood-proofing" upgrades for existing buildings.

The research drew conclusions using data on funding, number of properties addressed, and locations of land use changes in the two boroughs, including spatial analysis to document the results of various past programs. Maps of damaged properties, acquired

properties, and at-risk parts of the boroughs illustrate the effects of the strategies, with implications not only for how flooding has affected the historic and economic centers of the small municipalities of Lewisburg and Milton, but also how small towns throughout Pennsylvania and the U.S. might develop and apply their own mitigation plans to limit risk from future floods while sustaining the character and vitality of their historic neighborhoods.

Dr. Peter Petokas

Research Associate
Clean Water Institute
Lycoming College



For his ninth year, Dr. Petokas is continuing his research with the Eastern Hellbender salamander in tributaries of the Susquehanna River. Hellbenders have been on the decline due to amphibian chytrid fungus, a disease attributed to the global amphibian decline crisis. The Eastern Hellbender is presently undergoing review for possible protection under the federal Endangered Species Act.

To monitor hellbender populations, Dr. Petokas and his team lift the large cover rocks where they live, then capture, process, and release each salamander. Each hellbender is swabbed for chytrid spores on the skin, and the samples will later be sent to Cornell University where it will be determined if the individual is infected. Each captured specimen is also weighed, sexed, and tagged with a PIT tag (passive integrated transponder), which acts like a unique barcode for each animal. The 30-year life-expectancy of the hellbender makes monitoring their populations easier, and every year Dr. Petokas and his students capture between 200 and 300 individuals. While nearly forty percent of all individuals have contracted chytrid fungus, the effect of this disease on hellbender health is unknown.



Dr. Petokas and his students work on processing each Hellbender before releasing them back into the stream.

Another project Dr. Petokas is working is creating and placing nesting boxes for hellbender use. These concrete nest boxes have an opening at the top that allows Dr. Petokas and his team to extract hellbender's eggs while not disrupting the nest environment. Dr. Petokas plans to transport the eggs to the Bronx Zoo where they will be raised to an age where they are no longer subject to predation. The head-started individuals will eventually be released to restore or augment declining populations. Dr. Petokas and his students currently have 13 nest boxes installed and plan to install additional nest boxes in 2015.

Dr. Petokas is also continuing his study on native crayfish and the appearance and rapid spread of the non-native Rusty crayfish in north-central Pennsylvania. His study includes tissue sampling for mercury levels in areas affected by emissions from coal-fired power plants.

Camp Victory is another on-going project mentored by Dr. Petokas. Camp Victory, a summer camp designed for children with medical needs and chronic illnesses, now has a fully-equipped nature center. Dr. Petokas oversees two interns, Chelsea Taylor and Elise McAnnich, who have been running the educational programs for the children. While the camp is up and running, Dr. Petokas and the interns have been visiting other camps and nature centers to find ways to improve the environmental education program at Camp Victory.

Dr. Petokas and his students provide education and outreach to local schools, environmental groups, and the general public. If you would like to report a Hellbender sighting, request information on the Eastern Hellbender, on crayfish, or on vernal pool ecology, or schedule a presentation for a group, Dr. Petokas can be reached via email at petokas@lycoming.edu

Dr. Md. Khalequzzaman

Professor
Department of Geology
and Physics
Lock Haven University



Dr. Khalequzzaman, "Dr. K", is doing something new this year. First, he and his team are studying three creeks in the West Branch Susquehanna River watershed in Centre and Clinton Counties; namely, the Marsh Creek, Beech Creek, and Bald Eagle Creek. Both Marsh Creek and Beech Creek are tributaries to Bald Eagle Creek, and both are considered polluted streams; Marsh Creek has high nitrogen and phosphorous levels due to agricultural runoff and Beech Creek has high levels of metals due to acid mine drainage (AMD). Dr. K. and

his team floated down both Marsh Creek and Beech Creek into Bald Eagle Creek and took water samples to see how far down the AMD pollution from Beech Creek had to travel before it mixed with the water in Bald Eagle Creek. He is also looking at the impacts, if



Dr. K student Alex Neidig collecting water sample from Marsh Creek.

any, AMD has on Bald Eagle Creek which is currently an unpolluted stream. Last year, Dr. K and his team studied nearly sixty miles of stream in the West Branch of Susquehanna River for water quality parameters. This year, they are focusing on roughly four miles of Marsh Creek, Beech Creek, and Bald Eagle Creek. Besides just taking water samples, Dr. K is also taking soil samples in each creek to determine the nutrients that are present. He is looking for metals including: iron, manganese, aluminum, copper, arsenic, and zinc. Other parameters he is looking at are: alkalinity, acidity, pH, sulfate, total dissolved solids (TDS), and oxidation-reduction potential (ORP).

Another project that Dr. K and his team have started is a new lab procedure to treat AMD-polluted water. The procedure uses an electrolyte cell and runs the water through an anode and cathode, which acts as an electrical pulse. The pulse separates metals from the water. Once they are separated, the metals drop out to the bottom of the treatment tank and are collected. By extracting the metals from the water, this project would also increase pH levels from an acidic 3.9 pH to a more neutral 7 pH level. This project is still in the early stages and Dr. K hopes to be able to test for more parameters. However, once the kinks are worked out and more parameters are tested for, he plans to conduct field runs in an actual creek to see the result.

A project Dr. K is continuing is his collection of water quality data on the West Branch of the Susquehanna River. He is also continuing his data collection for water quality in the Marcellus Shale gas well drilling regions in Beech Creek watershed in Centre and Clinton Counties, and six sub-watersheds

in Clearfield County, involving members of Pennsylvania Senior Environmental Corps and other community-based citizen groups. For this study, Dr. K is testing for: TDS, pH, calcium, magnesium, sodium, barium, bromide, and chloride. Data collected yearly will be able to be compared with the baseline data he collected in 2013 to determine changes in water quality, if any.

Dr. Matthew McTammany Associate Professor of Biology Bucknell University



Dr. McTammany has continued studying diversity and community structure of benthic macroinvertebrates in the Susquehanna River. For the past three years, Dr. McTammany has used a combination of artificial substrates (rock baskets) and quantitative methods to sample benthic organisms from riffles between Lewisburg and Montoursville. He then identifies all the benthic organisms present to try and quantify the diversity of the communities and to determine how community structure changes over space or through inter-annual variability.

Dr. McTammany has two student projects this summer. The first project is headed by a graduate student in biology, Nicole King. Nicole is studying the aquatic-terrestrial interaction between emerging aquatic insects and terrestrial predators. Adult aquatic insects can provide a rich food resource to terrestrial predators, and this subsidy might change from small streams to large rivers. Nicole and her research team employed traps along 1st, 3rd, 5th, and 7th order streams to collect emerging aquatic insects and conducted nighttime surveys spiders or spiders in riparian habitats. The goal of this study is to link abundance of aquatic insects to diets of terrestrial predators along a gradient of stream size.

The second project is being completed by an incoming freshman, Leonard Orozco, a student in the Science, Technology,



McTammany STEM student Leonard, setting up his summer experiment to collect insects

Engineering, and Mathematics (STEM) Scholars Program. The purpose of the STEM Scholars Program is to expose students to research early in their academic careers to increase the number of students proficient in the fields of science and technology. Leonard's project correlates to Nicole King's graduate research by capturing and identifying adult aquatic insects from riparian areas. Leonard placed sticky traps along three streams and the West Branch Susquehanna River. Traps were collected after 7 days, and insects were then identified. The purpose of this research was to quantify the actual movement of aquatic insects into a terrestrial environment.

Geoff Smith

Susquehanna River Biologist Pennsylvania Fish and Boat Commission (PFBC)



Geoff Smith continues to collaborate with DEP, SRHCES, and other researchers to determine the cause of the health problems in the Susquehanna River Basin's Smallmouth Bass population. Over the course of the past year, this has included Brian Mangan (King's College), Mike Bilger (Susquehanna University), Jon Niles (Susquehanna University), and Jeff Newman (Lycoming College) as well as outside researchers Vicki Blazer (USGS) and Megan Kepler (Penn State University).

The 2014 field season saw the completion of a project investigating the role that parasites may have in Smallmouth Bass health

For more information on Brian Mangan, see page 6; Mike Bilger, see page 3; Jon Niles, see page 3; Jeff Newman, see page 4

issues that was initiated during 2013. The distribution of the fish parasite *Myxobolus inornatus* was assessed along with the distribution and diversity of potential worm hosts. Blazer and Kepler assessed the histopathology of fish, looking for presence of parasite in the tissues of the fish, while Mangan collected worm samples and Bilger conducted the taxonomy. Preliminary results indicate that the parasite was only found from fish collected at sites within the Susquehanna River Basin.

2014 also saw the beginning of a study in collaboration with PSU, USGS, DEP, and Jon Niles to track the movement of Smallmouth Bass. Smith, Kepler, and others radio-tagged Smallmouth Bass in Bald Eagle Creek, Pine Creek, and the West Branch Susquehanna River this Spring. Throughout the summer, Kepler has been tracking their movements. An additional 45 fish will be tagged during late-Summer or early-Autumn to increase the number of tagged fish in the system as well

as the amount of time fish will be available for tracking. Smith explained that using the movement information, the team hopes to determine if there is a link between contaminants in the soil and water with disease outbreaks in the Smallmouth Bass population. Last year and this year, the group looked at what contaminants were associated with different land uses.

Also during 2014, a new effort was initiated involving Jeff Newman investigating Largemouth Bass Virus (LMBV) and bacterial isolates from fish with signs of clinical disease. Newman and students in his lab are working to sequence the entire genome of LMBV isolates from the Susquehanna River to see if there are genomic differences and whether those are substantial enough to cause the virus to affect Smallmouth Bass. Additionally, Newman and his students are looking at bacterial isolates from lesions of young-of-year Smallmouth Bass to determine the bacterial community present in these affected fish as well as to look for novel bacterial species.

Josh Lookenbill

Biologist



Pennsylvania Department of Environmental Protection (PADEP)

Josh Lookenbill, a Lycoming College graduate and former intern of Dr. Mel Zimmerman, now works for the Department of Environmental Protection (PADEP) in cooperation with other federal, state and local partners to continue to collect physical, chemical and biological samples as part of the monitoring effort on the Susquehanna River. In 2012, PADEP targeted the Susquehanna River as an assessment priority and began developing monitoring and assessment protocols specific to large river systems. In 2013 sampling efforts were increased and included algal, benthic macroinvertebrate, fish and mussel sampling. Josh's job also requires him to collect water and sediment chemistry samples to target routine analytes as well as emerging or nontraditional parameters including endocrine disrupting compounds. Continuous instream monitors were also deployed in 2013 to monitor water temperature, pH, dissolved oxygen, specific conductance, and turbidity at select locations through the Basin. Josh is continuing to monitor these parameters in 2014.

For more information on other past interns, see page 14.

Updates From Ongoing Projects

Unassessed Waters Initiative

The Unassessed Waters Initiative was started in 2010 by the Pennsylvania Fish and Boat Commission (PFBC) to survey and record streams containing wild trout populations. The Department of Environmental Protection (DEP) has estimated that Pennsylvania contains over 86,000 miles of streams.

Prior to starting the Unassessed Waters Initiative, PFBC surveyed 21,654 miles of Pennsylvania streams. Of that, 9,372 miles were documented to contain wild trout populations. Another 3,305 miles of streams were added to the list because they were upstream of documented streams containing trout populations.

In the three years since the Unassessed Waters Initiative commenced, the state of Pennsylvania has recorded over 4,000 more miles of streams containing wild trout populations. The PFBC Partners such as DEP, Lycoming College, Susquehanna University, and Trout Unlimited have helped assess nearly 2,350 miles of streams of which over 50% contain wild trout populations. Of the rainbow trout, brown trout, and brook trout populations found, nearly 95% have been recorded brook trout.

Brook trout and brown trout look similar in color as juveniles and it may be difficult to distinguish between the two. However, you can identify adult brook trout from adult brown trout due to the red adipose fin on brook trout; brown trout have clear adipose fins. Rainbow fish are more colorful in appearance making them easier to identify.

The fish are identified when they are captured in the stream. PFBC has created an electro-shocking protocol for all partners to use. The protocol requires full protection gear such as waders and gloves to both keep the researchers safe from the electro-shock and to keep the capture method the same across the state.



Researchers use a battery backpack connected to a metal pole that sends pulses of electricity through the water to temporarily stun the fish, making them easier to catch. The stunned fish are caught with hand nets and placed in a bucket filled with water until they are processed. Each stream is sampled downstream to upstream for 100 meter. The 100 meter is then electro-shocked a second time to ensure all fish in within the sampling area have been caught. The fish are then processed for species, length, and overall appearance before being released back into the stream.

It is important to measure the wild trout populations in the streams in order for DEP and PFBC to determine the appropriate regulations for each stream. By combining DEP's water quality assessment with PFBC's wild trout assessments, Pennsylvania will have a better idea of which streams need tighter environmental control. In fact, the largest threat to undocumented wild trout populations is poor water quality due to lack of stream use regulation.

All trout documentation is input into a PFBC data website. From there, PFBC uses a mapping system called GIS to create maps with assessed and unassessed streams. This allows researchers to identify potential at-risk streams not yet assessed.

As the Unassessed Waters Initiative continues, PFBC will continue prioritizing streams. As of now, most streams likely to contain trout populations have been assessed and from that PFBC has created a list of high priority streams for regulation and re-assessment. They hope in the future to continue assessing streams and to create a statewide management plan for wild trout populations.

The Acadian Program

The 2014 Acadian Program in Regional Conservation and Stewardship conference was held July 27-August 3 in Winter Harbor, Maine. Program director, Jim Levitt, again asked Pennsylvania to put together a team to attend the conference. This year's team was comprised of Emily Vebrosky and Trent Lee from Lycoming College and Haley Giannone from Bloomsburg University and as well as Professor Mel Zimmerman from Lycoming College who was asked to sit on the research board. The other three teams asked to join were from Vietnam, Belize, and Chile. This program allows students from around the world to design innovative conservation strategies using the Downeast Maine and Atlantic Canadian region as problem models.

The week-long program was divided into three parts. The first part focused on the theory and practice of large landscape conservation with workshops in fisheries and working waterfronts, recreation and tourism, and ecosystem processes. Following that, the program shifted to part two as each team lead a half-day discussion focusing on "live" conservation initiatives in their home regions. After each team presented on their home region, the teams then came together to brainstorm different conservation solutions to help restore the Penobscot River watershed in Maine following the removal of large dams around the area.

The conservation strategies were devised using the vast array of public, private, non-profit and academic resources available.

Through this program, participants will gain a deeper understanding of large-scale conservation first hand while simultaneously developing international connections for future conservation issues.

Program partners include the Quebec-Labrador Foundation (QLF), the University of Maine, and the Schoodic Institute, located in Acadia National Park. Since 2011, nearly 30 undergraduate and graduate students from over 12 countries have enrolled in the program.



The Pennsylvania team: Trent Lee, Mel Zimmerman, Emily Vebrosky, and Haley Giannone.



Teams from Belize, Vietnam, Chile, and Pennsylvania at the Acadian Program in Maine.

Past Interns... Where are they now?

The Susquehanna River Heartland Coalition for Environmental Studies (SRHCES) has been meeting and working together for over 8 years. This spring, the group was asked, "Where are your past interns now, and what are they doing?" Here are a few of the answers...

J. Andrew Kilmer

Susquehanna University - Jack Holt

Andrew Kilmer was a research intern for Jack Holt during the summer of 2009. Andrew is currently a field technician in the Southeastern Domain of the National Ecological Observation Network (NEON). He mainly works with vascular plants, but has also worked with small mammal trapping, soil sampling, and carabid beetles. Though he no longer does any aquatic field work, the experience he gained with Dr. Holt has proven very useful.

David Haklar

Susquehanna University - Jack Holt

David Haklar has worked with the SRHCES as a Susquehanna University student during the summer of 2010. During that time, he had the privilege of working under Dr. Jack Holt while monitoring the Susquehanna



River below its confluence at Sunbury, PA. This opportunity allowed him to literally "get my feet wet" in a large, dynamic warmwater system. He started working for the Susquehanna River Basin Commission (SRBC) as an Environmental Technician following graduation in May 2011. David mainly performs aquatic biological surveys and sediment and nutrient monitoring. He can be found wading in a tributary one day and electrofishing the Susquehanna River by boat the next day.

Amanda Janicki

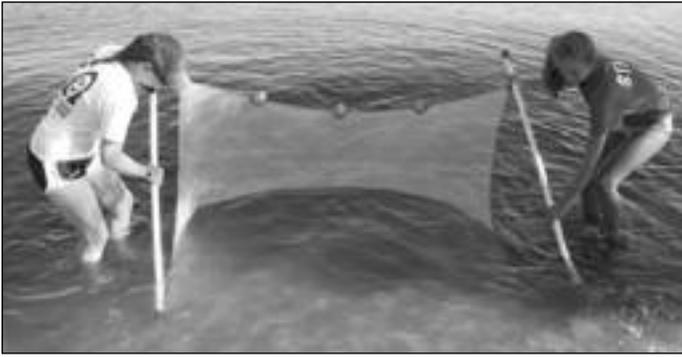
Susquehanna University - Carlos Iudica

Since graduating from Susquehanna University, Amanda has completed an M.S. in Biology from Missouri State University and is now in the last year of a Ph.D. program in Ecology and Evolutionary Biology at the University of Tennessee, Knoxville. Her Master's work was on the energetics of little brown bats infected with White-Nose Syndrome and her Ph.D. research involves the fungus that causes White-Nose Syndrome and infection prevalence of hibernating bats in the SE United States. Amanda attributes her hands-on time as an intern trapping small mammals with Dr. Iudica to giving her a solid foundation of experience for her current work.

Paige Uehling

Bucknell University - Matt McTammany

Paige interned with Dr. McTammany during the summer of 2012 to examine the effect of seston availability on filter feeder abundance. The experience strengthened her interest in research, particularly in the field of ecology, and she gained valuable guidance in research techniques. Since her internship, she had the opportunity to participate in an Research Experience for Undergraduates (REU) program at Texas A&M University - Corpus Christi examining oyster toxicity in south Texas bays. Paige recently returned from a research cruise on the US Coast Guard Cutter Healy polar icebreaker, where she volunteered as a research assistant for a project examining phytoplankton blooms in the Chukchi Sea. Currently, Paige is doing the Lutheran Volunteer Corps (LVC) in Tacoma, WA where she serves as an Outreach Coordinator for South Sound Outreach, a nonprofit that seeks to help residents establish financial stability and independence. Meanwhile, Paige is working on graduate applications, as she hope to pursue a PhD in marine biology.



Joanna Freeman and Molly Clark

Joanna Freeman

Bucknell University - Matt McTammany

Joanna worked with Matt McTammany for 2 years working on his Susquehanna River monitoring research as well as research for her Senior Thesis. His guidance and love of the river opened many doors and really solidified Joanna's love of environmental studies. After graduating from Bucknell University with a B.S. in Environmental Studies she went on to intern for the Susquehanna River Basin Commission for 6 months and complete a Post-Baccalaureate Certificate in G.I.S. from Penn State. From there, Joanna moved to Baltimore MD, where she completed an M.S. in Environmental Science and Policy from Johns Hopkins University. Joanna now works for the Alliance for the Chesapeake Bay as their Maryland Program Coordinator, working with citizens to install stormwater retrofits, plant trees, host stream cleanups and educate volunteers on the importance of a clean Chesapeake Bay. If she had not been a research intern with Professor McTammany, Joanna believes she would not be where she is today, working with citizens to improve the quality of the Chesapeake Bay.

Molly Clark

Bucknell University - Matt McTammany

Molly worked with Dr. McTammany under the Degenstein Foundation on a research project that developed into her senior thesis in 2011. After graduating from Bucknell in 2012 with a Bachelor of Science Degree in Environmental Studies, Molly spent about a year working for the Susquehanna River Basin Commission as an Associate Environmental Scientist. This position entailed traveling throughout the Susquehanna River watershed assisting with the field work for several river and stream monitoring projects as well as lab work analyzing water and macroinvertebrate samples and data analysis. Molly currently works at the

Chesapeake Bay Foundation in Annapolis, Maryland as a water quality research assistant. In this position, Molly assists with data compilation and analysis and helps track progress toward the implementation of the Clean Water Blueprint, including implemented best management practices and nutrient and sediment pollution reductions. Molly is also involved with several grant projects evaluating the benefit of agricultural practices as well as a pilot nutrient trading project.

Matt Wilson

Bucknell University - Matt McTammany

Matt Wilson finished his Master's at Bucknell under the guidance of Matt McTammany and was partially funded by SRHCES. After finishing his M.S. at Bucknell, Matt stayed at BU and worked for a summer as a technician for Matt McTammany. Last fall Matt moved to Vancouver, BC to begin a Ph.D. as a Four-Year-Fellow in the Department of Forest and Conservation Sciences at the University of British Columbia. Matt's current position is a direct result of his experience and research at Bucknell, which now includes 4 publications and others in revision or preparation and many of them were funded in part or whole by the Heartland Coalition. The uncommon position of being a graduate student working with the Heartland Coalition also gave Matt the opportunity to act in a[n unofficial] mentoring capacity for interns. He is grateful for that aspect of the experience, and believes it has also improved his abilities as a researcher and leader.

Brian Tanis

Susquehanna University - Carlos Iudica

Since graduating from Susquehanna University in 2010 in Ecology and Biology, Brian has earned a Master's degree at Fort Hays State University in Kansas in Biology and is currently working towards a Ph.D. at Oregon State University. Brian's research interests surround mammalian ecology, focusing in particular on interactions between apex and mesopredators. The need for deeper time studies was something Brian learned during his internship with the Susquehanna River Heartland Coalition for Environmental Studies, where Dr. Carlos Iudica and he worked to recreate the historical small mammal communities of Central Pennsylvania. This information helped to show how climatic alterations shaped ecosystems through the Holocene, providing key information for what we can expect in the future.

Zebidiah Buck

Lycoming College - Mel Zimmerman

Zebidiah Buck interned with Mel Zimmerman from 2009-2011. The Lycoming College Clean Water Institute has more helped prepare him for professional work in the field of Biology by giving him the practical experience he needed to lead a crew in the field. As a US Fish and Wildlife

Biological Field Technician, Zeb parallels the fisheries work to restore threatened Apache Trout in the White Mountains of Arizona with the experience he



received with the Clean Water Institute. The field of aquatics is a broad and diverse field, one which requires experience from a myriad of approaches and that is something that the Lycoming College Clean Water Institute helped prepare Zeb for. Zeb believes the importance of actual hands-on lab and field experience is paramount now that he has been in the workforce. He quotes, "Once you have that, your choice of disciplines within biology are nearly endless."

Fred Rogers

Lycoming College - Mel Zimmerman

Fred Rogers interned for Melvin Zimmerman and the Clean Water Institute at Lycoming College for two and a half years from 2010-2013. His work with water quality testing has helped him excel in his current job as a Lab Technician/Laborer at the Tiadaghton Valley Municipal Authority which is a wastewater treatment plant located in Jersey Shore, Pennsylvania. With the ongoing focus of efficient nutrient removal from treated effluent entering the Susquehanna River, it is important for Fred to work alongside the plant operator to make any changes to the treatment process in order to maintain high nutrient removal. Optimizing the treatment process by performing lab tests helps the operator to achieve the goal of high nutrient removal which has an impact in trying to improve the poor conditions of the Chesapeake Bay.

Updates from Our Partners

Geisinger Environmental Health Institute (EHI)

The joint Geisinger-Johns Hopkins Bloomberg School of Public Health EHI, directed by Brian S. Schwartz, continues its ongoing studies in environmental epidemiology in the region. Several investigators and staff of the Geisinger Center for Health Research are involved in these studies, including Annemarie Hirsch, Agnes Sundaresan, Sherry Yan, Lisa Bailey-Davis, Joseph DeWalle, Jake Mowery, Sy Brandau, Jennifer Irving, and Dione Mercer. There are many opportunities for collaboration and student involvement in these projects and several Bucknell and Bloomsburg University students have been working with us. Much information can be found on our website at http://www.geisinger.org/research/centers_departments/environmental/.

The EHI is currently involved in four primary projects:

- **Methicillin-resistant Staphylococcus Aureus (MRSA)**

This work was the PhD dissertation project of doctoral student Joan Casey, who has now completed the program. In two papers published in JAMA Internal Medicine and Environmental Health Perspectives, we found that persons living near crop fields to which swine manure had been applied had almost a 40% increased risk of infection with MRSA. Furthermore, specific molecular types of MRSA were implicated. This was the first study to link MRSA infection, rather than colonization, to agricultural practices, and the first to evaluate crop field application of manure as a possible exposure pathway.

- **Unconventional Natural Gas Development (UNGD), with funding from the National Institute of Health (NIH)**

We have begun studies to evaluate potential health impacts of UNGD. We are starting with two primary health conditions, asthma and pregnancy, and a number of health outcomes for each. The asthma work is the PhD dissertation project of doctoral student Sara Rasmussen. We have funding to create exposure models using geographic information systems (GIS), and are evaluating wells, compressor stations, well flaring, and well pond size and location. We started with the DEP dataset on wells, and found

much missing data, so used PA*IRIS and imputation to fill in missing data, to create a dataset with extensive information on location, dates of drilling, perforation, stimulation, and production, as well as well depth and production data. We worked with Skytruth in Shepardstown, WV, in the use of satellite data to identify wells that had been flared and the information on ponds. As compressor stations are a large source of air emissions and there are no existing datasets to characterize compressor stations, EHI environmental scientist Jennifer Irving led an effort in which we visited the six PADEP field offices, scanned over 5,000 documents (e.g., permits, applications, start letters), entered the data into databases, and are now cleaning the data. When all our datasets are complete, we will use GIS to evaluate how distance, phase of well development, production, and other exposure pathways may be associated with health outcomes.

We have also been doing spatial and temporal analysis of building radon levels in Pennsylvania, using PADEP's radon data from 1987 to 2013 (over 1.9 million measurements). We are evaluating how test type, test duration, building type, season, weather, geology, well water, year, UNGD, and other factors are related to building radon levels over time in the state.

- **Childhood Obesity (NIH-funded)**

The prevalence of childhood overweight and obesity are high in the region and this study is trying to understand how community and healthcare system factors may be contributing. We have information on over 163,000 geocoded children from ages 2 to 18 years. We have assembled an extensive dataset of changes in community features over time from 1997 to present in four domains relevant to eating and physical activity behaviors: land use, the physical activity environment, the food environment, and the social environment. In addition to traditional biostatistical approaches, we are also using systems science approaches, including complex dynamic systems models and agent-based models.

In our first paper, published in Pediatrics, we evaluated how health conditions and their treatment could influence body mass index (BMI) trajectories over time. This first paper focused on attention-deficit hyperactivity disorder (ADHD) and its treatment with stimulants. We found that the earlier

in life stimulants were started and the longer the duration of stimulant treatment, the stronger were both a delay in BMI growth in early life and a rebound in BMI growth in late adolescence. ADHD itself was not a strong predictor of BMI trajectories over time. This is the first study to report that stimulant treatment for ADHD could be associated with BMI rebound, and could help to explain prior studies that reported that kids with ADHD are at higher risk for obesity as both children and adults.

- **Chronic Rhinosinusitis (CRS) (NIH-funded)**

CRS is a disabling inflammatory condition of the upper airways, specifically the nose and sinuses. It has many links to environmental exposures, and we are studying several ways in which the environment could contribute to the onset, control, or natural history of the disease. This study is using both electronic health record data as well as primary data collection. We completed a baseline survey in which we mailed a self-administered questionnaire to over 23,000 patients, and will be following these patients over time as well as inviting some to complete sinus CT scans or sinus endoscopy. This study is funded for five years of work.

WKOK



In the 2013-2014 year, Sunbury Broadcasting Corporation's Newsradio 1070 WKOK continued its coverage of environmental stories. WKOK provided an open mic to several local and statewide groups to discuss topics ranging from the state of the Susquehanna River to the impacts of Marcellus Shale natural gas drilling.

Some highlights this year included a visit from Geoff Smith of the Pennsylvania Fish and Boat Commission. He was a guest in studio on WKOK's On The Mark program with Mark Lawrence. His focus was

on the smallmouth bass population in the Susquehanna River, talking about why they are declining and where anglers can find the best smallmouth bass.

Another guest familiar to On The Mark is Harry Campbell, Pennsylvania Executive Director of the Chesapeake Bay Foundation. 2014 started off with a January release of the CFB's polluted runoff report. Among many recommendations, Campbell told the audience that reducing polluted runoff is an investment for the economy, the environment and the general health of the community.

We talked several times with Reverend Dr. Leah Schade, who is a strong supporter of responsible natural gas drilling. We followed her journey as she spearheaded a group of Lutherans who took action against oil and gas companies, calling for them to be held up to standards of the Safe Drinking Water Act, the Clean Air Act and the Clean Water Act.

We also found out about some of the 'junk' in the Susquehanna River, but that there are very targeted efforts to help. Zach Stotter and Emily Robinson were featured as creators of the Susquehanna River cleanup, which brought hundreds of volunteers to the banks of the river picking up trash. In addition, boaters volunteered to help pull larger items out of the river.

WKOK also took time to highlight several environmental groups in The Valley, as well as promote many of their upcoming events. On WKOK Sunrise, our newest morning show, we talked with Erin Pierce of the Susquehanna Greenway Partnership, who promoted the paddle and pedal along the Susquehanna River. Other organizations highlighted included the Northcentral Pennsylvania Conservancy, Northumberland County Conservation District and the Responsible Drilling Alliance.

In the year ahead, WKOK will continue coverage and reporting of environmental activities and initiatives. You can hear a collection of these interviews at wkok.com.



SRHCES professors and students gathered at Lycoming College this summer to share information about their research. The summer 2014 interns presented brief summaries of their research projects. Some of the students will be continuing their research through next year while others will be wrapping up and summarizing results this fall.

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Susquehanna River Heartland Coalition for Environmental Studies

www.SRHCES.org