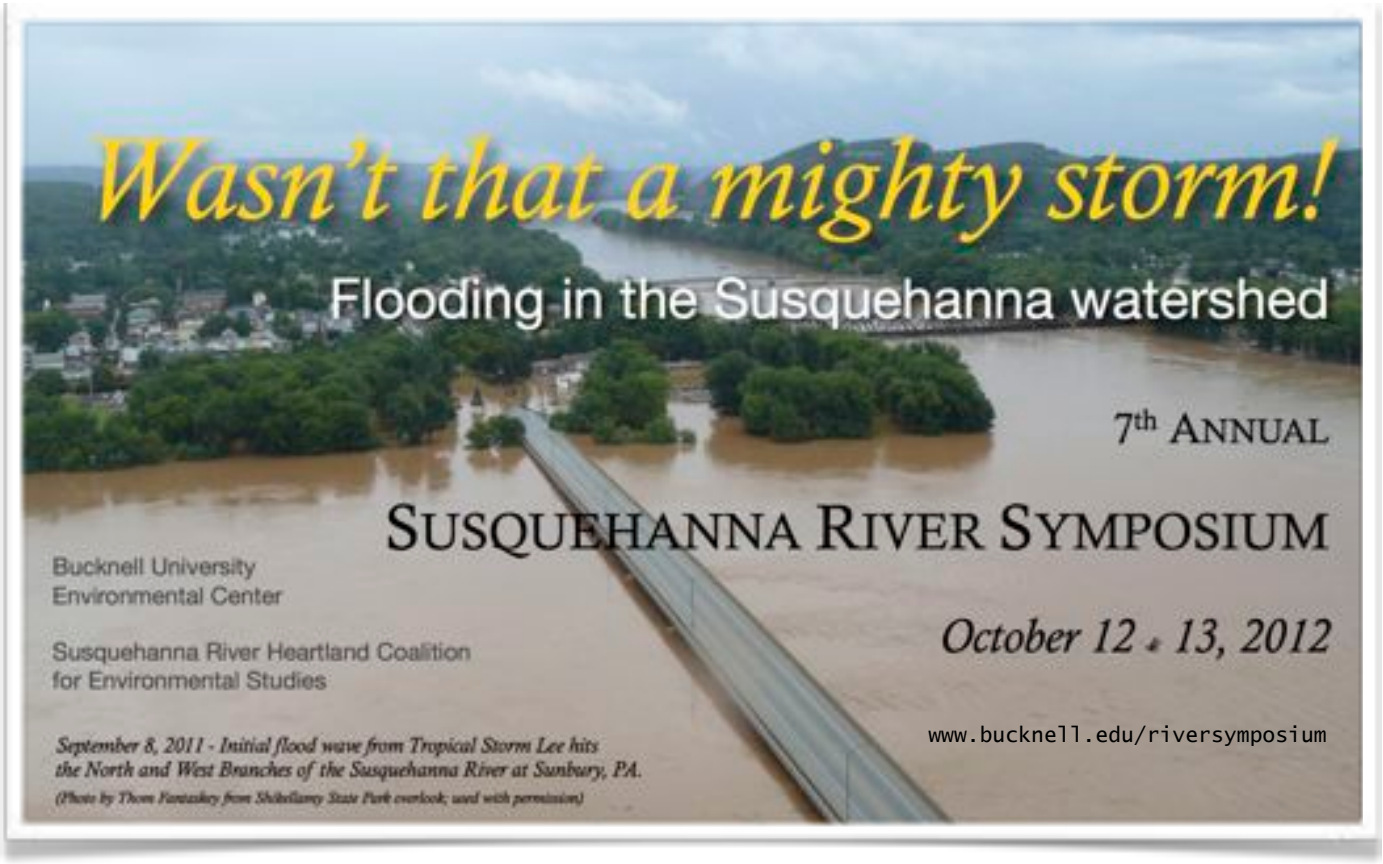

Research Posters

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Exhibits

RESEARCH POSTERS

MUSSEL POPULATION AND DISTRIBUTION ON BUFFALO CREEK, AN AMERICAN EEL STOCKED TRIBUTARY TO THE WEST BRANCH SUSQUEHANNA RIVER

Michael HUFNER[1], Sean P. REESE[2], Kayla YEE[3], and Matthew E. MCTAMMANY[1], [1]Department of Biology, [2]Environmental Center, [3]Civil and Environmental Engineering, Bucknell University, Lewisburg, PA 17837

Recent introductions of the American Eel, *Anguilla rostrata*, by the U.S. Fish and Wildlife Service (USFWS) into tributaries of the Susquehanna River, may have an enormous significance to the health and water quality of the Chesapeake Bay and its major tributary, the Susquehanna River (Minkinnen and Park 2009). Since the damming of the Susquehanna River in 1928 by the Conowingo Dam, catadromous freshwater eel populations have steadily declined (Richkus and Wahlen 2000). With the building of more dams upstream, the number of eels migrating up the Susquehanna River has significantly decreased (SRAFRC 1991, 1992, 1993). Freshwater mussels, particularly *E. complanata*, use the American Eel as a host for their glochidia, or the larval stage of their life cycle. To provide a baseline population estimate, we surveyed mussel populations in a major tributary to the Susquehanna River in Union County known as Buffalo Creek. Our baseline population estimates will allow for future studies to investigate the effectiveness of eel introductions on population size.

INFLUENCE OF FILTER FEEDERS ON SESTON AVAILABILITY AND QUALITY AND RESULTING LONGITUDINAL CHANGE IN FILTER-FEEDER ABUNDANCE AND COMPOSITION

Paige UEHLING and Matthew E. MCTAMMANY, Department of Biology, Bucknell University, Lewisburg, PA 17837

The goal of our study is to examine effects of filter-feeders on seston availability along a riffle of the Susquehanna River and conversely to see if seston affects density of filter feeders present at different lolcations along the riffle. We determined concentrations of suspended organic matter in six size fractions (0.7-1000 um) from water samples collected at 400-m intervals along a 1-mile long riffle in the West Branch Susquehanna River near Watsontown, PA. In addition, three invertebrate samples were collected at each site with a kick-net and were examined to see if the distribution of filter feeders along the riffle reflects locations with higher or lower seston amounts. The filter-feeder community was composed of dipterans, mayflies, and caddisflies. Total seston concentrations ranged from 1.28 mg/L to 2.2 mg/L throughout the riffle. Between 88 and 95% of seston was composed of the smallest size fraction (0.7-25 um). Our preliminary results showed that 87% of invertebrates at the upstream end of the riffle were filter feeders, 86% of which were caddisflies. Filter feeders comprised 77% of the benthic invertebrate community at the downstream end of the riffle, with caddisflies making up 74% of the filter feeders. Seston concentration did not decline along the riffle as predicted, which may be the result of rapid uptake of seston by filter feeders or turnover of seston pools throughout the riffle.

BIOLOGICAL ASSESSMENT OF THE SUSQUEHANNA RIVER USING PHYTOPLANKTON AND PERIPHYTON

Marc SANTIAGO and Jack HOLT, Department of Biology, Susquehanna University, Selinsgrove, PA 17870

Five sites were monitored between Sunbury and Selinsgrove on the Susquehanna River for periphyton and seven sites for phytoplankton (metaphyton). The purpose of the study was to examine the metaphyton and periphyton populations of the river during the summer in order to determine the stability of the algal ecosystem and assess the quality of the river. A total 87 species of algae were identified in the phytoplankton communities, which were sampled weekly. Artificial substrates for periphyton were placed in the river for a total of 3 weeks and 26 diatom taxa were found. Metrics such as the Pollution Tolerance Index (PTI), Shannon Weaver index and Bray Curtis were used to determine species distribution and site similarities from June 4 through July 19. Shannon Weaver values for phytoplankton ranged from 1.53 to 2.90 and 0.31 to 1.91 for periphyton. Pollution tolerance index (PTI) values were calculated for each site based on the observed periphyton collected from the periphytometers. Those PTI values ranged from 2.7 through 2.99 where site 4 had the lowest PTI value and 5 had the highest PTI Value.

A COMPREHENSIVE ANALYSIS OF MACROINVERTEBRATE DIVERSITY ON THE SUSQUEHANNA RIVER AT THE BYERS ISLAND TRANSECT FROM 2009 TO 2012

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The Susquehanna River ecosystem has been monitored for macroinvertebrate composition during the summer months of 2009, 2010, and 2012. Macroinvertebrates are significant determinants of stream health based on how sensitive they are to pollution. Our study utilized artificial substrates, rock baskets and Hester-Dendy samplers, at sites on the upper main stem along a transect that straddled Byers Island near Shamokin Dam, PA. The collection and identification of these organisms to family allowed us to determine pollution tolerance values and other comparative metrics. During the study, biological diversity declined as Ephemeroptera, Decapoda, and Amphipoda began to dominate causing the Hilsenhoff Biotic Index values to rise, and the percent EPT to fall. Overall, the pollution-tolerant macroinvertebrates increased in relative dominance since 2009; however, the difference likely is related to summer discharge levels. Our results underscore the need for more bioassessment studies to cover a wide range of flow regimes.

BEDFORM AND SEDIMENT CHARACTERIZATION OF THE WEST BRANCH OF THE SUSQUEHANNA RIVER

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The objective of this research is to characterize the bedform and sediment of the West Branch of the Susquehanna River from Muncy, PA to Milton, PA. Characterization was accomplished by investigating the bathymetry of the river bed and the sediment grain size in the reach. Bathymetry data along the reach of the river were collected using Lowrance and Doppler technology. A pebble count was also taken to obtain information on the median bed particle size. The bathymetry data was integrated with LIDAR elevation data sets and then interpreted using ArcGIS. This extensive investigation provides a greater insight to the history of the channel. In particular, there is evidence that suggests glacial damming occurred during the Pleistocene era, which contributed to the current form of the river.

IMPACTS OF POST-FLOOD STREAM CLEANING ON NITROGEN RETENTION IN CENTRAL PA STREAMS

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MERCURY GRADIENT FROM A COAL-FIRED POWER PLANT SITE

Thomas P. MANGAN, Ryan W. MCGRADY, Gina E. KELLETT, and Brian P. MANGAN, Environmental Program, King's College, Wilkes-Barre, PA 18711

Mercury is a ubiquitous environmental contaminant originating largely from the atmospheric waste streams of coal-fired power plants. "Hotspots" of mercury deposition/accumulation have been suspected and this concern has led states like Pennsylvania to resist cap-and-trade of mercury. We wished to investigate this concern by measuring the total mercury burden of a common forest spider (*Micrathena gracilis*) relative to their distance from a retired coal-fired power plant. Two transects were chosen in proximity to the power plant. Transect A followed the river in a general NE-SW direction along the Susquehanna River corridor, while Transect B followed a power line running NNW-SSE. Five to twelve spiders were collected at each of nine locations along Transect A and six locations along Transect B. The THg concentration of each spider was determined using a direct mercury analyzer. THg concentrations were highest at sites near the plant in both transects, but only Transect B showed a significant trend between concentration and distance ($P<0.05$). Transect B's elevation better matched the elevation of the smokestacks at the power plant, perhaps increasing the efficacy of mercury deposition in this direction. The observed variation in total mercury concentration between our individual sampling sites suggest that true "hotspots" of mercury deposition can occur in the environment. Additional testing should be done of soil samples along these same transects to see if soil concentrations of mercury support the findings we observed in spiders.

WATER QUALITY MONITORING ASSOCIATED WITH FARM BMPS

Quentin REINFORD, Mel ZIMMERMAN, Department of Biology, Lycoming College, Williamsport, PA 17701

Lycoming College Clean Water Institute has partnered with the Lycoming County Conservation district to monitor the water quality of an unnamed tributary to White Deer Hole Creek. BMPs were established at four farms in June of 2012 and water quality monitoring started above and below the project site one year prior and will continue for five years. Lelevogger sondes placed at three locations that monitor temperature and flow will allow load determinations of nutrients and sediment.

MERCURY DISTRIBUTION IN THE HELLGRAMMITE (CORYDALUS CORNUTUS)

Ryan W. MCGRADY, Thomas P. MANGAN, Gina E. KELLETT, and Brian P. MANGAN, Environmental Program, King's College, Wilkes-Barre, PA 18711

Measuring mercury concentrations of organisms is essential to understanding the movement of this ecotoxin through environments. Knowing how mercury is distributed within organisms helps researchers determine where to obtain representative samples. There are also practical limits to the amount of tissue that can be analyzed by most analytical methods. We examined the distribution of mercury within the body of hellgrammites (*Corydalus cornutus*) collected from the Susquehanna River. Hellgrammites were collected from two locations along the river and 10 specimens from each site were selected based on similar head-capsule width. Each hellgrammite was dissected into 10 sections: head, thorax, and eight abdominal segments. Each section was analyzed for total mercury concentration (THg) with a direct mercury analyzer. The median head capsule THg concentration was significantly greater than the abdominal segments ($P<0.001$), but not the thorax ($P>0.05$). Neither was there any statistically significant difference between the thorax and the abdominal segments. Our results suggest that any of these body segments would be viable representative samples of total mercury in hellgrammites. However, the body segment chosen for analysis could vary with the questions asked by the researcher. For example, head-capsules would be the segment of choice to determine the highest concentration of total mercury in hellgrammites. But given the difficulty of some predators to digest the chitinous head capsule, one of the softer abdominal segments might be preferable to better determine how much mercury might be made available in food-web studies. More research is needed to determine how THg varies among hellgrammites of different sizes.

ONGOING MONITORING OF SUSQUEHANNA RIVER AT THE SHADY NOOK SITE

Fathel SIOBHAN, Matthew BEREN and Ahmed LACHHAB, Earth and Environmental Sciences, Susquehanna University, Selinsgrove, PA 17870

This study continues the efforts on Susquehanna River monitoring of the Shady Nook site in the vicinity of Selinsgrove, PA. In the ongoing study, the physical and chemical properties are measured. In prior effort, the thermal plume and its physical dimensions were analyzed based on multiple thermal sensors placed along several transects. The temperature data from the sensors were matched with aerial Infrared Images and proved to match very closely. The plume was caused by the release of water used in the cooling of the Sunbury Generation, LLC power plant. The summer 2012, the power plant has significantly reduced injection of warm water due to its frequent interruptions. Chemical and physical data were collected and was found similar to the previous two summers. Instant snapshots of physical and chemical properties along transects across the river by YSI 556 multimeter showed similar trend as previous years with the exception of the warm plume toward the west of the site that no longer exits during our monitoring during the summer of 2012. Transects data allow accurately the determination of the boundary limit of the two type of waters of Susquehanna River at any given moment. Additionally, it was shown that water samples collected from site 1, 2, 3 and 4 matches water samples collected from further north and west of the two branches upstream.

WATER QUALITY ASSESSMENT OF MIDDLE CREEK BY MEANS OF PHYSICAL AND CHEMICAL PROPERTIES

Phoebe NICHOLLS and Ahmed LACHHAB, Earth and Environmental Sciences, Susquehanna University, Selinsgrove, PA 17870

Middle Creek is located in Snyder County, PA and is surrounded by a large farmland area. The headwater of this small stream starts at two separate branches, which merge and flow into Penns Creek which discharges into the Susquehanna River. Water quality analyses were performed along Middle Creek to measure the chemical and physical properties to study the impact of farmland on the stream. It is believed that high levels of pollution in the Susquehanna River and the Chesapeake Bay are caused by runoff from smaller upstream tributaries. Eleven different sites were selected to collect samples from: A, B, C, D, E, F, G, H, J, Faylor Lake and Walker Lake. These sites were further split into three components: the Main Branch, the Walker Lake extension and the Faylor Lake extension. Sampling of Middle Creek occurred once a week over the summers of 2011 and 2012 where all sites were sampled in one day. Temperature, pH, conductivity, TDS, and ORP were measured in the field using a Hach MP-6p multimeter. Dissolved oxygen was also measured using a YSI556 multimeter. Cation and anion concentrations were measured in the lab using a Dionex ICS-2000.

MIDDLE CREEK WATER ASSESSMENT USING WATER QUALITY INDEX (WQI)

Matthew BEREN and Ahmed LACHHAB, Earth and Environmental Sciences, Susquehanna University, Selinsgrove, PA 17870

Middle Creek is located in Snyder County, PA and is surrounded by a large farmland area. The headwater of this small stream starts at two separate branches, which merge and flow into Penns Creek, which discharges into the Susquehanna River. Water quality analyses were performed along Middle Creek by monitoring the chemical and physical properties. It is believed that high levels of pollution in the Susquehanna River and the Chesapeake Bay are caused by runoff from smaller upstream tributaries such as Middle Creek. This study focuses on the analysis of water quality using individual measured parameters and Water Quality Index (WQI) in 11 sites along Middle Creek. The sites were labeled A, B, C, D, E, F, G, H, J, Walker Lake (WL) and Faylor Lake (FL). Middle Creek was split into three sections: Faylor Lake extension (G, FL, F), Walker Lake extension (J, WL, H) and sites A through E. This allowed to depict trends in the data and showed where exactly higher levels of measured elements are located. The sites were sampled three times the first week, twice the second week and once a week for the last three weeks of monitoring. Temperature, pH, conductivity, TDS, DO and ORP were measured in the field using a YSI 556 MPS multimeter. Samples were tested to determine nutrient and ion levels. Four major nutrients (PO43-, NO2-, NH3 and NO3-) were measured using a DR2800 spectrophotometer while a Dionex ICS-2000 was used to measure anion and cations concentrations.

SHORT-TERM RESPONSE OF THE BENTHIC MACROINVERTEBRATE COMMUNITY TO CATASTROPHIC FLOODING FROM TROPICAL STORM LEE IN CENTRAL PENNSYLVANIA

Samuel SILKNETTER, John PANAS, Jonathan NILES, and Mike BILGER, Department of Biology, Susquehanna University, Selinsgrove, PA 17870

BATHYMETRY AND SEDIMENT ACCUMULATION OF WALKER LAKE, PA USING TWO GPR ANTENNAS AND A NEW INTEGRATED METHOD FOR DATA PROCESSING

Ahmed LACHHAB and Aaron BOOTERBAUGH, Earth and Environmental Sciences, Susquehanna University, Selinsgrove, PA 17870

Silting within all man-made reservoirs can be a major problem. Exploring a lake's bathymetry with electromagnetic 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 via multi-frequency ground penetrating radar (GPR) survey. The apparatus developed herein included two antennas placed on an inflatable boat towed by a 14' flat-bottom Jon Boat which was powered by a small electric trolling motor. Depending on the depth of the lake, either 400 or 100 MHz antenna was applied to identify the bathymetry, the amount of sediment deposited and their distribution. A total of eighteen transects were taken along the entire length of the lake. A new method with multiple approaches including RADAN 7, GPR Viewer, SAS 9.1.3 and MATLAB was developed and applied to generate three-dimensional and contour surface of the pre-1971 topography and bathymetry. The bathymetry, the volume of sediment and their accumulation rate were successfully measured. The lake was found to vary between 0.5 to 9 m in depth. Deposition of sediment takes place mainly near the inlet of the lake and gradually decreases toward the dam on the contrary to the depth of the lake. The depth of the sediment deposit ranges between 0 and 1 meter with an average of 30cm throughout the lake.

SPATIAL VARIABILITY OF BENTHIC INVERTEBRATE COMMUNITIES IN THE WEST BRANCH SUSQUEHANNA RIVER

Matthew E. MCTAMMANY, Ashley BRUNO, Matt WILSON, Biology Department, Bucknell University, Lewisburg, PA 17837

We are studying benthic invertebrate communities in the West Branch Susquehanna River to explore how much community structure varies in space and to determine what factors influence this spatial variability. To this end, we have sampled benthic invertebrates in distinct microhabitats with dramatically different physical conditions (rocky shoals and sandy backwaters) with and without emergent vegetation (primarily water willow). We have also conducted extensive quantitative sampling in 10 riffles from Montoursville to Lewisburg to determine how much benthic communities vary within and among riffle habitats, potentially revealing localized patterns related to patterns within riffles, influences of tributaries on river invertebrates, or broad neutral effects across 40 km of river length. Samples have been collected and are in the process of being sorted and identified for senior thesis (Bruno) and master's thesis (Wilson) projects.

SPATIAL AND TEMPORAL PATTERNS OF BENTHIC INVERTEBRATE COMMUNITIES IN THE SUSQUEHANNA RIVER REVEALED USING DATA FROM 20 YEARS OF SURVEYS BY MULTIPLE AGENCIES

Matthew J. WILSON[1], Matthew E. MCTAMMANY[1], Sean P. PEESE[2], Benjamin R. HAYES[2], Michael D. BILGER[3], [1]Department of Biology, [2]Environmental Center, Bucknell University, Lewisburg, PA 17837 and [3]EcoAnalysts Inc., 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. To account for differences in sampling, processing, and identification methods among agencies, we applied a standard method for standardizing sample size and resolving taxonomic ambiguities to 150 samples distributed across 10 locations in the Susquehanna River and major tributaries collected over 20 years by four agencies. Invertebrate communities were dominated by mayflies and caddisflies (45.6 to 83.2%) across all locations. Percent EPT and standard diversity measures were inversely correlated, indicating that traditional macroinvertebrate IBI approaches might not be applicable to large rivers. In addition to showing community composition shifts across subbasins, these data also document the spread of Asian clams (Corbicula) and the impact of black fly (Simuliidae) management. 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. We also suggest changes in future biomonitoring protocols to improve their effectiveness in bioassessment and ecological applications.

INFLUENCES OF BIOGEOCHEMICAL PROCESSES IN RESERVOIRS AND GROUNDWATER ON CATCHMENT-SCALE WATER CHEMISTRY OF A FORESTED STREAM IN CENTRAL PENNSYLVANIA

Matthew E. MCTAMMANY, Joanna W. FREEMAN, and M. L. D. CLARK, Department of Biology, Bucknell University, Lewisburg, PA 17837

We measured concentrations of nutrients (TDN, NO3-N, NH4-N, SRP) and dissolved organic carbon (DOC) along a forested stream in central Pennsylvania to determine effects of reservoirs, groundwater, and stream biogeochemical processes. Surface water was collected from 11 sites along 10 km of Roaring Creek (RC) from May to December 2011. Shallow groundwater was sampled from 9 wells arranged in 3 transects perpendicular to RC. Surface water sampling was conducted upstream and downstream of 2 water-supply reservoirs and near groundwater wells. TDN, NO3-N, and SRP concentrations were higher in groundwater than surface water. NH4-N concentrations were similar in groundwater and surface water during early summer but were higher in surface waters downstream of the largest reservoir during late summer and early fall. DOC concentrations decreased along RC despite increases downstream of each reservoir. Specif ic UV absorbance (SUVA) increased along RC, indicating that DOC composition became proportionally more aromatic. Most wells had higher DOC and lower SUVA than RC, but DOC and SUVA were similar to RC in some wells, suggesting that RC follows subsurface lateral flow paths.

THE "GRAVEL FLOOD": COARSE-GRAINED SEDIMENT TRANSPORT IN GRAVEL BED STREAMS DURING TROPICAL STORM LEE IN NORTH-CENTRAL PENNSYLVANIA (SEPTEMBER 2011)

R. Craig KOCHEL, Zachary HANCOCK, Jason MUHLBAUER, Darin ROCKWELL, Matthew SIRIANNI, and Benjamin HAYES, Geology, Bucknell University, Lewisburg, PA 17837

Calls for "stream cleaning," the local term for dredging of gravel from stream channels, in north-central Pennsylvania streams have been overwhelming since catastrophic flooding by Tropical Storm Lee in September 2011. Streams emanating from the Appalachian Plateau transported extraordinary volumes of coarse gravel, while also experiencing major bank erosion, avulsion, and chute formation during the flood. Detailed GIS-based mapping from helicopter reconnaissance photography and fieldwork in four major tributaries to the Susquehanna River document major pulses of gravel that moved downstream during the flood. New gravel bars typically range from 2-3 m thick and have areas over 300,000 m^2. Clasts on these bars commonly have long axes over 1.5 m and are mostly in the boulder and cobble gravel range. Estimated gravel transport by this flood along > 200 km of the streams studied is estimated at ~ 5,000,000 m3. The occurrence of gravel pulses in these Plateau streams are similar to those discussed by Jacobson and Gran (1999) in the Ozark Plateau of Missouri. Comparison of pre-flood and post-flood GIS mapping documented significant overall increases in gravel bar volume after the flood. In most cases, mapping showed clear downstream migration of gravel pulses. Most of the gravel appears to have been sourced from low terraces composed of gravelly sediments deposited in response to widespread logging of these watersheds nearly a century ago. However, contribution of gravel from tributaries is also suggested at some locations. Headwater tributary sources of gravel appear to be from logging legacy sediments as well as mass wasting of unstable glacial deposits. These rivers are experiencing a phase of disequilibrium in response to increased availability of gravel and are currently adjusting their morphology to return to multi-threaded systems where flood flows occupy numerous channels across wide floodplains. This morphology appears to have been common in the region prior to anthropogenic disturbance by logging, agriculture, and highway construction over a century ago. Understanding the trajectory of stream morphology in this region is critical in making wise management and land use policy-making decisions.

GEOMORPHIC IMPACT OF CATASTROPHIC FLOODING FROM TROPICALSTORM LEE (SEPTEMBER 2011) IN GRAVEL BED STREAMS OF THE APPALACHIAN PLATEAU, NORTH-CENTRAL PENNSYLVANIA

Zachary HANCOCK, R. Craig KOCHEL, Jason MUHLBAUER, Darin ROCKWELL, Matthew SIRIANNI, and Benjamin HAYES, Geology, Bucknell University, Lewisburg, PA 17837

Geomorphic work, whether expressed as sediment transport or landform modification was significant in gravel bed streams emanating from the Appalachian Plateau of north-central Pennsylvania during Tropical Storm Lee flooding in September, 2011. Detailed GIS-based mapping from post-flood helicopter photography and fieldwork documented geomorphic change along more than 200 km of four major tributaries to the Susquehanna River – Lycoming, Loyalsock, Muncy, and Fishing Creeks. Dominant geomorphic responses include: 1) erosion of chutes on the inside of meanders; 2) channel avulsion and reoccupation of prehistoric high flow anabranches disconnected from main channels by anthropogenic activity such as berm construction and highway fill; 3) extraordinary coarse gravel transport (bar growth and migration); 4) episodic downcutting and aggradation; 5) bank erosion; and 6) mass wasting and alluvial fan activation in glaciated headwater tributaries. While it is likely that geomorphic response to a flood with greater than 100-year recurrence would be significant in steep, gravel bed streams, the extreme magnitude of the response may have been amplified by anthropogenic disturbance. Regional clear cutting in these watersheds between 1850-1920 contributed sediment downstream. Dendrogeomorphic observations suggest that significant filling occurred prior to 1930, creating a low gravelly terrace along these streams. Watershed reforestation since 1930 has yielded relatively clear, aggressive water to downstream channels. Major floods during the past 40 years (1972, 1996, 2004, 2011) appear to have initiated widespread disequilibrium and erosion of the logging legacy gravel. Sediments from this remobilized fill now appear to be moving through these watersheds as major gravel pulses. Simultaneous aggradation of gravel bars above bankfull during floods is promoting bank erosion and channel avulsion. This flood caused extensive da mage to homes, farms, and highway infrastructure. Similar responses to floods are likely as these channels evolve through a protracted phase of disequilibrium during their adjustment from constrained single channels to multi-threaded gravel bed systems. Understanding the trajectory of these river systems has enormous implications for management and policy-making in the future.

IMPACTS OF POST-FLOOD INSTREAM DEBRIS CLEANING ON FISH POPULATIONS AND BIOMASS IN NORTH CENTRAL PENNSYLVANIA STREAMS

Rebekah ABER, Sam SILKNETTER, John PANAS, Andy ANTHONY, Mike BILGER, Jonathan NILES, Department of Biology, Susquehanna University, Selinsgrove, PA 17870

CATASTROPHIC FLOODING IN NORTH-CENTRAL PENNSYLVANIA: GEOMORPHIC FINDINGS FROM THE SEPTEMBER 2011 EVENT AND THEIR SIGNIFICANCE TO SEDIMENTOLOGY

Jason MUHLBAUER, R. Craig KOCHEL, Darin ROCKWELL, Zachary HANCOCK, Matthew SIRIANNI, and Benjamin HAYES, Geology, Bucknell University, Lewisburg, PA 17837

Tropical Storm Lee produced 25-36 cm of rainfall in north-central Pennsylvania in September, 2011. Loyalsock, Muncy, and Fishing creeks experienced catastrophic flooding resulting in avulsions, scour of chutes, and deposition/reworking of chute, mid-channel, and point bars. Sampling the largest grain size of gravel bars on each stream reveals downstream fining of resistant sandstone clasts. Differences in downstream trends in grain size are observed between streams, but a strict downstream fining trend does not occur. Inputs from bedrock outcrops, tributaries, and erosion of Pleistocene outwash terraces may explain variations in grain size along streams incised into the Appalachian Plateau. Sedimentological observations of the 2011 flood gravels suggest that these streams experienced hyperconcentrated flow during most of the flood. Surficial clasts on gravel bars are imbricated, but the lack of imbrication and high matrix content of sediments at depth suggests that surface imbrication of the largest clasts took place during the flood peak, armoring the bars. The imbricated clasts on the surface are the largest observed within the bars. Locally, these gravels form knickpoints that will not be disturbed until a flood of similar magnitude occurs. Analysis of bar surface gravels shows variation in grain size and imbrication. While there is little change in the largest clasts on individual point bars with distance downstream along the channel axis, variation is observed transverse to the channel axis across bar surfaces. The largest clasts are often concentrated near the active channel or in localized pockets. Significant fining occurs down the axis of chutes in several locations. USGS estimates for the flood recurrence interval average 120 years on these streams. Geomorphic observations, however, show that chutes scoured into early Holocene and Pleistocene deposits in several locations. This reworking of long undisturbed sediment suggests that a recurrence of thousands of years is possible. Dendrogeomorphic observations, however, provide evidence of major geomorphic change during the past 100 years. Disequilibrium caused by the recent influx of large gravels into these streams, which appears be related to historic logging, may be a trigger of frequent avulsion and scour during less catastrophic floods.

BASIN-SCALE INFLUENCE ON THE GEOMORPHIC IMPACTS OF THE TROPICAL STORM LEE FLOOD (SEPTEMBER, 2011) IN NORTH-CENTRAL PENNSYLVANIA

Darin ROCKWELL, R. Craig KOCHEL, Jason MUHLBAUER, Zachary HANCOCK, Matthew SIRIANNI, and Benjamin HAYES, Geology, Bucknell University, Lewisburg, PA 17837

Catastrophic flooding occurred from up to 40 cm of rain over two days in September, 2011 along several major tributaries to the Susquehanna River in north-central Pennsylvania. USGS estimates indicate that flood recurrence interval exceeded 100 years on several gaged streams. Geomorphic response to the flood varied markedly between watersheds. The largest runoff per unit area occurred in Swatara Creek where the discharge nearly doubled the previous record; however, geomorphic response was minor. Swatara Creek heads in the Ridge and Valley Province and enters the Susquehanna near Harrisburg in the Piedmont. Similarly, minor geomorphic change characterized other Ridge and Valley watersheds such as Chillisquaque Creek. In sharp contrast, major geomorphic change, including avulsion, chute formation, massive gravel transport, and bed, bank, and floodplain erosion characterized gravel bed streams emanati ng from the Appalachian Plateau. These major geomorphic responses occurred in watersheds with less rainfall than those to the south. Detailed basin morphometric analysis comparing both large-scale watersheds and subwatersheds using ArcGIS watershed modeling show that Plateau watersheds have greater basin relief, higher drainage density, higher ruggedness number, and steeper channel gradient than those to the south. Plateau watersheds also provided an abundant source of flood gravel from two sources: 1) widespread Pleistocene gravelly glacial sediments along steep hillslopes and terraces, and 2) extensive gravelly floodplain sediments inherited from the legacy of regional logging nearly a century earlier. Comparing basin morphometry data with regional studies (i.e. Patton and Baker 1976) shows that Plateau basins are prime candidates for generating flash floods. Major geomorphic change occurred where flashy flows were coincident with an abundant supply of coarse bedload (gravel) from relatively non-cohesive banks, steep channel gradient, and widespread disequilibrium in fluvial systems related to historic l and use changes. Minor geomorphic response occurred in streams that experienced flashy flows south of the Plateau, exhibiting lower ruggedness number, lower channel gradient, a lack of available coarse bedload, relatively cohesive banks, and less influence by logging legacy sediments.

WATER QUALITY ASSESSMENT OF THE LOWER WEST BRANCH SUSQUEHANNA RIVER

Chelsea BREWER, Mel ZIMMERMAN, Department of Biology, Lycoming College, Williamsport, PA 17701

Lycoming College Clean Water Institute has been monitoring the Lower West Branch Susquehanna River (between Lock Haven and Sunbury) for almost a decade. In addition to water chemistry from grab samples at 12 sites, macroinvertebrate density and diversity has been monitored from rock baskets and Hester Dendy samplers at Watsontown.

BIOLOGICAL RESPONSE OF TWO NORTH CENTRAL PA STREAMS AFTER FLOOD OF SEPTEMBER 2011

Fred ROGERS, Mel ZIMMERMAN, Department of Biology, Lycoming College, Williamsport, PA 17701

Within Pennsylvania, there exists a variety of threats to stream ecosystems. Agricultural activities, urbanization, and natural gas exploration are a few examples of anthropogenic threats. However, impacts of 100 and 500 year flood events can also significantly alter stream habitat and biota. This project compares pre and post data of the September 2011 flood on two tributaries of Loyalsock Creek (Big Bear Creek and Ogdonia Creek, in north central PA). Pre-data on these streams started in 1999 with Ogdonia as a control site for a Natural Stream Channel Design (NSCD) project on Big Bear Creek. A status update of the 127 NSCD structures along Big Bear Creek is presented. Macroinvertebrates and fish sampled 8-9 months after the flood indicate that the biota has returned to pre-flood densities.

WATER QUALITY MONITORING AFTER APPLICATION OF FARM BMPS

Quentin REINFORD, Mel ZIMMERMAN, Department of Biology, Lycoming College, Williamsport, PA 17701

In partnership with the Lycoming County Conservation District, Lycoming Clean Water Institute is monitoring the water quality of an unnamed tributary to White Deer Hole Creek in southern Lycoming County. Four farms are participating in the project. Monitoring of stream occurred for a year prior to application of BMPs in June 2012. Levelogger sondes for temperature and flow allow nutrient and sediment loads to be determined.

STATUS OF NORTH CENTRAL PENNSYLVANIA STREAM HABITAT RESTORATION PROJECTS

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The Northcentral Pennsylvania Conservancy and the Keystone Stream Team have been compiling a list of stream restoration projects in North Central PA. The NPC list examines the Fish and Boat Commission structures. For more information on the Fish and Boat structures, refer to their Habitat Improvement for Trout Streams publication found on the Fish and Boat Commission website. The KST list focus is on the Natural Stream Channel Design (Rosgen) projects in PA. I will be highlighting one KST (Roaring Branch) project and three Fish and Boat projects (Wallace Run, Mill Creek, and the Sheshequin Campground). My project is to collect and analyze pre-restoration and post-restoration data on fish, macro invertebrates and water chemistry of some of these local sites. The NPC has totaled 26 projects in this area, but the list is partial and needs updating. I have gathered fish population estimates and trout populations for four sites I am highlighting. Data indicate that habitat improvement has had a positive effect on biota.

CONTRIBUTION OF LYCOMING COLLEGE CWI TO THE PFBC UNASSESSED WATERS PROJECT (2010-2012)

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This is the third year that Lycoming College CWI has participated in the Unassessed waters project. To date a total of 230 streams have been completed in the Loyalsock (18), Lycoming (430) and Pine Creek (169) Watersheds by CWI. 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. Over 200 additional streams need to be assessed in these watersheds in the future

IMPACT OF BAMR'S AMD PASSIVE-TREATMENT FACILITY ON THE MIDDLE BRANCH OF BUG RUN, CLINTON COUNTY, PA

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Acid mine drainage (AMD) plagues most tributaries throughout the heavily forested plateau of the Beech Creek watershed, a north central PA basin contributing net acidity to the West Branch Susquehanna River. As part of a multi-year, community-based research project, water samples have been collected from PA DEP BAMR's Abandoned Mine Land Reclamation Project (BF 438-102.1), an AMD passive treatment facility, since it went online in the spring of 2006. The 2006-12 field seasons yielded geochemical data from this site, including pH, conductance, net acidity, alkalinity, DO, ORP, major anions, cations, and several trace metals, from collection and treatment ponds, artificial wetlands, and its natural, down-gradient drainage system. Data analyses and field observations demonstrate that the effectiveness of this passive treatment system has declined progressively throughout the sampling period. This facility does not appear to be achieving its original design goal, specifically--to provide significant water-quality improvement to its surface discharge watercourse, the Middle Branch of Big Run. Currently, this facility requires major maintenance in order to return it to original-design functionality. As a direct result of this ongoing monitoring program, several recommendations have been provided to the local watershed association and to the DEP relative to modifications and retrofits to this treatment system. The findings of this study also have implications applicable to the standard design used for other passive AMD-treatment facilities in Pennsylvania and elsewhere.

SEDIMENT DEPOSTION NEAR BRIDGES IN PENNSYLVANIA

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Gravel bed streams across central Pennsylvania often have problems related to large quantities of transported bed material. The natural movement of sediment can be disturbed when bridge structures are placed across a stream channel or a channel is modified due to an infrastructure project. Observations of stream characteristics and qualities provide information that help find out why sedimentation problems are occurring. The reason that bridge ways often have sediment deposits under them is because the channel often is widened during construction to meet flood flow requirements. When the channel widens the water velocity decreases and sediments either stop moving or fall out of suspension because of the decreased shear stress in the widened channel. In the summer of 2011, the Pennsylvania Department of Transportation (PennDOT) district offices were contacted to collect information regarding bridges with sedimentation problems that had been mitigated with stream restoration structures. Based on field observations, the stream restoration projects were either successes or failures, depending on their ability to mitigate the stream sedimentation problems. Although some of the restoration structures did work by either focusing or redirecting flow, or stabilizing the banks. Based on this information we can recognize trends that will help us improve the application of restoration structures to mitigate deposition problems at bridges in the region.

GEOCHEMICAL BASELINE STUDY OF TEN STREAM SITES IN THE BRIAR CREEK WATERSHED (COLUMBIA COUNTY, PA) IN RELATION TO LAND USE AND GEOLOGY OF THE SURROUNDING AREA

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Water samples were collected from 10 sites in the Briar Creek watershed on a biweekly basis from October 2011 to August 2012. In situ analyses of the samples included pH, temperature, dissolved oxygen, and conductivity. Turbidity was measured on site on unfiltered samples; alkalinity and acidity on filtered samples. Samples, both filtered and unfiltered, were preserved for later laboratory analyses for simple cations, anions, and selected heavy metals. Our data collection of chemistry and geology of the area is in support of a study by the Briar Creek Association for Watershed Solutions to characterize conditions in order to establish a watershed conservation plan for the Briar Creek watershed. Samples from two of the sites consistently showed higher values for iron than those of other sites. Samples from one of those two sites were also consistently higher in acidity, alkalinity, conductivity, barium, manganese, bromide, nitrate, sulfate, potassium, magnesium, and calcium. A third site was consistently lower in concentration for most of those same species. These trends are most likely related to local differences in geology and land use. In addition, we noticed coordinated high and low values in many species over time, possibly correlated with stream discharge which is under investigation.

COMMUNITY-BASED WATER QUALITY MONITORING PROJECTS IN CLINTON, CLEARFIELD, AND CENTRE COUNTIES, PA

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In the wake of Marcellus Shale gas-well drilling in central Pennsylvania, the Lock Haven University Geology program forged partnerships with several community-based organizations to monitor the quality of surface water in the vicinity of these drilling sites. The organizations that participated in these community-based water quality monitoring projects included the Clearfield and Centre County chapters of the Pennsylvania Senior Environmental Corps, Beech Creek Watershed Association, and the South Renovo Borough Water Supply System. Several sub-watersheds of the West Branch Susquehanna River, including the Hall Run, 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 field parameters included temperature, pH, DO, TDS, conductance, ORP, and water flow. Additional lab analyses yielded several cation and anion values, including total iron, aluminum, manganese, copper, calcium, magnesium, zinc, arsenic, barium, bromine, 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 meets the 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 negative impact from Marcellus Shale gas-well drilling on surface water 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 volunteering programs that are concerned with environmental and ecological impacts of human activities on natural resources.

ASSESSMENT OF CRAYFISH POPULATIONS IN SIX TRIBUTARIES OF THE WEST BRANCH OF THE SUSQUEHANNA RIVER

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We sampled crayfish populations in six tributaries of the West Branch of the Susquehanna River to determine the extent of invasion by non-native species. Our methods included use of seines in fast water and snorkeling in waterways where seining was not practicable. The predominant species captured was the exotic Allegheny crayfish (*Orocnectes obscurus*), which occurred in five of six tributaries, but not in Loyalsock Creek where the invasive rusty crayfish (*Orconectes rusticus*) was the sole species inhabiting the waterway. The native Appalachian brook crayfish (*Cambarus bartonii*) sometimes coexisted with *O. obscurus* in the upper reaches of waterways, but was generally less abundant. Use of a standard seining protocol permitted semi-quantitative estimates of crayfish abundance, with densities as high as 3.38 crayfish per square meter and as low as 0.43 crayfish per square meter. Sex ratios were often disparate, ranging from females being six times as abundant as males, to males being four times as abundant as females. We conclude that native crayfish species have been displaced, largely by *O. obscurus*, and to a lesser extent by *O. rusticus*, an aggressive exotic species that has not yet spread beyond Loyalsock Creek.

WEST END BERWICK URBAN RENEWAL PROJECT: A CASE STUDY FOR BUCKNELL'S PLACE STUDIES INITIATIVE

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The West End of Berwick was once a thriving community and home to many workers at the American Car and Foundry Company, which found great success from the mid-nineteenth to the mid-twentieth century coinciding with the booming coal industry. When rail cars were no longer needed as the economy shifted away from coal-based energy, the company was shut down and the service industry that supported those workers also began to crumble. As the economy of the community started to collapse, so did the infrastructure and housing. Berwick had little to offer in the way of jobs, so young working families stopped moving to the area and the population became much older. By 2009, most of the homes in West End Berwick, also referred to as the LaSalle Street neighborhood, were owned by elderly families or absentee landlords who rented to low-income individuals who had less of a stake in the community and maintaining g their property. Crime rates in Berwick increased, and the 300-block became notorious around Berwick and the surrounding towns as being drug-infested and unsafe. In an effort to revitalize this community and change outsider misconceptions, the Borough of Berwick applied to receive a grant to become a "Blueprint Committee" from the Federal Home Loan Bank of Pittsburgh. Upon receiving this grant, the Borough brought together faculty and students from Bucknell and Bloomsburg universities, SEDA-COG, the United Way, Columbia Country Housing Authority, and people from the community to implement a four-step process of beautification, crime prevention, rehabilitation, and redevelopment. Faculty involved with the Place Studies Initiative of Bucknell's Environmental Center and Bucknell students became involved in door-to-door surveys to understand what community members were concerned about and what they wanted their community to look like. The results have been overwhelmingly positive with a significant reduction in crime, many annual community events like carnivals and Halloween celebrations, a refurbished park, and dilapidated apartment buildings being torn down. Many more projects are in progress, and more improvements must be made but the great strides that his community has made should be highlighted as the work that the Place Studies Initiative and other community organizations and actors are capable of achieving.

INORGANIC GEOCHEMISTRY OF THE SUSQUEHANNA RIVER NEAR BYER'S ISLAND, SHAMOKIN DAM (NOTHUMBERLAND COUNTY) PA

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In 2009, we found elevated levels of heavy metals (copper, lead, and manganese) in water samples on the eastern transect on the Susquehanna River near the middle of Byer's Island. These were not found in either 2010 or 2011, summers with increased precipitation. In this year's study, we investigated the possibility that an old lead/zinc mine (Doughty Mine, in operation during the mid-1800s, located adjacent to the river's southeastern shore) is affecting the geochemistry of the latter. Water samples were collected by canoe and kayak from 18 sites spaced along 6 transects on either side of Byer's Island (upstream, center, and downstream end), an island in the Susquehanna River near Shamokin Dam. In situ analyses included pH, temperature, dissolved oxygen, and conductivity. Turbidity was measured onsite on unfiltered samples; alkalinity and acidity on filtered samples. Samples were preserved for later laboratory analyses for simple cations and anions (filtered) and selected metals (filtered and unfiltered, acidified pH<2). Nitrates and sulfates decrease in concentration with increasing proximity to the island. Conductivity and turbidity readings illustrate a lack of mixing of the two branches of the Susquehanna upstream of Byer's Island. Data reduction of the heavy metals are in process.

A STUDY OF ALEXANDER CAVERNS: STRUCTURAL GEOLOGY AND WATER CHEMISTRY

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Honey Creek emerges from Alexander Caverns and flows through the Benner and Loysburg Limestone Formations in Milroy, PA. The water chemistry of the creek was tested both within and just downstream from the cavern. In-situ analyses of pH, conductivity, and dissolved oxygen were taken at ten sampling sites. Alkalinity and acidity were conducted on filtered samples while turbidity was determined on the non-filtered samples for the ten sites. Samples were also tested for eleven different metals (Al, As, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Pb, and Zn) using ICP-OES. Testing for simple anions and cations was conducted using ion chromatography. Water samples were taken from the cave stream during the months of May and July 2012 in order to determine if there are any seasonal changes in water chemistry. Another sampling day will be conducted in the fall of 2012. Drip samples from the cave ceiling were also analyzed and compared to the water in the stream. Rock samples were taken from the cave and tested to determine if there was a direct correlation between rock type and water chemistry. Aside from the water chemistry, the structural geology of the cavern was determined by taking joint and fracture orientations of the limestone both inside the cavern and in two nearby quarries located within the same limestone formations.

ANNUAL SNAPSHOT #4: SUSQUEHANNA RIVER WATER CHEMISTRY AT MILTON, DANVILLE, WATSONTOWN, AND SHADY NOOK

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Water samples were collected from four transects on the Susquehanna River using canoe and kayak: 1) Danville (five sites), 2) Watsontown (three sites), 3) Milton (three sites), and 4) Shady Nook (six sites, three on each side of Byers Island). In situ measurements included pH, temperature, dissolved oxygen, and conductivity. On site, we analyzed immediately for turbidity, collected and preserved triplicate non-filtered subsamples, then filtered the remaining water. We analyzed the filtered samples for both alkalinity and acidity in triplicate, then preserved triplicate subsamples, for later laboratory analyses of simple cations, anions, and selected heavy metals. Previous research has revealed the differences in the water chemistry of the west branch, north branch, and main stem. Conductivity and turbidity were highest in the north branch. Also, sodium, chloride, bromide, and calcium were higher in concentration in the north branch than the west branch. Nitrate and sulfate concentrations were highest in the west branch. Lastly, acidity was found to be higher in the north branch, whereas alkalinity was higher in the west branch. This project was part of an ongoing study (fourth annual sampling) of the water chemistry of the Susquehanna River is in support of concurrent biological studies, all sponsored by the Susquehanna River Heartland Coalition for Environmental Studies.

INFLUENCE OF THE ONEIDA #3 ACID MINE DRAINAGE AND PASSIVE LIMESTONE TREATMENT ON SYSTEM ON LITTLE TOMHICKEN CREEK IN LUZERNE COUNTY PA

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Discharge from the Oneida #3 abandoned coal mine drainage tunnel enters Little Tomhicken Creek near Oneida, PA. This study is part of an ongoing effort to assess the efficacy of a passive limestone treatment system installed in December of 2009. Samples were collected at several transects: two sites in the mine drainage tunnel, two sites in Little Tomhicken Creek upstream of the confluence, three sites across the confluence of mine drainage water and creek water, two sites between the confluence and the entry point of the treated drainage into the stream, and two sites in creek below the treatment system effluent. In addition, we sampled the treatment system itself: one site at the exit of the limestone holding pond, one site at the exit of the first settling pond, and one site at the exit of the second settling pond. Dissolved oxygen, pH, and conductivity were measured in situ. A four liter sample was collected at each site; turbidity analyses were performed on the non-filtered samples, alkalinity and acidity analyses were promptly performed on filtered samples. Triplicate subsamples of both non-filtered and filtered were preserved for later ion and metal analyses in the laboratory. We found that the colloidal metal concentrations for both iron and aluminum in the outflow of the treatment system were higher than the creek itself. This indicates that the creek mitigated these metals more efficiently than the treatment system; therefore, suggesting that the settling ponds are truly a source of metal pollution waiting to be released.

DISPOSAL OF PHARMACEUTICAL WASTE FOR GEISINGER HEALTH SERVICES

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The active pharmaceutical ingredients (API) in unused pills and medical waste are hardly degradable and prone to accumulate in the ecosystem over time. Additionally, there is a growing problem with regard to adolescents having “pill parties” taking unused pharmaceuticals. As a consequence, the APIs need to be disposed appropriately. Geisinger Health System operates a pharmaceutical takeback program to aid with these end other problems associated with unused pharmacueticals. A task was given to determine the best way to treat the collected pharmaceuticals in a green, easy, and cost effective manner. In order to narrow down the options of disposal, a variety of technologies and processes are considered in this work as solutions to this challenge. After cursory comparisons, incineration and Molten Salt oxidation are chosen as the two most feasible processes for Geisinger’s current situation and are studied in depth. Each process was modeled based upon Geisinger’s expected waste. Mass and energy balances were then used along with other information to develop a life-cycle analysis comparing each process. This analysis incorporated operating and capital costs as well as environmental and regulatory issues. Based on the cost benefit analysis, we recommend that Geisinger continue to dispose of their collected pharmaceuticals via incineration.

USE OF HYDRO-ACOUSTICS IN UNDERGRADUATE TEACHING AND RESEARCH: MEASURING FLOW HYDRAULICS, RIVER BEDFORMS, AND SEDIMENT DISCHARGE IN THE SUSQUEHANNA WATERSHED, NORTH-CENTRAL PENNSYLVANIA

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The use of hydro-acoustic methods has greatly enhanced existing watershed-based courses by providing students the opportunity to learn ADCP technologies and compare it to traditional methods using Price-type AA bucket wheel and Marsh-McBirney™ electromagnetic meters. The Sontek RiverSurveyor™ ADCP and GPS facilitate use of field data for computing the measurement locations and associated depth and water velocity profiles, and provides a basis for collecting additional sediment and water-quality measurements and channel cross section information. During several storm events, students have collected suspended sediment data from eight tributaries to the West Branch (Pine Creek, Lycoming Creek, Loyalsock Creek, Muncy Creek, White Deer Creek, Chillisquaque Creek, Buffalo Creek and Penns Creek). The data are being used to assess variations in sediment discharges on a watershed scale and determine relationship of sediment discharge to historic land use, channel erosion, and other factors. Efforts currently underway include mapping flow hydraulics, bedload transport, gravel bedforms, and stream restoration structures on smaller tributaries and river morphology, groundwater upwellings, and aquatic habitat in the West Branch of the Susquehanna River. The data are being used create bathymetric maps showing pools, riffles, bars, islands, chutes, and side channels. This information can be combined with water temperature, water chemistry, and other biologic data to gain a better understanding of the aquatic habitat near the bed of the river and the distribution of shear stress in the channel and do bed forms reflect modern flow conditions or paleo-flood discharges.

DEVELOPMENT OF RELATIONAL DATABASE AND WEB PORTAL SOFTWARE TO MANAGE AND DISPLAY REAL-TIME DATA FROM A REMOTELY-DEPLOYED NETWORK OF WATER QUALITY SONDES OR OTHER DIGITAL INSTRUMENTS

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A water quality data management software system was developed that improves and automates the retrieval, storage, quality control, and analysis of large quantities of river water quality monitoring data. The software communicates with a network of remotely-deployed water quality sondes and moves the data to a database and web application that is accessible over the Internet by a wide variety of standards-based devices. The water quality data management system was designed to improve and automate the retrieval, storage, quality control, and analysis of large quantities of water quality sample data. Data moves from a network of remotely-deployed water quality sondes to a database and web application that is accessible over the Internet by a wide variety of standards based devices. The database is designed to be highly scalable and highly responsive even with millions of data rows. The system provides three QA/QC tools to maintain the highest level of data quality: (1) alerts, (2) filters, and (3) gap identification. Through a web-based console, administrators can create an unlimited number of alerts. Alerts will notify administrators via email or SMS when triggered. Alerts can be assigned against any parameter in the system. Alerts are triggered by either a minimum/maximum threshold or when a parameter exceeds an arbitrary percentage change over the previous X days moving average. A filter is similar to an alert, but instead automatically creates a new dataset with unwanted data removed. The original “raw” data is never discarded for future reference, but all analysis is done against the filtered datasets. Gap identification quickly identifies any missing data within the system and allows administrators to re-query third parties such as NexSens for that data and fill those gaps. Data are made accessible via Internet to any device capable of running a modern HTML5 browser. The high performance database allows several ways to view and dissect the data, including portfolio and time-series graphs, and tabular downloads in PDF, EXCEL and ASCII format.

POST-FLOOD ALTERNATIVES FOR RIVER CORRIDOR MANAGEMENT IN CENTRAL PENNSYLVANIA: HELPING RESOLVE RIVER AND LAND USE CONFLICTS IN AN ECONOMICALLY AND ECOLOGICALLY SUSTAINABLE MANNER

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Like many other states, Pennsylvania finds itself in an unending and escalating cycle of spending millions of dollars to maintain its stream and river channels, repair and rebuild flood damaged roads and bridges, and protect adjacent land uses from destruction by erosion or flooding, only to see these river management investments fail during the next flood or result in increased damage elsewhere, usually downstream. To complicate the problem, riparian landowners are increasingly strident about real and perceived failures of the state's river management policies to address their concerns as they lose valued property with every significant runoff event. At the same time, stream erosion is increasingly cited as one of the most significant statewide water resource concerns, as evidenced by physical and biological indicators of aquatic ecosystem health. Managing the conflict between people's land use expectations and river dynamics should be based on an examination of alternatives and cost-benefit analyses, in both the short and long-term, to both private and public interests. There are generally four different river corridor management alternatives: (1) channelization, (2) active geomorphic, (3) passive geomorphic, and (4) a combination of these alternatives. Changes to the shape of a river channel or changes in the inputs of water and sediment often lead to imbalance, and cause adjustments in river and floodplain geometry until balance is re-established. Natural adjustments to the river channel occur continually, but often dramatically manifest themselves during large flood events. The dynamic equilibrium of streams must be considered in order to anticipate how the stream may adjustments in the future. Traditional floodplain and channel management practices such as dredging or "stream cleaning" that are implemented to reduce or manage these conflicts have largely worsened the problem, or transferred it to an adjacent landowner. Each time a river has been straightened, dredged, bermed, and armored to mitigate flood damage without respect for the physical form and function of its channel and floodplain, adjustments were set in motion that, more often than not, led to further erosion.

EXHIBITORS

SUSQUEHANNA RIVER BASIN COMMISSION (SRBC)
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U.S. GEOLOGICAL SURVEY - PENNSYLVANIA WATER SCIENCE CENTER
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PENNSYLVANIA FISH AND BOAT COMMISSION (PA FBC)
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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)
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BUFFALO CREEK WATERSHED ASSOCIATION
Ben HOSKINS, Chairman, Buffalo Creek Watershed Association, Lewisburg, PA 17837

MERRILL W. LINN LAND AND WATERWAYS CONSERVANCY
W. Geoff GOODENOW, Chairman, Merrill W. Linn Land and Waterways Conservancy, Lewisburg, PA 17837