2026 Pennsylvania Aquatic Resource Restoration Conference

MARCH 3 - 4 PENN STATER HOTEL AND CONFERENCE CENTER

ABSTRACT FOR CONFERENCE SESSIONS

Familiarize yourself with the topics that will be discussed at the Pennsylvania Aquatic Resource Restoration Conference!

DAY 1 MARCH 3RD ABSTRACT

WELCOME - DEAN'S HALL (ALL DAY)

KEYNOTE SPEAKERS: (9:05 - 10:00)

LOST RIVER-WETLAND CORRIDORS AND MESSY FLOODPLAINS - DOROTHY MERRITTS, F&M COLLEGE AND ELLEN WOHL, COLORADO STATE UNIVERSITY

In Rambunctious Garden: Saving Nature in a Post-Wild World (2013), nature writer Emma Marris challenged conventional ecological restoration by asking readers to imagine a stream. She then noted that the typical mental image—a single-thread, meandering channel with high banks — is often a human construct rather than a historical reality. While high-energy, meandering streams are ubiquitous today, the geologic record indicates they did not exist in the mid-Atlantic region prior to land-use changes associated with colonial settlement. By analyzing valley-bottom strata and extensive backhoe trenches at dozens of sites in Pennsylvania and Maryland, we reconstructed the region's landscape evolution from the Last Full Glacial Maximum to the present. Following a late Pleistocene period of cold, dry tundra conditions and deeply frozen ground south of the continental ice sheet margin from ~30,000 to 11,500 years ago, warming at the onset of the Holocene Epoch triggered permafrost thaw and the initiation of widespread wetlands within several millennia. Hundreds of radiocarbon dates, thousands of extracted seeds and other macrofossils, numerous pollen studies, and the presence of beaver DNA in sediments reveal that spring-fed wetlands featured multiple small, shallow, anabranching channels and ponds throughout the Holocene. These wetland floodplains accumulated carbon-rich soils at rates of ~1 to 2 cm per century (although rates might have changed with time), producing an average of 1 meter of Holocene wetland soils. In essence, pre-colonial mid-Atlantic valley bottoms were not characterized by meandering streams that carried high sediment loads and built migrating gravel bars, but rather "wonderfully messy" low-energy wetlands that retained organic matter and fine sediment rather than transported it.

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TECHNICAL SESSION 1: UNDERSTANDING THE PAST (10:15 - 11:35)

LANDSCAPE MEMORY - (PAST EPISODES) - BEN HAYES, BUCKNELL UNIV. (30 MIN)

At multiple scales, the fingerprints of geologic and anthropogenic events in a watershed's past — some gradual or imperceptible and others catastrophic — are clearly visible in the landscape today. In essence, these "landscape memories" define a watershed's uniqueness, its structural fabric, baseline chemistry, hydraulic energy gradients, sediment continuity, drainage patterns, and alluvial architecture. These memories also help explain the complex social and ecological systems that cascade within and across the system over time. Unpacking and analyzing a landscape's "memory" provides insight into why stream behaves the way it does and helps predict how it might respond to various restoration scenarios or future floods, droughts, and other stressors. Restoration goals and outcomes can be greatly improved if the magnitude, timing, and extent of a watershed "memories" are documented, mapped, sequenced, and understood. Guiding images and restoration strategies can then prioritize how best to mitigate legacy barriers that impede ecological uplift and recovery and bring healing to wounded or broken relationships with the fluvial network, such as connectivity (lateral, longitudinal, and vertical) and hyporheic exchange. The result is more cost-effective and sustainable solutions that increase system resilience, reduce downstream flooding and erosion, and improve water quality and temperatures for fish and other aquatic life.

WHAT LIES BENEATH: THE GEOLOGICAL AND ENVIRONMENTAL TRANSITION FROM HOLOCENE WETLANDS TO HISTORIC LEGACY SEDIMENTS AND HOW THIS KNOWLEDGE INFORMS RESTORATION - ROBERT WALTER, F&M COLLEGE (30 MIN)

Over the past 20+ years, our research has shown that many valley corridors in the unglaciated Mid-Atlantic region of the US preserve detailed records of the geological and ecological history of these hydrodynamic systems spanning the last 10,000 years or more. This talk concerns the rapid transition from stream-wetland complexes - stable for much of the warm Holocene Epoch (the last 11,500 years) - to valley corridors choked with legacy sediments that are less than 350 years old. Following European settlement, soils eroded from newly cleared and tilled landscapes were trapped in millponds behind valley-blocking milldams. This was not the only mechanism for legacy sediment formation, as erosion and deposition still occurred in valley bottoms where mill dams were absent, but millpond sedimentation was the dominant mechanism for this region. There were tens of thousands of milldams in the Mid-Atlantic region, with possibly 16,000 in Pennsylvania alone, lining most 1st-3rd order valleys from head to mouth. Water powered mills were used for nearly every industrial/mechanical purpose, and the pervasiveness of millpond sedimentation led to the near eradication of Holocene stream-wetland ecosystems and burial of vegetated floodplains.

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Geologically speaking, this transformation was so rapid that we refer to it as the "Pompeii Effect". By early-20th Century, milldams were no longer needed or maintained, leading to widespread dam failures. Once breached, surface waters incised through the millpond sediments creating slotted channels with high, eroding banks. Single-thread meandering stream channels with high banks did not exist in these valleys before legacy sediment deposition and dam breaching, and are mere artifacts of 300-year-old anthropogenic disturbances to these valley ecosystems. An understanding of this geological/anthropogenic evolution offers the key to valley ecosystem restoration designs. Since restoration is meant to restore an altered ecosystem to a state that approaches its natural ecological functions, we must recognize that legacy sediments are the impairment and buried Holocene wetlands the restoration target.

EXAMINING THE CARBON IMPLICATIONS OF LEGACY SEDIMENT REMOVAL IN PA WATERSHEDS- **CHRIS WILLIAMS, F&M COLLEGE (20 MIN)**

Legacy sediment accumulation has elevated floodplains throughout the Mid-Atlantic region, impairing hydrologic connectivity, water quality, and ecosystem function. Restoration practices that remove legacy sediment and reconnect streams to their valley bottoms are increasingly implemented, yet their implications for carbon cycling and greenhouse gas emissions remain poorly constrained. We present results from a 2.3-mile restoration corridor along Little Conestoga Creek in Lancaster County, Pennsylvania, where pre-restoration floodplains, restored floodplains, and newly created wetlands can be directly compared. Field measurements show that restored wetlands generally release less carbon dioxide than legacy-sediment-impacted floodplains, while methane emissions increase, especially in depressional wetlands that remain saturated for long periods. In lab incubations, buried relict hydric soils exhibit low microbial activity under both aerobic and anaerobic conditions, suggesting minimal carbon loss during sediment removal or short-term exposure. Preliminary estimates indicate rapid soil carbon accumulation in restored floodplains. Together, these findings highlight both the benefits and trade-offs of floodplain restoration and underscore the importance of restoration design in maximizing carbon sequestration while minimizing methane emissions.

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TECHNICAL SESSION 2: CHARACTERIZING THE COLONIAL AND MODERN PAST (12:35 - 2:00)

HISTORIC WATERSHED ALTERATIONS (REGIONAL PATTERNS) - BEN HAYES, BUCKNELL UNIV (30 MIN)

Over the past two centuries, Pennsylvania landscapes have been altered so drastically that it can be difficult for stream restoration practitioners to have a sense of what changes likely took place in given watershed they may working in. Watershed alterations for agriculture, urbanization, and natural resource extraction (timber, oil, natural gas, gravel, and coal mining) are the dominant reasons for these alterations, but their timing, extent, and impact on the fluvial system varies considerably.

This presentation provides an overview of nine historic alterations to watersheds and how they varied regionally since colonization began in the 17th century. It also provides an historic overview of over 5,000 stream restoration projects completed across Pennsylvania in the past century and assesses the extent to which mitigating legacy alterations were considered by watershed managers and practitioners in their restoration plans and designs. This becomes increasingly important as watershed conservation and stream restoration practices continue to evolve from traditional form-based approaches to practices aimed at reestablishing physical, chemical, and biological processes that are needed to sustain river and floodplain ecosystems.

STRATIGRAPHIC INVESTIGATION TECHNIQUES - JUSTIN SPANGLER, LANDSTUDIES AND ROBERT WALTER, F&M COLLEGE (35 MIN)

Soils in depositional floodplains are the vigilant recordkeepers of watershed conditions, recording changes across long timespans. Pennsylvania's floodplains, mostly river-wetland corridors, had functioned in a quasi naturally stable state without substantial human intervention for over 10,000 years until European settlement in the late 17th and early 18th Centuries. These natural, stable floodplain ecosystems were quickly and severely altered following European settlement. Colonization ushered a wave of land clearing and industrialization that reduced the quality and quantity of modern stream and wetland functions to a mere shadow of the functions provided in the prior natural condition. If stream restoration is to fulfill its obligation to return an aquatic ecosystem to a condition close to its natural state, then it is critical to be able to identify the divergence between the natural condition and the degraded condition, particularly when evaluating modern aquatic resources and proposing restoration designs.

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Field observations, analytical data, and digital examples of various floodplain soil profiles will be presented to: 1) evaluate the common floodplain soil forming processes and 2) identify the environmental conditions that formed each soil layer. Results from additional laboratory analysis procedures such as organic matter content, radiocarbon dating, scanning electron microscopy, and paleo-botanical seed analysis will also be presented to further enhance field observations.

Attendees will be able to utilize this information to quickly identify common floodplain degradations in modern landscapes and find in-situ evidence of the natural condition. This information is critical in identifying the departure in the form and function of degraded aquatic resources.

TOOLS FOR LOCATING HISTORIC CHANGES - TWI, GEOMORPHON, BREACHED DAM DATA - DAVE GOERMAN, DEP DWET (20 MIN)

The presentation will provide an overview and discussion of a variety of data sets that have been recently developed by the Waterways and Wetlands program to assist with identifying potential restoration site locations, evaluating watershed alterations. Datasets like modeled restorable wetlands, topographic wetness index, breached dam locations, geomorphon landform, and valley mapping. In addition, a discussion of historic map resources that are available online will be included. These maps often show the location of pre 1900 waterpower era dam locations.

TECHNICAL SESSION 3: DESIGN CONSIDERATIONS (2:15 - 3:45)

EVIDENCE-BASED APPROACH - DAVE GOERMAN, DEP DWET (10 MIN)

This presentation will provide a quick overview of what makes up the evidence-based approach in relation to investigating the restoration potential of site and use of the EPA's Principles of Ecological Restoration of Aquatic Resources for project development. I'll provide a brief overview of the four basic steps in the evidence-based approach which includes Identify Historic Alterations, Natural/Unaltered Potential, Identify Modern Constraints, and Design/Modeling. Each step is critical to the overall process and provides invaluable data to the decision making of what is achievable at a given site. This brief presentation will help tie the previous technical sessions together with the **Principal and Key Restoration Design Considerations and Identifying & Overcoming Complicating Factors** presentations that immediately follow.

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PRINCIPAL AND KEY RESTORATION DESIGN CONSIDERATIONS - ART PAROLA, WETLAND STUDIES AND SOLUTIONS, INC. AND WARD OBERHOLTZER, LANDSTUDIES IDENTIFYING & OVERCOMING COMPLICATING FACTORS - DREW ALTLAND, STRAUGHAN ENVIRONMENTAL, INC. (80 MIN)

Presentation 1: (Art Parola) This presentation examines restoration design principles for integrated stream-floodplain systems across a continuum of valley settings, from unconfined alluvial valleys to steeper, more confined valleys typical of many Pennsylvania streams. Emphasis is placed on assessment and design methodologies that re-establish historic floodplain and channel processes, including the development of stream-wetland complexes characterized by low flood stress and enhanced retention of water, sediment, and carbon.

Presentation 2: (Drew Altland) This Presentation will focus on identifying complicating site conditions or constraints that limit idealized design approaches for integrated stream/wetland systems. This presentation will also provide design strategies to overcome or work within these site constraints to promote functional uplift and long-term sustainability.

Presentation 3: (Ward Oberholtzer) This presentation will discuss three restoration projects for stream-wetland systems in 3 different physiographic provinces of Pennsylvania: Conewago Creek (Piedmont); Robinson Fork (Appalachian Plateau-Longwall Mining); and Good Spring Run - Devils Hole (Ridge and Valley - Strip Mining). The sites vary significantly in drainage areas, site constraints, design methods, and construction techniques.

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GENERAL SESSION - DEAN'S HALL (8:45 - 9:05)

EXPERTISE SURVEY RESULTS, CLEAN WATER ACADEMY UPDATE, AND FUTURE OF WATERSHED RESTORATION PERMITTING - ANDY MCDONALD AND DAVE GOERMAN, DEP

We will discuss the experience and training survey results and how interdisciplinary knowledge, and collaboration is essential to developing comprehensive restoration projects. An update of the current and near future Clean Water Academy content will be provided, and a brief discussion of the emerging role of Watershed Restoration Permitting.

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BREAKOUT SESSION A (9:15 - 10:15)
DESIGN AND EVALUATION TOOLS - ROOM 206

RELIABILITY OF TWO-DIMENSIONAL HYDRODYNAMIC MODELS IN STREAM RESTORATION - ART PAROLA, WETLAND STUDIES AND SOLUTIONS, INC. (30 MIN)

Two-dimensional hydrodynamic models have become an indispensable tool for evaluating spatial patterns of flow velocity and boundary shear stress within stream channels and floodplains during flood events. The design of resilient stream restoration projects requires accurate prediction of these hydraulic forces to ensure channel stability, floodplain integrity, and long-term project performance under a range of flood conditions. Recent research has demonstrated that two-dimensional models can also be used to predict the type and distribution of wetland habitats that may evolve in response to flood-driven velocity patterns, linking hydraulic processes to ecological outcomes. As a result, two-dimensional modeling has emerged as a critical component of restoration design, enabling practitioners to evaluate whether floodplains are sufficiently wide and hydraulically connected to promote low-stress, retentive channel–floodplain systems. When applied appropriately, these models support restoration designs that balance flood resilience, geomorphic stability, and habitat development across a range of watershed settings.

USACE STREAM DESIGN EVALUATION TOOL - MATT GILBERT, PITTSBURGH DISTRICT USACE (30 MIN)

The Louisville Regulatory Division and the Water Resources Section, Hydrology and Hydraulics Branch has designed the Stream Resiliency and Sustainability Tool with the intention of equipping reviewers and designers with a consistent language to evaluate resiliency and long-term sustainability with respect to stream restoration projects. The tool provides output based on stream restoration design parameters, which then informs risk based decisions regarding these principles of sustainability and resiliency (ability to independently maintain functions and services after being subjected to damage caused by ecological disturbances). The goal was to develop a tool without prescribing/specifying a specific design approach. With the cooperation of project sponsor’s, the U.S. Army Corps’ Pittsburgh Regulatory Division has deployed this tool across its tri-state area of responsibility and offers an evaluation of the tool’s effectiveness in the following: ability to identify and expedite projects that provide appropriate performance based mitigation for lost ecological functions and services, ability to screen projects with potential for re-design costs, and its ability to accurately assess what have proven to be both resilient/sustainable and unsustainable design philosophies and methodologies.

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BREAKOUT SESSION A (9:15 - 10:15)
ECOLOGICAL CONSIDERATIONS - ROOM 207

KEY DESIGN CONSIDERATIONS FOR ECOLOGICAL BENEFITS - JEFF HARTRANFT, DEP DWET (40 MIN)

Guiding principles for ecological restoration of aquatic resources have been applied to project planning, design and implementation that addresses the most prevalent aquatic resource degradations in Pennsylvania. These principles were developed by the US Environmental Protection Agency over a quarter century ago and we demonstrate their continued applicability and refinement for natural aquatic resource restoration projects. After more than a decade of project implementations and results, the resiliency of restored aquatic ecosystem characteristics and processes provide multiple benefits and outcomes. These multiple benefits increase the cost-effectiveness of ecological focused restoration projects.

USE OF PENNSYLVANIA COMMUNITY PREDICTION TOOL FOR SITE RESTORATION - EPHRAIM ZIMMERMAN, WESTERN PA CONSERVANCY (20 MIN)

In addition to inventory of the state's rare plants and animals, a primary focus of the Pennsylvania Natural Heritage Program has been the classification and description of PA's plant communities. Understanding the plant communities of a given site is very important in conservation, ecological management, and restoration activities. However, understanding the plant communities often requires a high level of experience in the field – especially understanding how to recognize different plant species and ecological variables. The Pennsylvania Community Prediction Tool for Site Restoration (PPT) was developed by the PNHP to assist restoration practitioners in their efforts to establish native plant communities using species most likely to thrive at the site. Using native plant species and communities in restoration is thought to improve the project's success and support native wildlife species. The PPT may also be used as an educational tool to teach people about plant communities and the species that make up plant communities. In this session, attendees understand what a plant community is and how plant communities are defined in Pennsylvania, where one can obtain information on plant species and natural plant communities in Pennsylvania, and how the PPT was created and how it is to be used. Attendees will have the opportunity to run the PPT and use the tool to obtain a list of potential plant communities at a site and plant species that will thrive at a site.

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BREAKOUT SESSION A (9:15 - 10:15)
COMPARING PROJECT COSTS - ROOM 205

NSCD AND FLOODPLAIN RECONNECTION COST COMPARISON - KATIE WOLFF, RES (20 MIN)

This presentation compares project construction and long-term maintenance costs for two widely used stream restoration approaches: (1) floodplain reconnection designs and (2) natural stream channel design (NSCD) approaches. Using a dataset of recent RES projects across multiple states, the analysis evaluates commonly held assumptions regarding the relative cost of these methods, assumptions that are often repeated in the industry but rarely supported by empirical data. The results are intended to provide a more objective, evidence-based foundation for discussing cost expectations, design selection, and long-term performance considerations.

Initial findings indicate that construction costs for the two approaches are generally comparable, challenging the common assumption that floodplain reconnection is inherently more expensive. Maintenance costs, however, exhibit greater variability, but a tendency toward lower cost for floodplain reconnection. The presentation explores how factors such as regional construction pricing, footprint of grading, post-restoration growing conditions, and design complexity influence cost differences. Outliers, both high and low, are examined to distinguish methodological anomalies from meaningful cost drivers.

The session will also discuss the implications of limited datasets, the statistical results, the value of median-based comparisons, and the lessons from rural versus urban project contrasts. Finally, the presentation addresses conditions under which RES selects floodplain reconnection, highlighting system resilience, ecological lift, and long-term performance considerations.

This cost comparison is intended to support practitioners and regulators in developing realistic planning-level cost expectations and identifying key drivers of variability in project budgets.

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BREAKOUT SESSION A (9:15 - 10:15)
COMPARING PROJECT COSTS - ROOM 205

COMPENSATORY MITIGATION & RESTORATION COST EVALUATIONS - CHRISTY MOWER, CIVIL & ENVIRONMENTAL CONSULTANTS (20 MIN)

This presentation focuses on a single applicant's analysis comparing the relative costs and benefits of mitigation banking and permittee-responsible mitigation (PRM) as compensatory mitigation options for permitted impacts. An economic evaluation indicated, with 84% certainty, that mitigation banking was the most cost-effective and lower-risk alternative for their specific project. Cost categories assessed included upfront mitigation expenditures including internal planning and coordination, permitting and transaction costs, schedule delay risk, long-term operation and maintenance obligations, monitoring and reporting expenses, and contingent liability exposure. In this case, mitigation banking reduced total project costs by accelerating permit approval timelines to maintain operations and job security, minimizing administrative burden, and transferring long-term financial and compliance liabilities away from the permit applicant.

Additional cost efficiencies and risk reductions can be achieved when applicants engage with mitigation bankers in advance of permit needs to develop turnkey or single-client mitigation banks. Early collaboration allows applicants to secure assured mitigation capacity, improve regulatory predictability, and integrate mitigation planning into overall project schedules. By contributing to bank development, applicants may obtain mitigation credits at below-market rates, benefiting from shared upfront capital investment, economies of scale, and reduced market uncertainty. These arrangements further enhance cost certainty while maintaining consistency with the Final Mitigation Rule's preference for advance mitigation.

It's important to note that mitigation projects, banking or PRM, can both provide functional lift, long-term site stability, and enhanced ecosystem services if implementation by experienced restoration practitioners operating at a watershed scale. This analysis demonstrated that in this specific case, the turnkey mitigation banking approach offered predictable, cost-efficient, ecological uplift, and most importantly for the applicant, permit approvals on-time allowing for no hinderances in operation.

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BREAKOUT SESSION A (9:15 - 10:15)
COMPARING PROJECT COSTS - ROOM 205

WETLAND-FLOODPLAIN RESTORATION COST-EFFECTIVENESS - JAKE LAMB, F&M COLLEGE (20 MIN)

To clean up the Chesapeake Bay, the regional Chesapeake Bay Program (CBP) partnership targets nitrogen, phosphorus, and sediment as the key pollutants to be reduced in the upstream watershed. The CBP and various other local, state, and federal sources provide funding to implement best management practices (BMPs) that will reduce the levels of these three key pollutants. Cost-effectiveness is a method of economic analysis that identifies the least-cost method of achieving a goal- here, to clean the Chesapeake Bay. High price tags for wetland-floodplain restoration projects can make grantors and other key players hesitant to support and fund these projects. In this study, we perform a cost-effectiveness analysis that compares the cost per pound of pollution reduced by wetland-floodplain restorations with forest riparian buffers, grass buffers, and cover crops (the agricultural BMPs typically considered to be least cost). For wetland-floodplain restoration projects, we obtained cost and abatement data from practice implementation in southcentral Pennsylvania. For the agricultural BMPs, we obtained abatement data from the Chesapeake Assessment Scenario Tool (CAST) and costs from NRCS payment schedules in PA. Preliminary results of our research suggest that wetland-floodplain restoration is the most cost-effective of these BMPs for phosphorus and sediment abatement in the Bay by an order of magnitude, while being cost competitive for nitrogen. Overall, our research indicates that wetland-floodplain restoration is a highly cost-effective BMP for cleaning the Chesapeake Bay. As this is research in progress, precise numbers and further results will be shared during the presentation.

BREAKOUT SESSION B (10:30 - 12:00)
LONGTERM MONITORING AND RESEARCH- ROOM 206

BIG SPRING RUN CONTINUING RESEARCH AND OTHER REGIONAL FINDINGS - JULIA CARR, SHUYU CHANG, AND JOE GALELLA, F&M COLLEGE (45 MIN)

More than a hundred thousand milldams were constructed across the northeastern U.S., fundamentally altering the landscape. Sediment trapped and accumulated behind these structures burying pre-settlement Holocene wetlands, like a valley bottom Pompeii. After milldam failure, eroded legacy sediment has become a significant source of pollution in the Chesapeake Watershed. A new restoration paradigm is taking shape through the removal of legacy sediments, allowing original wetland-stream ecosystems to re-emerge.

Big Spring Run (BSR), located in Lancaster County, Pennsylvania, has served as a national pilot site for implementing and evaluating this restoration approach since 2008. Here, we examine Big Spring Run and test the hypothesis that floodplain wetland restoration via legacy sediment removal will: (1) Reestablish hydrological connectivity by increasing groundwater recharge and expanding floodplain capacity for more frequent overbank flow; (2) Moderate stream temperatures and reduce thermal sensitivity through enhanced hyporheic exchange between surface water and groundwater; (3) Reduce turbidity and improve water clarity by increasing residence time, decreasing flow velocity, and promoting frequent overbank flows that trap sediments on the floodplain; and (4) Enhance nutrient retention and removal by increasing water residence time and exposing organic-rich wetland soils that function as biogeochemical hotspots for denitrification.

BREAKOUT SESSION B (10:30 - 12:00)
LONGTERM MONITORING AND RESEARCH- ROOM 206

LONG TERM MONITORING OF HYDROLOGICAL AND BIOLOGICAL RESPONSES TO DYNAMIC ALLUVIAL VALLEY RESTORATION AT ROBINSON FORK, PA - KELLY JOHNSON, OHIO UNIV.

Dynamic alluvial valley restoration approaches have been implemented in multiple catchments at Robinson Fork in western Pennsylvania, with some sites now reaching 10 years or more post-restoration. As with many process-based restoration efforts, the aim is to establish a system that can evolve and change over time while maintaining desirable functions, such as reduced erosion, improved water storage, nutrient retention, and increased habitat heterogeneity. To better understand how restored dynamic alluvial valleys perform over time, we monitored hydrological and biological processes in six sections of restored alluvial valleys and four unrestored valleys over 4-5 water years. Restored sites included a range of valley size and habitat types, from small valleys with anastomosing channels through wet meadow habitat, to larger valleys with perennial, hard-bottomed channels, and lateral side channels. The unrestored sites were single thread, incised channels with low floodplain connectivity. We will discuss seasonal patterns in water depth and wet/dry cycles measured using HOBO water depth monitors, trail cameras, wet/dry (STIC) sensors, and soil moisture. Restored and unrestored sites differed in nutrient retention, based on quarterly water and stream sediment samples. Allochthonous inputs were lower at restored sites which had shorter woody vegetation than unrestored sites with mature forest canopy. However, leaf-litter breakdown rates were similar even though the composition of macroinvertebrate communities varied with channel type, seasonal flow variability, catchment size, and restoration status. Our results reinforce the importance of site-specific features and multiple assessment approaches to evaluate the performance of restored systems at different spatial and temporal scales.

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BREAKOUT SESSION B (10:30 - 12:00)
PERFORMANCE MEASURES, OUTCOMES AND LONG-TERM MAINTENANCE - ROOM 207

BEYOND THE CHANNEL - DYNAMIC ALLUVIAL VALLEY PERFORMANCE STANDARDS - SAM LEBERG, ECOSYSTEM PLANNING AND RESTORATION (30 MIN)

Stream restoration practice is becoming increasingly dynamic and multifaceted, as floodplain restoration strategies become more commonplace (e.g., legacy sediment removal, Stage 0 Restoration, beaver-related restoration, etc.). These techniques generally incorporate a larger section of the floodplain, create multiple channels, and may change in form over the monitoring period. Although these techniques have the potential for greater ecological function where appropriate, existing regulatory frameworks (designed for single-thread, perennial, transport reaches) have consistently lagged behind restoration trends. In this session I will first present the challenges that floodplain restoration presents to existing channel-based frameworks generally, and to compensatory mitigation specifically. I will then explore how these challenges are actively being addressed by existing methods, and present potential evaluation strategies for dynamic floodplain systems. Finally, I will present a comprehensive list of performance metrics and discuss potential credit and debiting strategies. This presentation will look at stream restoration in a national context and incorporates the input from expert practitioners, regulators, and academics. This work reflects the culmination of three years of research, conducted as an ORISE fellow in the Freshwater and Marine Regulatory Branch at the EPA.

OBSERVED PROJECT OUTCOMES - MONITORING LARGE SCALE PROJECTS AND RESULTS - SHAWYN YEAMANS, RES (30 MIN)

A review of historic and current monitoring and performance methodologies and results with a discussion of advantages, problems, and suggestions for improvement.

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BREAKOUT SESSION B (10:30 - 12:00)
PERFORMANCE MEASURES, OUTCOMES AND LONG-TERM MAINTENANCE - ROOM 207

VEGETATION MANAGEMENT IN RESTORED FLOODPLAIN/WETLAND COMPLEXES - NICK MYERS, LANDSTUDIES (30 MIN)

A major component of restoration projects is the use of vegetation to provide ecological diversity, nutrient uptake, aesthetic appeal, resiliency, and other considerations. What has been historically neglected are the maintenance needs of these projects, especially as they differ from other forms of green infrastructure. Management of these vegetation systems can present a challenge for landowners and contractors as it can require specialized knowledge in maintenance techniques appropriate for these kinds of landscapes, along with experience in plant identification. Invasive species are a particular concern in the ecological health of these sites. Adaptive management is a necessity as these projects mature and the diversity and balance of the plant community changes. Having staff that can manage these communities also presents an opportunity to monitor the sites and collect longer-term data.

BREAKOUT SESSION B (10:30 - 12:00)
COMMUNITY ENGAGEMENT AND PROJECT DEVELOPMENT - ROOM 205

COORDINATING A LARGE-SCALE PROJECT'S COMMUNITY ENGAGEMENT AND FUNDING - LITTLE CONESTOGA CREEK BLUE GREEN CONNECTOR EXPERIENCE - JOHN COX, LITTLE CONESTOGA CREEK FOUNDATION (45 MIN)

The presentation will explain the strategies pursued for coordinating a large stream restoration project begun in 2019 and known today as the Blue Green Connector. Using an evidence-based analysis of historic resource alterations and current degradation causes, led by The Steinman Foundation and the Little Conestoga Creek Foundation with public and private partners, it was initially envisioned as seven projects. It faced significant challenges due to location in four municipalities with 40 landowners in suburban Lancaster County. To facilitate and ultimately restoration of 25 acres of watercourse and floodplain wetlands, the project was combined into one comprehensive Watershed Restoration Permit (WRP) through collaboration with DEP, municipalities, county, and landowners. The session will discuss partnership development focusing on key elements of community outreach, municipal cooperation, collaboration strategies, and the benefits of the WRP for implementation and funding, as well as key lessons learned.

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BREAKOUT SESSION B (10:30 - 12:00)
COMMUNITY ENGAGEMENT AND PROJECT DEVELOPMENT - ROOM 205

INDIGENOUS ENGAGEMENT IN PA AND THE ROLE OF CULTURAL RESTORATION WITHIN THE CONTEXT OF ECOLOGICAL RESTORATION - LAUREL ETTER LONGENECKER, RIVER STEWARDS COLLABORATIVE AND ALYSSA HANNIGAN, LANDSTUDIES (45 MIN)

As conservation professionals we tend to focus on restoring projects for their function, such as pollutant load reductions, wildlife habitat enhancement, flood control, groundwater recharge, etc. While this is important, focusing on the functional aspects alone fails to engage people and culture in the process. Ecological restoration paired with an understanding of Indigenous lifeways has the capacity to move beyond function towards reestablishing healthy relationships between nature and culture.

This presentation will use examples from working within the Little Conestoga Creek Watershed to explore the meaning of a cultural-ecological relationship and how this relationship has changed since European colonization. Topics will cover current barriers that exist for working with Indigenous groups in Pennsylvania, recommendations for overcoming these barriers in conservation work, and the mutually beneficial opportunities that exist between the Indigenous community and conservation professionals.

TECHNICAL SESSION 4: DEMONSTRATION CASE STUDIES - DEAN'S HALL (1:00 - 2:30)

LITTLE ARNOT LARGE WOOD REINTRODUCTION - BEN HAYES, BUCKNELL UNIV. (30 MIN)

Little Arnot Run, a 9.51km3 watershed in the Allegheny National Forest, Pennsylvania, is typical of forested headwater streams in the Allegheny Plateau region — narrow alluvial valleys surrounded by steep valley sides that were clearcut during the 19th-century, with managed silviculture and oil and natural gas operations continuing today. The streams remain relatively straight and incised, confined by relic railroad berms, and disconnected from abandoned side channels and floodplain.

Beginning October 2019, detailed geomorphic surveys were combined with hydrologic data collected at a network of 1 weather station, 4 stream gages. and 16 piezometers installed along a 2km reach of the valley floor, show hyporheic exchange potential (HEP) to be approximately 1 x 10-4 , suggesting excellent potential for valley-wide groundwater storage and hyporheic uplift.

Lidar and field survey data suggested a pre-logging geomorphic grade line (GGL) of 0.012 could be achieved if large wood debris (LWD) and sediments from relic railroad berms were returned to the channel Prior to restoration, little to no hyporheic exchange occurred during summer and fall months, with riffles in the middle and lower reaches becoming completely dry.

Following restoration in August 2021, the lateral extent of hyporheic zone remained greatest during wet winter and spring months, but increased to as much as 30 m from the channel. Hyporheic flux rates from the stream to the adjacent alluvial aquifer remained high 0.23 m3 s-1) during the spring months, when water levels in the stream are high. During the driest period of the year (August - October), water levels are 0.2m higher across the valley and hyporheic exchange rates increased from 0 to 0.19m3 s-1 Because of the bedrock-alluvium architecture, groundwater gradients continue to be greatest down the axis of the valley and down-valley flow estimated to be 3 to 5 times greater than lateral flow rates. However, increased lateral hyporheic exchange during the hot, dry summer and fall months has consistently decreased stream temperatures during the summer by 2-4°C for the past five years. Side channels, now reconnected and flowing year round, provide refugia for native brook trout during spring floods and spawning habitat in the fall.

TECHNICAL SESSION 4: DEMONSTRATION CASE STUDIES - DEAN'S HALL (1:00 - 2:30)

ADAPTIVE APPROACHES TO AQUATIC RESOURCE RESTORATION: USE OF LARGE WOOD MATERIAL IN STAGE 0 REMEDIATION DESIGN APPROACH AT THE GOOD SPRING (AKA DEVIL'S HOLE) ABANDONED MINE RECLAMATION FLOODPLAIN RECONNECTION PROJECT - DAVE GOERMAN, DEP DWET (30 MIN)

This presentation will provide context to the use of adaptive design approaches and expand on the current state of the science. As an example, I will provide an overview of the design considerations and remedial activities done on a large-scale floodplain reestablishment project associated with an abandoned mine reclamation project. The project encompasses approximately 4,600 feet of floodplain valley reestablishment encompassing approximately 18 acres. The valley was originally buried under coal waste or culm that during events was heavily eroded and transported into the downstream communities along Good Spring Creek (GSC). A brief discussion of why intervention (aka the problems) was necessary to ensure the success of the original project objectives.

The work included excavation and placement of additional base level control log structures that were buried below the floodplain surface to prevent and control any accelerated erosion and prevent head cutting of channels along the valley.

DAY 2 MARCH 4TH ABSTRACT

Approximately 25,000 feet of 18-inch diameter logs were placed across the entire valley at a horizontal spacing based upon 0.5-foot vertical elevation increase. The design approach is intended to provide valley grade control so the stream channel(s) that form can move across the valley and maintain the same channel invert elevation and if erosion occurs it is controlled and prevented from propagating. The surface of the floodplain was then covered in woody debris (treetops and logs) to provide habitat, roughness, and to assist in development of an anabranched channel pattern. No stream channel was constructed; the site is self-evolving through alluvial processes.

TECHNICAL SESSION 4: DEMONSTRATION CASE STUDIES - DEAN'S HALL (1:00 - 2:30)

COMPREHENSIVE LEGACY SEDIMENT REMOVAL AND MULTI-BENEFIT OUTCOMES - ANDREW DONALDSON, JOHNSON, MIRMIRAN & THOMPSON, INC. AND BEN EHRHART, LANDSTUDIES (30 MIN)

While comprehensive legacy sediment removal floodplain restoration projects provide significant ecological uplift, they also provide numerous other benefits that bring value to communities. These ancillary benefits can drive additional funding opportunities that ultimately allow more restoration work to be completed under various programs. These benefits include sediment and nutrient reductions that can meet MS4, Chesapeake Bay, and local TMDL targets, peak attenuation and volume reduction that can meet post construction stormwater management requirements for land development activities, groundwater recharge that can offset consumptive water use, and local and regional flood hazard mitigation. Case studies will be discussed demonstrating the effectiveness of floodplain restoration projects in providing multiple benefits.

TECHNICAL SESSION 5: WATERSHED SCALE PROJECT CASE STUDIES - DEAN'S HALL (2:45 - 3:45)

ROBINSON FORK MITIGATION BANK - DAVE GOERMAN, DEP DWET, ART PAROLA, WETLAND STUDIES AND SOLUTIONS, INC, AND WARD OBERHOLTZER, LANDSTUDIES (40 MIN)

The Robinson Fork Mitigation bank project (Phase 1) broke all the traditional project approval and restoration design approaches in Pennsylvania. This project proposal's timing occurred during the broadening of the collective understanding of natural unaltered conditions, historic alterations and advancing restoration design approaches that fostered innovative and collaborative work beyond norms for the time. This enabled envisioning how large watershed-scale restoration projects are conceived, designed, approved, and constructed in PA.

DAY 2 MARCH 4TH ABSTRACT

This large 500-acre watershed scale mitigation bank is intended to reestablish, rehabilitate, enhance, and preserve self-sustaining functional stream, wetland, and floodplain valleys. Across the Project, approximately 95,949 linear feet of streams and 46.83 acres of wetlands were reestablished, rehabilitated, or enhanced. The session will explore how this project went from a preliminary proposal in the Spring of 2014 to a fully constructed project in 2017 and how this was accomplished through innovations made in the permit application and plan approval process; degradation/alterations prototype design approach; post restoration monitoring performance and research; and mitigation crediting.

TECHNICAL SESSION 5: WATERSHED SCALE PROJECT CASE STUDIES - DEAN'S HALL (2:45 - 3:45)

CONNECTING THE DOTS: SCIENCE BASED DECISION MAKING FOR RIVER RESTORATION - SU FANOK, PADE THE NATURE CONSERVANCY AND BEN EHRHART, LANDSTUDIES (20 MIN)

Stream restoration continues to be a global, multibilliondollar industry employing a wide range of approaches—yet fundamental questions remain. How do we identify where rivercorridor restoration will yield the greatest ecological benefit? How do we match restoration approaches to site conditions? How can projects achieve reach and watershedscale outcomes while balancing feasibility, site constraints, and cost?

This presentation shares a watershed partnership's journey to advance highly effective, durable, ecologically based stream and wetland restoration through the development of a provisional, science-informed decision framework designed to support more strategic restoration planning. Rooted in process-based restoration principles and the restoration literature, the framework guides practitioners in evaluating site potential, selecting appropriate restoration approaches, and anticipating ecological outcomes. Importantly, this framework is still under active development—an evolving tool that will benefit from continued testing, refinement, and new ideas from the restoration community.

The presentation will review core principles essential for restoration approach selection and then introduce a structured framework built through assessments of hydrologic, geomorphic, and ecological data. By bridging research and realworld application, the framework demonstrates how science can inform defensible, scalable, and ecologically grounded restoration decisions. Attendees will see how resource assessments shape decision criteria and how this approach moves restoration planning beyond ad hoc choices toward more strategic, evidencebased action across watersheds.