Abstracts and Speaker Biographies

Connecting Communities and Ecosystems in Restoration Practice

October 11-13, 2018. Southern CT State University, New Haven, CT

KEYNOTE AND PLENARY TALKS

Keynote Talk

Learning from the people and the land: Traditional ecological knowledge toward restoration of ecosystems and of our connection with nature

Stewart Diemont, SUNY College of Environmental Science and Forestry. Department of Environmental and Forest Biology, Graduate Program in Environmental Science - Ecosystem Restoration, and Center for Native Peoples and the Environment. sdiemont@esf.edu.

The traditional ecological knowledge of indigenous and local communities throughout the world could lend guidance for restoring ecosystems and adapting to climate change. Through a long-term relationship with place, communities often have intimate understanding of the nature that surrounds them, and of which they are a part. They also may have a strong understanding of how to sustainably manage that ecosystem.

Bio: Stew Diemont works with people to better understand how traditional knowledge can be part of ecosystem design. With his students and the people of communities in which he works, he has studied soil, plants, fungi, insects, and birds, as well as talked extensively with community members. Dr. Diemont will speak about his and his students' experiences working with a Zapotec community in Mexico; Mayan communities in Mexico, Belize and Guatemala; the Haudenosaunee of New York; and with traditional vineyard growers in Europe.

His ecosystem design focuses on connecting people with place. He is particularly interested in how food can be a part of ecosystem restoration in rural and urban settings. He will outline how restoration could move forward in partnership with traditional knowledge for sustainable socioecological systems.

Morning Plenary Talk

Trees New York and the Young Urban Foresters

Nelson Villarrubia, Trees New York. Nelson@treesny.org.

For nine years, Trees New York has run the hugely successful Young Urban Forester Internship. The internship, initially funded by the US Forest Service "More Kids in The Woods Program",

serves as a national model in engaging diverse communities in Urban Forestry. This internship is designed to remove the barriers that prevent low-income urban youth from entering environmental careers and exposes interns to a range of professional opportunities through education, hands-on stewardship, field trips and seminars with professionals.

Over the course of the 7-weeks, interns are introduced to urban forestry and help care for hundreds of street trees when they need it the most - the hottest and dryest weeks of summer! Nelson will discuss program design, curriculum development and best practices that will help ensure optimal success.

Bio: After 10 years with Trees New York, Nelson became Executive Director in 2013. As Executive Director, Nelson has introduced a host of innovative new projects and programs, including the Young Urban Forester Internship and FruiTrees New York. Nelson has drawn on his strong experience in program management and community engagement over the last few years to forge strategic partnerships and make several keen personnel choices, bringing strong and creative new staff and board leaders to the organization.

As a mission-driven non-profit leader with a passion for environmental and economic development, Nelson spearheaded the most successful fundraising effort in the history of the organization. In addition to his aptitude in managing people, fundraising and introducing a host of innovative new projects, Nelson is a strong collaborator who has forged fruitful partnerships with groups as diverse as the New York City Housing Authority and Green-Wood Cemetery to drive positive and substantive change. Nelson has an MS in Urban Affairs with a concentration in Environmental Policy.

Afternoon Plenary Talk

Social aspects of ecological restoration

Michelle L. Johnson, USDA Forest Service, NYC Urban Field Station. michelleljohnson@fs.fed.us.

Considering social aspects of ecological restoration has the potential to inform restoration choices and improve social-ecological outcomes. Civic organizations are increasingly recognized as playing a critical role in environmental governance. These organizations can advocate for, conserve, educate about, manage, monitor, and transform the local environment; in essence, they steward the local environment. The variety of individuals and organizations can result in complex governance networks; understanding how these organizations together work on environmental management can lead to improved management outcomes. At the same time, restoration efforts have the potential to affect people's experience and meaning of green and aquatic spaces. Research focused on this link between ecological condition and social use and meaning is an emerging frontier. In this talk, I draw upon two research projects, the New York City Region Stewardship Mapping and Assessment Project (STEW-MAP) and a social assessment of park use and meaning to discuss these relationships among civic action, ecological perception and meaning, and ecological restoration efforts.

Bio: Michelle Johnson is a research ecologist with the USDA Forest Service at the NYC Urban Field Station. Trained in both social and ecological sciences, her research toolkit includes spatial

analysis, quantitative social science, and field ecology methods. Her research areas at the NYC Urban Field Station broadly include urban natural resources stewardship and urban tree health, with a current focus on spatial analyses of environmental stewardship organizations' activities, a qualitative case study of interdisciplinary research & management efforts, and participatory social-ecological modeling. Dr. Johnson holds a B.S. in Biology from Eckerd College, a M.S. in Natural Resource Planning from the University of Vermont, and a PhD in Ecology and Environmental Sciences from the University of Maine.

TALKS IN BREAK-OUT SESSIONS

Session #1

Track 1: Monitoring & Restoration Assessment.

PIT-tagged tracer particle study of bed mobility in a Maine salmon river

Douglas Thompson, Connecticut College; Samuel Fixler, Connecticut College, Environmental Studies; Kalinda Roberts, Connecticut College, Biology; Moriah McKenna, Connecticut College, Biology and Anthropology; Emma Brooks, Connecticut College, Environmental Studies; Clare Loughlin, Environmental Studies; Anna Marshall, Connecticut Fund for the Environment, Save the Sound; Steven Koenig, Project SHARE, Eastport, ME.

A three-year study of particle mobilization along the Narraguagus River, Maine highlights variations in sediment-transport processes prior to a major large-wood (LW) addition restoration project. The mobility study utilizes laser total stations cross-sectional surveys and tracking of passive integrated transponder (PIT) tags embedded in glass spheres to document changes in channel-bed characteristics associated with current conditions and natural salmon spawning activities. In 2016, ten cross-sections, spaced 5-m apart, were surveyed with a laser total station in each of three different study reaches. A grid of 200 glass spheres embedded with PIT tags, with twenty alternating 25-mm and 40-mm size particles equally spaced along each of the ten transects, were placed to serve as point sensors to detect sediment mobilization within each reach. In 2017 and 2018, the site was revisited to determine if differences in PIT-tagged tracer particle mobilization reflect locations where LW exists and places where Atlantic salmon (*Salmo salar*) and sea lamprey (*Petromyzon marinus*) construct spawning redds. The positions of PIT-tagged tracer particles was recorded, but particles were not disturbed or uncovered to permit study of potential reworking of buried tracer particles the following year. Full tracer particle recovery will be determined in 2019 to determine if depths of tracer burial and changes in bed elevation vary among places near redds, LW additions and main channel locations. The data will be used to determine if salmon and lamprey redds are preferentially located in either places with greater evidence of sediment reworking or alternatively in stable areas? The study will help determine the degree of bed disruption associated with spawning activities and whether LW placement encourages similar sediment mobilization processes.

Bio: Douglas Thompson is the Rosemary Park Professor of Geosciences at Connecticut College, where he has taught for 21 years. Thompson studied geology and geography at Middlebury

College before obtaining his MS and PhD in Earth Resources at Colorado State University. He is a fluvial geomorphologist, an expert on pool-riffle sequences and the history of river restoration. He has authored dozens of articles and the book The Quest for the Golden Trout. Thompson is a fellow in the Geological Society of America.

Drones and river restoration: Assessing geomorphic impacts downstream of a small dam removal with aerial remote sensing approaches

Alexandra Evans, University of New Hampshire; Scott Greenwood, University of New Hampshire; Kevin Gardner, University of New Hampshire; Denise Burchsted, Keene State College

Dam removal is an increasingly popular management solution to limit liability, restore habitat, restore sediment fluxes, and address other ecological impacts of aging dam infrastructure. However, the river ecosystem responses from dam removal are poorly understood due to minimal pre-/post-removal studies, while the number of dam removals has been increasing throughout the United States (Foley et al. 2017; Hart et al. 2002; Poff & Hart, 2002). In addition, administrative, technical, and financial barriers often prevent sufficient collection of data for restoration project evaluation (Roni & Beechie, 2012; Bernhardt et al. 2005; NRC 1992). This work seeks to develop photogrammetric techniques using small unmanned aerial systems (sUAS, commonly referred to as "drones"), to assess geomorphic changes in riverine systems and validate them against conventional techniques. A DJI Phantom 3 Professional sUAS collected imagery downstream of a pair of small dams on the Bellamy River in Dover, NH pre- and post-removal. Geomorphic changes to the downstream reach were evaluated using digital surface models and orthomosaics created using commercially available structure-from-motion photogrammetry software (Agisoft PhotoScan Professional). Monumented cross sections were surveyed throughout the downstream area with a Topcon total station to measure channel dimensions while pebble counts characterized the river substrate pre- and post-dam removal. The results from the conventional measurement approaches were compared to the measurements made from the imagery products to help determine the efficacy of the aerial approach to measuring geomorphic change over time. These drone methods are a promising, low-cost approach to evaluating dam removal and other river management.

Bio: Alexandra Evans is a doctoral student advised by Dr. Kevin Gardner at University of New Hampshire in the Natural Resources & Earth Systems Science PhD program. She is developing close range remote sensing techniques using small unmanned aerial systems to study rivers and the ecological impacts from dam management decisions, such as dam removal. Her work is part of a larger, NSF EPSCoR interdisciplinary project, "Strengthening the scientific basis for decision making about dams: Multi-scale, coupled-systems research on ecological, social, and economic trade-offs", with collaborators throughout New England. Alexandra earned her B.S. in Environmental Science and M.S. in Geology from Rensselaer Polytechnic Institute in 2015.

Development of comprehensive NYC stream assessment framework to prioritize restoration and protection

Rebecca Swadek, NYC Parks; Marit Larson, NYC Parks; Emily Stephan, NYC Parks; Ellen Pehek, NYC Parks

Less than 20% of historic streams that once existed in New York City remain, and those left experience degradation due to urbanization and associated stressors, such as increased stormwater runoff. About half of the City's remaining wetlands and streams reside on NYC

parkland. As the quality and stability of streams is increasingly threatened by development and climate change pressure, assessing appropriate targets and priorities for restoration is critical. Through an assessment of current conditions and impacts, along with future potential stressors, we aim to set priority locations and strategies for stream restoration.

In order to assess appropriate management strategies for urban streams, we evaluated current conditions, causes of degradation, opportunities for restoration, and potential future impacts. We conducted an assessment of stream conditions, at 176 reaches, in 20 catchments across the city, focusing on geomorphic and biotic factors at the reach scale. We also analyzed various landscape scale features, including riparian buffer and impervious area attributes. We selected metrics from these assessments that could serve as indices (or scores) of relative stream reach condition and potential threat. Streams were classified based on geomorphic characteristics and runoff source to reduce the role of geomorphic or landscape context on our valuations of stream condition.

A streams' relative condition and impact score compared to the range of scores for streams across the city provides a basis for setting management priorities. Restoration efforts should be geared towards those streams in poor condition experiencing threats and adverse impacts, where appropriate restoration strategies are feasible. This first ever initiative to evaluate all NYC streams resulted in comprehensive assessment at the individual reach and watershed scale that allows us to prioritize management strategies and target efforts to maintain or improve stream conditions.

Bio: Rebecca Swadek, Senior Wetlands Restoration Program Manager at NYC Parks' Natural Resources Group, is a certified ecologist and restoration practitioner. In her role, she oversees restoration, monitoring, and watershed planning for NYC's wetlands and waterways. She has 10 years of experience with a background in botany, grassland and wetland ecology and restoration, and green infrastructure research. She has a BS in Biology from Texas A&M University and an MS in Environmental Science.

Connecting urban youth to nature through citizen science and ecological restoration

Jessica Schuler, The New York Botanical Garden; Tai Montanarella; NYBG, Jamie Boyer, NYBG; Todd Forrest, NYBG; Judith Hutton, NYBG; Mona Arriola, NYBG; Celia Baldwin, NYBG; Genevieve Rana, NYBG

The New York Botanical Garden is an advocate for the plant kingdom; this mission is achieved through three main program areas science, education, and horticulture. The Thain Family Forest program encompasses all three of these program areas through ongoing ecological restoration and monitoring work in the 50-acre urban, old-growth forest. Over the past 10 years, many youth programs have engaged in ecological restoration and monitoring work within the Forest. We find that the programs that include both a citizen science monitoring and hands-on restoration component are the most successful. Providing middle school and high school students with an authentic fieldwork experience, engaging them in data collection and allowing them to draw their own conclusions. This program model empowers students with the knowledge and ability to become environmental stewards. With more than 50% of the world's population living in urban areas, the stakes are now at their highest to engage urban youth in nature and environmental stewardship. This talk will discuss the curriculum that NYBG has developed to monitor invasive

plant species, water quality, and phenology to teach ecology and the importance of ecological restoration as a conservation practice to urban youth in New York City.

Bio: Jessica A. Schuler, Director of the Thain Family Forest at The New York Botanical Garden, is responsible for the management of the 50 acre, old growth urban Forest including ecological restoration and the development of education and research programs. She teaches about urban forest restoration, invasive species, and native plants. Jessica earned a BS in plant science with distinction in research from Cornell University, is an ISA-certified arborist and Certified Ecological Restoration Practitioner with the Society for Ecological Restoration. Jessica is an advocate for native plant conservation and ecological restoration.

Track 2: Meeting Human Needs with Restoration.

Park-as-lab: Building scientific understanding and community participation

Jessica Hoch, Randall's Island Park Alliance; Chris Girgenti, Randall's Island Park Alliance

As cities are subject to environmental stressors such as urban heat and storm surge, it is increasingly important to connect urban residents to natural areas to build social and ecological resilience and to engage citizens in setting ecological research and restoration priorities. The Randall's Island Park Alliance recently implemented an innovative ecology research program called "Park-as-Lab" (PAL), which connects students, scientists, and citizens with the restored salt marshes, freshwater wetland complex, meadows, and upland forests on Randall's Island. At the confluence of the East and Harlem Rivers in New York City, Randall's Island is an ideal resource for the study of urban restoration ecology. Built on collaborations with community groups from the surrounding neighborhoods of East Harlem and the South Bronx, advocacy organizations, and the research community, the PAL program supports partnerships by providing access, resources, and assistance for participants to research applied ecology and restoration ecology on the Island. The PAL program aims to promote STEM career pathways through connecting students interested in ecology and environmental science with relevant research and environmental monitoring projects, with a focus on engaging youth in adjacent neighborhoods. This talk will introduce the PAL program, highlight several research projects involving wetland and oyster reef restoration in New York City, and discuss how the PAL program's framework of building partnerships across the ecosystems on Randall's Island and regionally in New York City promotes a greater understanding of ecological and community resiliency.

Bios: Jessica Hoch coordinates ecological and environmental research at Randall's Island Park in New York City. She received her master's in Ecology, Evolution, and Conservation Biology from Columbia University, with a focus on plant-microbial interactions and urban ecology, and her bachelor's in Geography from McGill University.

Chris Girgenti is the Natural Areas Manager for the Randall's Island Park Alliance, a public-private partnership working with the City of New York to develop and program Randall's Island Park. Chris brings ten years of experience in applied conservation, community-based restoration, and environmental education. He currently oversees the adaptive management of 20 acres of restored natural areas in Randall's Island Park and the award-winning Waterfront Stewardship Program which connects residents through outreach, education, and direct participation to their surrounding environment. Chris' educational background includes a BA from Sarah Lawrence College with a concentration in Environmental Studies, landscape design coursework from the New

York Botanical Garden, and is currently a Master's candidate in the Duke Environmental Leadership- Master's in Environmental Management program at Duke University.

The regenerative farm observatory: Designing an experiential education landscape to teach sustainable agricultural practices

Ann Kearsley RLA, MLAUD, Ann Kearsley Design, RISD, Northeastern University

Agriculture is a major contributor to global greenhouse gas emissions. Regenerative Agriculture is a holistic approach to land management developed to help reverse the negative environmental impacts of both plant and animal farming. RA employs farming practices that increase soil organic matter and soil fertility, and sequester carbon in both soils and aboveground biomass.

The Wolfe's Neck Center for Agricultural and the Environment (Freeport, Maine) recently established the Regenerative Farm Observatory, a demonstration and research center for net-zero carbon farming practices. WNC is an working dairy where farm operations support numerous educational programs including a Dairy Farmer Apprenticeship Training Program, a Summer Farm Camp and a Teen Agriculture Program, and provides a year-round destination for school groups. Working with the farmers and educational staff, landscape architect Ann Kearsley developed a masterplan organizing the physical integration of the farm's educational and recreational programming with the agricultural operations.

The masterplan includes an Experiential Education Landscape, an open pedestrian space linking major program areas like classrooms, event spaces, the Dairy, livestock barns, pastures, crop fields, woodlands, and a seasonal campground. The Experiential Education Landscape is where visitors learn about both the sustainable practices of Regenerative Farming and the functional ecological and biological processes that make these practices successful. The challenge with designing a landscape that highlights the ecological processes supporting carbon sequestration, is that most of these critical processes take place in the soil - underground and out of sight.

This session will consider landscapes designed to connect people to the plant communities, biological processes and ecological function of their environment through experience and observation – landscapes designed to integrate science and the built environment.

Bios: Ann Kearsley RLA, MLAUD is a landscape architect and urban designer and the owner of Ann Kearsley Design in Portland, Maine, USA. She specializes in ecologically based landscape design with a particular focus on design and planning for agricultural landscapes where farming operations are integrated with experiential educational programming, research and community outreach. She teaches in the Landscape Architecture Programs at the Rhode Island School of Design (Providence, RI) and Northeastern University (Boston, MA).

Ecological restoration, livelihood and ecosystem services in a smallholder dominated rural landscape

Abdon Schmitt Filho, Federal University of Santa Catarina, Brazil & Gund Institute for the Environment UVM; Alfredo Fantini, Federal University of Santa Catarina, Brazil; Paulo Sinisgalli, University of São Paulo USP, Brazil; Joshua Farley, Community Development and Applied Economics Dept. & Gund Institute for Environment UVM; Lui M. Schmitt, Biology Program, The University of Vermont; Silvopastoral System and Ecological Restoration Lab - LASSre/UFSC, Brasil. LASSre@ufsc.br; LASSreBRAZIL@gmail.com.

Society must increase food production and restore vital ecosystem or suffer unacceptable consequences. Unfortunately, conventional agriculture may be the single greatest threat to ecosystem function. At the same time, reducing ecologically harmful agricultural inputs or restoring farmlands to native ecosystems threatens food production. We fell into this predicament because we designed agricultural and economic systems that failed to account for ecosystem services, and the path forward requires redesigning both systems. In Santa Rosa, Southern Brazil Atlantic Forest, we are working with family farmers, traditional communities, local government and NGOs to develop high biodiversity silvopastoral systems that achieve these goals, as well as the policies required for the adoption and dissemination. High Biodiversity Silvopastoral Systems (SSPnuclei) were designed in a participatory framework to embrace ecological restoration, livelihoods and multiple ecosystem services. Our goal was to restore ecosystems while providing shade for livestock, revenue from non-timber forest products (NTFP), biodiversity (50 native tree spp/ha), connectivity, and a changing landscape matrix from pasture to scattered forest. In each hectare 40 nuclei (5 m x 5 m) were fenced off temporarily. Inside, 22 native trees were planted from 4 functional groups. SSPnuclei has been implemented in pilot farms in Southern Brazil where biophysical variables and ES have been evaluated and will be presented – soil quality and carbon, biodiversity (birds, ants and dung beetles), microclimate, carbon sequestration and landscape characteristics. The system provided shade by the 2nd to 3rd year, produced banana and rose pepper in the 4th year, açai from Juçara in the 7th. Farmers recover restoration costs by the 7th - 8th year with revenue from NTFP. As a broad public policy, SPSnuclei could rehabilitate rural landscape of Atlantic Forest Biome ensuring restoration targets nationally declared.

Bios: Abdon L. Schmitt Filho is an Professor at University of Santa Catarina - UFSC, Brazil. His teaching and research efforts focus on designing agroecological systems that interconnect ecological restoration, rural livelihood and renewable agriculture in Southern Brazil. He is coordinator of Silvopastoral System and Ecological Restoration LAB (LASSre) - a Participatory Research Action Initiative that worked with more than 622 farmers.

Lui M. Schmitt is senior at The University of Vermont at Biology Program, and a Certified Lifeguard with four years of experience. He has been exposed to ecological rehabilitation of rural landscape since early ages. More recently, he has been involved with native communities from the country side of Ecuador. Good friendships, biology and health courses, sports and surf are highly ranked on his priorities.

Multifunction riparian forests: When ecological restoration is an economically viable practice for family farmers and traditional communities

Lui M. Schmitt, The University of Vermont; 1.Thais Buratto, MSc PGA/UFSC, Federal University of Santa Catariana, Brasil; 2.Lui M. Schmitt, Biology Program, The University of Vermont;3.Abdon Schmitt Filho, Prof. from Federal University of Santa Catarina, Brazil & Gund Institute for the

Environment UVM; 4.Paulo Sinisgalli, Prof. from University of São Paulo USP, Brazil; 5.Joshua Farley, Prof. from CDAE Dept. & Gund Institute for Environment UVM; 6. Silvopastoral Systems and Ecological Restoration Lab - LASSre/UFSC, Brasil. LASSre@ufsc.br; LASSreBRAZIL@gmail.com

In Brazil, only on private lands, there is a legal deficit of 19 million hectares of land that must be restored, according to the Brazilian legislation. Thus, farmers decision upon different land uses can determinate the future of ecological restoration in the country. These decisions are often influenced by social and economic factors. In such a scenario, strategies that help local farmers to restore their lands and synergically promote an economic return of investment could wide spread ecological restoration. Initiatives that incorporate income-generation activities such food production from non-timber forest products are crucial for the adoption any restoration program in a smallholder dominated landscape. This work aimed an economic evaluation of Multifunction Riparian Forest (MultRF) with further analyses of its potential to be wide spread adopted among family farmers and traditional communities. The model was developed using participatory approach (PAR) in the rural landscape of Santa Rosa de Lima, Southern Brazil Atlantic Forest Biome. The involvement of multi stockholders allowed the emergence of a practical approach with high value non-timber forest products from native species only. The Internal Rate of Return (IRR) of 27% and 6-year Payback demonstrate the competitiveness of the investment and offset initial costs at short period of time. Economic return and reduction of environmental liabilities can make MultRF a public police option to ensure large scale restoration targets formalized on nationally declared contributions (NDCs) in Brazil and other countries.

Bios: Lui M. Schmitt is senior at The University of Vermont at Biology Program, and a Certified Lifeguard with four years of experience. He has been exposed to ecological restoration and rehabilitation of rural landscape since early ages. More recently, he has been involved with native communities from the country side of Ecuador. Good friendships, biology and health, sports and surf are highly ranked on his priorities.

Abdon L. Schmitt Filho is an Professor at University of Santa Catarina - UFSC, Brazil. His teaching and research efforts focus on designing agroecological systems that interconnect ecological restoration, rural livelihood and renewable agriculture in Southern Brazil. He is coordinator of Silvopastoral System and Ecological Restoration LAB (LASSre) - a Participatory Research Action Initiative that has been working with more than 622 farmers.

Track 3: Restoration of a Cranberry Bog—Tidmarsh Farms.

Restoring wetlands on cranberry farmland: What we've learned, why it matters, and what's next

Alex Hackman, Massachusetts Division of Ecological Restoration

Recent declines in the Massachusetts cranberry industry create opportunities to transition once productive farmland to valuable new uses. Land protection and ecological restoration offer a potential 'green exit strategy' for landowners, with associated community benefits including improved water quality, reconnected waterways, restored fish and wildlife habitat, and new public open spaces. Over the past decade, numerous organizations have partnered to implement a first wave of such projects in Massachusetts, including at Tidmarsh Farms (Plymouth). Many others are now in progress. This talk will summarize lessons learned about the practice of ecological restoration on these lands. It will describe what needs to be learned (e.g. project-

driven changes in nutrient dynamics) to scale up for greater regional impact. Finally, it will introduce the new state program in Massachusetts dedicated to this work, and the network of partners coming together to advance the associated learning and practice.

Bio: Alex Hackman is a Restoration Ecologist for the Massachusetts Department of Fish and Game's Division of Ecological Restoration. For the past 11 years, Alex has managed river and wetland restoration projects, including dam removals, culvert replacements, river and floodplain reconstruction, and wetland restoration. Today, he manages a new state program dedicated to wetland restoration on retired and abandoned cranberry farmland. Alex holds an M.S. degree in Aquatic Ecological and Watershed Science from the University of Vermont, and is an SER Certified Ecological Restoration Practitioner.

Identifying groundwater discharge spatial patterns to inform process-based peatland restoration

Danielle K. Hare, Department of Natural Resources and the Environment, University of Connecticut, 1376 Storrs Rd, Unit 4087, Storrs CT 06269; David F. Boutt, Department of Geosciences, University of Massachusetts Amherst, 611 N. Pleasant St., Amherst, MA, 01003, USA; William P. Clement , Department of Geosciences, University of Massachusetts Amherst, 611 N. Pleasant St., Amherst, MA, 01003, USA; Christine E. Hatch Department of Geosciences, University of Massachusetts Amherst, 611 N. Pleasant St., Amherst, MA, 01003, USA; Glorianna Davenport, Living Observatory at Tidmarsh Farms, 139 Bartlett Road, Plymouth, MA, 02360, USA; Alex Hackman, Massachusetts Division of Ecological Restoration, 251 Causeway St., Suite 400, Boston, MA 02114

The distribution and magnitude of groundwater discharge can have a significant impact on the ecosystems services provided by the peatland environment. Of the many ecosystems services, groundwater influxes can provide thermal stability, which can be a critical restoration goal when redesigning the surface water structure in degraded systems. However, predicting these groundwater discharge locations can be difficult particularly in vast wetland areas that were modified through intensive anthropogenic practices. This research evaluates the spatial patterning of groundwater discharge and the subsurface structure of the peatland using heat-tracing methods and ground penetrating radar within a Massachusetts legacy cranberry farm peatland. These results informed the stream channel design to enhance groundwater connection as part of the site's large-scale ecosystem restoration. Pairing the peatland subsurface geophysics with the surficial expressions of groundwater led to a conceptual process-based model predicting peatland groundwater discharge locations. Understanding these drivers of groundwater discharge patterns can allow resource managers to more efficiently predict and locate groundwater seepage without invasive or laborious investigations, and incorporate this information into restoration design for these critical ecosystems.

Bio: Danielle Hare is hydrogeologist with expertise in process-based mechanics of surface water and groundwater transport and biogeochemical processing within these environments. The research presented was a part of her M.S. degree, where her thesis was one of the first published Living Observatory research projects. She is currently a Ph.D. student at the University of Connecticut in the Natural Resources and Environment Department. She has also spent four years working as an environmental remediation consultant.

Local adaptation of fish populations in response to stream habitat restoration at Tidmarsh Farm

Thomas F. Dimino, University of Massachusetts Boston, Sean McCanty, University of Massachusetts Boston, Alan Christian, University of Massachusetts Boston

Freshwater systems are experiencing a worldwide decline of biodiversity at a rate of over 4% per decade; 5 times higher than terrestrial systems. Stream geomorphological features are directly and indirectly linked to biodiversity in altered and pristine systems. Anthropogenic reduction in habitat diversity may affect populations by reducing gene flow and resulting in potential loss of intraspecific diversity. Restoration of structural habitat is often cited as a solution to lost biodiversity by returning impacted areas back to more pristine states through increasing the quality and quantity of habitat. Despite recent efforts to employ restoration as a conservation strategy, few studies have investigated the effects of habitat restoration on the evolutionary processes of biodiversity. In this study, we measured changes in habitat heterogeneity (HH) over time at Tidmarsh Farms (TF) from 2014-2018 and compared TF with 2 control treatments (an active cranberry farm and a least impacted reference system). We expect that HH increased at TF post active restoration and this increase has led to shifts in selection pressure and greater phenotypic diversity within fish populations. To measure this shift, morphometric analysis was done on 2 fish species, *A. quadratcus* and *F. diaphanous*, from samples collected between 2014 and 2018. Phenotypic diversity was evaluated using a series of polymorphic traits for each species, which were analyzed using a multivariate distance based test on a NMDS plot. Shifts in local adaptation also were evaluated using a Truss network analysis of body form and size. We hypothesize that post-active restoration, changes in flow regime, water temperature, sedimentation load and food sources will result in shifts in body morphology due to new selection pressures. We expect that the increase in HH will support greater phenotypic diversity in both species.

Thomas F. Dimino University of Massachusetts Boston

The physical habitat and aquatic invertebrate assemblage conditions during the passive phase of a cranberry bog restoration at Tidmarsh Farms, Plymouth, Massachusetts

Alan Christian, School for the Environment, University of Massachusetts Boston; Edgar M. Franck School for the Environment, University of Massachusetts Boston

The River Continuum Concept (RCC) models the expected relationship between in stream biota and the surrounding physical habitat in a pristine forested stream. Global change drivers such as land use land cover (LULC) change influences stream assemblages and ecosystem processes. River restoration can play an important role in counteracting LULC effects. Tidmarsh Farms Study Area (TFSA), including Beaver Dam Brook (BDB) and its surrounding wetland, was actively farmed for cranberries from the mid-1800s until 2010. Passive restoration was implemented in 2010 with a headwater dam being removed and bog going fallow. Active restoration occurred in the fall 2015/winter 2016. To establish passive restoration conditions, we established 8 sampling stations along 1st - 3rd order stream reaches of BDB in autumn 2012 and sampled for physical habitat and benthic macro invertebrates (BMI) on a seasonal basis through autumn 2013. Because Beaver Dam Brook is a wetland surrounded headwater system and not a forested headwater system, we expected the stream structure and function at TFSA will not follow RCC expectations. By monitoring and assessing the physical, chemical, and biological conditions of TFSA, we will provide

some picture of the conditions during passive restoration which will be useful for future restoration projects and the establishment of expectations.

Alan D. Christian, Associate Professor, School for the Environment, University of Massachusetts Boston

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Session #2

Track 1: Anadromous Fish and Connectivity.

Post-dam removal monitoring of active and passive restoration approaches

Paul Woodworth, Princeton Hydro; Laura Wildman, Princeton Hydro; Anna Marshall, Save the Sound; Gwen McDonald, Save the Sound.

With thousands of obsolete and failing dams that are being considered for removal across the country, there is a great need to achieve ecological restoration goals cost-effectively. Balancing passive and active approaches to sediment management and channel restoration can achieve restoration goals while lowering design and construction costs. A low-head dam in southeastern CT on Whitford Brook was heavily sedimented in and supported a diverse wetland complex and bifurcated river channel. Past experience with dam removals showed that the existing vegetation would stabilize the majority of impounded sediment and the wetland complex would adjust gradually following removal. Removed in 2015, the dam removal design proposed excavating a pilot channel to balance the conflicting regulatory concerns of (i) downstream sediment release and (ii) storing sediment onsite. Post-dam removal monitoring survey data, photos, and drone footage will be presented to depict the gradual release of impounded sediment, geomorphic adjustment, and wetland vegetation transition. This project represents an important real-world example for both practitioners and the regulatory community to apply to future projects.

Bio: Paul M. Woodworth, Princeton Hydro. Focused on removing obsolete dams and restoring rivers, Mr. Woodworth has advanced over 50 barrier removal projects since joining Princeton Hydro in 2008. He is responsible for integrating fluvial geomorphology into the assessment and restoration of stream channels, wetlands, and floodplains.

Road-crossing culverts as ecological barriers to anadromous river herring migration

Derrick Alcott, UMass Amherst; Theodore Castro-Santos, USGS

Road-crossing culverts are a common feature of streams and rivers world-wide. These structures can serve as barriers to animal movement, resulting in habitat fragmentation. The existing body of literature focuses on physical features such as flow dynamics and whether or not the culvert is perched when assessing the passability of these structures. In this study, we present evidence that culverts can serve as ecological barriers to migration for anadromous river herring in a Massachusetts coastal stream.

Bio: Derrick Alcott is a PhD candidate at the University of Massachusetts Amherst in the Organismic and Evolutionary Biology Program. Derrick is advised by Dr. Theodore Castro-Santos

of the U.S. Geological Survey S.O. Conte Diadromous Fish Research Center. Derrick's dissertation focuses on river herring movement behavior around anthropogenic barriers to migration. He is also the current president of That's Life [Science] a graduate student run life sciences outreach blog.

Westchester County volunteer river herring survey

Victoria O'Neill, NYSDEC/NEIWPCC

River herring, alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*), are anadromous fish that spend the majority of their time in the Atlantic Ocean and only enter freshwater tributaries along the eastern seaboard of the U.S. during the spring to spawn. River herring populations have dwindled over the last hundred years due to overfishing, declines in water quality, and the creation of impediments, such as dams, along tributaries that prevent access to freshwater spawning grounds. Many of these dams no longer serve their original purpose, such as harnessing water power for grain and textile mills or creating ponds for ice harvest. Despite these impediments, small, remnant runs of spawning herring do exist within New York waters. The Long Island Volunteer River Herring Survey (initiated in 2006 by the Environmental Defense Fund and continued to date by Seatuck Environmental Association) trains citizen scientists to monitor their local creeks every spring for spawning alewife and blueback herring. To date, volunteers have surveyed dozens of Long Island tributaries and, as a result, have found and reported several remnant spawning runs. This information has been critical in justifying and planning fish passage projects on Long Island. In 2018, the Long Island Sound Study and Save the Sound partnered to create the first ever Westchester County Volunteer River Herring Survey. The intention was to educate the public about herring and stream access, spur interest in local citizen scientists, and collect data on river impediments and remnant spawning runs. Although no river herring were reported during the 2018 Westchester County survey, the effort successfully attracted 12 dedicated volunteers who monitored 5 different locations and reported over 60 distinct observations. The data collected during this effort has provided new data that will inform future stream impediment assessments and the 2019 Westchester County Volunteer River Herring Survey.

Bio: Victoria O'Neill is the Long Island Sound Study Habitat Restoration & Stewardship Coordinator at New York State Department of Environmental Conservation/New England Interstate Water Pollution Control Commission. Victoria conducts activities associated with Long Island Sound Study funding, including preparing and evaluating project applications for habitat restoration, assessment, monitoring, and research funding. She develops partnerships to restore Long Island Sound habitats; works with regional staff to help partners prepare project workplans; and coordinates NYSDEC activities associated with the Long Island Sound Study Habitat Restoration and Stewardship workgroup. Victoria has an B.S in Biology from S.U.N.Y. Geneseo and an M.S. in Biology from the College of William & Mary.

Restoring alewife to the Bronx River, NYC

Danica Warns, NYC Parks; Marit Larson, NYC Parks; Rebecca Swadek, NYC Parks

The Bronx River, New York City's largest (and only) freshwater river, flows right through the heart of the Bronx. Years of industrialization, development, and pollution turned this once ecologically thriving river into a neglected wasteland. For decades, local organizations have been working with local communities to reclaim and restore the river. Over the past 30 years, the Bronx River

has seen improved water quality, and with it, the return of native wildlife and a renewed appreciation for this unique urban waterway. In particular, Alewife (*Alosa pseudoharengus*) was observed at the downstream-most impediment in the early 2000s. NYC Parks, in partnership with the Bronx River Alliance, the Wildlife Conservation Society, NOAA, and several other local groups, are working to restore habitat through the design and construction of steep-pass fishways that allow Alewife to access upstream freshwater spawning habitat when dam removal is not possible. In 2015, NYC Parks constructed the first fishway at the E 182nd Street Dam. The first Alewife was observed traversing the passage through video monitoring on April 11, 2017 and the river was stocked with 400 Alewife from Bride Brook, CT later that month; stocking will occur annually to supplement the population, until a sustainable size is reached. Since 2017, over 230 Alewife have traversed the dam, 158 in 2018 alone. Engaging local partners and volunteers, NYC Parks continues to monitor annual use of the fishway and the success of the stocked Alewife and their offspring. Additionally, we are currently advocating for the installation of additional fishways at the remaining upstream barriers to further connect and restore the river. In addition to the restoration of an ecosystem, those living within Environmental Justice-designated and historically under-served Bronx neighborhoods have been reconnected with local nature and, working together, have witnessed the return of fish, birds, and even beavers to the Bronx River.

Bio: Danica Warns is a part of the Wetland Restoration Team at NYC Parks' Division of Forestry, Horticulture and Natural Resources, which manages over 5,000 acres of wetlands throughout New York City. With a B.S. in Marine Sciences and a M.A. in Marine Conservation and Policy, both from Stony Brook University's School of Marine and Atmospheric Sciences, Danica works where the city's freshwaters meet the coast, restoring and protecting habitat for migratory fish.

Track 2: Coastal Communities.

Urban oases in the New Haven Harbor watershed: Community-based land stewardship to benefit wildlife and human health

Blake, Katherine, Audubon Connecticut; Holsenbeck, Suzannah, Common Ground High School, Urban Farm and Environmental Education Center; Huminski, Suzie, Southern CT State University

The Urban Oases Program in the New Haven Harbor Watershed improves and conserves important stop-over habitat for migrating songbirds and creates healthy and accessible urban green spaces for people to enjoy. A suite of partners through the Urban Wildlife Refuge Partnership are bringing this project to life across New Haven: Audubon Connecticut, Common Ground High School, Urban Farm and Environmental Education Center, the U.S. Fish and Wildlife Service, the New Haven Urban Resources Initiative, Southern CT State University, the Yale School of Forestry, New Haven Departments of Education and Parks, Recreation and Trees, the Yale Peabody Museum, a citizen advisory council, and local neighborhood groups. Together, we are creating a network of oases for birds and people in municipal parks, schoolyards, and vacant lots across Connecticut.

We will highlight two programs being implemented by this partnership – the Schoolyard Habitat and Urban Oases Programs. The Schoolyard Habitat Program is a place-based environmental model that creates habitats, trains teachers and connects students to the natural environment. The Program is an initiative in partnership with the U.S. Fish and Wildlife Service that develops healthy schoolyard habitats for both children and wildlife and integrates place-based environmental education into the school curriculum.

The Urban Oases Program is an innovative model of community-based conservation that engages multiple stakeholders in the creation of healthy, sustainable communities, particularly in underserved neighborhoods. There are four urban oases sites and 3 schoolyard habitats within a half mile of the SCSU campus. This project focuses on habitat restoration and stewardship, citizen science, advocacy, education, and outreach in the Greater New Haven region.

Bios: Katherine Blake is the Bird-friendly Communities Manager for Audubon Connecticut. She manages Audubon's Urban Oases, Schoolyard Habitat and Plants for Birds Programs. She works with numerous partners in creating bird friendly communities in Connecticut schools, parks and yards. Katie coordinates activities and communications among partners implementing urban oases sites and schoolyard habitats as the partner lead for the Urban Wildlife Refuge Partnership. She also educates communities on the benefits of bird-friendly landscaping. Prior to joining Audubon, Katie was the Coordinator for the MassConn Sustainable Forest Partnership. Here she conducted forest landowner outreach and managed forest protection initiatives. Early in her career, Kate spent 10 years studying various bird populations on numerous research projects around the world. Katie has a Master's in Conservation Biology from Antioch University New England and a B.A. in Environmental Studies from Mount Holyoke College.

Suzannah Holsenbeck oversees all components of the CT Schoolyards Program of Common Ground High School Urban Farm and Environmental Education Center, including the School Garden Resource Center, the Schoolyard Habitat Programs, and partnerships with schools and other community organizations. She is responsible for steering the CT Schoolyards work and launching new and innovative programming such as the CT School Garden Awards Program and our seasonal Farm & Garden Institutes. Before coming to Common Ground, Suzannah spent over ten years as an administrator and teacher in a variety of public schools in New Haven, CT, Boston, MA and the Rosebud Reservation in South Dakota. She also spent time learning how to be an organic farmer at The Farm School in Athol, MA. She has a B.A. in English Literature from Yale and an M.Ed. in Urban Education from the Harvard Graduate School of Education. She serves on the Board of the Ulysses Grant Foundation and The Mountain School of Milton Academy.

New Haven Long Wharf living shoreline and salt marsh enhancement

Hande McCaw, PE, GZA; Paul Davis, PhD, GZA; Daniel Stapleton, PE, GZA

GZA has been working with the City of New Haven since 2015 to study and implement a flood protection for Long Wharf district which has suffered erosion loss as part of recent storm events. As a vital public coastal access to nearly a mile of coastal waterfront in an urban setting, New Haven has targeted protection of the public resource with coastal resiliency and ecological restoration as primary goals for the project. The project has evolved through design project alternatives that alleviated coastal flood risk that are also relevant to the character of the neighborhoods/district areas.

A detailed flood vulnerability analysis determined primary flood-risk locations and coastal flood elevations associated with different return period storm events and sea level rise. Existing coastal habitat and biological resources were characterized to examine options for enhancement of geomorphologically appropriate design. An integrated/hybrid flood protection system at the flood prone shoreline was designed including "dune" systems, augmented salt marsh habitat and oyster reef. The City has actively been working with the regulatory community in partnership to advance this project to permitting and implementation stages. The regulatory approach for

allowing and supporting such living shoreline projects is necessarily evolving to consider such projects along and within existing habitats protected under existing regulations. Therefore, a continued working partnership between stakeholders, municipal, state and federal entities is critical to allowing creative and beneficial living shoreline resiliency projects, for this and other similar projects.

Bios: Ms. Hande McCaw, P.E. is a senior coastal engineer with GZA based in the Norwood, MA office with >10 years of coastal experience. She has a M.S. in Coastal and Oceanographic Engineering from the University of Florida and B.S. in Civil Engineering from Middle East Technical University. Ms. McCaw provides beach and shoreline transformation and restoration, storm surge/wave/sediment transport numerical modeling expertise as well as technical modeling support, staff training and project management for GZA's coastal hydraulics and extreme flooding practice. Ms. McCaw has worked on numerous feasibility studies and beach management plans, for locations in the eastern U.S. coastline. She has also performed numerous coastal analyses and assessments including wave hindcasting, storm surge analysis, numerical along and cross-shore change modeling and shoreline recession analysis. Her numerical modeling experience also includes wave transformation, circulation and sediment transport modeling.

Paul Davis is a Principal Ecologist at GZA GeoEnvironmental Inc. in the Springfield, MA office since 1986, with a PhD in Biological Studies from the URI and Masters Degrees in Zoology and Environmental Policy. He is lead for Natural Resources & Ecological Services at GZA, with > 50 professional scientists in 11 offices. He has certifications in wetlands (PWS), ecological restoration (CERP), and soils (CPSS). He has >30 years experience with wetland and aquatic resource assessment, ecological restoration, soil science, water quality, impact minimization/mitigation design and permitting. His work includes assessment, design, permitting and construction monitoring of aquatic, wetland and terrestrial ecological restoration projects, primarily in MA and CT.

Salt marsh restoration in NYC: Assessment of condition and recommendations for future design and monitoring

Christopher Haight, NYC Parks; Rebecca Swadek, NYC Parks; Novem Auyeung, NYC Parks; Marit Larson, NYC Parks

In the last century, over 80 percent of the salt marsh in New York City (NYC) has been lost due to development, pollution, and accelerated sea-level rise. These wetlands are an invaluable natural resource that provides habitat for many species, filters pollutants, protects shorelines, and offers open space and opportunities for education and recreation for local communities. Since 1991, dozens of restoration projects have restored over 200 acres of salt marsh across NYC. Many of these restorations have been conducted by the NYC Department of Parks & Recreation (NYC Parks) or by other entities on NYC Parks' land. To better learn from nearly 20 years of restoration practice, NYC Parks conducted a study to assess the condition of salt marsh restoration projects on parkland. At 22 salt marsh restoration projects constructed between 1995 and 2013, we examined vegetation cover, stem height, benthic fauna abundance, plant biomass, soil properties, creek geomorphology, and the change in vegetated footprint over time. We compared these parameters to those at adjacent, naturally occurring marshes. We also spoke with restoration project manager to learn more about project challenges. Overall, we found that restored marshes achieved restoration objectives. In particular, the vegetated footprint of native species had less than 20 percent reduction on average in the past 20 years. However, other

processes are slower to develop in restored sites compared to reference sites such as soil organic content and belowground biomass, which take multiple decades to develop. Based on this information, we developed updated recommendations for urban salt marsh restoration design and monitoring. Salt marsh restoration in a highly urban environment like NYC continues to be a vital tool, together with other conservation actions, to help protect this diminishing resource, and on-going review of sustainable practices are critical in the face of on-going impacts, including sea level rise.

Bio: Christopher Haight is an ecologist and project manager with NYC Parks Division of Forestry, Horticulture, and Natural Resources where he conducts restoration monitoring in salt marshes, freshwater wetlands, and grasslands. Chris has 9 years of experience working in salt marshes and conducting field research. He has a BA in Environmental Studies from Connecticut College and an MA in Conservation Biology from Columbia University.

Impacts of sea-level rise on salt marsh productivity: Can thin-layer placement help?

Andrew Payne, Department of Natural Resources and the Environment, The University of New Hampshire, Durham, NH; David Burdick, Department of Natural Resources, Jackson Estuarine Laboratory, Durham, NH

Salt marshes, valued for their ecosystem services such as flood control, carbon capture, and nutrient cycling are currently under threat of drowning due to sea-level rise. Marshes build in elevation through growth of roots and rhizomes belowground and deposition of sediments aboveground, but this growth is unable to keep pace with sea-level rise in the majority of marshes in the United States. Using marsh organ experiments, researchers have shown that aboveground growth is impaired at high rates of flooding, but effects on belowground growth is less understood. The application of a thin layer of sediment to the marsh surface (thin-layer placement) is a potential mitigation tool for increased flooding, but its effects on plant growth and elevation gain are understudied, especially in New England marshes. Using a novel application of the marsh organ, we found that belowground production decreased linearly as flooding duration increased for both *Spartina patens*, and *Spartina alterniflora*. The addition of 10cm of sand to plant pots resulted in fewer stems for both species. Thin-layer placement also impaired productivity at higher elevations for both species, but had no effect at lower elevations. Although these differences were not statistically significant, they suggest that thin-layer placement may harm plants at higher elevations if too much sediment is applied, at least in the short-term. However, productivity at lower elevations recovered from sediment addition as quickly as two months, indicating thin-layer placement is a promising method for reducing marsh loss if applied correctly.

Bio: Andrew Payne is currently finishing up his master's degree in Natural Resources at the University of New Hampshire. He studies the mechanisms of belowground plant growth and sediment deposition that historically have allowed marshes to maintain elevation relative to sea level. His aim to better understand the effects of sea level rise on marsh habitat loss and to aid in restoration strategies.

Track 3: Restoration of a Cranberry Bog—Tidmarsh Farms.

Leveraging learning: Living observatory and ecological restoration of former cranberry farms

Glorianna Davenport, Living Observatory

Ecological Restoration provides a potential exit strategy for cranberry farmlands in South Eastern Massachusetts. The Eel River (completed 2010), Tidmarsh Farms Restoration Project (completed 2016) and a restoration that is currently in planning for the Foothills Preserve provide sequential examples of an ecological restoration methodology that can scale. Steps for a successful exit include the decision to conserve the land and a plan for realizing the restoration. This plan is best framed in partnership with federal and state agencies, municipalities and NGO's who can help the leverage the property's potential and identify resources to help realize the plan. However learning from past ecological restorations is critical to improving techniques and methodologies for future restorations. Living Observatory (LO), a non-profit distributed co-laboratory, was founded in 2011 in part to address the well-understood deficit in monitoring and learning associated with such projects and to bring the "Arc of Change" story to the general public.

Bio: Glorianna Davenport is a Founder and President of Living Observatory and a founding Member of the MIT Media Laboratory (Cambridge MA). As a trustee of Tidmarsh Farms, she managed the effort to transition the farms out of cranberry production and to ecologically restore the wetlands. Trained as a filmmaker, Davenport works with Living Observatory collaborators on the development of a platform and techniques to help scientists record and the public explore "the arc of change" across restored landscapes.

How will we know what worked? Measuring moisture and hydrology in a cranberry bog and future wetland

Christine Hatch, Umass Amherst; Erika Ito, UMass Amherst; Michael Cosh, USDA-ARS; Luke McInnis, UMass Amherst; Marie Maxwell, Amherst College

The Foothills Preserve in Plymouth, Massachusetts offers a unique opportunity to study first-principle measurements of hydrologic parameters that drive an engineered hydrologic system across time and space from operating farm with intensive water control and management, through fallow conditions, and into future wetland preserve. For this project, we focus our exploration on groundwater flowpaths, surface water mixing, underground thermal regimes and soil moisture monitoring to map out the interconnected web of hydrology and ecology beneath the surface ultimately to help guide wetland restoration practices and management.

In order to assess the effectiveness of specific practices, we must first characterize the existing hydrology of the fallow cranberry bog prior to any interventions (scheduled for late 2019). To do this, we collected soil water samples from 18 piezometers (screened in the underlying peat as well as the farm-surface sand) and surface streams and springs, and analyzed these for temperature, basic water chemistry and water isotopes. We measured soil moisture with gravimetric samples at four depths (0-5, 5-10, 10-20 and 20-30cm) and with a field probe at 71 locations. We monitor temperature at root-zone depths of 10, 20 and 30 cm along a 900-meter-long transect using fiber optic DTS to identify moisture and GW conditions. Finally, we installed a long-term station to measure weather and soil moisture variables. These studies are coupled with surface vegetation monitoring, that will connect underlying hydrologic and thermal conditions with vegetation expression at the surface over time.

Comparison of field probe soil moisture data across a restored site to data across the pre-restoration site shows promise, monitoring will continue through restoration of the current site. In addition, work is ongoing to analyze detailed elevation changes from micro-topography disturbance, and compare it to the resulting surface moisture regime.

Bio: Dr. Christine Hatch is Research-Extension Liaison for the Center for Agriculture, Food and the Environment (CAFÉ), and Extension Associate Professor in the Geosciences Department of at UMass Amherst. She is currently an Associate Editor of Water Resources Research. Dr. Hatch's research focuses on using heat as a tracer and DTS to assess movement of water in hydrologic systems, including SW-GW interactions, soil moisture, and thermal refugia. A founder of RiverSmart Communities, she supports managing watersheds in ways that allow rivers to function as whole, integrated systems at once sensitive to ecological continuity, flood prevention and community resilience. As the USDA Climate Hub liaison for Massachusetts, she is investigating the broader impacts of stream temperatures and other water resources issues under changing climate conditions through her coordination of the Eureka! Program with girls inc. of Holyoke among others.

The effects of ecosystem restoration on community and landscape biodiversity in southeastern Massachusetts headwater streams: A case-study of Tidmarsh Farms cranberry bog restoration

Sean T. McCanty, University of Massachusetts Boston; Alan D. Christian, University of Massachusetts Boston

Streams are dynamic systems shaped by geographic location, hydrology, riparian vegetation, and in-stream habitat. Furthermore, ecosystem disturbance plays a major role in structuring stream communities and ecosystem processes. Disturbances include natural occurrences, such as flooding, drought, and fire events and anthropogenic disturbances such as land use changes, damming, and pollution. Agricultural use acts as a press disturbance regime, homogenizing the surrounding landscape and simplifying in-stream habitat, leaving legacy effects after farming ceases. Active restoration is intended to ameliorate these effects by reintroducing variation, with the goal of shifting the ecosystem into a more diverse and natural state. The act of restoration therefore is acts as a pulse disturbance, attempting to shift the community from one system state to another. In our study, we used a Before-After-Control-Impact (BACI) design to investigate the effects of disturbance regimes on structural, compositional, and functional attributes of macroinvertebrate and habitat/ecosystem biodiversity in a least-impacted stream system, an active flow-through cranberry bog system, and a restored flow-through cranberry bog system in Southeastern Massachusetts from 2015-2017. Overall, we expected a compositional shift in the restored treatment away from the active cranberry bog and towards the least disturbed system, however, the restored treatment is likely to achieve an alternative stable state, at least in the immediate future.

Sean T. McCanty, Biology Department, University of Massachusetts Boston

Amphibian and reptile diversity at Tidmarsh Mass Audubon Sanctuary

Thilina Surasinghe, Department of Biological Sciences, Bridgewater State University, MA; Kim Tochhio, Department of Biological Sciences, Bridgewater State University, MA; Brett Sheehan, Department of Biological Sciences, Bridgewater State University, MA; Dan Venuto, Department of Biological Sciences, Bridgewater State University, MA; Nikki Montanaro, Department of Biological

Sciences, Bridgewater State University, MA; Victoria Schneider, Department of Biological Sciences, Bridgewater State University, MA; Amanda Deguire, Department of Biological Sciences, Bridgewater State University, MA; Ashley Zimmerman, Department of Biological Sciences, Bridgewater State University, MA; Gene Albanese, Massachusetts Audubon Society, MA.

Wetland destruction is among the major environmental issues in the US, which can be attributed to decades of urbanization, infrastructure development, and industrial agriculture. Recognition of ecosystem services provided by wetlands and science-based environmental policies have led to substantial efforts in wetland restoration throughout the US. Among restored wetlands in MA, Tidmarsh Mass Audubon Sanctuary is unique, particularly given the strategic location in the Narragansett/Bristol lowlands and the availability of suitable habitats to native amphibians and reptiles. In this study, our specific objectives are to (1) inventory species richness of herpetofauna; (2) study their habitat associations; and (3) to establish a long-term herpetofaunal monitoring protocol. We use multiple standardized techniques in this survey: cover boards; funnel traps, hoop traps, crab traps, and minnow traps; call surveys; and visual encounter surveys. Currently, our species-checklist includes 12 species of amphibians (American bullfrog, green frog, wood frog, spring peepers, northern leopard frog, grey tree frog, American toad, Fowler's toad, pickerel frog, spotted salamander, four-toad salamander, and eastern red-backed salamander) and 11 species of reptiles (eastern painted turtle, common musk turtle, common snapping turtle, eastern box turtle, spotted turtle, black racer, common garter snake, ribbon snake, ring-necked snake, eastern hognose, pond slider). The current herpetofaunal assemblage at Tidmarsh is comparatively lower than the regional amphibian and reptile species pool. This indicates that Tidmarsh is still being colonized by herpetofauna and the species accumulation will likely continue as both habitat structure and functions at Tidmarsh reach its ecological equilibrium. We will continue our surveys across multiple years to fully appraise the species composition and habitat associations of herpetofauna at Tidmarsh.

Bio: Dr. Surasinghe is a wildlife ecologist with specialization in landscape ecology and conservation biology. Currently, he serves as an Assistant Professor in the Dept. of Biological Sciences at Bridgewater State University. His research focuses on community organization and biotic homogenization along urban-rural gradients; impacts of current and historical land uses on stream and wetland ecosystems. landscape-scale conservation planning; ecology of freshwater ecosystems; and exploring tropical biodiversity and conservation potential in "trees-outside-forests".

Session #3

Track 1: Freshwater Restoration in Practice.

An alternative method for wetland restoration in a changing climate

Gillian Davies, BSC Group, Inc., Melissa Kaplan, BSC Group, Inc., Mickey Spokas, Stockbridge School of Agriculture and Department of Environmental Conservation, University of Massachusetts, Michael Toohill, BSC Group, Inc.

In an effort to incorporate emerging scientific knowledge regarding the interactions between wetlands and climate change into wetland restoration and creation, and to achieve greater ecological function while potentially reducing design and construction costs, an innovative wetland construction methodology was applied to a Massachusetts electric transmission line Right-of-Way (ROW) project. This methodology translocated intact soil and vegetation from an impacted "donor" wetland directly to the restoration and creation site (replication site), thereby minimizing disturbance to soil, microbial and vegetative structure and function and reducing temporal wetland loss. The experimentally constructed site included areas of wetland restoration as well as areas of wetland creation. A traditionally constructed replication site, also including both wetland restoration and wetland creation areas, was constructed immediately adjacent to the experimentally constructed replication wetland. Additionally, an adjacent undisturbed wetland was utilized as a reference wetland. These areas were monitored and evaluated at the end of the first growing season.

Massachusetts experienced a drought during the 2016 growing season (first growing season). The experimentally constructed wetland appeared to withstand the drought better than the traditionally constructed wetland. Thus, translocating blocks of vegetation and soils from impact site to replication site appears to enhance climate change resiliency, while also protecting ecosystem carbon, improving ecological function, reducing temporal loss of wetland function, and reducing project costs. The time necessary for the translocated wetland to meet regulatory success was significantly shorter than that of the traditionally planted replication site. In addition, the translocated wetland resulted in reduced costs because there was no need to purchase nursery stock and manufactured soil or manage the construction site for erosion.

Bios: Gillian T. Davies, PWS, registered Soil Scientist (SSSSNE), Senior Ecological Scientist/Associate, BSC Group, Inc, Worcester, MA. Gillian provides a broad range of ecological consulting services (e.g. ecological climate resiliency, wetland restoration and creation, permitting, peer review, environmental monitoring, expert witness testimony), and manages projects, focusing on providing innovative solutions that often incorporate the latest research on wetlands and climate change. She co-authored the recently published Wetlands In a Changing Climate: Science, Policy and Management and has just completed a 3-year term on the international Society of Wetland Scientists Executive Board. She served as the Society's President from 2016-2017, and is now a Visiting Scholar at the Tufts University Global Development and Environment Institute. Gillian holds a Masters of Environmental Studies from the Yale School of Forestry and Environmental Studies and a Bachelor of Arts from Williams College.

Melissa G. Kaplan, PWS, Senior Project Manager/Wetland Scientist, BSC Group, Inc, Worcester, MA. Melissa leads BSC project teams in local, state, and federal permitting efforts, wetland delineations, threatened and endangered species surveys, feasibility studies, and environmental monitoring of construction activities for large-scale utility companies, solar developments, municipal projects, and others. Ms. Kaplan holds an MS in Marine Biology, a BS in Zoology, several professional certifications, and she has sixteen years of professional environmental and biological consulting experience. She routinely leads BSC project teams in providing environmental consulting services from the early coordination phase to permitting phase to the final construction monitoring phase for numerous projects throughout Massachusetts, Rhode Island, Connecticut and New Hampshire. Melissa holds a Master's of Science in Marine Biology from Nova Southeastern University and a Bachelor of Science in Zoology from University of Florida.

Michael Toohill, PWS, CE, CERP, Sr. Project Manager/Associate, BSC Group, Inc., Co-Founder/Board Member, New England Chapter, Society for Ecological Restoration and SER Restoration Practitioner Certification Program. Mike is an environmental scientist with over thirty years of experience in environmental impact evaluation and mitigation design. Mike leads interdisciplinary teams on complicated infrastructure and land development projects for both public and private sector clients. Mike has a broad background in many facets of environmental impact assessment including terrestrial and aquatic ecology, ecological restoration, impact assessment, wetland delineation and mitigation design, and habitat evaluation. Mike routinely works on large, linear infrastructure projects and has presented on various topics at past conferences for ESA, SER, AWWA, and other organizations.

Flood mitigation design to project communities and restore anadromous fish migration: A case study of Aberjona River flood mitigation program.

Ryan Lizewski, VHB

The Town of Winchester, located in Massachusetts approximately 10 miles northeast of Boston, has experienced numerous devastating floods which have imperiled public safety, disrupted businesses and schools, and led to over $25 million in estimated economic losses since 1996. Winchester is located within the Mystic River watershed and the Aberjona River is the primary source of flooding within the Town. The Town has since conducted an exhaustive study and developed a suite of flood mitigation projects to reduce the magnitude and duration of flooding within the Town. Furthermore, the mitigation program has the unique opportunity to also help restore one of the largest herring migrations in the Commonwealth of Massachusetts.

The Mystic and Aberjona River ecosystems historically supported a significant mitigation route and provided spawning habitat for many anadromous species including the Blueback herring (*Alosa aestivilis*) and Alewife (*Alosa pseudoharengus*). Over the past century the extensive development and urbanization of the watershed, culverting streams, construction dams, and filling of floodplain and wetlands have not only contributed to increasing flood risk to the community but has also been a barrier to migration and spawning of the herring and many other aquatic species.

The suite of projects in the flood mitigation program include river widening, dam/spillway modifications, culvert/bridge improvements, and fish ladder retrofits. After completion of the program, the program will have removed approximately 150 properties from the 1-percent annual chance floodplain and reduced base flood elevations by up to 4.0- feet within Winchester. Already with 12 of the 14 projects completed, herring have returned in record numbers to the Aberjona River and into upstream spawning habit.

Bio: Ryan Lizewski, PE is a Water Resources Engineer at VHB specializing in fluvial geomorphology, surface hydrology, riverine hydraulics, culvert/bridge scour, and floodplain management.

Reconnecting our streams

Megan Lung, NYS DEC Hudson River Estuary Program and New England Water Pollution Control Commission (NEIWPCC)

Road stream crossings within the Hudson River Estuary Watershed may serve as barriers to aquatic organisms moving up and down stream, contribute to habitat fragmentation and degradation and serve as costly hazards to communities during flood events. Using protocols developed by the North Atlantic Aquatic Connectivity Collaborative (NAACC) and in partnership with the New York State Water Resource Institute with Cornell University, the Hudson River Estuary Program (HREP) has provided interested municipal partners with an initial barrier assessment. Crossings are modeled for passibility, how easy it is for aquatic and riparian organisms to access up and downstream habit for various ecological functions. The crossings were also modeled for hydraulic capacity under current precipitation levels and projected into 2050 under the influence of climate change. The HREP shares this information back with interested town and county partners and encourages these partners to apply to NYS DEC or HREP grants to improve these crossings. From 2013-2017, the Culvert Prioritization Project has assessed over 1.2 million acres of the Hudson River estuary watershed, approximately 37% of the program boundary with a goal of completing assessments for 50% of the watershed for the 2020 Action Agenda. In providing communities with barrier assessments that identify crossings that are hazards from both an environmental and human viewpoint, the Estuary Program seeks to continue to be a resource for communities and their natural environments. The Project offers technical assistance, grant funding and web tools to aid municipalities and partner agencies in reconnecting streams to benefit organisms and communities. This talk will walk audience through the Estuary Program's process starting with creating a road-stream crossing inventory, municipalities prioritizing sites within the inventory, selecting sites to design, and construction.

Bio: Megan is a native of the state of Michigan but now works on behalf of the Hudson River and its tributaries in New York to support ecologically connected streams while balancing human community concerns such as flooding and development. She has been an Environmental Analyst for the New York State Department of Environmental Conservation Hudson River Estuary Program/New England Interstate Water Pollution Control Commission since 2015. Prior to this, Megan served in AmeriCorps for 2.5 years with the Student Conservation Association in Massachusetts, Wyoming and New York. Megan is a proud Michigan Wolverine and holds Bachelors of Science degrees in Ecology and Evolutionary Biology, and History from the University of Michigan.

River Run: DER's film outreach effort on restoration and resiliency in Massachusetts

Kristopher Houle, Massachusetts Division of Ecological Restoration

Beginning in 2015, in the wake of Hurricane Sandy, the Massachusetts Division of Ecological Restoration (DER) set out to remove ten dams that threatened public infrastructure, exacerbated local flooding, blocked access to habitat for fish and other species, and impaired the ecologic integrity of the Commonwealth's rivers. In an effort to demonstrate the community benefits

achieved through these dam removals, DER employed a multifaceted, statewide outreach strategy that included development of six dam removal short films. This presentation will touch on the key elements of urban dam removal and how challenges encountered during design and implementation can be leveraged to create effective tools for public outreach. The presentation will unveil and showcase one or more dam removal films highlighting how healthy rivers impart resilient communities and how broad partnerships lead to local action. Funding for this effort was provided in part by the U.S. Department of the Interior through a grant from the National Fish and Wildlife Foundation's Hurricane Sandy Coastal Resiliency Competitive Grant Program.

Bio: Kristopher Houle is a Project Manager and Ecological Restoration Specialist for the Massachusetts Division of Ecological Restoration. Kris has served on the SER New England Chapter board since 2014, first as the New Hampshire State Director and more recently as the chapter Treasurer. Kris is a registered Professional Engineer in Massachusetts and holds M.S. and B.S. degrees in civil/water resources engineering. Kris has over ten years of experience managing, designing, and overseeing implementation of restoration efforts in Massachusetts and New England.

Track 2: Restoring Resilience—The Big Picture.

Incorporating the social benefits of ecological restoration into planning, decision making, and monitoring

David Martin, U.S. EPA; Marisa Mazzotta, U.S. EPA; Justin Bousquin, U.S. EPA

Ecological restoration has traditionally been planned by evaluating ecosystem conditions, biodiversity, and production of ecosystem services, whereas evaluating the social benefits of restoration is uncommon. We present a decision-making approach to evaluate the social benefits of restoration, in terms of who benefits and by how much, to aid in comparing multiple courses of action in urban areas. Our approach was developed through a collaborative case study in the Woonasquatucket River watershed, which spans rural land to the urban city center of Providence, Rhode Island. We partnered with a non-profit watershed organization to prioritize dozens of candidate wetland restoration sites in terms of potential flood water retention, scenic landscape, education, recreation, bird watching, and social equity benefits. We developed 24 benefit indicators based on several site characteristics: beneficiaries, site access, complementary landscape features that potentially enhance benefits, landscape features that may substitute for site benefits, social vulnerability to stressors, and how reliably benefits will be provided into the future. We applied conceptual modeling and spatial analysis to estimate indicator values for each candidate restoration site. Lastly, we applied methods for multi-criteria decision analysis to rank the sites and help the organization prioritize strategies for writing grant applications to fund restoration in the watershed. Results indicate that restoration sites in urban areas can provide greater social benefits than sites in less developed areas. This research provides an alternative way of planning for ecological restoration to that of traditional planning studies. We close by emphasizing the need for empirical research into monitoring the social benefits of ecological restoration.

David M. Martin, U.S. EPA Office of Research and Development, Narragansett, Rhode Island

A discussion of stationarity, transformation and adaptive capacity in restoration and preservation practices

James Tait, Werth Center for Coastal and Marine Studies at SCSU

Due to thermal inertia produced by anthropogenic increases in atmospheric greenhouse gases, global climate change is locked in for most of the century with mitigation efforts mainly effecting outcomes at the end of the 21st century. As a result, changes in ecosystem baselines are inevitable and to some extent unpredictable. Temperature, precipitation and runoff regimes are being altered globally and will very likely continue to be altered in the future, most likely at an accelerated pace. This presents challenges to the notions of restoration and preservation in the sense of what to preserve and what the goals of restoration are. It has been suggested that, given the progressive and anticipated loss of the stationarity of the Holocene climate, a sensible goal might be to enhance the ability of ecosystems to adapt by removing anthropogenic influences such as pollution, physical barriers, habitat destruction, and introduction of alien species that might stifle such adaptation. Policies developed to achieve such goals should be dynamic in themselves, designed to evolve along with evolving ecological baselines. The growing phenomenon of citizen science could be used to provide the kind of data needed to create such responsive policies. The involvement of citizen science would also tend to raise levels of ecological awareness and concern within communities.

Bio: Dr. James Tait received a Ph. D. is Earth Sciences, with a specialty in coastal oceanography, from the University of California at Santa Cruz. His current research focuses on the coastal impacts of large storms such as Irene and Sandy. He is co-founder and co-coordinator of the Werth Center for Coastal and Marine Studies at SCSU. He has worked with coastal communities to develop resilience in the face of rising sea level and storm intensification.

A forest management framework for New York City

Helen M. Forgione, The Natural Areas Conservancy; Clara C. Pregitzer, The Natural Areas Conservancy and Yale School of Forestry and Environmental Studies; Kristen L. King, New York City Parks and Recreation, Division of Forestry Horticulture and Natural Resources ; Sarah Charlop-Powers, The Natural Areas Conservancy; Jennifer Greenfeld, New York City Parks and Recreation, Division of Forestry Horticulture and Natural Resources.

New York City's forested natural areas provide important benefits to the city including high-quality recreation, enhanced biodiversity, and improved air and water quality. The Natural Areas Conservancy (NAC) and the New York City Department of Parks and Recreation (NYC Parks) have developed a 25-year Forest Management Framework intended to guide the restoration, management and community engagement of NYC Parks' 7,300 acres of forested natural areas. The framework, NYC's first citywide forest management plan, is based on new comprehensive data marking the culmination of six years of research, data collection, and analysis by NAC scientists including ecological conditions and visitor perceptions and experiences. The framework categorizes the condition of forests in more than 50 parks across the five boroughs, based on metrics for ecological health and threat. Each condition category was correlated with best practices, staffing and contractual structures, and cost estimates. This approach facilitates the prioritization of future restoration activities, the ability to track changes in forest health over time, and the ability to estimate the level of investment needed to maximize ecological condition and visitor experience at the scale of a park, borough, or city. The framework calls for an investment

of $385 million over 25 years to ensure that the city's forests achieve their full potential for recreation and conservation.

Bio: Helen Forgione is the Senior Ecologist at the Natural Areas Conservancy, a nonprofit organization that restores and conserves the green and blue spaces of New York City in order to enhance the lives of all New Yorkers. Helen has established NAC's citywide assessment of NYC's natural areas including 10,000 acres of municipal forest, grassland and wetland. Helen has held previous positions at the NYC Department of Environmental Protection and NYC Department of Parks and Recreation and has over 25 years of experience working in ecology in the NYC metropolitan region. Helen holds a MS in Ecology and Evolutionary Biology from Rutgers University and a BS in Biology from the University of Connecticut.

The story of a unique partnership to restore the Fannie Stebbins Wildlife Refuge

Chris Polatin, Polatin Ecological Services, LLC; Karen Lombard, The Nature Conservancy

We will share the inspiring story of the Fannie Stebbins Wildlife Refuge, the largest remaining intact floodplain along the Connecticut River in the Town of Longmeadow, a suburb of Springfield, the 3rd largest city in Massachusetts. The Refuge is the site of an ambitious $400,000 floodplain forest restoration project that includes the reforestation of 30-acres of former agricultural land, invasive plant management and hydraulic restoration on 223 acres. The project represents a unique partnership between private conservation organizations (Allen Bird Club and Fannie Stebbins Memorial Wildlife Refuge, Inc.), NGO's (The Nature Conservancy), and federal agencies (USFWS Silvio O. Conte National Fish and Wildlife Refuge and USDA Natural Resources Conservation Service) who have worked together to first protect and now restore this unique place.

Bios: Chris Polatin, Polatin Ecological Services, LLC. Chris practices ecological restoration through his involvement with Land Stewardship, Inc. and Polatin Ecological Services, LLC. He has a BA in Environmental Studies (conservation science & natural history) (University of California Santa Cruz) and an MS in Conservation Biology (Antioch University New England). He is a Certified Ecological Restoration Practitioner through the Society for Ecological Restoration (SER). Chris co-chairs the Gill Conservation Commission (Massachusetts), serves as a board member for Friends of the Fannie Stebbins Wildlife Refuge, as New Hampshire director for SER – New England, and chairs the Certification Committee for SER.

Karen Lombard, Director of Stewardship and Restoration, The Nature Conservancy Massachusetts Chapter. Karen oversee land management and restoration for the MA Chapter of The Nature Conservancy (TNC). She leads a team that manages over 6000 acres of TNC fee land and monitors over 2,500 acres in conservation easement land. Current projects include initiation of and participation in a Sandplain Grassland Network to identify research and management needs in sandplain grasslands along the coastal plain of the Northeast, managing a restoration project to restore a floodplain forest along the Connecticut River and working to improve technology for stewards across TNC.

Track 3: Protecting and Restoring Native Species.

Freshkills anthropogenic succession study, Phase I: Deer cafeteria study

Rich Hallett, USFS; M Piana, USDA Forest Service, M Johnson, Rutgers University, B Simmons, USDA Forest Service, R Zalesny Jr., USDA Forest Service, B Swain, The Dawson Corporation

Background: Freshkills Park is a 890-hectare public park being built on top of a landfill reclamation project on Staten Island in New York City. The Freshkills anthropogenic succession study is a designed experiment that was installed "off cap" but is on top of a "legacy dump." The experimental goal is to test three planting palettes for their ability to out compete exotic invasive plant species and become established on a site with highly disturbed soils.

Methods: Palette 1 included willow (Salix spp.) and poplar (Populus spp.) genotypes selected using phyto-recurrent selection techniques; Palette 2 included a mix of 18 species of shrubs and trees selected by the NYC Department of Parks and Recreation for the site; Palette 3 was a 50/50 mix of Palettes 1 and 2. Twelve plots were established, 4 replicates per palette. The study area was not fenced and there are 135 deer per square mile on Staten Island. Tree growth and diameter were recorded along with mortality and deer browse severity.

Bio: Dr. Hallett applies remote sensing technology and early stress detection techniques to urban forests. His research takes information from plot level studies on forest health, productivity, and ecosystem function, which he uses to examine those issues at a landscape or regional scale. This means being able to work across paradigms, such as individuals and institutions that only trust ground-level data gathered at the tree itself, and those that want to incorporate the most advanced technology to view forests and ecological systems for thousands of miles with no human contact involved. He works to devise, develop, or modify techniques that allow us to expand our studies spatially while maintaining the necessary scientific rigor. This provides valuable information and new knowledge about the impacts of large scale phenomena such as acid rain, forest decline, and introduced pests and diseases.

Floodplain forest restoration, five years since planting - are we successful yet?

Julie Richburg, The Trustees (of Reservations)

The Bartholomew's Cobble Floodplain Forest Restoration and Habitat Improvement Project restored 10 acres of major river floodplain forest habitat and controlled invasive species on an additional 75 acres of habitat adjacent to the Housatonic River in Sheffield, MA. Three fields adding up to approximately ten acres were planted with more than 1,700 floodplain adapted trees to expand the extent of the Major River Floodplain Forest (a state designated priority habitat) on the property. We have been collecting information on which species, which fields, and which growing stock have survived the initial planting in 2013. In addition, the removal of invasive, non-native plant species has improved the habitats and protected the diversity of the natural communities at Bartholomew's Cobble, which provides habitat for more than 25 rare species. Both the increase in size of floodplain forest at the site and the control of invasive plant species in surrounding habitats is improving the resiliency and health of these priority habitats along the Housatonic River.

Bio: Dr. Julie Richburg is currently the Regional Ecologist for The Trustees (a state-wide non-profit land trust) in Massachusetts. She works on natural resource inventory and management for the 40 properties owned or managed by The Trustees in western MA. Julie has a Master's degree and

PhD in forest ecology from the University of Massachusetts Amherst where she studied the impacts of road salt on plant species within a calcareous basin fen natural community in Stockbridge and control of woody invasive plants using mechanical and prescribed fire treatments across the Northeast. In 2009, she organized a partnership of individuals, organizations, and agencies interested in invasive species control within the Westfield River Watershed. She is currently the chair for the Massachusetts Invasive Plant Advisory Group.

Emerging new invasive species threat, the hardy kiwi vine (*Actinidia arguta*). Survey efforts for *Actinidia arguta* in Berkshire County, Mass and the first large-scale control project at Kennedy Park and Pleasant Valley Sanctuary, Lenox, Massachusetts

Jess Toro, Native Habitat Restoration

Hardy Kiwi vine (*Actinidia arguta*) is a non-native, invasive plant that threatens the forests of Western Massachusetts. Hardy Kiwi vine can grow over 20-35 feet/year and forms dense mats of intertwining vines that can overwhelm other vegetation, including trees. The weight of the vines during the growing season in addition to snow and ice loading on the vines breaks down the tree canopy, creating "amphitheaters" of only kiwi vine. Because Hardy Kiwi has not yet spread extensively, a coordinated effort to rapidly detect and control establishing populations occurred in 2017-2018. One of the largest known infestations in New England is found on two adjacent properties, Kennedy Park and Pleasant Valley Wildlife Sanctuary in Lenox, Massachusetts. The first large-scale control of the Hardy Kiwi vine was initiated through partnership of the Town of Lenox, MassAudubon and the Mass Natural Heritage and Endangered Species Program in 2015. Between 2016 to 2018, the project focused treatment of 160 acres of patches of kiwi vine across 450 acres. Native Habitat Restoration will present the approach for survey efforts for Hardy Kiwi in Berkshire County, as well as control results from the treatment efforts of this species.

Bio: Jessica Toro is the co-owner of Native Habitat Restoration based in Stockbridge, Mass. She has designed and implemented many invasive control and restoration efforts over the past 20 years. Prior to starting Native Habitat Restoration, Jessica worked for 11 years at the Nature Conservancy as the Conservation Program Manager of the Berkshire Taconic Landscape. Both at The Nature Conservancy and at Native Habitat Restoration, Jessica designed the restoration of floodplain forests, woodlands, and riparian areas as well as specializing in projects to improve rare wetlands and critical habitat for federally listed species.

Enhancing and restoring habitat for wildlife on small and large acreages: Native plants and wildlife are inextricably linked

Peter Picone, CT DEEP Wildlife Division

Habitat managers can improve biological diversity by encouraging native vegetation which has co-evolved with wildlife and by managing invasive non-natives both on small and large acreages. Enhancing or creating wildlife habitat requires understanding a species food, water, cover and space needs. There are approximately 1800 native plant species in Connecticut that create the plant communities which wildlife depend upon. I will show examples of utilizing native plants to provide seasonal habitat components for a variety of wildlife and improving/restoring site conditions for native plants through the management of selected invasive non-natives on state-owned and privately-owned property. I will highlight practical habitat enhancements completed at Sessions Wood Wildlife Management Area (764 acres) in Burlington, Connecticut and Charter Oak Tree Farm (40 acres) in Sprague, Connecticut.

Bio: Peter Picone is a wildlife biologist for the Department of Energy and Environmental Protection's Wildlife Division. He has a B.S. from the University of Connecticut's College of Agriculture and Natural Resources. He has worked as a wildlife biologist for the past 27 years and has experience managing and enhancing habitats on state-owned land and his 40 acre private property at Charter Oak Tree Farm in Sprague, CT.

POSTERS

Marsh morphosis: A climate-responsive and adaptive design framework for habitat restoration and recreation in the Rumney Marsh Reservation

Sadiqa Ansari, Landscape Designer

The Rumney Marsh Area of Critical Environmental Concern (ACEC) has been characterized by the U.S. Fish and Wildlife Service as one of the most biologically significant estuaries in Massachusetts north of Boston. The area includes approximately 1000 acres of highly productive saltmarsh, tidal flats, and shallow sub-tidal channels. The purpose of this Master's capstone project was to develop a landscape design strategy for the marsh that will integrate research and design focused on improving habitat, creating recreational opportunities and mitigating the long term impacts of climate change. A brief evaluation of existing case studies on wetland development was developed as a matrix to guide on the framework needed for the research and learn how other projects address these issues. Body of literature from fields such as wetland restoration, urban ecology, landscape design etc. was also reviewed as a means to provide useful information regarding how wetland systems work and also behave in an urban context. A thorough analysis of the site's quantitative and qualitative data was done to facilitate the process through which the design strategy can take place, focusing on the marshland by extending programs from the surrounding social context, while at the same time, enhancing its ecological value, and prepare for climate change. By developing such strategies that are in tune with the environment and sensitive to the natural systems, the proposal will try to establish design interventions to allow access and recreational opportunities while enhancing the marsh landscape community and ecology. Through this project, an experimental method is developed to create an open space strategy that is capable of supporting the diverse social interactions and ecological demands of such a wetland system.

Bio: My name is Sadiqa Ansari. Having completed my undergraduate degree in architecture in 2010 from India, I worked for five years in various design firms. This professional experience motivated me to gain an insight into the landscape design process. I recently graduated from Penn State and I am a landscape designer. For my capstone design and research, I worked on a climate responsive and adaptive design framework for the Rumney Marsh Reservation. Eventually, having had the exposure towards lateral thinking, I would like to go back to my homeland and strive to inculcate more sensitivity and awareness towards designing for people and the environment.

Ecological responses to restoration actions: Plant community shift in response to grass-specific herbicide

Leland Bennion, University of Pittsburgh; Janette Aryana Ferguson, Field Botanist; Cheryl Schultz, Washington State University

Invasive species alter ecosystem structure, impact biodiversity through extirpation and extinction, and have significant economic costs. In Oregon's Willamette Valley, the invasive grasses *Arrhenatherum elatius* and *Lolium arundinaceum* alter the dynamics of phenologically-paired interactions between an endangered butterfly, *Plebejus icarioides fenderi* (Fender's blue), and its larval hostplant, *Lupinus oreganus* (Kincaid's lupine). To restore this interaction, we established a three-year experiment where post-emergent grass-specific herbicide, fluazifop-p-butyl, was applied to known Fender's blue habitat. Plant community data were recorded throughout the growing season at eight paired plots for one year prior to treatment and three years during treatment. We asked whether the annual application of herbicide could reduce the height of invasive grasses to levels at or beneath the height of the racemes of Kincaid's lupine throughout the Fender's blue flight season. We hypothesized that following the release from the competitive dominance of the invasive grasses, native nectar sources for Fender's blue and forb species would increase in cover and frequency. Grass-specific herbicide reduced grass height during the flight season of Fender's blue, but with several costs to plant systems community. We found no change in native nectar resources and a reduction in lupine growth in plots that had been treated with herbicide. Each study site had multiple secondary invaders during the three years of treatment; the long-term impact of these new invaders is unknown. We suggest that herbicide application results in a net negative effect in the context Fender's blue habitat restoration, the costs to primary resources for Fender's blue and the influx of secondary invaders may be as problematic as the primary target invasion by non-native grasses.

Bio: Leland completed his M.S. in Biology in 2018 as a member of the Schultz Conservation Biology lab at Washington State University. His thesis work focused on evaluating the effects of treatments for invasive species in the habitat of the endangered Fender's blue butterfly. More specifically, he evaluated how the target and non-target effects of taxa-specific herbicide application altered the availability of critical resources for Fender's blue and whether these changes in habitat could result in a net gain for the population. He is currently working as a Research Technician in the Kuebbing lab at the University of Pittsburgh. He is excited to learn much about the region and its flora. Leland loves exploring the backcountry, traveling the back roads and trying new things.

Urban stream restoration: Material processing and conveyance channels

Madeline Berg, James Madison University; Christine May, James Madison University

Stream restoration is gaining popularity in the Mid - Atlantic region to offset impacts from urbanization, such as increased levels of impervious surfaces and decreased vegetation along stream banks, changing the flow patterns of the water. Due to these changes urban stream systems have high erosion rates resulting in increased nutrients into the Chesapeake Bay. Different restoration practices such as conveyance and material processing channels can play a role in the amount of nutrients leaving streams. Conveyance channels are constructed to protect existing utility and infrastructure placed adjacent streams from erosion. This practice prioritizes channel stability and may result in reduced other stream functions (e.g., nutrient uptake). Material processing channel design techniques developed after the use of wood in Pacific Northwest

restoration. These streams work to meet the Total Maximum Daily Load levels while providing fish and wildlife habitat and supporting a reduction of instream energy and associated erosion. They work to retain nutrients, sediment, and organic matter raising the water level, connecting it with the floodplain. This study evaluated these two restoration practices in terms of macroinvertebrate diversity and abundance as well as organic retention to help professionals and citizens gain awareness for the different restoration practices.

Bio: My name is Maddie Berg and I am a second year Biology Masters student at James Madison University. My thesis is focused on stream restoration and I hope to work in the restoration field after completing my Masters.

Dam, dam, dam: Examination of stream physical, chemical, and biological characteristics of three dam removals in the Mill River, Massachusetts

Delilah Bethel, University of Massachusetts Boston; Sean McCanty, University of Massachusetts Boston; Alan Christian, University of Massachusetts Boston

The construction of dams to generate power, control river flow, create a water supply, and control flooding has a long history in New England and the U.S. Massachusetts alone has over 3,000 dams, many of which are no longer serving their intended purpose and are being considered for removal and restoration. Previous studies have shown how dams alter the ecological, hydrological, and water quality within the system and ultimately resulting in decreased biodiversity of a system. Removal and restoration of failed or obsolete dams has become popular due to no financial loss for companies and to increase overall stream ecosystem structure and function. As part of a working group effort, the Mill River near Taunton Massachusetts underwent three dam removals since 2010 with the last dam removal occurring in January 2018. In addition to being affected by dams, the Mill River watershed has a variety of land use and land cover (LULC) ranging from mostly forested to more urban LULC. In this study, we examine the physical, chemical, and biological characteristics of the Mill River along a headwater to mouth gradient and in association with the three dam removals through sampling 10 stations. Physical habitat assessments, surface water grab samples, and macroinvertebrates will be used as proxies to determine the ecological and environmental effects of LULC and dam removal. We expect to observe an urban gradient throughout the system and improved physical, chemical, and biological characteristics at dam removal and restoration stations. These outcomes should aid state officials and agencies understand the effects of dam removals in the context of larger scale LULC.

Delilah Bethel, Aquatic Ecology, University of Massachusetts Boston

Working together for healthy streams: The US FWS national fish passage program

Cathy Bozek, US Fish and Wildlife Service

Would you like assistance in restoring river habitat? Through the National Fish Passage Program (NFPP), the US Fish and Wildlife Service (US FWS) works with partners to remove fish passage barriers to promote healthy streams and river systems. We collaborate with federal, state, and local agencies, non-profit organizations, local communities, and landowners, and we support projects with funding and technical assistance. Our projects connect and improve habitat and build sustainable populations of target fish and mussel species, while also providing benefits to the community such as improved public safety and recreational opportunities. Come talk with the NFPP Coordinator for the Northeast, and learn how to get involved. We can discuss the types of

projects supported through NFPP, who you should contact if you have a project idea, and how to partner with the US FWS to improve river habitat and fish passage throughout the Northeast.

Bio: Cathy Bozek is a biologist in the Fish and Aquatic Conservation Program of the US Fish and Wildlife Service Northeast Region. As coordinator of the Fish Passage Program in the northeast, she focuses on working with FWS staff and partners to prioritize and implement projects that restore fish passage and river processes through barrier removal. Cathy has over 15 years of experience in aquatic habitat restoration, and has worked at The Nature Conservancy and the NOAA Restoration Center. She has a M.S. in Water Resource Management from the University of New Hampshire and a B.A. in Geology from Colgate University.

Evaluating a U.S. Army Corps of Engineers replenishment project at Hammonasset Beach State Park and designing a sustainable sediment restoration plan

Lauren Brideau, Werth Center for Coastal and Marine Studies, Southern Connecticut State University

One million people annually visit Connecticut's largest coastal park, and with over two miles of oceanfront, Hammonasset Beach State Park in Madison, Connecticut is ecologically and socially significant to local and regional communities. Hammonasset Beach is an ecosystem that sustains terrestrial and aquatic species who rely on it as a spawning location, migration site, and home. A long-standing concern is that Hammonasset Beach is characteristically erosive, particularly at its western end. In December 2017, the Army Corps of Engineers completed a $9-million-dollar beach replenishment project to address this erosion by constructing a 200-foot wide berm that stretches one mile along the beach with sand dredged from the mouth of the Housatonic River. Importing sand for beach replenishment, however, is a temporary but costly solution because waves, wind and currents from Long Island Sound will eventually cause the project to erode again. Due to the lack of a sufficiently energetic, fair-weather wave field in the Sound, the sand is not put back onto the beach once it erodes. The goal of the Werth Center for Coastal and Marine Studies at Southern Connecticut State University is to determine where the sand is going and create a sediment management plan as a beach restoration technique. Results of 27 profiles across 1.68 miles of Hammonasset beach are already revealing negative changes in the replenished beach area. It was discovered that 14 of the 16 beach profiles in the replenishment zone have a beach width less than that of the original project design. This research project is important since widening the beach allows for education, observation, and recreation, as well as other ecological services to be provided by Hammonasset to the human population.

Bio: Lauren Brideau is a research assistant and fellow at the Werth Center for Coastal and Marine Studies. With the Werth Center, she is working to measure the effectiveness of a recent Army Corps of Engineers beach replenishment project at Hammonasset Beach State Park. Lauren hopes to use this knowledge to initiate a more sustainable sediment management plan for the state. She is also an Honors College student at Southern Connecticut State University majoring in Environmental Systems and Sustainability. Lauren has interned at the non-profit organization, Harbor Watch, where she worked in the field and lab to monitor and improve water quality in Long Island Sound. In addition, she enjoys volunteering with the tag-and-release research study, Project Limulus, as well as being an active participant in the Unified Water Study and volunteering on benthic research trawls.

Grass-roots restoration of a phrag-mented urban wetland

Elisabeth Cianciola, Charles River Watershed Association

To the trained eye, many urban greenspaces appear to be vegetated solely by invasive plants. This can be disheartening to restoration experts, who see new sources of invasive plants surrounding the potential restoration site, and can significantly impact city-dwellers experience of nature. While there are many such places across the Charles River watershed, we identified a location where we thought that an invasive plant management effort might be worthwhile in an urban setting. In 2009, two gravel wetlands were built along the Charles River at Magazine Beach Park in Cambridge, MA to filter stormwater runoff from the athletic fields at the park. By 2016, purple loosestrife had appeared in both wetlands, but only one of these wetlands was infested by the invasive grass *Phragmites australis*. The Fenway neighborhood of Boston, just across the Charles River from Magazine Beach Park, is infested with some of the largest *Phragmites* plants on record and is prone to fires and occupation by homeless encampments, neither of which were desired for the gravel wetlands at Magazine Beach Park.

With financial support from the National Fish and Wildlife Foundation's Five Star and Urban Waters program, the Charles River Watershed Association and the Magazine Beach Partners were able to work with local and state agencies and community groups to develop and execute a plan for managing these invasive plants without using herbicides. Our approach incorporated manual removal techniques, science-based site management, native plant restoration, and on-site and electronic public education. You will take away from this presentation our best practices for: managing invasive plants, specifically purple loosestrife and *Phragmites australis*, managing volunteers in an urban wetland, and measuring the impact of wetland restoration, as well as encouragement in your own commitment to battling invasive plants!

Bio: Elisabeth Cianciola manages the Field Science program for the Charles River Watershed Association (CRWA), including water quality monitoring, recreational water quality notification, and monitoring stormwater treatment systems. She is also actively involved in supporting CRWA's volunteer programs, including chemical and biological water quality monitoring and invasive water chestnut removal. Elisabeth has a B.S. in Environmental Science from Trinity College, where she conducted research in areas as diverse as water quality sampling in urban rivers, rain garden design, and the taxonomy of algae. She also has an M.S. in Natural Resources from the University of New Hampshire, where she taught courses focused on wetland and freshwater resources. Her Master's thesis research focused on monitoring algae in Great Bay Estuary. Prior to joining CRWA, Elisabeth served as Interim River Steward for the Connecticut River Watershed Council and as an environmental consultant.

Prioritizing culvert replacement projects for brook trout restoration in the Warner River Watershed

Kat Crowley, Plymouth State University; Amy Villamagna, Plymouth State University; Ben Nugent, New Hampshire Fish and Game Department

Culverts pose a passage barrier for many species. Given the prevalence of undersized culverts in some watersheds, it can be challenging to prioritize restoration efforts. Our goal was to identify culverts within otherwise pristine brook trout habitat in the Warner River Watershed (central New Hampshire) that could be targeted for replacement. To accomplish this goal, we created a weighted, multi-parameter framework that ranks culverts based on potential restoration benefit.

We included commonly-used prioritization parameters in the framework, such as upstream and downstream mileage that would become accessible given culvert replacement, passability by aquatic organisms, total number of culverts upstream, and parameters of special interest for our project, such as brook trout density, percent impervious cover and percent agricultural land in the watershed, and openness ratio of the culverts. We also included parameters of interest to towns, such as culvert structure condition and likelihood of failing during a 50-year flood event, to engage local elected officials in the process of culvert replacement. After culverts were ranked based on these parameters, we further examined the highest-scoring culverts in ArcGIS to assess the potential to connect historically isolated brook trout populations. When our results are finalized, we will partner with towns within the watershed to apply for grant funding to replace our highest priority culverts. Although this framework was developed for the Warner River Watershed, we believe it will be applicable to other watersheds where brook trout are impacted by undersized culverts.

Bio: Kat Crowley is a 2nd year Master's student in Environmental Science and Policy at Plymouth State University (Plymouth, NH). Her thesis work involves identifying management and restoration priority areas in the Warner River Watershed in central New Hampshire. Kat's professional goals are to develop watershed management plans, strengthen local volunteer monitoring programs, and better understand conflict over river and lake restoration projects.

What is stream restoration vegetation success? It depends.

Meghan Fellows, Fairfax County Department of Public Works and Environmental Services, Fairfax, VA; Jonathan Witt, Fairfax County Department of Public Works and Environmental Services, Fairfax, VA; Chris Ruck, Fairfax County Department of Public Works and Environmental Services, Fairfax, VA

Vegetation success often has project specific definitions; the range spans from a regulatory-type requirement of minimum percent ground cover to a private land owner's requirement for 100% success of large woody stock (maybe even 10-years post construction!) The lack of a single target can explain confusion between must haves, needs, and wants in understanding vegetation success – and that's before we even bring in the goal, ecological uplift. We've spent the last two summers defining vegetation success at every step of the restoration process, from pre-restoration avoidance of high quality resources to post-restoration ecosystem function. The nuances of vegetation location, diversity and structure can have a large impact on whole system stream restoration success. First, I will discuss the evaluation methods and scales to apply that allow for multiple definitions of success. Second, I will use the data from the Fairfax Riparian Forest Vegetation Success (RFVS) data set to discuss setting more nuanced and specific goals than simply, is it green? We can show that 4-years post planting, metrics such as plant diversity and floristic quality are very high (and high is a good thing), however, soil texture and nutrient content are more reflective of compost and amendments than natural soil. Metrics such as canopy cover and shrub density remain poor and more characteristic of a fresh disturbance than a recovering ecosystem. The goal is to identify a metric(s) early on that can indicate a function-based vegetation success trajectory.

Bio: Meghan Fellows, Fairfax County Department of Public Works and Environmental Services, Fairfax, VA, has worked on restoring plants professionally for 15 years, longer if you count the tomatoes from space experiment in high school. She has restored endangered plants, murdered kudzu and is now enamored with a suite of mid-successional native species. She is currently a

restoration ecologist/project manager for the stream restoration program in Fairfax County, Virginia. Meghan's committed to the theory of adaptive management and restorations that provide ecological uplift.

Development trajectory of retired agricultural wetlands probed through soil characterization in an 88-year chronosequence

Benjamin Hoekstra, Grinnell College; Chris Neill, The Woods Hole Research Center; Michael Whittemore, The Nature Conservancy MA

As the New England cranberry industry continues to decline, there is increasing interest in the active restoration of retired cranberry farms aimed to develop valuable ecosystem services such as nitrogen removal and habitat provision conferred by functioning wetlands. Given the limited availability of funds to pursue land acquisition and restoration efforts, government and private agencies require methods of assessing those characteristics of retired farms which may predict their ecosystem function development and the cost, viability, or requirements of a restoration project. Greater understanding of the development trajectory of retired farms during unmanaged, passive naturalization may inform the process of site prioritization for active restoration through the elucidation of vegetation, soil, or hydrology characteristics with predictive power. Our investigation aimed to assess the ecosystem function development of retired cranberry farms in South-Eastern Massachusetts during passive naturalization through the analysis of chemical and physical properties of soils in an 88-year chronosequence (n = 18). We found a linear increase in soil moisture and organic layer depth with retirement age, even while the mass-percent of coarse sand (>250 um) remained nearly constant at 80%. Previous vegetation surveys at 3 sites suggested positive association between soil moisture and wetland plant colonization; these results show retirement time is a key driver of moisture content. No increases in percent carbon and nitrogen were observed until ~30 years after retirement. This delay may support our hypothesis that successional dynamics of tree colonization impacts species diversity and topsoil biogeochemistry. Later vegetation surveys planned for the fall of 2018 at the remaining 15 sites will allow for more rigorous investigation of soil-plant linkages and grant insight into the development trajectories and restoration amenabilities of retired cranberry farms.

Bio: I am Ben Hoekstra, a senior undergraduate from Grinnell College majoring in chemistry. I intend to pursue an advanced degree in environmental engineering after finishing my bachelors degree and have interests in water chemistry, nutrient remediation, and land-use change.

Reconnecting our streams: Aquatic barrier mitigation in the Hudson River Estuary Watershed

Erin Lefkowitz, NYSDEC Hudson River Estuary Program and Student Conservation Association/AmeriCorps; Megan Lung, NYSDEC Hudson River Estuary Program and New England Interstate Water Pollution Control Commission

Poorly designed and failing road-stream crossings (e.g., culverts and bridges) present barriers to the movement of aquatic and semi-aquatic organisms (e.g., fish, turtles and salamanders), and hazards to communities by increasing the risk of flooding. As part of its Culvert Prioritization Project, the Hudson River Estuary Program of the New York State Department of Environmental Conservation (NYSDEC) has been working with interested partners to assess all road-stream crossings within the Hudson River Estuary Watershed, and to prioritize those crossings most in need of replacement. Prioritization is ranked based on a combination of a crossing's passability and capacity scores. Passability is an evaluation of how well aquatic and semi-aquatic organisms can

move through a barrier, and is based on field surveys following protocols developed by the North Atlantic Aquatic Connectivity Collaborative (NAACC). Capacity represents the maximum storm size a culvert or bridge could successfully pass without water overtopping the road, and is determined by hydrology modelling conducted by the New York State Water Resources Institute at Cornell University (NYSWRI). Once priority crossings have been identified, Estuary Program staff coordinate with interested municipalities and local organizations to facilitate the replacement of those crossings, with the ultimate goal of removing barriers to organism movement and reducing flooding hazards for communities.

Bio: Erin Lefkowitz is a member of the Student Conservation Association and AmeriCorps, serving a ten-month term as the Watershed Specialist with the New York State Department of Environmental Conservation in New Paltz. Although sometimes allowed to plant a tree or play on the computer, the bulk of her work consists of lurking in culverts and crawling through poison ivy to assess road-stream crossings in the Hudson River Estuary watershed.

Reintroducing *Capparaceae* nurse plant species to restore overgrazed semiarid chaco forests in Argentina: A study of seed germination to facilitate seedling production

María Fernanda Martínez Gálvez, Instituto Argentino de Investigaciones de Zonas Áridas-CONICET-Argentina; Carolina Trigo, Instituto de Bio y Geociencias del NOA-CONICET-Argentina; Alejandro Emiliano Alauie, Universidad Nacional de Salta-Argentina; Johanna Croce, Instituto de Bio y Geociencias del NOA-CONICET-Argentina; Andrés Tálamo, Instituto de Bio y Geociencias del NOA-CONICET-Argentina; Carol Baskin, Departament of Biology-University of Kenctucky-United States.

Overgrazing of Semiarid Chaco Forest (Argentina) drastically diminishes the vegetation cover and compacts the soil creating "peladares" (vegetation gaps). To recover these environments, it is necessary to perform environmental restoration techniques. Reintroducing nurse plant species is a convenient technique because these plants provide a favorable microsite to protect other plant species that may have been dispersed to the site and have regenerated from seeds. *Capparaceae* shrubs could perform as good nurse plants because they are not palatable and form perennial canopies. However, to produce new individuals for restoration activities, we must know their germination requirements. We studied the germination requirements of five species of *Capparaceae* shrubs from Semiarid Chaco Forest: *Anisocapparis speciosa*, *Cynophalla retusa*, *Capparis atamisquea*, *Capparicordis tweedieana*, and *Sarcotoxicum salicifolium*. We evaluated seed germination in light/dark at 27°C. For those species with less than 70% germination, we evaluated the ability of seeds to imbibe water and we applied dormancy-breaking treatments (dry storage at room temperature, cold and warm stratification, and hormone treatments). Seeds of *A. speciosa* and *C. retusa* were not dormant and germinated to high percentages. Nevertheless, *C. atamisquea, C. tweedieana,* and *S. salicifolium* seeds germinated to less than 70%; furthermore, they had water-permeable seed coats. The best treatment to promote germination of *C. tweedieana* seeds was warm stratification at 30°C during 6 weeks. Still, we could not improve germination of *S. salicifolium* and *C. atamisquea* seeds with the pretreatments tested; thus, further studies are needed. Propagation of some *Capparaceae* species, in some cases using a pretreatment, is now possible; which means that seedlings of these species can be produced for restoration programs in Semiarid Chaco Forest (Argentina).

Bio: My name is María Fernanda Martínez Gálvez and I am 29 years old. I am a PhD student at the Argentinean Research Institute of Arid Zones in Mendoza, Argentina. My thesis is entitle Soil Seed Bank and Germination of Potential Nurse Shrubs: Implications for the Restoration of

Overgrazed Places in the Semiarid Chaco. I have a fellowship from the National Council of Science and Technology of Argentina to develop my research. I am a professor of Inorganic Chemistry for the Degree of Oenology at the National University of Salta, Argentina.

Testing for seasonal profiles along the Connecticut coast

Brooke Mercaldi, Werth Center for Coastal and Marine Studies, Southern Connecticut State University

One of the important ecological services beaches provide is the creation of buffers against storm wave damage to coastal structures and infrastructure. Observations of the impacts of storm waves in the wake of Irene and Sandy include that wider and higher beaches provide greater protection for the communities located behind them. There is a common conception that the presence of Long Island protects the Connecticut coast from storm damage. However, the effects of Irene and Sandy on coastal structures have revealed the possibility that Connecticut's coast operates significantly differently from open-ocean beaches. This research suggests the state's coastal dynamics may leave the shoreline exceptionally vulnerable to storm damage.

Bio: Brooke Mercaldi is the research coordinator for the Coastal Processes Lab at the Werth Center for Coastal and Marine Studies located at Southern Connecticut State University. She is also the lead researcher on a project called "Testing for Seasonal Beach Profiles Along the Connecticut Coast". This project examines the role of beaches in protecting coastal structures and infrastructure against the impacts of large storms such as hurricanes Irene and Sandy. Brooke is also a student in the Honors College majoring in Environmental Systems and Sustainability Studies with a concentration in Coastal and Marine Systems. She spent last summer as a Fellow with Sustainable CT.

Dissolved oxygen in beaver ponds

Jessica Nekowitsch, Keene State College

Natural dams, such as beaver dams, are well known for their physical disruption of waterways. The question is; do these dams affect the overall water quality of rivers? Currently, we are studying the effects of a beaver dam on Hosley Brook in Hancock, New Hampshire. The research focuses on the effects of the dam on dissolved oxygen levels within the brook. To collect our data, we placed dissolved oxygen sensors along the waterway in four locations; one upstream of the dam in a free flowing reach, two more upstream of the dam in a beaver meadow and beaver pond, and one just downstream of the dam. We recorded the data every 15 minutes for the first six months of 2015. Preliminary analysis shows that the dissolved oxygen levels are diurnal; meaning they are climbing during the day when the sun is out, and then dropping down at night. Most likely, this trend is associated with algal daytime photosynthesis and nighttime respiration. Further analysis of the data indicates higher levels of dissolved oxygen in the beaver meadow when compared to those in the first free flowing reach. We believe this is caused by photosynthesis in the meadow. The beaver pond we studied has the least amount of dissolved oxygen, indicating that a large amount of respiration is taking place in this area. This is probably due to micro-organisms. The number of micro-organisms is higher in this area because they are decomposing organic matter found at the bottom of the pond. Finally, we have found that dissolved oxygen levels are roughly the same in the free flowing reach after the dam as they are in the free flowing reach before the dam. This means that the dam isn't affecting the overall oxygen levels of the river, even if there are some localized fluctuations.

Bio: Jessica Nekowitsch is an undergraduate student currently attending Keene State College. She is in her junior year working towards a bachelor's degree in environmental engineering. This summer was her first time as an intern doing research in environmental studies, and she hopes to continue her work next summer.

Warblers and snakes: Making the most of an agricultural past

Dylan O'Leary, Presenter and team member, The Nature Conservancy; Murray McHugh, TNC Project Lead; Mark Labarr, Audubon VT Project Lead; Margaret Fowle, Audubon VT Project Lead

Golden-winged warblers (*Vermivora chrysoptera*) have sustained sharp population declines over the last 50 years and are listed as Near Threatened by the International Union for Conservation of Nature. Habitat loss from urban sprawl, aging forests and destruction of their wintering grounds have reduced their numbers and shifted their range northwest making VT part of the very eastern edge of their existence. Helen W. Buckner Memorial Preserve at Bald Mountain in West Haven, VT sustains the largest population in the northeast of these dynamic little birds, due in large part to the agricultural legacy of the area. State endangered timber rattlesnakes (*Crotalus horridus*), state threatened eastern ratsnakes (*Pantherophis alleghaniensis*), and the eastern ribbon snake (*Thamnophis sauritus*), a species of special concern, have all etched out an existence here as well and rely heavily upon the abundance of leopard frogs (*Lithobates pipiens*) in the fields surrounding the talus slopes. The Vermont Chapter of The Nature Conservancy has teamed up with Audubon Vermont and Green Mountain College in two simultaneous efforts to utilize old agricultural fields to restore ideal habitat for these imperiled species. Our management plan with Audubon includes extensive brush clearing via mechanical and chemical means, protocol testing to develop efficient ways of monitoring population changes, deployment of geolocators to elucidate migration habits, and community stewardship in the form of an annual "Warbler Blitz". New this year, in partnership with Green Mountain College, we are testing different mowing patterns. They will coincide with the warbler management and the monitoring of amphibian population changes via drift fences. We are also putting college students to work, constructing wooden structures or 'snake hotels' for snakes to congregate and bask in, putting us at the cutting edge of herp hospitality.

Bio: Dylan O'Leary is starting his third Americorps term of service as a Field Assistant and Outreach Coordinator for the Vermont Chapter of The Nature Conservancy. He received his B.S. in Biology from Ithaca College in 2012 where he focused his studies on animal behavior and field techniques. Before TNC, Dylan spent 4 years pursuing wildlife related conservation positions around the country, working with a wide variety of animals and institutions. His main passion is for conducting research that will inform and shape the best management practices possible.

Effects of salt marsh tidal restoration on soil microbial process rates

Sean Ooi, University of Connecticut, Department of Natural Resources and the Environment; Aidan Barry, University of Connecticut; Ashley Helton, University of Connecticut, Department of Natural Resources and the Environment and Center for Environmental Science and Engineering; Beth Lawrence, University of Connecticut, Department of Natural Resources and the Environment and Center for Environmental Science and Engineering; Chris Elphick University of Connecticut, Department of Ecology and Evolutionary Biology; Blaire Steven, University of Connecticut, Center for Environmental Science and Engineering and Department of Environmental Sciences.

Tidal restoration techniques such as culvert enlargement or removal are widely used in New England salt marshes to remove invasive plant species (e.g. *Phragmites australis*) and restore marsh hydrology, salinity, and plant species composition to pre-restriction conditions. However, the effects of tidal restoration on carbon and nitrogen cycling are not well understood. In 2017, we quantified soil microbial respiration (i.e., carbon mineralization (Cmin), substrate induced respiration (SIR)) and denitrification potential from three major salt marsh vegetation zones (*Spartina alterniflora, Spartina patens*, and *P. australis*) across 10 tidally restored and 10 tidally unrestored salt marshes in Connecticut. Surprisingly, tidal restoration did not significantly affect any of the microbial processes or soil chemistry parameters (i.e., EC, pH, SO4-, Cl-, NO3-, NH4+) we measured, though there were distinct patterns among vegetation zones. *Spartina*-dominated zones consistently had greater rates of Cmin and SIR than *P. australis*. In contrast, *P. australis* and *S. patens* had significantly greater denitrification potential than *S. alterniflora*. Our results suggest that soil chemistry and microbial processes are strongly associated with vegetation zones, hence are better indicators of biogeochemical processes than tidal restoration status. Further analysis aims to demonstrate the effectiveness of using changes in vegetation zones as indicators of the biogeochemical effects of tidal restoration.

Bio: Sean Khan Ooi; University of Connecticut, Department of Natural Resources and the Environment

Assessing aquatic wildlife of the Keene portion of the Ashuelot River before dam removal, using underwater video

Gabriela Pacheco, Keene State College; Denise Burchsted, Keene State College

Over the last decade, the City of Keene has been investigating the feasibility of removing or modifying the West Street Dam, to respond to a Notice of Deficiency from the State of New Hampshire. Currently, the Ashuelot River hosts a variety of aquatic wildlife, nonaquatic wildlife, and plant life including rare and endangered species such as Wood Turtles, Bog Violet, and the Dwarf Wedge Mussel. Past feasibility reports indicate a wide range of effects after a removal or modification to the dam. Before anything is done, beginning an assessment of the river's wildlife and characteristics was done to get an idea of the river's current aquatic habitats, specifically fish abundance and species richness. Two methods using underwater cameras were implemented over a 4000 meter distance. The methods include a stationary camera pointed at bait in vegetated, pooled, and log jammed areas and a camera travelling upstream to capture fish during their travel. Our preliminary investigation of these data shows that the dam does not make much of an impact on fish communities. This poster presents our preliminary findings and insight gained from this method of sampling, along with challenges and recommendations for further research. The use of underwater video provided us a new way of assessing aquatic wildlife in a non-invasive way.

Bio: Environmental Studies, Gabriela Pacheco, Keene State College

Forging community partnerships and building the Unity Trail in Waynesburg, Pennsylvania

Janet Paladino, Waynesburg University

We are Waynesburg University, a Christian liberal arts college located in Waynesburg, Pennsylvania, at the gateway to Appalachia. One of our most important missions is to serve the local community through environmental education and stewardship, and to provide opportunities where people can make connections with the natural world. We are working to restore and preserve an urban forest located on land owned both by our University and the Borough of Waynesburg. There are currently no natural ecosystems in the Borough of Waynesburg available for public use. We have named this wooded area "Unity Trial", to signify the cooperative relationship forged between our University and the Borough of Waynesburg, who are working together to restore and maintain a valuable forest ecosystem for the enjoyment and education of all members of our community. Our efforts seek to provide a sense of place in a locality that was largely impacted by the negative effects of the industrialization and the mining of fossil fuels and to reestablish the important relationship between humans and natural ecosystems. We discuss our accomplishments and challenges in trail construction and ecological restoration, and important efforts to build a sustainable relationship between Waynesburg University and the community.

Bio: Dr. Janet Paladino, ScD, Professor and Director of Environmental Science at Waynesburg University. I have a doctorate degree in Environmental Health from the University of Pittsburgh with twenty-seven years of professional experience in public health, toxicology and health risk assessment, consulting, environmental science, research, education and environmental stewardship. My current interests include the improvement of community public health through experiences with nature. I am on the Board of Trustees with the West Virginia Botanic Garden, and perform over 100 hours of community service per year. jpaladin@waynesburg.edu

Addressing erosion in natural areas under a changing climate

Julie Richburg, The Trustees (of Reservations)

As natural resource managers, our efforts to address the impacts of climate change on our properties have focused on protecting habitats, maximizing connectivity, managing for ecological processes and functions, limiting non-climate stresses, and maintaining species richness. But we need to continue to expand our toolbox to address new challenges such as increased rainfall resulting in new areas of runoff and increasing erosion. The Trustees are currently working on multiple erosion mitigation and stabilization projects along with our neighbors and town officials.

Bio: Dr. Julie Richburg is currently the Regional Ecologist for The Trustees (a state-wide non-profit land trust) in western Massachusetts. She works on natural resource inventory and management. Most recently she has been working on several projects to address erosion on Trustees' properties, restoring 10 acres of floodplain forest, and planning for the stewardship of 3,000 acres of forest at Notchview Reservation. Julie has a Master's degree and PhD in forest ecology from the University of Massachusetts Amherst where she studied the impacts of road salt on plant species within a calcareous basin fen natural community in Stockbridge and control of woody invasive plants using mechanical and prescribed fire treatments across the Northeast. In 2009, she organized a partnership of individuals, organizations, and agencies interested in invasive species

control within the Westfield River Watershed. She is currently the chair for the Massachusetts Invasive Plant Advisory Group.

The impact of forest management on edge effects in roadside forests

Julia A. Rogers, University of Connecticut Department of Natural Resources; Robert T. Fahey, University of Connecticut Department of Natural Resources; John C. Volin, University of Connecticut Department of Natural Resources, and Thomas E. Worthley, University of Connecticut Department of Natural Resources, and University of Connecticut Cooperative Extension Service

New England is among the most heavily forested region in the country, and this forest is heavily fragmented by roads and development. There is a need to improve the resilience of this forest cover to storms and other disturbances especially along roadways and adjacent to built infrastructure. To this end, we developed a roadside forest management program entitled "Stormwise" with the goal of reducing the risk of tree-caused damage to infrastructure; however, widespread roadside forest management practices may increase edge influence into the forest, changing the abiotic environment, and the plant communities in these forests. The objective of our study was to quantify the magnitude and depth of edge effects on plant communities and environmental conditions in "Stormwise" roadside forest management treatments throughout Connecticut. We estimated the percent cover of native and invasive nonnative plants and measured the light environment along perpendicular transects to the road at eight managed sites and eight paired control sites. Light availability was greater in managed sites relative to control sites. Managed sites also had marginally greater percent cover of woody plants than control sites. We also analyzed each parameter for the distance at which the edge environment was different from the interior points on the transect (depth of edge influence). There was no detected edge influence in control sites for any parameters. In managed sites, the depth of edge influence for light extended only to 2.5m, but reached to 15m for woody species richness and diversity. The percent cover of invasive plants showed a greater edge influence (10m) than that for native plant percent cover (5m). Based on the enhanced edge influence observed in managed sites, we are conducting a follow-up study to examine the effects of management on the growth responses of native and invasive nonnative plants.

Bio: Julia Rogers is a graduate student at the University of Connecticut in the Department of Natural Resources and the Environment. She graduated from Colby College in 2016 with a bachelor's degree in biology with a concentration in ecology and evolution. In addition to her master's degree, she volunteers with Joshua's Trust, the local land trust, and is a member of the town's conservation commission.

Mycoremediation strategies for watershed health

Jessica Rubin, Mycoevolve; Hannah Huber, Mycoevolve; Dr. Arash Ghalehgolabbehbahani, UVM; Sue Van Hook, Haut Terrain; Alex Dorr, Mushroom Revival; Dr. Josef Gorres, UVM

Mycoevolve, in partnership with University of Vermont, and funded by EPSCoR, conducted an experiment using the mushroom species *Stropharia rugosoannulata*, otherwise known as the garden giant, wine cap, or King Stropharia, to reduce E. coli in simulated farm effluent. In Vermont water quality in the Lake Champlain watershed is frequently contaminated by excess fertilizer, nutrient runoff, algae blooms, and E. coli largely due to the dairy industry. Mycoevolve and UVM's first in-greenhouse project contributes to a small yet growing field, combining grassroots remediation strategies with academic research, and is a crucial step towards understanding how

mycoremediation (a form of bioremediation using fungi) may be applied in the future by farmers and land "owners" to better manage landscapes for improved water quality. Results from this study will inform the next phase of outdoor mycofiltration mat installation in swales, wetlands, riparian buffers, and rain gardens to support watershed health.

Bios: Jess Rubin, founder of Mycoevolve, has dedicated her life to listening to and reading surrounding living landscapes for guidance in earth repair. Over the years she has served as a wilderness guide, gardener, farmer, teacher, corridor monitor, and research technician while earning a Cornell University BA in Ecological Literature & Native American studies, a Masters of Environmental Science from Antioch New England, a middle & high school science teaching license, several certificates in outdoor education, herbalism, nature awareness, and permaculture. She tends Mycoevolve's ecological resilience service offering earthworks, education, and research from the inspiration of her oldest mentors, lichen. To learn more check out: www.mycoevolve.net.

Hannah Huber is Mycoevolve's Research Technician, and is also a graduate student at Antioch University New England self-designing her Master's in Applied Mycology and Ecological Restoration. She completed her Bachelor's degree in 2014 at Paul Smith's College in biology and environmental science, with a minor in chemistry, and while there met her first mycology mentor, mushroom dye artist Susan Hopkins. Originally from Michigan, Hannah began her mushroom education in the 90's hunting for morels with her father as a toddler. Hannah believes in the intelligence of fungi to lend a "helping hypha." Learn more about Hannah's mycological adventures at hannahshyphae.com.

Dissolved oxygen response to dam removal in Massachusetts streams

Samuel Sillen, Massachusetts Cooperative Fish and Wildlife Research Unit, University of Massachusetts Amherst; Peter Zaidel, Massachusetts Cooperative Fish and Wildlife Research Unit, University of Massachusetts Amherst; Allison Roy, U.S. Geologic Survey; Keith Nislow, U.S.D.A. Forest Service, Northern Research Station, University of Massachusetts Amherst; Kristopher Houle, Massachusetts Division of Ecological Restoration; Beth Lambert, Massachusetts Division of Ecological Restoration

Dam removal can restore previously impaired streams by increasing habitat connectivity, recovering ecological processes, and improving water quality. However, less than 10% of dam removal projects have been scientifically evaluated for ecosystem changes following removal, with water quality being one of the most underrepresented metrics. The relatively few studies that have monitored water quality at dam removal sites are often have limited temporal data and collectively yield ambiguous results. To address this research gap, we monitored the short-term response of dissolved oxygen to dam removal at eight sites in Massachusetts. Continuous dissolved oxygen concentrations were measured upstream, downstream, and within impoundments for three, one-week periods in summer months (July, August, September) before and after dam removal. We found that while the majority of sites exhibited reduced dissolved oxygen within impoundments compared to upstream reaches prior to removal (mean = 0.96 mg/L lower in impoundments), downstream dissolved oxygen was similar to upstream, presumably due to the reaeration that occurs as water spills over these surface-release dams. Following dam removal, the reduction in impoundment dissolved oxygen was eliminated in all but one site. Although the magnitude of dissolved oxygen impacts was variable across sites, these results show that dam removal can lead to relatively immediate (i.e., within a year) recovery of dissolved oxygen in former impoundments.

Bio: Samuel Sillen, Massachusetts Cooperative Fish and Wildlife Research Unit, University of Massachusetts Amherst. I joined the Massachusetts Cooperative Fish and Wildlife Research Unit in September 2015, where I served as a field technician for three years. Following my graduation from the University of Massachusetts Amherst in May 2018, I am currently monitoring the impacts of dam removal on water temperature and dissolved oxygen concentrations in Massachusetts streams.

Connecting restoration projects and community stewardship

Natasha Tarbell, Werth Center for Coastal and Marine Studies, Southern Connecticut State University

In this poster presentation, we will explore the connections between leadership, communication, and community engagement through a lens of service learning focused around small-scale ecological restoration projects. Using residential rain gardens in New Haven as a case study, this poster will demonstrate how contemporary leadership theories and community engagement can be understood and implemented through environmental service learning. Experiences from the field will be provided with connections made to theories and best practices of leadership.

Bio: Natasha Tarbell is a junior and an honor's student at Southern Connecticut State University class of 2020 majoring in psychology.

Road deicing salt impacts on forested wetland seedbanks in southern New England

Samantha Walker, University of Connecticut, Department of Natural Resources and the Environment, Storrs, Connecticut; Beth A. Lawrence, University of Connecticut, Center for Environmental Science and Engineering, Storrs, Connecticut

Road deicing salts (largely NaCl) may be impacting forested wetland resilience and the capacity for passive restoration by diminishing seedbank responses; however, there is little known about how fluctuating water regimes interact with salinity levels to affect freshwater wetland seedling emergence. We conducted a full factorial seedbank experiment (with four-fold replication) to test how road salt concentration (6 levels: 0, 0.5, 1, 2, 4, 8 ppt), frequency of salt exposure (pulse, constant) and water level (surface, 2 cm below surface) affect seedling density, plant species richness, and biomass from soils collected from a red maple forested wetland in eastern Connecticut. Preliminary analyses indicate a threshold salinity level between 1 and 2 ppt, with ≥ 2 ppt decreasing seedling density, richness and biomass. Soils exposed to pulses of salinity had higher seedling density and richness than constant salinity but aboveground biomass did not differ among salt exposure treatments. The seedling responses did not differ among the two water level treatments we employed, likely because they were not distinct enough. Our data suggest that elevated salinity levels in roadside forested wetlands ≥ 2 ppt may reduce the abundance, diversity and vigor of the vegetation community; however, the pulsing nature of road salt inputs during storm freeze-thaw events may reduce seed exposure and mitigate deleterious effects. This study elucidates results of recent vegetation surveys of road-adjacent forested wetlands in eastern CT, where ground layer composition was minimally altered with distance from road, likely because plants were exposed to salinity levels below threshold values (2ppt) and to pulses of road salt-enriched water which reduced forested wetland plant community shifts.

Bio: Sammy is currently a master's student at the University of Connecticut studying the impacts of deicing salts on plant community composition and function in forested wetlands in New England. She has a BS in Environmental Science and Management from University of Rhode Island.

In situ effect of combined utilization of fly ash, polyacrylamide and vegetation reconstruction on sand stabilization in north China

Yitong Wang, China Agricultural University; Kai Yang, Advanced Materials Institute, Qilu University of Technology; Zejun Tang, China Agricultural University;

This study evaluated the resistance to wind erosion of a consolidated soil layer (CSL) by conducting a one-year field experiment. The CSLs consisted of the experimental soil (classified as a sandy soil), fly ash (FA) at three addition rates (5, 10 and 15% (w/w) soil) and polyacrylamide (PAM) at two addition rates (0.05 and 0.1% (w/w) soil). In Region A (A1-A6), FA and PAM were homogeneously mixed with the sandy soil before being loaded onto the test regions. In Region B (B1-B6), the sandy soil and FA were homogeneously mixed before being loaded onto the test region, and PAM was scattered onto the surface. And *Achnatherum splendens* (*A.splendens*) were transplanted into both regions. In both regions, an appropriate amount of water was thereafter uniformly sprayed onto the surface. The results show that the moisture content of CSLs at different depths is obviously higher than that of the sandy soil at the same depth. During the transplanting process, the mortality of *splendens* in most CSLs was lower than that of the control (CK). And in the higher water content CSLs, *splendens* were obviously superior to the control in three aspects: the number of sins, the height of the plant and the area of the leaf covered. Therefore, CSLs can provide a good transplanting and growth environment by improving the water content of sandy soil, and CSLs-vegetation consolidation can be used for the study of soil desertification repair.

Yitong Wang, China Agricultural University