

Tuesday, October 8, 2019 1:00pm - 4:30pm

Identifying Natural Areas for Conservation Symposium

ASSESSING THE ECOLOGICAL INTEGRITY OF NATURAL AREAS: FROM SITE TO REGIONAL CLIMATE SCALES

Topic: Identifying Natural Areas for Conservation

Don Faber-Langendoen
NatureServe

Bill Nichols
NH Natural Heritage Bureau

Justin Schlawin
Maine Natural Areas Program

Kathleen Strakosch Walz
Natural Heritage Program, NJDEP Off Natural Lands Management

Theo Witsell
Arkansas Natural Heritage Commission

Abstracts

1. An Overview of NatureServe's Ecological Integrity Assessment (EIA) Method

Bill Nichols, NH Natural Heritage Bureau

NatureServe and network partners have recently developed a methodology for assessing the ecological integrity of wetlands. Ecological integrity assessments are here defined as 'an assessment of the degree to which, under current conditions, the structure, composition, processes, and connectivity of an ecosystem corresponds to reference conditions, and are within the bounds of natural or historical disturbance regimes.' Major components of EIA include three primary rank factors (landscape context, on-site condition, and size), subdivided into six major ecological factors of landscape, buffer, vegetation, hydrology, soils, and size. Metrics that are chosen provide information on the integrity or sustainability of the major ecological factors and their relationship to associated stressors. Together these are the components that capture the structure, composition, processes, and connectivity of an ecosystem. This presentation will provide an overview of the rapid (Level 2), largely field-based version of this wetland assessment method as applied in New Hampshire. A universally applicable upland EIA method now under development will also be briefly discussed.

2. Evaluating Maine's Floodplain Forests Using Ecological Integrity Assessment Methodology

Justin Schlawin
Maine Natural Areas Program

The Maine Natural Areas Program has implemented a comprehensive field survey to map floodplain forests and associated rare plants in Maine. Conservation, restoration, or mitigation of wetlands requires an understanding of the full spectrum of ecological conditions for each system. The Maine Natural Areas Program has recently adopted Ecological Integrity Assessment (EIA) methodology for objectively evaluating and scoring the condition of wetlands.

This methodology has been applied to floodplain forests to identify conservation priorities and to identify baselines for restoration or change to these systems.

3. New Jersey's Wetland Condition Assessment Intensification Study: A Multi-Tiered Assessment of Wetlands and Watersheds

Kathleen Strakosch Walz, New Jersey Natural Heritage Program,
Don Faber-Langendoen, NatureServe

The New Jersey Department of Environmental Protection conducted an EPA-funded multi-year research project to develop a statewide wetland condition assessment and establish a monitoring network for freshwater and estuarine wetlands. A 3-tiered condition assessment method was applied, based on NatureServe's Ecological Integrity Assessment (EIA), in conjunction with protocols from the National Wetland Condition Assessment (NWCA). The EIA method is largely a Level 2 rapid assessment method, but also includes Level 3 quantitative vegetation plot data. Ecological attributes of landscape context and condition (vegetation, soils, hydrology) were assessed, and a separate stressor evaluation was conducted. Using a Generalized Random Tessellation Stratified (GRTS) design, 312 replicate sampling sites were selected, stratified by four wetland types (Cowardin PEM, PSS, PFO, E2EM) and 12 HUC8 watersheds. EIA Level 2 and 3 data and stressor assessment data were collected from 114 sites, including 68 GRTS sites, 38 NWCA sites, and 8 headwater spring wetland sites. These data were used to calibrate the condition model and guide selection of Level 1 metrics. A comparative study of two focal watersheds was done to compare wetland condition in a relatively rural versus an urban landscape. Results showed a high correlation between stressors, EIA scores, and floristic quality (Cover-weighted Mean C and NWCA Vegetation Multimetric Index). These ground-based metrics provided a robust measure of wetland condition across wetland types in the two focal watersheds. In turn, a Level 1 metric (Land Use Index) was sufficiently predictive of on-site ecological integrity to provide the basis for a state-wide, watershed and wetland type-based assessment of condition using the 344 combined EIA and NWCA GRTS sites.

4. Development and Application of Ecological Integrity Assessment (EIA) Protocols in Arkansas

Theo Witsell, Arkansas Natural Heritage Commission;
Milo Pyne, NatureServe;
Tom Foti, Oakleaf Institute

Shrinking staff size and other resource reductions at both the Arkansas Natural Heritage Commission (ANHC - Arkansas's Natural Heritage Program) and among conservation partners, have emphasized the need for rapid, simplified protocols for identifying high quality element occurrences (EOs) of natural communities and for monitoring their status and condition over time. Over the past decade, NatureServe has been working with the ANHC to develop a new classification of Arkansas Natural Communities based on NatureServe's Ecological Systems and, more recently, to develop Ecological Integrity Assessment (EIA) protocols to meet this need. For this project, NatureServe and Arkansas adopted NatureServe's existing wetland EIA protocol and developed new criteria needed to assess upland communities. The Arkansas natural community types were combined into 8 general wetland types (USNVC formations) and 8 general upland types that could be assessed using the same or similar metrics. The metrics assess three primary factors of community occurrences – Landscape Context, Condition and Size. Each general feature incorporates more specific factors – Landscape Context includes landscape and buffer; Condition includes vegetation, hydrology, soil and natural disturbance, and Size includes absolute patch size/patch type, and change in size. The same general metric often applies across the general wetland or upland types, but may have variants that are specific to a particular general type. In Arkansas, Landscape Context is assessed with 6 metrics having no variants, Condition is assessed with 13 metrics with a total of 49 variants, and Size has one metric with 9 variants. All metrics are managed in NatureServe's EcoObs database. Field testing of the EIA protocols and their use for producing EO RANKS (conservation value ratings) began in 2018 and continued in 2019. A workshop to train ANHC staff, conservation partners, and potential contractors was held in May 2019 and protocols are now being used in the ANHC's first ever County Natural Heritage Inventories (NHIs) as well as in other projects.

5. Applying Ecological Integrity Assessments to address forest vulnerability to climate change in National Parks of the

National Capital Region.

Don Faber-Langendoen, NatureServe
Regan Smyth, NatureServe
Carl Nordman, NatureServe
Michael Lee, NatureServe

Natural area managers must address climate change stressors to ecosystems that they manage, alongside the existing stressors from exotic invasive plants and insects, herbivore overbrowsing, hydrologic alterations, and others. In the National Parks of the National Capital Region (NCR), managers are committed to developing adaptive management strategies that incorporate climate change with other stressors. Here, we first present the degree of climate change that NCR park ecosystems have experienced using the Habitat Climate Change Vulnerability Index (HCCVI) model. It uses three standard climate change categories: Sensitivity (or Ecological Integrity), Adaptive Capacity (aka terrestrial resilience: landscape diversity and local connectedness), and Exposure. Next, we applied HCCVI to the three matrix upland forest ecosystems in the park, first using general ecological integrity metrics to inform Sensitivity scores for each forest type, then fine-tuning the Sensitivity scoring using ecological integrity evaluations of each stand within each park. We identified forest stands that are still in excellent to good integrity (low Sensitivity to climate change). Third, we addressed stand-level Adaptive Capacity, including their degree of topographic complexity and connectivity with adjacent natural areas. These refined measures of Sensitivity and Adaptive Capacity were then used to re-run the HCCVI models to provide spatially explicit information on the most resilience and vulnerable forest stands. Our stand-level assessment provides a spatially-explicit map that can guide adaptive management strategies, emphasizing forest stands of high existing integrity and good connectivity. We conclude by noting that wetland ecosystems in NCR are constrained by a different mix of stressors and will need separate adaptive management strategies.

Tuesday, October 8, 2019 1:00pm - 4:30pm

Invasive Species Management and Prevention Symposium

Communication and Management of Emerging Forest Pests and Pathogens

Topic: Advances in State Forest Management

Daniel Volk
Cleveland Metroparks

Mike Hutchinson
Pennsylvania Department of Agriculture

Jonathan Shields
Ohio Department of Agriculture

Bill Oldland
US Forest Service

Kathy Smith
Ohio State University Extension

Session title: Communication and Management of Emerging Forest Pests and Pathogens

This symposium is being organized to showcase emerging forest pests and pathogens. Specifically, the goal is to illustrate how information is communicated among local, state, federal, and private entities and determine how to establish management protocols for new threats.

How to Respond when Dealing with Emerging Pests or Pathogens

William Oldland¹
¹US Forest Service

When new forest pests arrive they can either become problematic or blend into the background. If a new pest population increases and begins to cause damage, it can be intimidating to begin proper management. Who do you talk to? How do you report your findings? How do you sample for it? And, how do you obtain funds for management or basic research? This session will cover some of these questions by discussing and comparing this process with examples of gypsy moth, Southern Pine Beetle and Hemlock Woolly Adelgid.

Outreach and communication to private landowners

Kathy Smith¹ and Amy Stone

¹Ohio State University Extension Program Director / Forestry

Responding to emerging pests or pathogens can be difficult with limited resources. Private landowners make up a majority of land in Ohio and can be a valuable resource to utilize. Ohio State University Extension is a resource for outreach to the community in order to engage a wider audience and encourage participation in various programs including identification and eradication of pests.

Beech Leaf Disease: an Undiagnosed Threat to Beech Forests

Daniel R. Volk¹ and Constance E. Hausman¹

¹Cleveland Metroparks, 2277 W Ridgewood Dr, Parma, OH 44134

Undiagnosed beech leaf disease (BLD) has led to significantly reduced canopies, dead branches, and sapling mortality (5-10cm DBH) across Ohio, Pennsylvania, New York, and Ontario since its discovery in northeastern Ohio in 2012. In order to determine the range of BLD, we are using Tree Health Survey, a citizen science-based app, to encourage widespread observation of symptoms. Users can be trained to identify BLD symptoms, track location, and record symptom pictures using Tree Health Survey. Park natural resource managers, members of the public, and naturalists have made up a majority of reports through 2018. Separately, 13 monitoring plots were established across Cuyahoga County in 2015 to track the progression of symptoms in 302 individual trees. Overall canopy and healthy leaves have declined, while symptomatic leaves have increased.

Spotted Lanternfly: What We Have Learned / How We Respond

Michael Hutchinson¹

¹Pennsylvania Department of Agriculture

Spotted lanternfly (SLF) is an invasive planthopper native to China, India, and Vietnam. First discovered in southeast Pennsylvania in 2014, it has now spread to multiple counties in that portion of the Commonwealth and several neighboring states. This insect has the potential to greatly impact agricultural crops such as grapes, hops, and hardwoods. It is also reducing the quality of life for people living in heavily infested areas. Penn State University and Extension, United States Department of Agriculture (USDA), and PA Department of Agriculture (PDA) have joined forces to control and contain the spread of SLF. Penn State University is leading research efforts to answer the many questions about the insect's biology and pesticide studies. USDA and PDA are actively treating locations where SLF has been reported. USDA is treating on the outer edges and moving inward towards the center of the quarantine. PDA is treating areas where the population numbers are high, targeting high risk pathways, and surveying all counties in the state outside the quarantine looking for SLF.

Asian Longhorned Beetle (ALB) Cooperative Eradication Program Efforts in Southwest Ohio

Jonathan M. Shields¹

¹Ohio Department of Agriculture, Division of Plant Health

Natural areas managers are increasingly being called upon to monitor for and to address invasive species and exotic pests. One such pest, the Asian Longhorned Beetle (ALB) (*Anoplophora glabripennis*), is particularly dangerous due to its large host range which includes 12 genera of trees. The larval stage of ALB feeds in the heartwood of these trees which can impair water and nutrient transport and causes structural damage resulting in limb loss, and eventually the death of the tree. ALB has been introduced on several occasions and in several locations in North America including New York, Chicago, Toronto, New Jersey, Massachusetts, and Ohio.

Asian longhorned beetle was first identified in Tate Township, Ohio in 2011, near the village of Bethel in the southwest part of the state. Within months, multiple government agencies, led by the Ohio Department of Agriculture (ODA) and the United States Department of Agriculture, Animal and Plant Health Inspection Service (USDA APHIS), had established quarantines as well as a detection and eradication program. Since the initial detection in June 2011, the quarantined area has expanded, and then contracted somewhat as a product of the program's activities.

The Ohio ALB Cooperative Eradication Program has built upon the successes of ALB response programs in other areas and has created novel approaches to improve the chances of successfully eradicating the Asian longhorned beetle from Ohio. ALB program staff have increased survey efficiency, improved data management tools, and have developed a quality assurance plan that verifies the work is completed to the highest standards. Innovative treatment strategies have shortened the path to confident declarations of eradication. Regulatory efforts have prevented further

spread of the pest. Research continues into novel detection and eradication methods, and outreach efforts spread the word about harmful pests and create more citizen scientists with the tools to report infestation. These efforts can benefit natural areas managers by providing better tools for ongoing surveillance, rapid response to detections, and a greater likelihood of successful eradication of this dangerous pest.

Discussion / Question and Answer Session

Tuesday, October 8, 2019 1:00pm - 4:30pm

Management of Natural Areas in an Urban Environment Symposium

Managing Urban Natural Areas: Finding Practical Solutions to Complex Problems

Topic: Urban Natural Areas and Green Infrastructure

Anna Johnson

Pennsylvania Natural Heritage Program

Clara Pregitzer

Natural Areas Conservancy

Leslie Brandt

Northern Institute of Applied Climate Science

Clare Maffei

US Fish & Wildlife Service, UMBC

Jordan Fischbach

RAND Climate Resilience Center

The ecology of urban areas depends on interwoven systems such as forests, meadows, transit networks, underground infrastructure. Successfully managing 'natural' spaces in the city must account for aspects of the full urban ecological complex, including human systems. In this symposium, we will bring together a diverse group of urban natural areas researchers and practitioners to share case studies which highlight data-driven approaches to addressing environmental issues in urban natural areas. Each presenter will share a case study which highlights the interplay between human and natural systems, describing projects addressing issues such as climate change, stormwater management, challenges in urban forestry, urban biodiversity, and connecting diverse urban human communities with nature, and highlighting work done in cities across the country, such as Pittsburgh, Baltimore, New York City, and Chicago. This symposium seeks to highlight 1) common obstacles encountered across the case studies and 2) consistently useful tools or practices which lead to successful implementation of urban natural areas management or monitoring programs, across variable environmental contexts and political or socioeconomic landscapes.

The goal of this symposium is to create a forum for sharing best practices for achieving management goals in complex urban natural areas, and to connect urban natural areas professionals working on similar issues but in different cities. Discussion in this symposium can be extended for conference participants through participation in a linked field workshop taking place in natural areas across Pittsburgh, the Pittsburgh Urban Wilds Field Workshop. This workshop will make stops relevant to integrated pest management, watershed, forest and meadow restoration, green stormwater infrastructure, engaging young people, trail building, and workforce development.

Symposium Participant Talks:

1.

Title: Untapped Common Ground: The Care of Forested Natural Areas in American Cities

Presenter(s): Clara Pregitzer, Natural Areas Conservancy & Yale University, Sarah Charlop-Powers, Natural Areas Conservancy

Abstract: For the first time, the majority of people on the planet live in urban areas and there is increased interest in managing and studying greenspace within and across cities. The majority of city parkland is natural areas (84%) and forested natural areas contribute to improved human health, mitigate the negative impacts of climate change and support ecological functions within cities. Despite being a dominant type of urban greenspace, natural areas often go unnoticed, are underutilized, and under resourced in contrast to the other forms of urban nature and parkland. We present results from a survey of 125 land managers representing 111 cities across the United States. We share trends across the nation in the motivations and priorities for management, common management interventions, data used to inform decision making, and challenges and opportunities for improving the care of this resource. In addition to survey findings we will highlight innovative work in cities across the U.S.

2.

Title: Adapting urban natural areas to climate change

Presenter(s): Leslie Brandt, Northern Institute of Applied Climate Science, US Forest Service; Patricia Leopold, Northern Institute of Applied Climate Science, US Forest Service.

Abstract: Urban natural areas offer a variety of benefits to people living in cities, including recreation opportunities, shade, and clean air and water. Compared to developed urban landscapes and wildland forests managed for timber, these areas have tended to be minimally managed and overwhelmed with nonnative species invasions. As climate changes, urban natural areas may be particularly vulnerable, due to increased pollution, high fragmentation, and lower biodiversity compared to intact natural communities. This talk will examine methods for assessing the vulnerability of urban natural areas to climate change and provide case studies of how urban natural areas across the United States are adapting, using case studies from Chicago, IL, Austin, TX, and St. Paul, MN.

3.

Title: Engaging diverse communities with urban nature

Presenter(s): Camila Rivera-Tinsley, Pittsburgh Parks Conservancy

Abstract: This talk will present a case study of work conducted in Pittsburgh, focused on encouraging diversity within the environmental workforce, as well as cultivating community partnerships to increase diversity and cultural competency, through environmental educational programs in urban public parks.

4.

Title: Baltimore Biodiversity Toolkit: focused plans for urban wildlife

Presenter(s): Clare Maffei, US Fish & Wildlife Service; University of Maryland, Baltimore County

Abstract: The Baltimore Biodiversity Toolkit is being developed to consolidate wildlife-centric project methods tailored for the urban landscape. We've coupled community values and interactive maps to prioritize strategies and centralized local resources on direct actions for rapid habitat restoration. This toolkit is accessible for neighbors adding nature to their front stoop as well as organizations with large scale land management initiatives. Our mission incorporates an integrated framework for using community science apps (iNaturalist especially) for project assessment and community engagement.

5.

Title: Evaluating the flood risk and climate resilience benefits from green infrastructure in key Pittsburgh watersheds

Presenter(s): Jordan R. Fischbach, RAND Climate Resilience Center

Abstract: The City of Pittsburgh is challenged by a number of stormwater impacts, including flooding and sewer overflows. Climate change is expected to exacerbate these impacts by increasing the intensity or volume of rainfall from storms. In this talk, I will describe how our RAND Corporation team is working to address this urgent planning need by combining simulation modeling, methods for decision making under deep uncertainty, and ecosystem service valuation, to evaluate the potential benefits and costs from green stormwater infrastructure in the city's Negley Run and Four Mile Run watersheds.

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Managing Natural Areas in a Changing Climate Symposium

Protecting and Managing Conservation Lands and Waters for Climate Resilience

Topic: Climate Change – Species and Natural Communities on the Move

Elizabeth Johnson
The Nature Conservancy

Jean Lorber
The Nature Conservancy

Meredith Malone
PA Dept. of Conservation and Natural Resources

Brad Maurer
The Nature Conservancy

Ben Rhodes
The Nature Conservancy

Symposium Title: Protecting and Managing Conservation Lands and Waters for Climate Resilience

Climate-resilient lands and waters, if protected and appropriately managed, are expected to continue supporting a diverse array of species and communities as the climate changes, even though individual players or communities may change over time. But how do we as resource managers effectively conserve land and water to maintain or increase resilience to climate change? What strategies do we employ to improve conditions and maintain ecological processes, create options for species to move and/or adapt to changing conditions, or maintain biological legacies that persist to recolonize sites?

This symposium includes several case studies and examples of efforts to utilize current scientific thinking to drive protection and management decisions on-the-ground and in-the-water. The symposium will conclude with facilitated discussion among participants on how we as conservation practitioners protect, maintain, and enhance resiliency in lands and waters where we work.

Presentation Title: Examining restoration goals in the context of climate change: a case study from the George Washington-Jefferson National Forest. Jean Lorber, The Nature Conservancy-Virginia

Abstract: The George Washington National Forests' plan was updated in 2016, one of the first revisions in the nation that elevated ecological restoration goals using the 2012 Planning Rule. Since 2016, a large-scale restoration project has been proposed. We'll examine the new Plan's restoration goals, how the proposed project addresses those goals, and examine both through the lens of climate change adaptation and resiliency.

Presentation Title: Implementing the DCNR Climate Change Adaptation & Mitigation Plan in the South Mountain Landscape of Southcentral Pennsylvania. Meredith Malone and Andrew Rohrbaugh, PA Department of Conservation and Natural Resources.

Abstract: DCNR will talk about the process of planning and starting a climate change resiliency project on the South Mountain landscape in southcentral Pennsylvania. This project aims to implement the DCNR Climate Change Adaptation and Mitigation Plan at three state parks and the state forest district within this landscape, while also working to leverage knowledge from external organizations. While the project is just beginning, lessons learned from its initiation may be helpful for other conservation organizations interested in working with partners to address climate change issues on a landscape scale.

Presentation Title: Conserving a Critical Climate Corridor on the Kittatinny Ridge. Elizabeth Johnson, The Nature Conservancy

Abstract: The Kittatinny Ridge landscape stretches from Maryland to New York and is one of the most critical climate corridors for the movement of species from the Southern Appalachian Mountains to the Northern Appalachian

Mountains and beyond. This session will describe how we transformed large-scale resiliency data into local and regional land protection priorities and formed a successful land protection partnership to ensure the connectivity of this landscape. Then we will discuss how TNC and its partners have developed their management plans for the Cove Mountain complex located at the heart of the Kittatinny Ridge through the lens of managing for resiliency to climate change.

Presentation Title: Evaluating the Management of Dams under a Changing Climate – Case Studies on the Upper Allegheny River. Brad Maurer, The Nature Conservancy and Rose Reilly, United States Army Corps of Engineers Pittsburgh District.

Abstract: The Nature Conservancy and the U.S. Army Corps of Engineers, Pittsburgh District will showcase their efforts to re-evaluate the management of dams under a changing climate. Through the Sustainable Rivers Program, a unique and innovative partnership between the Conservancy and the Corps, water managers are assembling research on the unique flow requirements of rivers and using this information to inform how dam operations can achieve environmental flows - scientific prescriptions for the timing and level of water flow that must occur downstream of dams in order to revive and sustain critical ecological functions and habitat for species. Presentations by The Nature Conservancy and US Army Corp of Engineers will illustrate tools, approaches, and partnerships being used to evaluate dam operations impacting hundreds of miles of the Upper Allegheny River.

Presentation Title: Landscape-Scale Restoration on the Monongahela National Forest. Ben Rhodes, The Nature Conservancy; Shane Jones, USFS; Dustin Wichterman, Trout Unlimited

Abstract: Region-wide ecological degradation during the Industrial Logging Era dramatically altered the highlands of West Virginia. Keystone species such as red spruce were decimated, rampant wildfires degraded the soil, and the area's hydrology was heavily impacted by erosion, logging roads, and railways. Now, a century later, the area's forests, soils, and streams still face a long road to recovery.

The Nature Conservancy has partnered with the Monongahela National Forest, Trout Unlimited, Canaan Valley Institute, and other organizations to restore resilience and connectivity to this crucial area. This presentation will describe the comprehensive partnership-based ecological restoration being undertaken in the Upper Greenbrier North project area, which sits in the heart of West Virginia's spruce highlands. The Upper Greenbrier North project has successfully implemented cutting-edge restoration techniques by incorporating the knowledge and expertise of multiple organizations into a spatially interconnected matrix of on-the-ground activities.

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Mitigating the Impact of Energy Development Symposium

Partnerships in Nature and How Energy Corridors Can Help

Topic: Mitigating the Impact of Energy Development

Anand Persad
The Davey Institute

Phillip Charlton
Utility Arborist's Association

Gregory Dahle
West Virginia University

Stan Vera-Art
Beyond Compliance

Dave Bienemann
Hamilton City

Green Space ROW Management, Environmental Stewardship and Partnerships
Phil Charlton

Tree and vegetation are a ubiquitous part of and provide ecosystem value to our energy corridors and rights of ways (ROW). While the role of ROW's in habitat creation is not new, increased focus in Integrated Vegetation Management (IVM) and the added role of community partnerships with state and local bodies and utilities make for relationships that ultimately add value to these greenspaces. The Utility Arborist's Association (UAA) has embarked on a mission to further embrace environmental stewardship and has established a task force to assist with the prioritization of achieving several goals towards a healthier and more native ROW. This initiative gathers information on current land management tactics, regulatory considerations and proposes to offer to the industry added value of ROW management that provide greenspaces and natural areas that are sustainable and maximize its ecosystem worth. Partnerships with entities such as the Natural Area Association also dovetails with the wider objective of cross-pollinating land management across industries.

Pollinator health and Managing for Sustainability in Utility Corridors
Stan Vera-Art

Utility corridors offer vast resources of green spaces, many often providing ideal habitat for native flora and fauna. Management of these green spaces are often governed by best management practices and Integrated Vegetation Management (IVM) considerations. Pollinator health in these rights of ways (ROW) has become a much-emphasized metric to ecosystem health and worthiness and an indicator of how well we are doing and what we are leaving behind. This presentation looks at compliance in IVM tactics and bridges the BMP's we employ today with what more is needed to be prepared to face a future of increased challenges. A video of pollinator health and pollinators in ROW will be presented as part of the talk.

Case Studies of Natural Areas Intersecting Utility Energy Corridors
Anand Persad-

Energy corridors thread the landscape and provide cumulations of many miles of open tracts and flyways. These right's of ways (ROW's) offer easy mobility to organisms from one location and/or geography to another. In many cases, land management techniques employed in these corridors focus on Integrated techniques (IVM) and coupled with best practices often subscribe to a higher standard for ecosystem health and services. Depending on adjacent land usage to ROW's, differing tactics sometimes may occur, for example when adjacent lands are natural area tracts that abut the ROW. This study presents data on several instances where ROW's corridors may bisect or abut with natural areas and investigates plant species composition, dynamics and resulting invertebrate populations under differing tactics. By investigating the BMP's in use in either situation and analyzing the greenspace, we can help determine effectiveness of strategies in providing greenspaces that may promote more native species and be more sustainable in energy corridors.

Restoration of Native Trees in Rights of Ways: Community Partnerships
Greg Dahle

Insects such as the Emerald Ash Borer and diseases such as Dutch Elm Disease and Oak Wilt may take a toll on community trees and have an effect on the tree population that warrants restoration activities. The right tree in the right space, as we know is a golden rule especially in the areas under wire or near off-corridor areas and in natural areas along energy corridors. Tree restoration may offer communities the opportunity to become engaged and the use of native plant material is often a paramount consideration and a sustainable initiative. This presentation looks at community based tree restoration initiatives and evaluates tree-species characteristics from a biomechanical standpoint and/or wind resistance after restoration and also delves into the growth characteristics of several commonly planted species. The added benefits of native trees and potential for early season blooms that may provide pollen and nectar for early arriving pollinators are also compared for tree species occurring prior to restoration and upon planting with native species. This partnership in restoring natural spaces that intersect energy corridors, coupled with the need to address the plight of pollinators allow for engagement and participation of green space land managers and the larger community working together to preserve these longer-lived elements of our

greenspaces.

Case Studies of Mitigating Opportunistic Vegetation and Woodlots On and Off Energy Corridors

Dave Bieneman and Anna De Toro

In many areas of the country energy corridors may be left largely unmanaged with remedial work done as needed or minimally to achieve energy reliability. In recent years more communities and land managers are understanding the importance that ROW areas may serve as potential habitats. In many cases trees and woodlots and non-productive scrubland may be converted to provide enhanced habitat quality.

Data is presented on soil biological activity (SBA) and plant species that emerge in several regions of North America including Trumbull County, OH and Hamilton OH, on case studies where long-existing woody, invasive and right's of way (ROW) non-compatible plant material is removed by mechanical means or with herbicides. Plant succession evaluations indicate that some mesic forbs emerge from native seedbanks and can co-exist with other native plants and grasses. Twenty three species of invertebrates were found in these early pioneer communities, among them several pollinator species were present including several native hymenopteran (bee) species. The challenges associated with utilizing proper techniques including the timing of herbicide applications are identified and include addressing the balance of compatible and non-compatible plant species in these ROW's.

Tuesday, October 8, 2019 1:00pm - 2:30pm

Native Plant Conservation Initiatives

Grassroots seed propagation of New England Native Plants

Topic: Native Plant Conservation Initiatives

Heather McCargo

Wild Seed Project

The seeds of New England native plants have different germination requirements than the seeds of cultivated plants or wild plants from warmer and dryer western climates. This talk will discuss the different types of strategies needed to collect and sow the seeds of northeastern wildflowers, ferns, shrubs and trees with an emphasis on outdoor seed sowing in pots or growing beds with organic nursery practices. Growing natives from seed is a great way to produce a lot of plants inexpensively and to protect the genetic diversity of our native plants. Maine based Wild Seed Project is a 501c3 nonprofit that works to demystify native seed sowing so that a wide range of citizens, both amateur and professional, can participate in increasing native plant populations in developed and wild landscapes.

The Arkansas Native Seed Program: an initiative to develop a native seed industry with locally-sourced plant materials

Topic: Native Plant Conservation Initiatives

Jennifer Ogle

Arkansas Native Seed Program

Jonathan Young

Audubon Arkansas

Theo Witsell

Arkansas Natural Heritage Commission

Diverse native plant communities provide many essential benefits, including filtration and purification of stormwater, climate regulation, and vital habitat and food resources for pollinators and other wildlife. Remnant natural communities face a barrage of threats from human activities – fragmentation, destruction, and invasion by non-native plants, to name a few. Although native plant materials are increasingly required for public and private revegetation and restoration projects in Arkansas, locally-sourced seed is not readily available and so land managers must resort to using seed of non-local or even unknown origin. These materials bring non-local genes into native populations and have the potential to reduce the fitness of those populations. Non-local native seeds are also not necessarily adapted

to local environmental conditions and may be less likely to establish and survive.

The Arkansas Native Seed Program, a collaborative effort of several state, federal, and private conservation partners led by the Arkansas Natural Heritage Commission, seeks to address these issues by developing a native seed industry using ecologically appropriate, ecoregionally-sourced native plant materials for large-scale revegetation and restoration projects. This type of program has not been attempted previously in Arkansas, and many challenges exist due to a lack of local knowledge about growing native plants at a large scale and a nearly complete lack of infrastructure for growing, storing, and distributing native seed in the state at the scale required for such an ambitious project.

The program employs ecologists and biologists to determine demand for seed, delineate appropriate seed zones, compile target species lists for collection, and identify appropriate plant community remnants from which to collect seed. We engage volunteers to harvest seed from approved collection sites, partner with nurseries to clean the seed and propagate plants from that seed, and work with local farmers to grow those plants in an agricultural setting and harvest seed for commercial distribution. Though in its early stages, the program is showing much promise toward achieving its goals of facilitating a native seed industry in Arkansas that can provide the materials needed for large-scale ecological restoration, stimulating seed supply and enhancing restoration opportunities across the state, and educating the public on the importance of using native seed for restoration.

Tuesday, October 8, 2019 1:00pm - 4:30pm

Using Data and Technology to Advance Conservation Symposium

The importance of genetics to restoring species of special interest in Appalachian ecosystems.

Topic: Using Data and Technology to Advance Conservation

John Carlson
Pennsylvania State University

Krystle Swartz
Pennsylvania State University

Thomas Weathers
Penn State University

Tatyana Zhebentyayeva
Penn State University

Sara Fitzsimmons
The American Chestnut Foundation

1) Title: 'Genetic diversity in the rare parasitic tree Buffalo Nut'

Speaker: Krystle Swartz, Penn State University

Abstract: Buffalo Nut is a unique facultative hemi-parasitic species that can reproduce clonally or sexually.

Fragmented stands of Buffalo Nut in Pennsylvania forests represent the northern-most populations of the plant.

These populations could be the originators for new stands expected to arise as climate change shifts this species native range further north. When observing a stand of this species, it is impossible to be sure if individual trees are clones of a common parental plant or if familial structure exists as a product of sexual reproduction. Our recent study was the first to use genetic techniques to determine relatedness of plants and assess the diversity of collected samples. We then compared diversity found in the samples from Pennsylvania to samples collected in other states. Our findings, along with other data, provide evidence that Buffalo Nut is becoming increasingly rare in PA forests and allows us to make best practice suggestions for conservation of this species.

2) Title: 'Conservation genetics of native brook trout in the Great Smoky Mountains National Park'

Speaker: T. Casey Weathers, Penn State University

Abstract: Since the outset of European settlement in North America, human activity has contributed to the fragmentation of fish populations. To better understand how human activity has affected population connectivity, we examined genetic variation at the DNA level in Brook Trout across southern Appalachia. Our results suggested that gene flow between populations is affected by both natural and man-made barriers. Our results suggest assisted upstream migration and removal of stocked nonnative salmonid species and habitat restoration efforts are needed to improve the outlook for headwater Brook Trout populations.

3, 4) Title: 'Restoration of the American chestnut'

Speaker: Tatyana Zhebentyayeva, Penn State University, and Sara Fitzsimmons, The American Chestnut Foundation

Abstract: The introductions of the chestnut blight fungus to North America in 1904 and to Europe in 1938 led to severe epidemics devastating American chestnut (*Castanea dentata*) and European chestnut (*C. sativa*) populations. Asian Chestnut species, such as Chinese chestnut (*Castanea mollissima*), are naturally resistant to chestnut blight fungus, and are being used as parent trees for transfer of resistance genes to *C. dentata* and *C. sativa* by breeding. Sara Fitzsimmons, Director of Restoration and Science Coordinator for the North Central Region of The American Chestnut Foundation, will present the back-cross breeding approach underway and how volunteers in state chapters are contributing. Dr. Zhebentyayeva will explain how genes for resistance to chestnut blight and other diseases are being identified, and genome-wide tools are being developed to advance chestnut breeding.

5) Title: 'Genetic opportunities for restoring green ash and American beech'

Speaker: John, Penn State University

Abstract: American beech and green ash are aesthetically, ecologically and economically important native trees of our eastern hardwood forests. Both are suffering high rates of mortality due to the spread of exotic insects. The invasive sap-feeding woolly beech scale insect transfers the beech bark disease (BBD) to American beech, while the emerald ash borer (EAB) threatens all native ash species in North America. A small percentage of trees survive BBD and EAB attack, showing signs of natural resistance to the insect in greenhouse tests. We have conducted genetic studies to determine what variations in gene sequence may be related such cases of natural resistance.

Tuesday, October 8, 2019 3:00pm - 4:30pm

Management Planning to Advance the Conservation of Special Species/Natural Communities session A

Current Research and Conservation Action for the Federally Threatened White Fringeless Orchid (*Platanthera integrilabia*)

Topic: Management Planning to advance the Conservation of Special Species/Natural Communities

Roger McCoy

TN Division of Natural Areas

Todd Crabtree

TN Division of Natural Areas

Geoff Call

U.S. Fish and Wildlife Service

Current Research and Conservation Action for the Federally Threatened White Fringeless Orchid (*Platanthera integrilabia*) in Tennessee

Roger McCoy, Todd Crabtree (TN Division of Natural Areas), and Geoff Call (U.S. Fish and Wildlife Service)

Known occurrences of the federally threatened white fringeless orchid (*Platanthera integrilabia*) reside within the Cumberland Plateau with a few isolated populations in the Blue Ridge, Piedmont, and Coastal Plain physiographic provinces. The species' habitat includes acidic forested streamheads with an overstory of red maple and black gum, an understory that includes possumhaw (*Viburnum nudum*) and/or mountain azalea (*Rhododendron canescens*), a

herbaceous layer often thick with ferns including New York fern, royal fern, and cinnamon fern, and patches of Sphagnum spp. With proper hydrology the species also occurs within successional dynamic herb-dominated open wet meadows within powerlines or other maintained sites; such sites normally contain a greater number of flowering individuals in contrast with forested habitats. Prior to and since the U.S. Fish and Wildlife Service listed white fringeless orchid as threatened in 2016, the USFWS has partnered with the Tennessee Division of Natural Areas and other organizations on a variety of projects. Research and conservation activities include searches both within and beyond the species' known range, monitoring known populations and documenting current threats, developing GIS-based habitat models for different states, seed and germplasm collection for propagation, population management, and safeguarding, habitat management to reduce woody species competition, and evaluating ecophysiological responses to various light and soil moisture levels. Botanists require flowering individuals for field verification of *Platanthera integrilabia* thus potential occurrences remain unconfirmed due to the lack of flowering *Platanthera* spp. within forested habitats. To aid confirmation – and ultimately conservation – of this federally listed plant, researchers at the University of Tennessee, Knoxville have recently developed DNA barcoding allowing for identification of *Platanthera integrilabia* with only a small amount of leaf material.

Restoration of rare seep habitat in the Illinois River floodplain

Topic: Management Planning to advance the Conservation of Special Species/Natural Communities

Anna Braum

The Wetlands Initiative

Anna Braum, The Wetlands Initiative

Gary Sullivan, The Wetlands Initiative

The Dore Seep Nature Preserve in Putnam County, Illinois, is a 26-acre seep that is part of the 95-acre Senachwine Seep Natural Area, the largest identified example of this rare natural habitat in Illinois. Seeps are groundwater dependent systems characterized by diffuse flows of cool, mineralized groundwater with low nutrient concentrations and a pH of 7.0 or above. Aerial photographs dating to the 1930s indicate that the Dore Seep was historically dominated by a herbaceous plant community interspersed by isolated patches of trees and shrubs. In the succeeding years, the hydrologic regime was altered to promote activities such as grazing, which fostered the growth of woody early successional and invasive species. Since the Wetlands Initiative began managing the Dore Seep in 2003, management activities have focused on restoring hydrology, removing woody and non-native species, and reestablishing the native herbaceous plant community, with an emphasis on expanding suitable habitat for state-listed species. Between 2007-2018, survey plots within the seep were revisited six times in order to evaluate changes in the plant community in response to management activities. We present the results of this analysis and discuss implications for the conservation and management of rare wetland communities.

Successes (and failures) of *Oxypolis canbyi* restoration in a Delmarva bay

Topic: Wetlands Conservation (for Rare Species)

Deborah Landau

The Nature Conservancy

Successes (and failures) of *Oxypolis canbyi* restoration in a Delmarva bay

Deborah Landau, PhD and Gabe Cahalan, The Nature Conservancy, Maryland/DC Chapter

The challenge of protecting rare species is exacerbated when working in declining and degraded habitats. Restoring these areas and their associated species can be a complicated balance between restoration activities and maintaining a light touch in a sensitive habitat. The Nature Conservancy spent decades attempting to restore the only Maryland population of Canby's dropwort (*Oxypolis canbyi*, G2/S1) in a seasonal depression wetland ('Delmarva bay') through transplantings and woody vegetation control, with limited success. Ultimately, a controlled burn was executed, utilizing the fuel type transition as a natural firebreak. The result was a successful burn with minimal negative disruption to the wetland, and a doubling of the *Oxypolis* population. A subsequent burn two years later

resulted in a quadrupling of the population, and expansion of the zone in which the plant resides. This suggests that manually reducing woody plant competition may not be sufficient for restoring these depressional wetland habitats and their associated species. The factors involved are discussed.

Wednesday, October 9, 2019 8:30am - 12:30pm

Engaging the Public in Management of Natural Areas Symposium

Integrating Education into Conservation Planning to Foster Stewardship

Topic: Management Planning to advance the Conservation of Special Species/Natural Communities

Danielle Forchette

Western Pennsylvania Conservancy

Miranda Crotsley

Jennings Environmental Education Center

Marijke Hecht

University of Pittsburgh Center for Learning in Out of School

Camila Rivera-Tinsley

Pittsburgh Parks Conservancy

Dr. Becky Thomas

Slippery Rock University

Miranda Crotsley, Jennings Environmental Education Center

Jennings Environmental Education Center frequently demonstrates that integrating the community into resource management work has benefits for the public and conservation scientists, alike. From high school student research, bolstered by inquiry-based science teaching and partnerships, to collaborations with local post-secondary institutions; and from social media outreach to citizen science, professionals can not only learn from their communities and integrate their findings into management practice, they can simultaneously build community trust in science, and strengthen community identity as contributors to science. Miranda Crotsley, Program Coordinator at Jennings Environmental Education Center, a Pennsylvania State Park, will discuss local and statewide efforts to integrate the public into conservation and resource management work. She will detail their work related to education and prairie and endangered species management, among other topics, paying particular attention to how partnerships amongst land managers, scientists, educators, and the community at-large has benefited all parties.

Fostering Reflective Stewardship: Integrative Learning in Experiential Education

Danielle Forchette, Western Pennsylvania Conservancy

Engaging youth in real-world, hands-on conservation experiences can be a powerful way to build the next generation of environmental stewards. However, not all experiences are equally educative, and some experiences can be mis-educative in ways that may suppress future engagement. How can we promote wholistic development of learners' personal, academic, career, and civic identities as environmental stewards? How can we support reflective stewardship in relation to contemporary social issues and in community contexts? How can we encourage justice-oriented stewardship that fosters inclusion and equity? Drawing on experiential learning theory and practice, this session will explore key features of quality learning experiences—such as authenticity, intention, preparedness, and critical reflection—to discuss the promise and challenge of inviting learners into the real-world of conservation work.

Becoming a naturalist: Interest development across the learning ecology

Authors: Marijke Hecht, Karen Knutson, Kevin Crowley

Engagement with and study of nature is increasingly important for science literacy and civic engagement. Spurred on

by challenges of the Anthropocene, many informal learning institutions are exploring how their collections, programs, and scientific expertise can be mobilized to create new naturalist learning pathways for children and youth. In this paper, we explore retrospective life histories of 18 adult naturalists to examine experiences that they recall supporting their interest development in the natural world. Drawing on interest and informal learning literature, our analysis reveals how elements across the learning ecology, including school, family, and out-of-school learning, work together to support the development of naturalist practices and identities. We found that interest development in nature occurred across the learning ecology and that expression of situational or individual interest depended on the participants' age and the type of learning experience. A closer examination of three individual cases—a serious amateur naturalist, an environmental educator, and an ecologist—reveals some of the nuanced ways that interest in nature arises, is maintained, and can eventually develop into a deep, lifelong naturalist identity. We consider implications for how one might conceptualize and support informal learning pathways that involve deep engagement with and connections to nature.

LEARNING BY DOING: PREPARING UNIVERSITY STUDENTS FOR THE RESEARCH-IMPLEMENTATION SPACE IN NATURAL RESOURCE MANAGEMENT

Dr. Becky Thomas, Assistant Professor of Park Resource Management, Slippery Rock University

Today's natural resource management professionals must demonstrate expertise in a variety of areas, including technical skills related to ecosystem science and management as well as interpretation and communication skills to translate this science to public audiences. Community-engaged service learning values both academic and practice-based knowledge. It also provides students with the opportunity to address an applied research need in collaboration with practitioners while building a tangible knowledge and skill base. This session will highlight lessons learned from a senior capstone Wildlife and Wildlands Field Methods and Management course that has placed students in the research-implementation space between Slippery Rock University, the community, and four state parks in Western Pennsylvania since 2016. Past student projects have focused on, for example, recreational impacts on terrestrial salamanders, American woodcock monitoring, macroinvertebrates and stream health, migratory songbirds, and vernal pools. Findings have been used to inform park management at each site and to enhance interpretation of scientific information to the public. Through this experience, students become prepared to enter the field of practice as reflective, community-engaged practitioners who can exercise reciprocity, value different ways of knowing, and demonstrate comfort with the uncertainty and ambiguity that often underpins this work.

Wednesday, October 9, 2019 8:30am - 10:00am

Identifying Natural Areas for Conservation

A program to characterize biodiversity at a global level in selected representative sites.

Topic: Management Planning to advance the Conservation of Special Species/Natural Communities

John Wenzel

Carnegie Museum of Natural History

John Pickering

University of Georgia

As natural habitats become more fragmented, it is important to prioritize those we will try to preserve. To accomplish this, we need to develop rapid assessment tools to evaluate biodiversity at any given site. By relying on select preserves and well-studied locations, we expect to create protocols to be implemented at poorly known sites to create the baseline data that will be needed for management.

Design approaches to preserve a university-owned natural area: The Musser Gap to Valleylands (MG2V) project at Penn State

Topic: Identifying Natural Areas for Conservation

Charles Cole

Penn State University

Title: Design approaches to preserve a university-owned natural area: The Musser Gap to Valleylands (MG2V) project at Penn

State

Presenter: Charles Andrew Cole, Ph.D., Associate Professor of Landscape Architecture & Ecology; cac13@psu.edu; 814-865-5735

Co-authors: Lisa DuRussel, MLA, Assistant Teaching Professor, Practitioner-in-residence
Dan Meehan, IT Specialist

Ken Tamminga, MURP, Distinguished Professor of Landscape Architecture

Tom Yahner, MLA, Emeritus Associate Professor of Landscape Architecture

Abstract

In Spring 2018, Penn State University recognized that a 365-acre tract of land represented a rare opportunity to set a new and more sustainable land and water management trajectory—one that safeguarded a vital and vulnerable freshwater aquifer, enhanced terrestrial and aquatic habitat, and provided for sustainable ecosystems-based monitoring and nature appreciation that 'lies lightly on the land.' The University asked faculty in the Department of Landscape Architecture with expertise in land conservation and ecosystem restoration to offer two interdisciplinary courses over an academic year to study a University-owned tract of land in the Musser Gap and adjacent valleylands area. The fall 2018 course developed background data on site characteristics, including agriculture, water, wildlife, recreation, among other aspects. The spring 2019 course used the fall information, and interactions with community members, to develop four preliminary design ideas for consideration by Penn State going forward. The design ideas varied from naturalization involving meadow and grasslands, complete reforestation, recreation, and agriculture. The student team presented the findings of their analyses to campus leaders, and the general public, to help to inform the University's long-term planning for the land, and future community-based consultations. We provide details on the process of preserving sensitive lands on university property, as well as the mechanics of gathering site data and working with the community to develop ideas that respect local natural and cultural sensitivities.

The Devil and the Deep Blue Lake: Natural Area Acquisition and Stewardship Protect a Major Arkansas Drinking Reservoir

Topic: Best Management Practices on land for Freshwater Ecosystem Integrity

Dustin Lynch

Arkansas Natural Heritage Commission

The Arkansas Natural Heritage Commission (ANHC)'s 1225-ha Devil's Eyebrow Natural Area (DNA), located at the northern end of Beaver Lake along Indian Creek, Butler Creek, and their tributaries, is an ecologically significant site in the Ozark Highlands that falls primarily within the Beaver Lake Watershed, deemed the number-one priority watershed by Arkansas's Unified Watershed Assessments and Restoration Priorities Report due to its designation as an extraordinary water resource, the presence of imperiled aquatic species in the watershed, its role as one of the most important supplies of drinking water in the state, and its status as both an impaired water body and an interstate 'water of concern.' Beaver Lake supplies drinking water to more than 420,000 people, one in eight Arkansans, and industries including the Walmart Home Office in northwest Arkansas. DNA protects 5 km of Beaver Lake frontage and 7.5 km of critical tributaries in the watershed and is part of a broader interconnected Conservation Corridor that includes Nature Conservancy preserves, Army Corps of Engineers property surrounding Beaver Lake, Hobbs State Park Conservation Area in Arkansas, and the Mark Twain National Forest and Roaring River State Park in Missouri. Water quality protection and improvement has been a critical component driving the funding of DNA, as well as both a direct and indirect focus of much of ANHC's ongoing restoration efforts on the property. Road improvements to decrease sedimentation, reforestation efforts, and feral swine removal have all served to improve water quality in the watershed. A project to improve glade habitat for several species of greatest conservation need through cedar removal has had the added benefit of providing aquatic habitat structure for fish and improving angling opportunities in Beaver Lake. This project serves as a model for conservation partnerships in critical watersheds and also highlights how efforts to directly improve water quality, as well as efforts with indirect benefits to watersheds (conceived primarily to restore terrestrial habitats), can have far-ranging benefits for ecosystems, imperiled species, and stakeholders. Here we present how the ANHC and its conservation partners have successfully used various strategies to build local support, leverage funding, engage the public, and conduct meaningful conservation at a regional scale.

Wednesday, October 9, 2019 8:30am - 12:30pm

Managing Natural Areas in a Changing Climate Symposium B

Flexible tools to increase the effectiveness and scale of land conservation for environmental and climate resilience

Topic: Using Data and Technology to Advance Conservation

Tom Robinson
Bay Area Open Space Council

Matt Freeman
Santa Clara Valley Open Space Authority

Adam Garcia
Greenbelt Alliance

Elizabeth O'Neil Donoghue
The Nature Conservancy, California Chapter

Nicole Heller
Carnegie Museum of Natural History

Symposium Overview

The San Francisco Bay Area is a global biodiversity hotspot and like many urbanizing regions, it is experiencing rapid population growth and an uncertain climate future. Selecting and conserving natural areas, including multi-benefit working lands for landscape and community resilience in the face of climate change, is more important now than ever. Yet the challenges are great and span multiple scales, from the site to the ecoregion and the from parcel to the jurisdiction. This symposium brings together conservation practitioners from the San Francisco Bay Area and beyond to share new decision support processes and tools that are making an impact, particularly on co-developing a shared vision for a resilient region and mobilizing diverse actors toward realizing that vision.

Speaker #1: Tom Robinson, Bay Area Open Space Council

Title #1: Increasing the pace and scale of conservation action in the San Francisco Bay Area through the Conservation Lands Network

Abstract #1: Ensuring the persistence of biodiversity and the health of ecosystems requires conserving sites that are ecologically significant at the ecoregional scale (the scale of plant and animal populations). However, land acquisition and stewardship decisions are often made at the local scale (the scale of land use decision-making). Local land acquisition and stewardship project managers need data at all scales but often lack the means or mandate to conduct planning at larger scales. Funders of conservation, too, seek data at ecologically relevant scales in order to choose where to invest. Furthermore, both project managers and funders demand rigorous planning methods; vetted assumptions, underlying data, and analysis results; and straightforward information delivery systems. Increasingly, all actors want to know how climate change may impact or shift population ranges and therefore significant sites. We advocate for collaborative planning processes that result in a mapped network of connected habitat for a given ecoregion that 1) includes full representation of existing habitats with an emphasis on local rarity, 2) incorporates expert knowledge, 3) is attainable with aspirational but realistic funding levels, and 4) is robust to expected effects of climate change. In this talk, I will demonstrate such a planning framework we jointly developed in the San Francisco Bay Area called the Bay Area Conservation Lands Network and review the ingredients to its successful uptake by practitioners.

Speaker #2: Nicole E. Heller, Carnegie Museum of Natural History

Title #2: Adapting conservation tools and approaches to account for climate change

Abstract #2: A key issue for effective conservation is ensuring investments are smart in the face of climate change. While there are analytic methods that have been piloted for incorporating climate change into systematic planning, more often practitioners need methods to evaluate climate risks and make decisions using existing tools and data resources. Moreover, there are inherent uncertainties in incorporating climate model projections directly into systematic planning, as conservation priorities may alter dramatically depending on which climate models, emissions scenarios, and time periods are used, depending on which species or conservation target is under-consideration, and

even which adaptation philosophy is adopted. What are more flexible strategies for managers and planners to use with existing conservation tools and climate data to evaluate and adapt plans? In this talk, I will discuss research to develop climate-smart approaches to adapt tools in the San Francisco Bay Area and in connection with the development of the Conservation Lands Network (CLN) Explorer tool. I will illustrate a range of approaches to evaluate and adapt conservation tools for robust land protection and stewardship decisions.

Speaker #3: Adam Garcia, Greenbelt Alliance

Title #3: Promoting awareness of the threat of development and opportunities for regional open space protection through policy analysis mapping

Abstract #3: The growing outward pressure of our cities is placing considerable strain on the capacity of surrounding wild and food producing lands. Assessing development pressure on greenbelt lands at the eco-regional scale is challenging due to the number of jurisdictions involved. The different cities, counties, and districts have their unique policies to govern their landscape. How do we estimate the environmental threat when looking across multiple planning cultures? And how do we highlight where policy protection is lacking? The San Francisco Bay Area, a 9-county, 101-city urban/wildland planning region is an ideal location to innovate techniques to address these challenges. Since 1989, Greenbelt Alliance has conducted the At Risk research which scours, processes, and analyzes planning information to tell the story of imminent and potential loss of open space. On one hand the data portrays where new greenfield development will most likely occur given the combination of zoning, growth boundaries, and past proposals, while the other side maps out where jurisdictions double down to protect open space values. This recurrent message is helping maintain an awareness of those most vital landscapes, mapping where land trusts and park districts can prioritize protecting most threatened areas, sharing policies between cities to better steward their natural resources, and providing a platform for regional growth inside existing growth boundaries. Without At Risk the unique and irreplaceable open spaces interspersing the Bay Area's cities might have long been lost.

Speaker #4: Elizabeth O'Donoghue, The Nature Conservancy, California Chapter

Title #4: Where the rubber meets the road: Meeting the conservation data needs of land use and transportation planners through an regional greenprint

Abstract #4: The Bay Area Greenprint is an innovative, science-based, easy-to-use online tool that integrates the Conservation Lands Network and At Risk Analysis to reveal for land use and transportation planners the multiple benefits of natural and agricultural lands across the nine San Francisco Bay Area counties. This new tool informs land-use planning and development decisions in effective ways by streamlining data and delivering vetted metrics of ten "nature's values and benefits" in a flexible and freely available web platform. While the use of greenprints has been growing nationally and globally to help practitioners make data-driven conservation decisions, the Bay Area Greenprint is unique in its values and benefits framing, user-friendly interface, and incorporation of climate change metrics and policy information. This presentation will outline the need for the Greenprint, the unique, cross-sectional collaboration that allowed for its creation, how it was developed, and a demonstration of the tool in action. We will show how the Greenprint can be used to align an understanding of environmental threats and opportunities with particular demographic data, such as communities disproportionately burdened by pollution.

Speaker #5: Matt Freeman, Santa Clara Valley Open Space Authority

Title #5: From greenprint to greenbelt: Translating conservation science into policy and partnerships to conserve the Coyote Valley

Abstract #5: Located at the southern edge of San Jose, California, the 7,400-acre Coyote Valley is a last-chance landscape. For decades it was anticipated to become the site of a major high-tech campus and home to tens of thousands of new residents. Spared from development in part by the vagaries of the boom-and-bust economy, the Coyote Valley emerged as a top priority for conservation as revealed by the Conservation Lands Network Explorer, through the Santa Clara Valley Greenprint and the Bay Area Greenprint, and other analyses. This talk recounts how the Open Space Authority and its partners integrated data from these conservation planning efforts into a compelling, multi-benefit vision for the Coyote Valley. It will focus on the development of key partnerships and land conservation strategies built around three key themes: 1) Coyote Valley's role as a critical landscape linkage for regional habitat connectivity; 2) its natural floodplain values and opportunities for green infrastructure projects that benefit both the natural and urban environment; and 3) how the protection of its open spaces and agricultural lands helps achieve California's climate goals by reducing Greenhouse Gas emissions associated with urban development. While the story of land conservation in Coyote Valley is still being written, the many successes to date can be attributed in part

to investments in conservation planning tools and through strategic partnerships that align local and state policies with on-the-ground projects that utilize nature as infrastructure.

Wednesday, October 9, 2019 8:30am - 10:00am

Monitoring Conservation Initiatives

"Every cog and wheel": the Importance of Multi-taxa Baseline Inventory in Management and Restoration Planning

Topic: Management Planning to advance the Conservation of Special Species/Natural Communities

Matthew Sarver

Sarver Ecological, LLC

Taxonomically diverse baseline biotic inventory is rarely conducted prior to restoration planning. A 'research-implementation gap' is prevalent in restoration practice, and practitioners often lack financial and technical resources for intensive ecological studies. Opportunistic or ad hoc approaches to restoration and management, however, are unlikely to yield optimal return on investment. Likewise, a focal species approach based on one or a few species fails to account for tradeoffs inherent in conflicting habitat needs of multiple species of conservation concern that may be present at a site. Restorations based primarily on vascular plant diversity or natural vegetative communities may not provide for the specific needs of species of conservation concern, since natural communities themselves do not serve as adequate surrogates for rare species occurrence. Further, restoration efforts based on incomplete survey data may do more harm than good with respect to some rare species and communities.

We completed an ecological assessment and restoration plan for 4,500 acres of bayshore habitat at Delaware Wild Lands Taylor's Bridge Complex on the Middle Atlantic Coastal Plain. We surveyed remnant natural vegetation and calculated mean coefficients of conservatism for vegetation polygons. We then overlaid point occurrence data for plant, bird, herpetile, odonate, lepidopteran, and native bee species of conservation concern from both targeted surveys and incidental observations. From these spatial data, we generated cores of high quality resources based upon both vegetation 'intactness' and rare species occurrence. These cores were then buffered and connected in phased restoration concept designs.

This case study demonstrates how broad, rapid, baseline inventory across multiple taxa provides critical data to inform restoration and management planning at multiple spatial and temporal scales. We documented a surprising number of species of conservation concern within a coastal agricultural landscape, including new populations of several state-listed species. For example, we located only the second known occurrence in the state for a rare skipper that is restricted to the edges of tidal marshes, where commonly-prescribed dormant-season burns are likely to result in local extinction, and where late summer mowing schedules may destroy critical adult nectar sources. Similar data on the co-occurrence of several other species of concern, including marsh birds and plants, allowed us to identify synergies and conflicts among the habitat needs of various species and guilds, and incorporate them into the design. In addition to directly influencing more effective restoration designs and management prescriptions, our approach yields a 'toolbox' of multiple charismatic taxa that may be suitable as indicator species for monitoring or as flagship species to help increase stakeholder support and funding availability for restoration efforts.

Hydrology Monitoring: methods and applications in a changing landscape

Topic: Climate Change – Species and Natural Communities on the Move

Kathleen Walz

New Jersey Department of Environmental Protection

Why monitor hydrology? What do you need to know? Approaches to monitoring hydrology in freshwater and coastal wetlands will be discussed. Topics include the role of geomorphology and soils, hydrodynamics and geochemistry, precipitation, sea level rise, the changing climate, groundwater and surface water assessments, duration and frequency of sampling, hydrology monitoring equipment, data collection options, interpretation of results, adaptive monitoring, and application of findings to conservation, management, and restoration. Examples will be given from hydrology monitoring projects in a small-karst landscape of northern New Jersey, using water level data to develop vegetation-hydrology models for rare wetlands in the Pinelands, determining the roles of groundwater and tidal

flooding in coastal sea level fen and tidal marsh ecosystems, and establishing long-term hydrology monitoring in reference wetlands for climate-related analyses.

Long Term Monitoring of Riparian Restoration Projects in New York State

Topic: Best Management Practices on land for Freshwater Ecosystem Integrity

Colleen Lutz
University at Albany

Long Term Monitoring of Riparian Restoration Projects in New York State

Colleen Lutz, Biodiversity and Conservation Biology Program, University at Albany
clutz@albany.edu, 518-567-9131

Healthy riparian zones are important for the overall health of stream and river ecosystems. They protect streams from nutrient loading, sedimentation, and large temperature fluctuations while providing critical habitat for birds and other sensitive species. These areas, once undisturbed, have become degraded by anthropogenic activities such as agriculture, residential and commercial development, and recreational overuse. As a result, conservation partners have begun restoration projects to address these issues.

The Salmon River is a prized river for its recreational activities. Known for its amazing salmon runs, anglers frequent this area in the spring and fall hoping to catch Atlantic and Pacific Salmon. Following surveys completed in 2011 and 2012, the river was found to have a high amount of invasive Japanese Knotweed, at multiple locations along the shore. An aggressive removal project was completed in 2013 and monitoring was continued until 2015. The goal of the project is to suppress Japanese Knotweed while launching an intensive education and outreach program to reduce its spread.

The Schoharie Creek is an important recreational area and part of the New York City West of Hudson Reservoir System, providing drinking water for New York City. Historically, it has been impacted extreme weather events due to the topography of the valley and lack of proper vegetative riparian buffers. In 2007, a management plan was created to improve the resiliency of the Schoharie Valley by coordinating land use and development, while promoting the ecological integrity of the riparian areas.

Long term assessments of these management plans are essential to determine if the pre-restoration goals have been met and if not, why? It is also important to evaluate the differences in riparian regeneration between passive and active restoration areas. These key issues must be addressed to help resource managers prepare effective management plans for riparian conservation or restoration in at-risk streams and rivers.

Wednesday, October 9, 2019 8:30am - 10:00am

Restoration of Natural Areas Qualities on Prairies session A

Functional diversity of restored meadows

Topic: Restoration of Natural Areas Qualities

Keri Plevniak
Cleveland State University

Functional diversity of restored meadows

Keri A. Plevniak* and Emily Rauschert
Biological, Geological and Environmental Sciences, Cleveland State University

k.plevniak@vikes.csuohio.edu

Disturbed and degraded habitats have been restored with the goal of re-establishing native plant communities. These results are often analyzed from a perspective of whether or not the new community has higher native richness or

diversity, but taxonomic richness alone does not tell us about how restored ecosystems function. This research assesses the progress of several meadow restoration efforts through plant functional trait diversity. Functional traits are a valuable tool to analyze restorations because of their relationship to how plant communities are structured and to the provisioning of ecosystem services. The range and abundance of traits can give insight to how an ecosystem is functioning and if it is meeting restoration goals. This research addresses questions regarding (1.) how seeding method influences functional diversity and (2.) how functional diversity differs between seeded meadows and those that were not seeded. To understand how seeding method may influence functional diversity, broadcast and drill seeded plots were established and monitored prior to and post-restoration. For a regional perspective, meadows in Northeast Ohio that were restored were compared to meadows that were not restored to understand how functional diversity might differ. We hypothesized that drill seeding would have greater functional diversity and that seeded, restored areas will have greater functional diversity than those that were not restored. Leaf, height, seed, phenology and root traits were used for functional diversity analysis. Traits were collected from the TRY database, an online plant trait database, and from field samples. Vegetation surveys were conducted using the North Carolina Vegetation Survey protocol and focused on the presence and abundance of species. A regression analysis found that native species abundance increased with increasing time since restoration (p-value = .02, R² = .89). The coefficient of conservatism was high in seeded plots, especially for those plots restored by broadcast seeding. Another benefit to broadcast seeding was higher species abundance and richness of species from the seed mix. The floral phenology resulting from most restored plots revealed lower abundance of floral resource provisioning in Fall. Multivariate functional diversity indices did not change due to restoration. More research will be needed to determine how functional diversity changes with restoration and its relationship with community assembly. Tracking the progress of these restorations will provide valuable information to natural areas managers when planning restoration activities.

Prairie puzzles: Plants, pedosphere, pollinators, passerines.

Topic: Restoration of Natural Areas Qualities

Rebecca Swab
The Wilds

Nicola Lorenz
Ohio State University

Richard Dick
Ohio State university

Prairie puzzles: Plants, pedosphere, pollinators, passerines.

Rebecca M Swab

Nicola Lorenz

Richard Dick

Background/Question/Methods:

After mining and reclamation, soils are in poor condition, often suffering from compaction, low nutrient availability, and the loss of soil organic carbon and soil microbial community among other issues. On reclaimed mine land in southeast Ohio, we replaced the non-native mix of cool season grasses and forbs which was used in reclamation with native prairie species, planting 672 acres of prairie between 1999 and 2016. Prairie plants are known for their deep roots, and have been shown to improve soil properties in prairie restorations on agricultural lands. Our restoration goals for this project were to a) increase soil health b) increase plant diversity c) increase native plant composition, and d) improve habitat for pollinators or other wildlife. To evaluate success of this restoration, we monitored the vegetation community and soil properties from 2016-2018, comparing prairies of different ages and cool season 'baselines'

Results/Conclusions:

While the plant community composition shifted with age of prairie, and floristic quality was generally higher in prairies, species diversity and richness were not higher in older prairies as compared with the baselines. Many soil properties did not show significant differences between prairie areas and baselines as well. Glucosidase activity, a measure of microbial activity, was higher in younger prairies than baseline, but was lower in older prairies than baseline. Comparisons with restored prairies in an agricultural area showed similar results, with the oldest (planted in 1975) prairie having the lowest glucosidase activity as compared with those planted in 2001 and 2015. Results indicate that prairies may have naturally lower soil microbial activity (slower carbon turnover) but higher soil organic carbon

than other grassland types. Despite this, prairies act as a sink for organic carbon, suggesting a buildup of a stable organic carbon pool over time (carbon sequestration). This is another example of how low microbial activities might not indicate poor soil health, demonstrating profound consideration of soil forming processes is fundamental for evaluating soil health when comparing different ecosystem types. Determining the success of our restoration goals was more challenging than expected, but over all we can call the prairie restorations effective in establishing a native plant community and soil properties typical for prairies.

The Native Plant Conservation Campaign - a national native plant society for the United States

Topic: Native Plant Conservation Initiatives

Emily Roberson

Native Plant Conservation Campaign

Plants are second-class conservation citizens. Botanists have coined the term 'plant blindness' to refer to the all too common 'inability to see or notice plants in [the] environment.' Sadly, plant blindness is widespread among policymakers, the media and the public. Even environmental groups often overlook native plants in their work. As a result, plants are discriminated against in every aspect of law, policies and budgets for science and conservation.

The Native Plant Conservation Campaign (NPCC) was created to combat these problems. The NPCC is a national network of Affiliate plant conservation groups including native plant societies, botanic gardens and others. In 2017, the NPCC passed the 50 Affiliate mark and now represents more than 250,000 native plant enthusiasts. The mission of the NPCC is to promote the conservation of native plants and their habitats through collaboration, education, research and advocacy.

This presentation will describe the NPCC, our approach to native plant conservation advocacy, and our plans for 2019 and beyond, including programs to encourage use of locally adapted native plants in landscaping and land management, increase staffing and funding for plant science and conservation, and strengthen legal protections for imperiled plants.

The presentation will also discuss the growing understanding of the Ecosystem Services (also known as Nature Based Solutions) delivered by native plant communities, such as water purification, erosion control, storm protection, pollinator habitat, and buffering of climate change. In recent years, our understanding of the breadth of these services and of their importance to human societies and economies has increased tremendously. This offers new tools effectively to communicate the importance of native plant conservation to audiences that traditionally have been difficult to reach. Even those not interested in native plants for their beauty or inherent value may pay attention when they learn that native plant communities can save \$100s of millions in hurricane damage, or \$billions in water treatment costs.

For more information, see PLANTSOCIETIES.ORG.

What do we do when restoration is no longer an option?

Topic: Restoration of Natural Areas Qualities

Peter Dunwiddie

University of Washington

Title: What Do We Do When Restoration is No Longer an Option?

Author: Peter W. Dunwiddie, University of Washington

One of the strengths of ecological restoration practitioners has been a prudent and humble recognition of the magnitude of our own ignorance. We seek out reference sites to identify which assemblages of species might provide the most appropriate restoration or management goals, and study intact ecosystems to better understand key ecological processes and the interconnected relationships between the biota and the environment. While restoration has always been a creative process, traditionally it has also had a strong retrospective element, leaning more towards re-creation – or at least imitation – of existing ecological systems rather than innovation and designing anew. But where do we turn for restoration guidance when these traditional approaches no longer appear possible, practical, or even prudent? In many regions, reference sites are highly degraded or non-existent, leaving little clues

about their historical composition. Furthermore, climate models often project conditions that match sites hundreds of miles away, rendering the use of locally-sourced plant material for ecological restoration arguably short-sighted and perhaps even unwise. Urban sprawl and rural development often have coalesced to a point where the restoration of functioning ecological systems is now largely or entirely precluded in the small and highly fragmented natural areas that remain. In this talk, I review the broad spectrum of approaches and attitudes towards restoration that have arisen in response to this changing world. This includes a continuum that extends from a steadfast adherence to historical vegetation types and native species, a triage approach that entirely abandons some systems and species in favor of others, to an urgent advocacy of assisted migration and embrace of novel ecosystems. Examples from prairie restoration in the Pacific Northwest will be used to illustrate both positive and negative aspects of different perspectives along this spectrum, focusing especially on the most challenging and refractory sites.

Wednesday, October 9, 2019 8:30am - 10:00am

Riparian Communities/Plant Conservation session A

As *Marshallia* Goes, So Goes the Scour Habitat? Lessons from the Youghiogheny River Gorge

Topic: Management Planning to advance the Conservation of Special Species/Natural Communities

Steve Grund

Western Pennsylvania Conservancy/PA Natural Heritage Program

The Youghiogheny River Gorge is by far the most important area for plant biodiversity in Pennsylvania. This is due to a number of factors, most significantly the geographic position at the northern edge of a number of Appalachian endemics, including several of global significance, and the presence of a high-gradient white-water river and the accompanying scour systems that host highly specialized plant species due to the harshness of the environment. Due to lack of baseline data from the time a dam was constructed upstream of the gorge in 1944, the impacts from that dam on the scour ecosystems, as well as impacts resulting from other human activities such as whitewater recreation, introduction of exotic species, and of course anthropogenic climate change, are difficult to gauge.

Marshallia grandiflora (large-flowered marshallia, or Barbara's buttons) is the most frequent of the several globally at-risk plant species that grow along the Youghiogheny River. We have good data on the sizes of the populations going back to the early 1980's. Sampling frequency has been low, but we have enough revisits to get a good indication that there has been some decline. By intensifying the monitoring of *Marshallia*, combined with the monitoring of overall vegetation and physical parameters, we plan to analyze variation and trends within the ecosystems to recognize problems, and thus to inform management so we can do our best to insure the continued health of these unique habitats.

We will discuss past and ongoing work to inventory plant diversity, to protect the significant ecosystems and surrounding landscape, and to manage for biodiversity. Ongoing and anticipated threats and responses will also be covered.

Mapping and Inventory of Riverscour Communities in Arkansas

Topic: Management Planning to advance the Conservation of Special Species/Natural Communities

Theo Witsell

Arkansas Natural Heritage Commission

Virginia McDaniel

US Forest Service Southern Research Station

Stephen Walker

Arkansas State Parks/US Forest Service (retired)

Paul Nelson

Central Hardwoods Joint Venture

Mapping and Inventory of Riverscour Communities in Arkansas

Theo Witsell, Arkansas Natural Heritage Commission; Virginia McDaniel, US Forest Service Southern Research

Station; Stephen Walker, Arkansas State Parks & US Forest Service (retired); Paul Nelson, Central Hardwoods Joint Venture

The Interior Highlands (Ozark Highlands, Boston Mountains, Arkansas Valley, and Ouachita Mountains EPA Level IV Ecoregions) of Arkansas, Missouri, and Oklahoma represent a regional biodiversity hot spot and support a number of natural communities of state and global conservation concern. Among the most unique, biologically diverse, and rarity-rich of these is riverscours, or 'scour prairie', a suite of open shrub-grassland communities that occur along the banks and terraces of high gradient mountain rivers and are maintained by the scouring action of occasional violent flood events. These dynamic communities are hydrologically complex and support a mosaic of microhabitats that range from permanent wetlands to xeric, glade-like rock outcrops. They also contain complex mosaics of substrates with zones of bedrock, boulders, cobble, gravel, sand, and silt, which sort out along energy and geomorphic gradients. Riverscours communities in Arkansas support a number of plant species of state and global conservation concern including *Acer leucoderme* (G5S2S3), *Amorpha ouachitensis* (G3S3), *Amsonia hubrichtii* (G3S3), *Apocynum sibiricum* (GNRS1), *Calamovilfa arcuata* (G2G3S1), *Carex emoryi* (G5S1), *Carex gigantea* (G4S1S2), *Didiplis diandra* (G5S1S3), *Dulichium arundinaceum* (G5S2S3), *Eleocharis wolfii* (G3G5S3), *Gratiola brevifolia* (G4S3), *Harperella nodosa* (G2S2, federally listed Endangered), *Helianthus occidentalis plantagineus* (G5T2T3S1), *Liatris compacta* (G3S3), *Marshallia caespitosa caespitosa* (G4T4S2), *Marshallia caespitosa signata* (G4T4S1), *Solidago ptarmicoides* (G5S1S2), *Stenanthium gramineum* (G4G5S3), *Vernonia lettermanii* (G3S3), and *Vitis rupestris* (G3S3), as well as several taxa believed to be new-to-science. A number of these and other species present are riverscours obligates and share a disjunct distribution pattern, also occurring in riverscours in the Cumberland Plateau, Ridge and Valley, and other Ecoregions. Recent mapping efforts used GIS to analyze aerial imagery and map riverscours throughout the Interior Highlands. An overview of these communities, results of this mapping work, and inventory work conducted to date will be discussed.

Protecting rare riparian prairies using science-based management

Topic: Management Planning to advance the Conservation of Special Species/Natural Communities

Stephanie Perles

National Park Service

Protecting rare riparian prairies using science-based management

Stephanie Perles

National Park Service

Knowing the condition of natural resources in protected areas is fundamental to the management and preservation of these resources. As the National Park Service (NPS) is confronted with increasingly complex natural resource challenges, the Inventory and Monitoring Program provides scientifically sound information on the current status and long-term trends in the composition, structure, and function of park ecosystems, and to determine how well current management practices are sustaining those ecosystems.

Within its nine national parks, the Eastern Rivers and Mountains Network (ERMN) of the NPS contains 14 diverse, unique, and globally significant plant communities associated with the floodplains and other geomorphic and hydrologic features of large rivers. These rare communities also provide unique habitats on which numerous rare plant species depend. Nearly 50 state-rare plant species and one species listed as federally threatened occur in the riparian zones of the Delaware, New, Gauley, and Bluestone rivers. Since it is not feasible for the ERMN to effectively monitor all 14 rare riparian communities, we considered numerous biological and logistical factors, and then selected three riparian prairie communities as the monitoring targets. The objective of monitoring the rare riparian prairies is to provide information on the condition of the parks' riparian prairies and how this condition is changing over time, in order to inform management decisions affecting these riparian systems.

This monitoring program has documented changes in the distribution, abundance, and composition of plant species within the Calcareous Riverside Outcrop and Calcareous Riverside Seep communities in the Delaware Water Gap National Recreation Area. Over a twelve year period, the following findings were documented:

- Significant shifts in community structure with increased woody cover, primarily invasive exotic woody shrubs.
- The appearance of three new invasive exotic plant species and the spread of eight other previously observed invasive exotic species.

- Significant shifts in community composition, as seen in significant changes in abundance for many individual species. These composition changes highlight three processes occurring in the Calcareous Riverside Outcrop and Calcareous Riverside Seep communities: a) species migration within the site, b) inter-annual variation in composition due to varying hydrologic conditions, and c) species migration among sites within in the river corridor, which underscores the importance of preserving multiple occurrences of rare communities within a river system.

Wednesday, October 9, 2019 8:30am - 10:00am

Using Data and Technology to Advance Conservation

A national map of biodiversity irreplaceability to guide conservation investment

Topic: Using Data and Technology to Advance Conservation

Healy Hamilton
NatureServe

Regan Smyth
NatureServe

Timothy Howard
New York Natural Heritage Program

Christopher Tracey
Pennsylvania Natural Heritage Program

Anne Chazal
Virginia Natural Heritage Program

The natural heritage of the United States is the foundation of our country's economic, ecological, cultural and spiritual wellbeing. Although federal, state and municipal government agencies together with private land trusts and other non-profits have made enormous progress at conserving natural areas, to date only about 13% of our nation's land area is formally protected. Many species and ecosystems remain poorly represented or absent entirely from existing protected areas. As opportunities for government-led conservation acquisitions are increasingly diminished, community, NGO, and private conservation efforts are required to limit further degradation of our natural heritage. To guide the most effective future conservation investment by these sectors, there is urgent need for a national map showing the regions with high concentrations of at-risk species, emphasizing where species with the smallest ranges, and thus the fewest options for conserving them, occur. NatureServe, Esri, TNC and Microsoft are collaborating to produce a national map of biodiversity irreplaceability. This effort is founded in the high-quality species occurrence data and species distribution modeling expertise within the NatureServe network of Natural Heritage Programs. Together with Esri's support to build a national environmental predictor library, a Microsoft AI for Earth grant to create cloud-based computational infrastructure, and The Nature Conservancy's conservation planning expertise, we are analyzing the relative density of 2700 at-risk species across the conterminous United States. With existing biodiversity observation data, scientifically mature analysis tools, and modern visualization and communication technology, we can provide defensible and inspiring guidance toward protection of the most crucial lands and waters that sustain the biological richness of our nation.

Field validation of species distribution models for on-the ground management: a case study of WV federally listed plants

Topic: Native Plant Conservation Initiatives

Crystal Krause
Davis & Elkins College

Paul Harmon
West Virginia Division of Natural Resources

Jacob Henry
West Virginia Division of Natural Resources

Field validation of species distribution models for on-the-ground management: a case study of WV federally listed plants

Crystal Krause^{1,2}, Paul Harmon² and Jacob Henry²

¹ Davis & Elkins College, krausec@dewv.edu

² West Virginia Division of Natural Resources, Paul.J.Harmon@wv.gov and Jacob.B.Henry@wv.gov

Species distribution models (SDMs) have been a widely discussed topic in conservation for over twenty years. A quick Google Scholar search gives you an idea of the number of papers reporting results from SDMs (4.5 million). A new focus in SDM research on how conservationist (species experts and land managers) can use the model results for on-the-ground conservation work. We now have checklists to communicate model attributes and uses, guidelines on best-practice standards in model development, and numerous statistical packages to create SDMs. For those whom the models are intended, though, we have provided little guidance on how to use models in the field. How do we evaluate model performance in terms of conservation practices? How do we incorporate and improve SDMs with that field evaluation data? For this project, we're developing strategies to answer these questions. For the past four years, we've been developing SDMs for West Virginia's six federally-listed plant species. After model completion, we realized there was a lack of understanding of how to use the results in on-the-ground management. By designing field validation methods that anyone can use, our goal is to have more SDMs being used in conservation planning.

GIS and field-based methods modeling the distribution of the Worm-eating Warbler (*Helmitheros vermivorum*)

Topic: Using Data and Technology to Advance Conservation

Summers Cleary
Virginia Outdoors Foundation

GIS and field-based methods modeling the distribution of the Worm-eating Warbler (*Helmitheros vermivorum*): applied methods for enhanced natural resource conservation management

Summers Cleary, Virginia Outdoors Foundation
scleary@vofonline.org, 804-441-1144

Studies of bird distributions, their habitat, their resource distribution, and species-specific natural habitat characteristics can provide essential data for implementing and improving effective conservation and management plans. Management of wildlife habitat for conservation relies on knowledge of the biological and ecological factors that affect the geographic population distribution. This project presents a geographic information science (GIS) based spatial analysis of the geographic distribution of the breeding Worm-eating Warbler (*Helmitheros vermivorum*) (WEWA) in Crow's Nest Natural Area Preserve, Stafford County, Va. The results identify predicted areas of WEWA breeding sites and the environmental variables most influential on breeding site selection. Maximum entropy (Maxent) species distribution modeling, coupled with field-based occurrence data, quantifies the correlations between environmental factors in the study area and the known distribution of the WEWA over a four-year period: 2014 – 2017. Species presence data is sourced from annual Breeding Bird Survey occurrence data. GIS methods derive a suite of environmental variables based on known habitat preferences for the WEWA: slope, aspect, elevation, and vegetation density. A fifth variable used, Forest community type, was derived from pre-existing data from the Department of Conservation and Recreation; Natural Heritage Division. A kernel density analysis estimates vegetation density for the entire vertical structure of the study area, broken into eight classes, using Light Detection and Ranging (LiDAR) data. Model results show WEWA breeding habitat selection to be most influenced by elevation, slope, and dense vegetation above ground level; specifically, dense canopy vegetation and dense herb vegetation. The results of Maxent predictive modeling identify ecological variables influencing the distribution of the WEWA during the breeding season, highlighting specific attributes of each environmental predictor. Discovering relationships between habitat characteristics and bird presence can offer a basic understanding of habitat preference, providing, at minimum, two scales of conservation management potential: streamlining conservation efforts to both known and potential areas of WEWA breeding sites, and the ability to focus on protecting and conserving species-specific

Wednesday, October 9, 2019 11:00am - 12:30pm

Identifying Natural Areas for Conservation focus on Pollinators

Conservation and Management of Rare Wetland Butterflies: Strategies for Modeling and Habitat Enhancement

Topic: Pollinators in Natural Areas Management

Christopher Tracey

Pennsylvania Natural Heritage Program

Conservation and Management of Rare Wetland Butterflies: Strategies for Modeling and Habitat Enhancement

AUTHORS: Jen Selfridge, Maryland Natural Heritage Program; Betsy Leppo, Pennsylvania Natural Heritage Program; Christopher Tracey*, Pennsylvania Natural Heritage Program

ABSTRACT: The status and distribution of many wetland butterfly species in the mid-Atlantic is uncertain. For some species declines are well documented and may span a decade or more, while others are of conservation concern based on low encounter rates and a lack of recent survey records. We attempted to improve our understanding of wetland butterfly species of greatest conservation need (SGCN) by updating location data for 14 species in the region, and modeling distribution and climate condition for each species. In 2016-2017 we searched for new species occurrences, revisited historic sites, and refined all occurrence data for each of the 14 species for use in the models. Species Distribution Models (SDM) were used to predict suitable habitat for each species; using Random Forests, which can handle rare species with few known locations and large environmental predictor datasets. We generated classified output using a suite of different thresholds customized to each individual SDM. These thresholds allow the user to view potential habitat for a given species. Climate Envelope Models (CEMs) were used to delineate areas of climate suitability for each species by correlating georeferenced species occurrences with observed climate conditions using a MaxEnt framework. The CEM defined values of climate variables around species occurrences, thereby delimiting a 'climate envelope' within which species occur. These climate models were projected to future climate scenarios to understand the effects of climate change on the distribution of each species, allowing us to make predictions about how the range of a given species could expand, contract, or shift. Finally, we overlaid the fine scale SDM data and coarse future climate envelopes to look at the combined impacts of habitat suitability and climate change in order to determine potentially important areas for site-level conservation activities.

Vermont Conservation Design - Using coarse filters for a conservation vision in a changing climate

Topic: Climate Change – Species and Natural Communities on the Move

Bob Zaino

Vermont Fish & Wildlife Department

Eric Sorenson

Vermont Fish & Wildlife Department

Vermont Conservation Design - Using coarse filters for a conservation vision in a changing climate

Eric Sorenson and Bob Zaino

Vermont Fish and Wildlife Department

Vermont Conservation Design is a scientific vision for conservation success in the state. Using the coarse filter approach to conservation, it identifies a practical, simple, and efficient set of coarse filter features, such as forest blocks, surface waters, riparian areas, and natural communities, that collectively form an intact, connected, and diverse landscape. If these features are conserved, stewarded, and appropriately managed into the future, we have high confidence that Vermont will retain its current biological diversity and that species and natural communities will

be able to move and adapt in response to climate change. The design offers a vision for an ecologically functional landscape that can help unify the state's conservation efforts, including those by state and federal agencies, land trusts, and private landowners.

This talk will discuss the scientific underpinnings of this design, how we chose the individual coarse filter components and their respective conservation targets, the steps we used to build support for this as a vision, and the ways this design is now being used to further conservation efforts in Vermont.

Wednesday, October 9, 2019 11:00am - 12:30pm

Invasive Species Management and Prevention Speed Learning A

Biotic and abiotic factors drivers of the success of the invasive plant, lesser celandine

Topic: Invasive Species Management and Prevention

Emily Rauschert
Cleveland State University

Justin Kermack
Cleveland State University

Allison Paolucci
Ohio University

Sarah Kyker
Holden Forests and Gardens

David Burke
Holden Forests and Gardens

Biotic and abiotic factors drivers of the success of the invasive plant, lesser celandine

Emily S.J. Rauschert^{1,2}, Justin Kermack¹, Allison Paolucci³, Sarah Kyker² and David Burke²

Cleveland State University, Holden Forests and Gardens, and Ohio University

Lesser celandine (*Ranunculus ficaria*), an ephemeral perennial invasive plant, is becoming more widespread in river valleys throughout the Northeastern United States and the Pacific Northwest. This herbaceous buttercup creates extensive dense mats, likely limiting native species growth during a spring window critical for growth. Its unusual reproductive output of asexually produced bulbils and tubers, as well as seeds, allow it to rapidly spread once present. However, as with any invasive plant, its reproductive success and survival can vary considerably. In Northeast Ohio, we examined lesser celandine populations in several river valleys, to determine what biotic and abiotic characteristics are associated with successful invasions.

We quantified lesser celandine abundance and reproductive output (seed, bulbil and tuber production) in plants collected from plots spanning a disturbance gradient away from a river. There was high variability observed between sample sites; densities of lesser celandine were as high as 11,425 plants/m² in some areas, with an overall mean of 2,772 plants/m². We did not observe any seed production in our sample plots, although an adjacent areas had some plants that produced seeds. Soil characteristics, rather than landscape placement, appeared to drive plant performance; specifically phosphorus, calcium and LTI all had significantly positive relationships with plant biomass and bulbil counts, while soil pH was significantly positively related to biomass. Soils with high percent silt showed significantly positive relationships with bulbil and tuber counts; this may be driven by high calcium levels in these areas.

Another potential factor influencing lesser celandine plant performance is the presence or absence of beneficial fungal-root associations. We hypothesized that that lesser celandine biomass and reproductive output would be driven by community composition of endophytic root fungi. Terminal restriction fragment length polymorphism and cloning were used in conjunction to determine the differences in the community composition of endophytic root colonization for each site. Microscopy was used to confirm the presence of structures indicative of endophytic fungi. We determined lesser celandine that was colonized by fungal communities consisting of ericoid mycorrhizae and dark septate endophytes had a significantly higher average biomass than plants that were colonized by parasitic root endophyte communities. However, fungal colonization was not associated with differences in the reproductive output of lesser celandine.

We also examined the plant communities in areas with and without lesser celandine present in a different watershed in Northeast Ohio. Several other non-native species were common in heavily invaded plots: garlic mustard, woodland bittercress, multiflora rose and dame's rocket. It appears that there is still considerable native diversity present near even the most heavily invaded plots, offering opportunities for local restoration following invasive removal. However, because lesser celandine is associated with lower levels of native diversity and percent cover, it is important to remove lesser celandine population as early as possible in the invasion process. These studies together help expand the current limited understanding of lesser celandine and can help identify where this species is most likely to be problematic.

Hemlock Woolly Adelgid and Headwater Stream Biodiversity: No Evidence for Significant Short-term Impacts

Topic: Invasive Species Management and Prevention

Allison Koehle
Juniata College

As Hemlock Woolly Adelgid (*Adelges pseudotsugae*, hereafter HWA) has caused declines of *Tsuga canadensis* (hereafter hemlock), we sought to describe whether impacts to hemlock health were affecting the biotic and abiotic properties of headwater streams found in hemlock stands. In nine streams in Pennsylvania we assessed hemlock health, macroinvertebrate and fish abundance and diversity, and stream pH, and conductivity. Our sample streams exhibited substantial variation in all of these variables, including hemlock health, which ranged from healthy and unaffected by HWA to canopy reductions down to 47% of un-impacted status. Despite this variation in hemlock health, we observed no significant associated differences in stream biota or chemistry. Longer time-series data and greater sample sizes are necessary before concluding that HWA has little impact on headwater streams, however, our findings caution against quick decisions to under-plant other species to replace declining hemlock.

Shedding light on invasive shrubs in eastern deciduous forests of North America

Topic: Invasive Species Management and Prevention

Erynn Maynard-Bean
Penn State University

Shedding light on invasive shrubs in eastern deciduous forests of North America.

Erynn Maynard-Bean, Margot Kaye and Eric Burkhart. Penn State University.

The timing of leaf emergence and senescence in deciduous plants, called leaf phenology, influences competition and community dynamics, and scales up to ecosystem processes such as carbon sequestration and water movement. Invasive shrubs are an emergent concern in temperate deciduous forests of eastern North America where they are growing in richness and abundance at the expense of native species across taxa. The extended leaf phenology of invasive shrubs has been shown to provide photosynthetic benefits as well as negative impacts to native species by producing seasonally novel understory shade. However, studies have occurred at local scales, while phenological response varies across regions with environmental cues such as temperature, daylength, and precipitation. To understand whether broad patterns of extended leaf phenology of invasive compared to native shrubs hold across the eastern U.S., we developed a citizen science campaign in partnership with the USA National Phenology Network (USA-NPN). We find that below 45.05°N non-native, invasive shrubs have significantly earlier leaf emergence, and below 44.57°N later leaf off compared to shrubs originating in North America. The predicted difference is greatest at lower latitudes (e.g. 38.1 [24.3, 52.2] days earlier and 38.9 [16.0, 59.2] days later at 36.45°N, [95% credible intervals]) and decreases northward. These results provide a context for local-scale research: impacts from novel shade can apply to other sites and become more pronounced further south. We also use environmental variables to

understand whether native and invasive shrubs respond to the same environmental cues differently or to different cues entirely. Small changes to spring and fall phenology have dramatic impacts to temperate, deciduous forest carbon budgets. Understanding the regional environmental correlates of the novel extended leaf phenology of a growing component of these forests will improve the ability to estimate forest carbon and productivity and to predict how climate change may influence this system.

So Many Weeds, So Little Time: Evaluating Sites and Species to Prioritize Invasive Species Work in PA State Parks

Topic: Invasive Species Management and Prevention

Arthur Gover
Penn State

Rachel Reese
PA DCNR, Bureau of State Parks

Michael DiRinaldo
PA DCNR, Bureau of State Parks

Emilee Euker
PA DCNR, Bureau of State Parks

Shon Robbins
PA DCNR, Bureau of State Parks

So Many Weeds, So Little Time: Evaluating Sites and Species to Prioritize Invasive Species Work in PA State Parks
Art Gover, Penn State

Rachel Reese, Michael DiRinaldo, Emilee Euker, Shon Robbins, PA Department of Conservation and Natural Resources, Bureau of State Parks

Though Mission Critical, it is nobody's job – by position title - at a Pennsylvania State Park to manage natural resources. Invasive species are managed by a collaboration of park staff, the regional Field Specialist, and DCNR-funded staff from Penn State. The process breaks coarsely into prioritization, prescription, and implementation. Work is prioritized based on the intersecting characters of land unit ecological integrity and the invasive species present. This approach emphasizes acting quickly on the information at hand and improving the priority assessment over time as observations increase through work outings.

Five indices – stewardship value and outreach value of the land unit; and invasive species extent, impact, and restoration effort are used to generate a Priority Index from 0 to 10. The planning team develops the prioritization with data at hand – park staff knowledge, existing resource management reports, PA Natural Heritage Surveys, and occasional additional surveys. The process is aided by macro-driven workbook file that aids in the prioritization and prescription.

The prescriptive phase emphasizes Integrated Pest Management and accounts for a range of operational skills, from volunteers to contractors, and includes cultural, mechanical, biological, and chemical operations. Work days emphasize operational training, with particular emphasis on target identification and low-volume spot treatment using backpack sprayers. Plant identification is a key component, as this results in park staff engaging in survey throughout the year as they complete other work. It also allows for reduced intensity of preliminary survey, as only a few key species need to be attributed to a site to initiate work. Staff with identification skills can subsequently identify additional targets and treat as encountered. Herbicide operations emphasize use of a broad-spectrum mixture to allow treatment of all viable targets.

Stream Salamander Community Responses and Sublethal Impacts of Imidacloprid Exposure

Topic: Best Management Practices on land for Freshwater Ecosystem Integrity

Sara Crayton
WVU

Stream Salamander Community Responses and Sublethal Impacts of Imidacloprid Exposure

Sara Crayton*, School of Natural Resources, West Virginia University, 322 Percival Hall, Morgantown, WV 26506. sc0038@mix.wvu.edu;

Dr. Petra Wood, U.S. Geological Survey, West Virginia Cooperative Fish and Wildlife Research Unit, 322 Percival Hall, Morgantown, WV 26506. pbwood@wvu.edu;

Dr. Donald Brown, School of Natural Resources, West Virginia University, 322 Percival Hall, Morgantown, WV 26506. donald.brown1@mail.wvu.edu;

Dr. Yong-Lak Park, Division of Plant and Soil Sciences, West Virginia University, Morgantown, WV 26506. Yong-Lak.Park@mail.wvu.edu;

The insecticide imidacloprid is widely used to mitigate hemlock (*Tsuga* spp.) mortality resulting from the invasive Hemlock Woolly Adelgid (HWA; *Adelges tsugae*), but evidence suggests that imidacloprid can have negative impacts on adjacent stream systems. Studies have demonstrated that imidacloprid can negatively impact benthic macroinvertebrate assemblages and anuran survival, but no studies have assessed the effects of imidacloprid on salamanders. In 2017 and 2018, we sampled salamander communities at 48 streams in the New River Gorge National River and Monongahela National Forest areas of West Virginia. Of the 48 study streams, 24 were directly adjacent to HWA treatment areas and 24 were not. Using standard sampling protocols, salamanders were captured by flipping cover objects and searching through leaf litter. We weighed and measured all salamanders to calculate body condition index (BCI). Additionally, we investigated whether stream salamanders bioaccumulate imidacloprid from HWA treatments. We humanely euthanized 175 salamanders of the genus *Desmognathus* captured in HWA treatment areas and used liquid chromatography-tandem mass spectrometry (LC-MS/MS) to quantify the concentration of imidacloprid in the salamander tissues. Preliminary analyses were conducted on data collected in 2017. We used redundancy analysis (RDA) to determine the habitat variables most associated with larva and adult/subadult abundances of salamander species, and t-tests to determine if body condition of adults/subadults differed between treatment and control sites. The final larva and adult/subadult RDA models contained 9 and 11 environmental predictors, and explained 57% and 51% of the variation in abundances, respectively. However, the species triplots indicated that imidacloprid treatment was not a strong explanatory variable for either model. Body condition did not significantly differ between treated and control sites for 5 salamander species. Additional analyses will be presented assessing the relationships between imidacloprid concentrations in the water and stream sediment and salamander abundances, while controlling for environmental variables. We will also present results comparing imidacloprid concentrations in salamander tissues to imidacloprid concentrations in stream water and sediment and treatment histories.

Understanding the Growth and Composition of Japanese Knotweed Stands: Implications for Management

Topic: Invasive Species Management and Prevention

Joseph Jaros

University of Pittsburgh

Understanding the Growth and Composition of Japanese Knotweed Stands: Implications for Management

Joseph Jaros and Sara Kuebbing

Biology Department, University of Pittsburgh

Japanese knotweed (*Polygonum cuspidatum*) is one of the most common invasive plant species in the United States and causes severe economic and ecological harm. Knotweed forms dense stands with nearly 100% cover, and easily reproduce from rhizome fragments. Yet, there are few effective management strategies to control knotweed. We used a combination of growth studies and field surveys to characterize knotweed seedling development and knotweed stand composition. The goal of these studies is to understand the limits of natural knotweed populations in order to focus management efforts and propose novel management strategies.

First, in a growth chamber study designed to test how soil microbial communities and light levels affect knotweed seedling growth, we grew knotweed seeds collected from populations within Frick Park, Pittsburgh. Seedlings were

grown under 3 different light intensities (10%, 40% and 100% maximum light) with either soil collected from underneath a knotweed stand, soil from a riparian area without knotweed populations, or a sterile soil. Results show that seedling development is reduced in shaded conditions, with leaves of seedlings grown in low light 85% smaller than leaves of seedlings in full light after 5 weeks of growth. Knotweed also shows a negative soil-feedback where seedlings grown in soils collected from existing knotweed stands were smaller than seedlings grown in sterilized potting soil or riparian soil. Seedlings in knotweed soil were 13% shorter than plants grown in sterile soil and 9% shorter than plants grown in riparian soil. Taken together, these results demonstrate that knotweed seedlings are unlikely to grow well in naturally occurring dense stands of knotweed.

Our future research will pair data from growth chamber studies with field observational information about the growth and spread of existing knotweed stands. We will use surveys of existing knotweed stands to measure knotweed height and stem density to examine how environmental factors within stands influence the growth of knotweed and other plants. Stand surveys may also show which native plants compete best against knotweed. Assessing variation in growth within a knotweed stand in light of its community composition will show factors that hinder the growth of knotweed. This information could inform management strategies. By understanding the limits of knotweed growth, novel management techniques can focus on manipulating stands to disfavor knotweed growth and promote native regeneration.

Wednesday, October 9, 2019 11:00am - 12:30pm

Management Planning to Advance the Conservation of Special Species/Natural Communities session B

Ecosystem Engineers: Shaping Healthy Forests in the Face of Multiple Stressors

Topic: Management Planning to advance the Conservation of Special Species/Natural Communities

Ron Rohrbaugh
Audubon Pennsylvania

Katie Loucks
Audubon Pennsylvania

Ecosystem Engineers: Shaping Healthy Forests in the Face of Multiple Stressors

Ron Rohrbaugh, Dir. Conservation Science and Forest Programs, Audubon Pennsylvania
Katie Loucks, Forest Program Associate, Audubon Pennsylvania

Emerging science reveals that meeting the full breeding cycle needs of many forest birds cannot be achieved through simply maintaining homogenous forest conditions on the landscape. Creating appropriate, diverse forest ages and structural conditions to support breeding birds requires the use of multiple techniques, including strategic timber harvesting and actively controlling stressors, such as insect pests, tree diseases, invasive plants, and over-browsing by white-tailed deer. The goal is to create a dynamic mosaic of forest ages and structural conditions over landscape and regional scales. Audubon's Healthy Forest Initiative seeks to create desired, healthy forest conditions through landscape-scale decision support, management planning, forester training, landowner outreach, and sustainable markets. This presentation will have special emphasis on the impacts of deer by reporting on new findings from a statewide analysis of deer and bird population dynamics during the past 37 years.

Monitoring the effects of white-tailed deer and promoting restoration of forest plant communities

Topic: Management of Wildlife Habitat

AUTUMN SABO
PENN STATE BEAVER

Ungulates impact forest systems worldwide. Plant, animal and fungal communities, the physical structure of the forest floor, and nutrient cycling can all be altered by the abundance of ungulates. Even human well-being can be affected by forest ungulates. For example, the incidence of Lyme disease appears to increase with white-tailed deer

abundance in some areas.

Researchers often use fences to exclude ungulates, which allows for the study of forest resilience and recovery. Results from my field studies in the Upper Midwest demonstrate increases in the quantity and diversity of woody plants, declines in invasive plant cover, and changes to the soil structure inside deer fences compared to areas with ambient deer pressure. Altered environmental conditions at the understory level may contribute to limited native herb recovery. I will discuss possible techniques to alter abiotic variables in order to encourage restoration of diverse herb communities.

While exclosures are valuable for learning about recovery following the removal of deer pressure, they are ineffective at addressing how varying deer densities affect ecosystems. Controlled experiments that test multiple deer population levels pose many logistical challenges. Thus, monitoring areas with different ambient deer abundances can serve as a useful method for guiding deer management goals. Data from camera traps and vegetation measurements (e.g., vertical cover, browse and twig age surveys) collected in the Upper Midwest and Mid-Atlantic will be compared.

In order to guide management and restoration activities at regional, national and global levels, ecologists need standard research protocols that are broadly implemented over long time periods. I will propose components of a basic monitoring protocol that could rely on citizen scientists or college undergraduates for standardized data collection and input. Some project elements we will discuss during the question and answer session, if time allows, include 1) physical design of the satellite projects 2) ungulate and forest variables to measure 3) data management and use 4) funding, and 5) future plans.

Using Prescribed Fire as a Tool to Restore Gameland Habitats

Topic: Management of Wildlife Habitat

Scott Bearer

Pennsylvania Game Commission

The PA Game Commission owns and manages 1.5 million acres of gamelands across the state. In addition, for over 80 years the Commission has worked with private forest landowners to enroll an additional 2.3 million acres of private lands into the Hunter Access program. Being mandated to manage for wildlife conservation and hunting opportunities, the primary goal for these lands is the sustainable management of habitats for game and non-game wild birds, mammals, and other fauna. The Game Commission has been a leader in implementation of prescribed fire to promote healthy oak forest, increase berry crops, stimulate browse production, maintain grasses and barrens communities, and reduce tick populations. This presentation will review the past, present, and future of the Commission's fire program and discuss opportunities on the horizon.

Wednesday, October 9, 2019 11:00am - 12:30pm

Restoration of Natural Areas Qualities on Prairies session B

Investigating Geoedaphic Meadows, Glades, and Grasslands in Southeastern Pennsylvania

Topic: Management Planning to advance the Conservation of Special Species/Natural Communities

Will Ryan

Academy of Natural Sciences

Synopsis

Mafic glades, which are native-species-rich grasslands and meadows occurring on soils weathered from diabase and other mafic rock formations have never been described or classified in Pennsylvania. We propose a multi-pronged research effort to better understand a plant community or group of related communities that are found within these sites. Presence-absence data have already been compiled for two dozen sites, all on sheet diabase in the Northern Piedmont ecoregion's Gettysburg-Newark Lowland section, also known as the Triassic Basin. Those sites are inhabited by at least 31 species listed as endangered, threatened, near-threatened, or in other categories of conservation need by the Pennsylvania Biological Survey (Table 1). It is highly likely that other occurrences exist on

sheet diabase in the same ecoregion. There is anecdotal evidence that the same or similar communities may occur on other mafic bedrock formations and in other ecoregions, namely metadiabase, metabasalt, gabbro, metagabbro, gabbroic gneiss, or mafic gneiss in the Northern Piedmont ecoregion (all sections) and New England ecoregion (Reading Prong section), and greenstone schist or metabasalt in the Blue Ridge ecoregion (South Mountain section). Parts of 15 counties are potentially involved: Adams, Berks, Bucks, Chester, Cumberland, Dauphin, Delaware, Franklin, Lancaster, Lebanon, Lehigh, Montgomery, Northampton, Philadelphia, and York (Figures 1 and 2). Communities with little or no woody plant cover specific to soils weathered from mafic rock formations are classified and recognized as having high conservation importance by the natural heritage programs to the south and northwest of Pennsylvania, in the Piedmont, Blue Ridge, and Northern Lakes and Forests Level III ecoregions (Table 2). Twelve mafic communities are ranked G1, nine of which lack substantial tree canopy, and nine are ranked G2 or G3, four of which are treeless or nearly so. One of the objectives of the proposed research is to determine whether Pennsylvania's mafic communities will fit any of those described elsewhere in eastern North America, whether they merit classification as newly described communities, or whether they exist as definable entities at all. This project will set the stage for genetic investigations of the most critically endangered species by clarifying the highly localized distributions of mafic specialists and semi-specialists within the study area. It would also lay the groundwork for rare plant recovery planning by compiling and synthesizing all available information pertinent to the community's conservation.

Mafic glades are disturbance-dependent communities, generally maintained by annual or less-frequent mowing, light grazing, or in a few cases prescribed fire. Diabase/mafic openings in Pennsylvania have been observed to be especially quick to change in relative species abundances with changes in disturbance regime. Yet the most diverse of them must have been stable or at least recurring in the same location, based on the extraordinary clusters of rare species, many of which lack the early-successional trait of prolifically producing long-distance dispersing propagules.

Clues on how to restore and maintain the mafic glade communities come from collectively nearly 30 years' experience by the investigators in conducting experiments and adaptive management trials at several of the serpentine (ultramafic) grasslands (which overlap mafic glades in species and ecological processes) and in monitoring and analyzing results of varied disturbance regimes. There is also a small literature on the stewardship needs of constituent species of highest conservation need and on stewardship experience with mafic glades in Pennsylvania and other states.

Learning to say goodbye to Michigan's rare prairie flora

Topic: Management Planning to advance the Conservation of Special Species/Natural Communities

Tyler Bassett

Michigan Natural Features Inventory

Brad Slaughter

Orbis Environmental Consulting

LEARNING TO SAY GOODBYE TO MICHIGAN'S RARE PRAIRIE FLORA

Tyler J. Bassett (Michigan Natural Features Inventory, Michigan State University Extension); Bradford S. Slaughter (Orbis Environmental Consulting)

Midwestern tallgrass prairie and oak savanna are among the most endangered ecosystems in North America, with as little as 0.01 – 2% persisting in mostly isolated fragments. These remnants often bear little semblance to historical conditions due to livestock grazing, incursion of woody species, establishment and spread of invasive species, and an absence of critical natural disturbances such as fire and grazing by native ungulates. Consequently, a diversity of fire-adapted and shade-intolerant plant species have been reduced to small, scattered populations in degraded habitats, and their fates are compounded by a lack of protection and insufficient management. In southern Michigan, 98 vascular plant species of conservation concern occur primarily in prairie and savanna habitats. The status of these species can serve as a proxy for the status of prairie and savanna habitats in the state. We utilized natural heritage database records to conduct status assessments for four long-lived perennial plant species typical of prairie and savanna habitats: *Amorpha canescens* (leadplant), *Baptisia lactea* (white false indigo), *Coreopsis palmata* (prairie

coreopsis), and *Ruellia humilis* (hairy wild petunia). All four species have declined considerably since c. 1980, with populations increasingly restricted to the few protected, managed sites. Our results lend urgency to the identification, protection, and management of the remaining populations of these and other rare prairie and savanna taxa and their associated habitats.

Wednesday, October 9, 2019 11:00am - 12:30pm

Riparian Communities/Plant Conservation session B

AWASH IN WATER AND PEOPLE: CHALLENGES OF CONSERVING BEACH AND DUNE ECOSYSTEMS IN NY STATE PARKS

Topic: Management Planning to advance the Conservation of Special Species/Natural Communities

Julie Lundgren
NY Natural Heritage Program

Julie Lundgren
NY Natural Heritage Program
jalundgr@esf.edu

Title: Awash in water and people: Challenges of conserving beach and dune ecosystems in NY State Parks

NY State Parks owns some of the most important beach and dune ecosystems in the state for biological diversity. Beautiful in their own right, these natural landscapes support a number of rare species restricted to these habitats such as piping plovers, seabeach amaranth, Great Lakes sand cherry, some tiger beetles and bees, as well as migratory birds and monarchs, and many other species of concern. Yet these shores on both Lake Ontario and the Atlantic Ocean are squeezed between high recreational pressures and the high waters from increasing flood events and sea level rise. Is there any room to succeed in saving these shores? Are there other conversations we should be having with managers, media, the public to promote better conservation? NY Natural Heritage Program has had a long-standing partnership with State Parks to help with stewardship issues and will discuss examples of challenges faced, some of the successes, and potential tools to help managers, the worried public, and the flora and fauna of these shoreline ecosystems.

Thanks to NY State Office of Parks, Recreation and Historic Preservation for their long support of the partnership with NY Natural Heritage Program.

Restoration of Species Diversity and Hydrologic Function in Wetlands within the Coastal Dune Lake Watershed

Topic: Wetlands Conservation (for Rare Species)

Emily Coffey
Atlanta Botanical Garden

Jeff Talbert
Atlanta Botanical Garden

Ashlynn Smith
Atlanta Botanical Garden

Restoration of Species Diversity and Hydrologic Function in Wetlands within the Coastal Dune Lake Watershed
Emily E. D. Coffey, Jeff Talbert, & Ashlynn Smith

Atlanta Botanical Garden, Research and Conservation Department, Atlanta, GA 30309, USA

The Atlanta Botanical Garden in partnership with the Florida Park Service are restoring 320 acres of wetlands at Deer Lake State Park in Walton County, Florida. The project is tasked with improving water quality and restoring wetlands within the watershed of globally rare and imperiled coastal dune lakes in Walton County, Florida. This is

made possible by an approximately \$6 million grant funded by the Gulf Environmental Benefit Fund (GEBF) through the National Fish and Wildlife Foundation (NFWF). Decades of fire exclusion has led to the degradation of wetlands throughout the southeast. Formerly pruned by frequent naturally occurring fires, areas of wetland hardwood shrubs have expanded their footprint into open herbaceous wetlands. In the continuing absence of fire the shrubs grew to tree form stands, shading out grasses, pitcher plants, and orchids among many other herbaceous species. Reintroduction of fire alone is not enough to restore these wetlands. This project uses both human labor and mechanical means to cut the hardwoods, chip them, and remove the biomass from the site to return the wetlands to an herbaceous dominated, nutrient poor, natural state. Prescribed fire is also reintroduced to mimic the natural process and to reduce the buildup of organic litter. Members of the Atlanta Botanical Garden Conservation and Research Department are responsible for the project coordination, monitoring, and data collection while the Florida Park Service is responsible for the operational components; prescribed fires are conducted jointly. The project as funded will continue through 2023.

Wednesday, October 9, 2019 2:00pm - 3:30pm

Invasive Species Management and Prevention Speed Learning B

Collaborating with Watercraft Inspection Data to Mitigate Aquatic Invasive Species in NY and PA

Topic: Invasive Species Management and Prevention

John Marino

New York Natural Heritage Program

Nick Decker

PA DCNR Bureau of State Parks

John Marino, GIS Applications Developer, New York Natural Heritage Program - iMapInvasives Team

Nick Decker, Resource Manager, Pennsylvania Department of Conservation and Natural Resources - Bureau of State Parks

Recreational boating can be a major pathway for introducing aquatic invasive species to new waterbodies, so inspecting boats upon launching and retrieving is an important preventative measure. The data collected from interactions with boaters at watercraft inspection stations can provide important insights for invasive species risk assessments and management decisions, and standardizing this data can help with cross-jurisdictional outlooks.

In New York, The New York Natural Heritage Program, in conjunction with New York State Department of Environmental Conservation and Office of Parks, Recreation, and Historic Preservation, has developed a pilot smartphone application (titled the 'Watercraft Inspection Steward Program Application,' otherwise known as 'WISPA') to capture standardized data for watercraft inspection stewards across New York State and upload that data into a centralized database. In 2019, the program's third season, WISPA was used by approximately 200 boat launch stewards comprising 15 organizations, which is expected to result in over 150,000 data records.

Similarly, Pennsylvania has piloted a voluntary boat launch stewardship program at Pymatuning Reservoir for three years, and Pennsylvania State Parks are poised to expand the program in 2019 to include 9 other major recreational lakes across the state. Through this expansion Pennsylvania State Parks expects to increase awareness and use of practices for preventing the spread of aquatic invasive species. The results of the 2019 season program are Pennsylvania's start to a similar framework that is in place in New York.

Since both states utilize the iMapInvasives platform (an internet-based multi-taxa invasive species tracking and management platform), new opportunities exist to join different datasets together to aid in invasive species early detection efforts and identification of spread vectors.

Presenters will highlight the successes and challenges of the respective programs to-date and identify opportunities for further collaboration.

Incorporating human behavior into ecological models of invasive species: a dreissenid mussel case study

Topic: Invasive Species Management and Prevention

Carra Carrillo
US Army Engineer R&D Center

Incorporating human behavior into ecological models of invasive species: a dreissenid mussel case study

Carra Carrillo, Safra Altman, Todd Swannack
US Army Engineer Research and Development Center, Environmental Laboratory

Jacque Keele, Yale Passamaneck, Sherri Pucherelli
US Bureau of Reclamation

Humans have the ability to make drastic changes to an ecosystem, and understanding how human behavior contributes to the continued spread of aquatic invasive species can help refine and optimize management strategies. Across the United States, lakes, rivers, and reservoirs that were once free of invasive dreissenid mussels now test positive for their presence. Through a collaborative effort, the Integrated Ecological Modeling Team at the Army Engineer Research and Development Center and the U.S. Bureau of Reclamation used a predictive modelling approach to quantify the risk of dreissenid mussel dispersal and colonization across multiple spatial scales within the Western U.S. In addition to developing a model that incorporates spatially explicit habitat and population dynamics, one critical area of focus was to integrate human behavior. Specifically, we looked at the impact of human behavior on the probability of mussel spread to uninfected lakes and reservoirs. The results show that as the number of human interactions increases (e.g. moving to multiple lakes, attractiveness of lakes, etc.), the probability of colonization increases. The results of this model will help the Bureau of Reclamation determine ways to decrease the future risk of mussel spread in uninfected bodies of water. This approach provides a methodology for understanding regional patterns of dreissenid mussel colonization and spread, informing management strategies throughout the U.S.

INHABIT: a web application to deliver habitat suitability models and bridge the scientist-practitioner divide

Topic: Invasive Species Management and Prevention

Terri Hogan
NPS

The National Park Service (NPS) mission to preserve unimpaired the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations must be accomplished while addressing the range of challenges that land managers face today. This includes the impacts of invasive species on native plant and animal communities and ecosystem function. However, the NPS is hampered by the scope of the invasive species problem compared to available resources to combat invasive species. Habitat suitability models for invasive species can provide practitioners with information to advise watch lists and target population searches. While many suitability models exist, there is often a divide between researchers creating these models and practitioners who may find them useful in informing land management actions. We have formed a scientist-practitioner partnership to create national models for several high priority species that are integrated into the Invasive Species Habitat Tool (INHABIT), a web application displaying visual and statistical summaries of nationwide habitat suitability models. The models are based on aggregated occurrence data and a species-specific set of predictors from a library of nationwide predictors that we assembled. The models are built following a common protocol, promoting model repeatability and credibility. Managers provide feedback both on the models and on INHABIT's features through various outlets. The content and functionality of INHABIT are designed to provide practical information leading to enhanced land management actions, including mapped products with interactive thresholds to define suitability based on management objectives (with field-device compatible download options), information on modeled environmental relationships, and tabular proximity summaries to inform management area watch lists. Based on comments and suggestions of practitioners, INHABIT is actively evolving to help bridge the gap between scientists and practitioners to help land managers make strategic decisions about where to focus limited resources to best address invasive plant control.

Phragmites management in the Great Lakes basin: science and collaboration as pillars of invasive species management

Topic: Invasive Species Management and Prevention

Samantha Stanton
Great Lakes Commission

Phragmites management in the Great Lakes basin: science and collaboration as pillars of invasive species management

Samantha Stanton¹, Daniel D. Engel², Elaine Ferrier¹, Christine Dumoulin³, Kurt P. Kowalski³, Erika Jensen¹

¹Great Lakes Commission

² Five Rivers Services, LLC contractor in support of USGS

³United States Geological Survey, Great Lakes Science Center

Non-native *Phragmites australis* is a highly invasive wetland grass in North America, and managers across the Great Lakes basin are working to control it. However, practitioners have reported difficulty in collaborating across the Phragmites community. The Great Lakes Phragmites Collaborative (GLPC) was formed to support managers in achieving their diverse management goals. Since its formation, the GLPC has created a strong network among Phragmites professionals and provided a wide range of Phragmites resources including a comprehensive website (<http://www.greatlakesphragmites.net>), best management practices, webinars on research and management topics, and multi-media outreach tools. A survey distributed by the GLPC identified the need for standardized monitoring protocols, decision support tools, and a central repository of Phragmites management data to improve control efficacy and determined that an adaptive management program could provide some of these tools. Thus, the Phragmites Adaptive Management Framework (PAMF) was developed to reduce uncertainty in Phragmites control. Using an adaptive management strategy and a data-driven predictive model, PAMF partners with Phragmites managers across the basin to refine best management practices and provide site-specific management guidance. PAMF provided participant guidance for the first time in August 2018 to over 300 acres of land impacted by Phragmites with additional enrollment occurring in 2019. This presentation will focus on the use of a collaborative approach to Phragmites management as well as benefits and lessons learned from 2 years of successful implementation of an adaptive management approach to invasive Phragmites management.

TRACKING INVASIVE SPECIES USING CITIZEN SCIENCE, WATER CHESTNUT AND JUMPING WORMS OH MY!

Topic: Invasive Species Management and Prevention

Colleen Lutz
New York Natural Heritage Program

TRACKING INVASIVE SPECIES USING CITIZEN SCIENCE, WATER CHESTNUT AND JUMPING WORMS OH MY!

Colleen Lutz, New York Natural Heritage Program
colleen.lutz@dec.ny.gov, 518-402-8913

In recent years, citizen science has been broadly used to help natural resource professionals acquire more actionable information about site management and invasive species.

Since its inception in 2010, iMapInvasives has combined crowd-sourced data with information collected by state agencies and partners to help resource professionals understand the distribution of invasive species across New York State. This online all-taxa database of tracked invasives species is currently entering its tenth year in existence and has been undergoing some important changes to mainstream the appearance and broaden the network of participating states. With new tools come more opportunities to engage our audience, especially citizen scientists.

We have used unique and fun techniques to engage a broad demographic of users, such as creating a Certified Trainers Network and promoting targeted species mapping challenges that have inspired outdoor enthusiasts to be on the lookout for invaders on their property or in their lake. We hope these techniques will lead to more early detection of small populations before they become established in natural areas.

What the Sniff is All About

Topic: Invasive Species Management and Prevention

Kristin Gies
Mequon Nature Preserve, Inc

I will be discussing the benefits of using professional scent detection canines to assist with conservation work in not only the Midwest, but throughout the country.

The attendees will learn why and how detection canines can find target odors and explain the science behind a dog's amazing ability to find target odor in the natural environment. Scent detection canines have the ability to find odor that humans could never detect, in places humans may not be able to go. They also have the capacity to find multiple targets of various species of plants, mammals, amphibians, and even bacteria.

Attendees will learn how trained dogs can be an effective and efficient tool to assist with conservation programs, including how they can be used to search large areas of land or in difficult terrain with minimal impact on the ecosystem. Examples of current projects will be presented, along with potential for new applications.

Join us to learn about the opportunities to use conservation dogs in many areas of the world of conservation and how we can partner with organizations! Attendees will have an opportunity to ask the presenter questions at the end of the presentation.

Wednesday, October 9, 2019 2:00pm - 3:30pm

Managing Natural Areas in a Changing Climate

Bringing stewardship into focus in conservation planning in the Anthropocene

Topic: Management Planning to advance the Conservation of Special Species/Natural Communities

Nicole Heller
Carnegie Museum of Natural History

In the Anthropocene, with human driven global and local changes dominating and degrading ecosystems whether they are protected or not, active management - or stewardship - is increasingly viewed as an essential element of conservation. At the same time, stewardship activities are often planned as an afterthought to land protection and proper budgets are not secured. Stewardship activities are often implemented through working lands partners, and there is little evaluation or knowledge of management techniques and outcomes. Furthermore, there is a lot of variation in what is considered stewardship and how costs and benefits are evaluated. There is a need to improve mapping, monitoring and evaluation of stewardship practices as part of conservation planning and long-term management. In this paper, I will discuss an effort with the Santa Cruz Mountain Stewardship Network to map and monitor stewardship as part of defining socio-ecological land health and coordinated regional conservation planning. We hope this emerging framework will support improved conservation planning and outcomes in the face of global change.

Mid-Atlantic Forest Ecosystem Responses in a Changing Climate

Topic: Climate Change – Species and Natural Communities on the Move

Patricia Leopold
Northern Institute of Applied Climate Science

Danielle Shannon
Northern Institute of Applied Climate Science

Forest ecosystems will be affected directly and indirectly by a changing climate over the 21st century. A new assessment evaluates the vulnerability of 11 forest ecosystems in the Mid-Atlantic region (Pennsylvania, New Jersey, Delaware, eastern Maryland, and southern New York) under a range of future climates. We synthesized and summarized information on the contemporary landscape, provided information on past climate trends, and described a range of projected future climates. This information was used to parameterize and run multiple forest impact models, which provided a range of potential tree responses to climate. Finally, we brought these results before two multidisciplinary panels of scientists and land managers familiar with the forests of this region to assess ecosystem vulnerability through a formal consensus-based expert elicitation process. Analysis of climate records indicates that average temperatures and total precipitation in the region have increased. Downscaled climate models project

potential increases in temperature in every season, but vary in projections for precipitation. The forest impact models project declines in growth and suitable habitat for many mesic species, including American beech, eastern hemlock, eastern white pine, red spruce, and sugar maple. Species that tolerate hotter, drier conditions are projected to persist or increase, including black oak, northern red oak, pignut hickory, sweetgum, and white oak. The montane spruce-fir and lowland conifer forest communities were determined to be the most vulnerable ecosystems in the interior portion of the Mid-Atlantic region. Maritime and tidal swamp forest communities were determined to be the most vulnerable ecosystems in the coastal plain portion of the region. The woodland, glade, and barrens forest community was perceived as less vulnerable to projected changes in climate. These projected changes in climate and the associated impacts and vulnerabilities will have important implications for economically valuable timber species, forest-dependent animals and plants, recreation, and long-term natural resource planning.

Responding to Climate Change Impacts in Forested Watershed Management

Topic: Climate Change – Species and Natural Communities on the Move

Danielle Shannon

Northern Institute of Applied Climate Science

Patricia Leopold

Northern Institute of Applied Climate Science

We rely on forests to capture, store, filter, and release clean cold water to our streams and lakes. Our forested watersheds and the vitality of our aquatic communities have been shaped by the unique combination of landscape, climate, and land-use. Over the next several decades, projected climate change will challenge the long-term stability of our forests and the quality and quantity of water resources. Given these challenges, it is important for forest and conservation organizations to be forward looking, flexible and responsive to ongoing changes and to consider site-specific vulnerabilities, risks, opportunities, and ways to adapt to climate change. This presentation will review tools, resources and partnerships developed by the Northern Institute of Applied Climate Science and the U.S. Forest Service with a specific focus on adaptation tools relevant to water resources and forest management in the Midwest and Northeast while also providing highlights of real-world stories of land managers who are intentionally incorporating climate change considerations into resource management and conservation to adapt to this challenge.

Authors: Danielle Shannon, Patricia R. Butler-Leopold, Christopher W. Swanston, Maria K. Janowiak, Stephen D. Handler, Kristen M. Schmitt, Leslie A. Brandt, Todd Ontl

Affiliation: Northern Institute of Applied Climate Science, USDA Northern Forests Climate Hub

Wednesday, October 9, 2019 2:00pm - 3:30pm

Native Plant Conservation Initiatives Speed Learning

Collaborative Plant Conservation: Five Perspectives

Topic: Native Plant Conservation Initiatives

Kristi Allen

Pennsylvania Plant Conservation Network

David Lincicome

Tennessee Natural Heritage Program

Tara Littlefield

Office of Kentucky Nature Preserves

Michael Kunz

North Carolina Botanical Garden

Micah Jasny
Native Plant Trust

Symposium: Collaborative Plant Conservation: Five Perspectives
Kristi Allen, C-krallen@pa.gov, (717)783-3327

Moderator: Kristi Allen / Program Coordinator / Pennsylvania Plant Conservation Network

One Sentence Summary: This session will discuss various examples of how state and federal agencies, universities, citizen scientists, botanical gardens, businesses, and conservation enthusiasts are collaborating to successfully conserve rare plant species.

Presenters: David Lincicome Tennessee Natural Heritage Program Manager & Cooper Breeden Conservation Coordinator for Tennessee Plant Conservation Alliance and Southeastern Grasslands Initiative

Title: 'Formation of the Tennessee Plant Conservation Alliance: No need to reinvent the wheel but sometimes a few new spokes might be in order.'

Abstract: Based upon the nationally recognized success of the Georgia Plant Conservation Alliance and the New England Plant Conservation Program, the Plant Conservation Alliance (PCA) model has now been adopted by other states, including Tennessee, to successfully implement at-risk plant conservation. A PCA is a network of private and public entities that agree to work together to leverage expertise and resources for the common goal of conserving the state's native plants and their habitats, using targeted conservation horticulture and habitat restoration. PCA's emphasize an informal structure and building of trust for efficient communication of diverse scientific data and institutional perspectives. State Natural Heritage Programs, assisted by the PCA, play a vital role in maintaining databases used to assess the botanical diversity of each state and establishing conservation priorities. A major strength of the PCA model, and founded upon trust, is the effective use of trained volunteers (Citizen Science) to perform conservation actions. I will discuss the formation of the Tennessee PCA, its emerging structure and operations, and plans for the future. In addition, I will discuss obstacles we have faced and the ways we have tried to overcome them. The PCA model is an innovative, practical and effective tool for at-risk plant conservation.

Presenter: Tara Littlefield Plant Conservation Section Manager/Senior Natural Heritage Botanist at the Office of Kentucky Nature Preserves; President of the Kentucky Native Plant Society; Kentucky Plant Conservation Alliance Coordinator

Title: Growing a network to protect our rare and declining flora: The start of Kentucky's Plant Conservation Alliance

Abstract:

Over the past 13 years working as a natural heritage botanist across Kentucky, monitoring and assessing the state of the flora, it became very apparent that the task of preventing extinctions and declines of our rare and native flora was much too great for just a few to tackle. There seemed to be a general sense of hopelessness and discouragement amongst the few botanists and natural areas managers that worked on plant conservation issues across the state. Many of our rare plant records were becoming historic and rare plant populations and their communities had drastically declined along with the staff and resources we needed to tackle the problems. With approximately 25% of our state flora designated as endangered, threatened, or special concern, and many more native plant communities on the decline, something had to be done in order to conserve, protect and enhance populations of rare plants or else extirpations and more loss were inevitable. Our native plants and their communities are the foundation of life and it was too important to not try to change the course. The only way to really make a meaningful impact to recover rare plants and restore the diversity our natural areas was to create a network of plant conservation partners that focused more on these efforts. But how is this done? And who are our partners? How important is outreach and education? What are examples of active and future projects? What are challenges we have faced in creating a new movement? I will discuss what we have done in Kentucky over the past decade to tackle the problem of our declining flora by creating new partnerships amongst state agencies, nonprofits, NGOs, volunteers, and private companies as well as increasing education and outreach of the importance of Kentucky's native plants through our Native Plant Society. I will also discuss specific plant conservation projects such white fringeless orchid restoration, the Kentucky clover, and the wood lily/roadside grassland rare plant project as examples of recent plant conservation efforts that came

from increasing our network.

Presenters: Kristi Allen Program Coordinator & Carly Evans MPA University of Georgia, Athens '19
Pennsylvania Plant Conservation Network & Georgia State Botanical Gardens

Title: 'The importance of interdisciplinary collaboration in plant conservation: perspectives from a social worker and public administrator'

Abstract:

Conservation work has historically been relegated to professionals in the natural sciences. However, it is important to note that no endeavor occurs in a vacuum. An interdisciplinary approach to conservation, comprising a multitude of skills allows for more dynamic solutions.

The field of social work provides lessons for conservation work, which are being applied by the newly developing Pennsylvania Plant Conservation Network. Organizational leadership, conflict resolution, group facilitation, and systems thinking are important components of building a network of conservationists.

The Georgia Plant Conservation Alliance (GPCA) is a professional network of botanical gardens, state and federal agencies, non-profit organizations, universities, and large land-owning companies working together on statewide plant conservation projects. Prior to the creation of the GPCA, conservation projects, public outreach efforts and government initiatives were managed separately, requiring professionals to reach out to individual subject matter experts on a per project basis. GPCA brings together all conservation biology disciplines including botany, genetics, horticulture, ecology, geology, and land management with specialists in hydrology, restoration ecology, and adaptive management. With the addition of a public administrative lens, GPCA can ensure their hands-on conservation efforts do not go unnoticed by policy makers.

Presenter: Michael Kunz Conservation Ecologist

North Carolina Botanical Garden, University of North Carolina at Chapel Hill

Title: 'A rose by another name can smell as sweet: Over 20 years of conservation networking in North Carolina'

Abstract: The growth of formalized conservation networks across multiple geographic scales has been a boon for the conservation of rare plants. Networks such as Plant Conservation Alliances or Rare Plant Task Forces bring together partners from multiple backgrounds to work toward common, conservation oriented goals and can serve as a powerful unified voice. The success of these networks often rely on dynamic individuals serving as a central hub to maintain organization, plan, and coordinate activities. While a formalized partnership is often ideal, informal networks can also be effective and beneficial to plant conservation. Using examples from North Carolina, I will discuss how we have built and maintained a strong informal network over the last two decades as well as hurdles we have faced in creating a more formal partnership. We will explore the similarities we share with other networks, what has worked, and what has not, in maintaining these partnerships that are integral for plant conservation.

Presenter: Micah Jasny Botanical Coordinator

Native Plant Trust, Framingham, Massachusetts

Title: 'Plant Conservation and the Future of Endangered Plant Species Protection'

Abstract:

The incorporation of citizen science into modern conservation efforts has become a necessity in order to successfully maintain biological diversity, particularly in regions threatened by fragmentation caused by development and population growth. The Native Plant Trust's Plant Conservation Volunteer (PCV) program serves a prime example of how citizen science efforts can be harnessed to benefit the rare plants in situ while being mutually beneficial for the passionate volunteers involved in the program.

Started in Massachusetts in 1993, the Native Plant Trust's PCV program is the oldest rare plant monitoring program in the country and engages conservation-minded volunteers in rare plant monitoring and seed collection, habitat management, invasive species monitoring and control, and general botanical surveys of selected natural areas.

Since its creation, the program has grown to a consortium of over 120 professional botanists and over 500 amateur volunteer botanists and become an essential resource not only for the Native Plant Trust, but for each of the six New England State's Natural Heritage Programs (Connecticut, Massachusetts, Maine, New Hampshire, Rhode Island, and Vermont).

Under the supervision of the Botanical Coordinator, Plant Conservation Volunteers (PCVs) complete an online course and participate in annual training on how to properly conduct rare plants surveys and collections. The PCVs are then able to register to conduct rare plant surveys from a list compiled by Native Plant Trust conservation staff in coordination with each New England state botanists. Each year, PCVs conduct between 300 and 400 rare plant surveys and approximately 120 seed collections to be added to the Native Plant Trust's seed bank each year. In return, the Native Plant Trust offers a number of educational opportunities and field trips to the volunteers. Over the past 26 years, PCVs have contributed to a number of conservation successes. PCV's have helped in identifying populations of rare species thought to have been extirpated including the discovery of chaff-seed (*Schwalbea americana*) which had not been seen in New England for over 40 years. Additionally, PCV's helped monitor restored populations of Robbins' cinquefoil (*Potentilla robbinsiana*) resulting in the first removal of a plant from the Federal Endangered Species List. The contributions by PCVs have helped, and will continue, to help provide information to improve management and conservation decisions that protect and foster these rare plant species. It is critical for conservation organizations to continue to engage citizen scientists for the protection of rare plants on the landscape.

Wednesday, October 9, 2019 2:00pm - 3:30pm

Restoration and Management of Urban Natural Areas

Assessing and Enhancing Ecological Value in the Allegheny County Park System

Topic: Management Planning to advance the Conservation of Special Species/Natural Communities

Joel PERKOVICH
Allegheny County Parks Dept.

Joel Perkovich
Allegheny County Parks Dept.

TITLE: Assessing and Enhancing Ecological Value in the Allegheny County Park System
PRESENTERS: Joel Perkovich, PLA, ASLA, landscape architect, Allegheny County Parks Dept. Sara Madden, project manager, Allegheny County Parks Dept.

The Allegheny County Parks system consists of 9 parks totaling over 12,000 acres and offers a wide range of passive and active recreational opportunities. Maintaining and improving the integrity of natural areas against the persistent threat of invasive plants, pests, and pathogens can seem overwhelming and impossible at times. This presentation will review the planning, implementation, and maintenance methods for various natural areas enhancement projects that have occurred in the parks over the past 3 years. Projects include reforestation and riparian restoration plantings, and meadows. The implementation of these projects is largely a reflection of ecological assessment studies that have been conducted by the Western PA Conservancy in 4 of the 9 county parks. These reports inventory the quality of existing plant communities and highlight opportunities for restoration and green infrastructure projects. Between 2016 and 2019 the Parks Department will have converted approximately 25 acres of marginal or mowed turf land to native grass and wildflower meadow and planted over 5,000 woody restoration plantings. The presenters will also discuss the role of design and interpretive elements to help cultivate public acceptance and appreciation of naturalistic landscapes in public parks.

Effect of legacy sediment removal and floodplain reconnection on riparian plant communities

Topic: Restoration of Natural Areas Qualities

Vanessa Beauchamp
Towson University

Patrick Baltzer
Towson University

Effect of legacy sediment removal and floodplain reconnection on riparian plant communities

Patrick Baltzer and Vanessa B. Beauchamp

Stream restoration is a common practice to address hydrologic and geomorphic changes in floodplains, with the aim of reducing sediment and nutrient export. Legacy sediment removal and floodplain reconnection is a stream restoration practice that involves removing sediment accumulated behind historic mill dams. This process reconnects incised streams to their floodplains and should result in a lower, wetter floodplain dominated by native hydrophytic plant species, but how these ecosystems will actually recover from such a large disturbance is not yet fully known. This project surveyed herbaceous and woody vegetation at six restoration sites central Maryland in spring and fall of 2017 & 2018 to determine how this type of stream restoration affects riparian plant communities. Three sites involved comparison of reference and previously restored sites and three additional sites were assessed before and after restoration. One major consequence of restoration was an average reduction in basal area of 81% between unrestored and restored sites. In addition to the reduced tree canopy, restored herbaceous communities had more hydrophytic vegetation than reference sites but had similar levels of richness, evenness and a similar proportion of native species. Restoration decreased the difference in vegetation composition among sites, but did not affect within-site beta diversity. Despite the decrease in among site beta diversity, comparison of vegetation community composition on restored and unrestored reaches using non-metric multidimensional scaling showed that the majority of the variation in both herbaceous and woody community composition among locations can be attributed to site; however restoration status was still an important determinant of community composition. Graminoid importance was higher in restored sites, likely in response to the more open canopy and high seed dispersal capabilities of these species. Abundance of ferns (*Parathelypteris noveboracensis*; New York fern, *Polystichum acrostichoides*; Christmas fern) and skunk cabbage (*Symplocarpus foetidus*) was lower at restored sites suggesting these species and others with underground rhizomes are negatively impacted by this type of restoration. Intentional planting of these and similar species may be necessary to start populations in restored floodplains after legacy sediment removal.

Fish and Freighters - Habitat Restoration Along the Cuyahoga River's Shipping Channel

Topic: Urban Natural Areas and Green Infrastructure

Valerie Carter-Stone
Cleveland Metroparks

Fish and Freighters - Habitat Restoration Alongside the Cuyahoga River's Shipping Channel

This restoration of 2,800 feet of natural shoreline and 11-acres along the Cuyahoga River serves as a national test model for creating fish and wildlife habitat within urban shipping lanes.

The Cuyahoga River Area of Concern was established in 1987 through a binational agreement with Canada, and one specific impairment noted was the loss of fish and wildlife habitat. Creation of the Scranton Road property was a collaborative effort between numerous partner agencies and organizations to provide habitat for fish and wildlife where a marina, rail yard, and coal storage depot once stood.

Throughout the 5-mile Cuyahoga River shipping channel, steel bulkheads and concrete pilings line the river and hold the banks in place, eliminating important connectivity between riparian and riverine systems. The restoration process at Scranton Road began in 2013 with removing most of these obstructions for 2/3rds of a mile, taking away 38,000 cubic yards of contaminated soil, and sloping the newly exposed river banks. The results included 2,800 ft of natural shoreline, a 2-acre fish habitat along the Cuyahoga River shipping lane, and 9 upland acres of meadow.

This urban park now provides crucial aquatic habitat within a five mile stretch of highly altered river which is stagnant, unnaturally deep, and lacking in shade and structure. Scranton Road offers native aquatic plants, macroinvertebrates, and fish an escape from these conditions and an opportunity to safely forage and reproduce away from recreational boats and freighter traffic. Establishment of safe zones within the shipping channel is imperative to reconnect aquatic life in Lake Erie and within the upper reaches of the Cuyahoga watershed. This is particularly noteworthy as conversations have turned to evaluating the possibility of reintroducing a potamodorous lake sturgeon population here.

Enormous lake freighters navigating the Cuyahoga River's ship channel create strong waves and extreme turbidity not experienced in natural riverine systems. Likewise, water levels fluctuate significantly here in response to Lake Erie. Harsh and inconsistent conditions meant that initial attempts to establish important in-water herbaceous

vegetation were unsuccessful and there were repeat failures of the floating booms intended to exclude trash and boats from the aquatic sanctuary.

Submergent plants are quickly coated with sediments and therefore cannot photosynthesize, while the substrate isn't firm enough to hold and protect emergent species. Plants also find themselves both above the water line and fully submerged for extended periods of time.

Although springtime ice flows initially made floating wetlands look impractical, brainstorming enabled the few remaining bulkheads to be strategically used in providing adequate protection. Sixteen mats were then carefully sculpted to minimize wave impact and moored using a traditional set of defined connections and pressure points which quickly failed. An innovative and successful solution was then created in response, using a fluid system of tether attachments between cables and PVC pipes that distributes forces over a larger surface.

In terms of successfully incorporating aquatic vegetation into the site, the native plants installed within the floating wetlands have done very well. 'Above ground' portions have shown impressive growth rates and root development beneath the floating wetlands is extraordinary. The mats themselves also serve as a growth medium for non-planted aquatic species to anchor onto and flourish. Providing in-water shade, roots, and plants incorporates important food and shelter within this previously barren aquatic site.

Similarly, there were repeat failures of the floating booms intended to exclude trash and boats from this aquatic sanctuary. Because extensive research and trials with different products on the market showed that this site's needs are not met by products currently available, Cleveland Metroparks partnered with Cleveland-Cuyahoga County Port Authority and Cleveland Institute of Art to design a prototype that uses biomimicry principles. Numerous designs were conceived and tested by the students and one promising concept was ultimately selected for additional development and evaluation. Prototypes were placed across a 44-foot span in the Cuyahoga River in September 2018 and have functioned well thus far. If the design continues to perform satisfactorily, it may be produced in larger numbers for use throughout this restoration site, and innovations made here may ultimately lead to a marketable product appropriate for other challenging urban rivers.

Electroshocking studies conducted by Ohio Environmental Protection Agency and Ohio Department of Natural Resources have regularly assessed the condition of fish population and diversity throughout the Cuyahoga River watershed and at Scranton Rd restoration site specifically. Results indicate that both fish species diversity and richness have increased significantly and several pollution intolerant species now occur. Within its first four years, there have been improvements in fish numbers and diversity of fish species, with noteworthy findings including the first recorded Northern pike (*Esox lucius*) within the shipping channel. Due to frequent breakages in the floating booms, comparisons could also be made and they indicate that fish populations behind intact booms are healthier and more robust. Therefore, the importance of finding a durable floating boom design has been confirmed and specifically documented, and all partners are encouraged that the prototypes continue to function well without breakage.

Bird surveys likewise show increases in puddle and diving ducks, wading birds, and wetland-specialists, and a significant rise in passerines during spring and fall migrations. Sixty-nine avian species were recorded 2010 to 2014, with 34 additional species appearing 2014 to 2017.

Fish and wildlife improvements have been significant, although success has meant wildlife management challenges. Ironically, in a site created to provide fish and wildlife habitat, wildlife herbivory now poses a significant threat. Canada geese (*Branta canadensis*) and mute swans (*Cygnus olor*) have destroyed herbaceous vegetation, while shrubs and trees are targeted by rabbits and beavers, including traditionally non-desirable trees like white pines (*Pinus strobus*).

These eleven acres of restored terrestrial and aquatic habitats now attract and support increasing migrant and resident species alongside a busy shipping channel within a heavily industrialized urban setting.

Targeted Forest Management and Restoration Efforts to Protect Coldwater Stream Habitats

Topic: Best Management Practices on land for Freshwater Ecosystem Integrity

Alicia Beattie

Chagrin River Watershed Partners

Targeted Forest Management and Restoration Efforts to Protect Coldwater Stream Habitats
Alicia Beattie, Associate Director of Chagrin River Watershed Partners, Inc.
abeattie@crwp.org; (440)-975-3870 *1003

More frequent and intense storm events contribute to more severe erosion, bank destabilization, and loss of high-quality habitat for species sensitive to increased sediment loading and heated stormwater from developed areas. Warmer winters also help facilitate the spread of invasive species threatening riparian forest buffers that protect coldwater and other high-quality stream systems. Chagrin River Watershed Partners, Inc., (CRWP) a nonprofit organization in Northeast Ohio made up of member communities, park districts, and counties, is leading efforts to preserve and restore sensitive coldwater stream habitats. CRWP's approach includes watershed planning, assisting members in implementing model codes such as riparian and wetland setbacks and stormwater regulations that incentivize green infrastructure, and targeted preservation, reforestation and restoration working with public and private landowners to improve habitat resiliency. CRWP is also coordinating a large-scale forest management and monitoring project funded by the Wildlife Conservation Society Climate Adaptation Fund to enhance the resiliency of 500 acres of forests buffering coldwater streams in the Chagrin and lower Grand River watersheds. Core partners include the Holden Arboretum, Cleveland Metroparks, Geauga Park District, Lake Metroparks, and Lake County SWCD. This presentation will highlight collaborative partnerships and strategies to sustain wildlife habitat by helping riparian forests and coldwater streams adapt to climate change.

Urban Headwater Stream Restoration: Maximizing Funding and Resources to Meet Multiple Objectives

Topic: Urban Natural Areas and Green Infrastructure

Kevin Grieser
Biohabitats, Inc.

Suzanne Hoehne
Biohabitats, Inc.

Presentation Title: Urban Headwater Stream Restoration: Maximizing Funding and Resources to Meet Multiple Objectives

Presenter/Author: Kevin Grieser, Biohabitats, kgrieser@biohabitats.com, 216.539.7852
Co-Author: Suzanne Hoehne, Biohabitats, shoehne@biohabitats.com, 502.650.8880

Abstract: In many urban watersheds our streams are ditched, channelized, piped or simply integrated into the City's stormwater infrastructure. This is even more prevalent with our smaller headwater streams as they are often moved or 'disappear' to underground pipes to accommodate development. Cleveland and Northeast Ohio is not immune to this historic practice however, we are blessed with a strong network of watershed groups, park and sewer districts who are dedicated to restoring our streams, as well as, a number of local and state funding mechanisms for stream restoration and green infrastructure projects.

In 2019 the West Creek Conservancy restored approximately 525 linear feet of degraded West Creek headwaters in Parma, OH using funding from Ohio EPA's Nonpoint Source 319 Grant Program. Historic straightening, channelization and floodplain filling had left this stretch of West Creek in a severely degraded state with little aquatic habitat and floodplain connectivity. Confined to a lot between an equipment rental company and a retirement home, this stretch of stream had the potential to become a small oasis in an otherwise urban landscape. Using a valley restoration approach with both a single, base-flow channel and stage 0, multi-stem channel, the project met multiple objectives including: stabilizing the channel, creating floodplain storage, adding sinuosity, providing in-stream aquatic habitat, removing invasive species, improving water quality, treating adjacent stormwater runoff, installing habitat features and replanting with natives. The design-build project was designed by Biohabitats, constructed by Meadville Land Service and planted by the Cleveland Metroparks Watershed Volunteer Program and staff from the Northeast Ohio Regional Sewer District. The project is an example of maximizing restoration dollars to meet multiple objectives. Both the design-build approach and use of outside help to plant the project then allowed more of the project funding to go directly back into the restoration activities.

Conference topics: Urban Natural Areas and Green Infrastructure; Restoration of Natural Areas Qualities

Restoration of Natural Areas Qualities on Presque Isle

Presque Isle Priority Wetland Restoration (Erie, PA), 2012-2018 and Beyond

Topic: Invasive Species Management and Prevention

Robert Whyte

California University of Pennsylvania

Amber Stillwell

Regional Science Consortium

Holly Best

PA Dept. of Conservation and Natural Resources

Jen Salem

Go Native Erie!/Regional Science Consortium

Sean Dalton

Regional Science Consortium

Title: An Epic War: Presque Isle State Park vs. Invasive Plants

Authors: Holly Best (PA Department of Conservation and Natural Resources)

Since the mid 1980's, the quantity of invasive plants found at Presque Isle State Park has increased substantially. The Park started battling the plants via mechanical means in the 1990's, but it wasn't enough. Fortunately, we were able to collaborate with Ducks Unlimited to receive a large amount of Great Lakes Restoration Initiative and Sustain our Great Lakes funding to be able to arm ourselves and actually win some of the battles on the Park to turn things around. This presentation will summarize the work being done at the Park and why Presque Isle State Park is such an important place to preserve. Many other allies have joined in the battle and bring their own special training and skills, including the Regional Science Consortium, Go Native Erie, California University of PA, and Erie Bird Observatory. This presentation will be about invasive plants, partnerships, and how the park is trying to beat the odds.

Title: The Integration of Plant Monitoring Data into iMapInvasives as part of the Presque Isle Priority Wetland Restoration (PIPWR) Project

Authors: Robert S. Whyte (California University of Pennsylvania) and Amy L. Jewitt (iMapInvasives Coordinator, Pennsylvania Natural Heritage Program, Western Pennsylvania Conservancy)

The Presque Isle Priority Wetland Restoration (PIPWR) project is a comprehensive multi-agency effort coordinated by Ducks Unlimited in cooperation with the PA Department of Conservation and Natural Resources, the Regional Science Consortium and other non-profits and area universities. The project was initiated in 2012 and recently completed phase II which ran from 2016-2018. Phase III of the project is planned to run from 2019-2021. The goal of the PIPWR project is to restore 400 acres of coastal wetland habitat at Presque Isle State Park and improve native habitat structure and complexity, hydrologic connectivity, and water quality.

Presque Isle State Park is home to several unique ecological communities including numerous emergent wetlands and an open-water lagoon system. Many of these native wetland plant communities have been outcompeted and overrun by invasive species including *Phragmites australis*, *Typha angustifolia*, and *Typha glauca*. From 2012-2018, PIPWR project members monitored and measured the change in plant species composition and habitat structure by completing a comprehensive survey of the wetland vegetation in designated treatment areas (and control sites) before and after removal of *Phragmites* and other invasive and non-native species.

This monitoring data was later integrated into the Pennsylvania iMapInvasives database, an on-line, GIS-based data management system available to the general public and used to assist citizen scientists and natural resource professionals working to protect our natural resources from the threat of invasive species. By integrating this monitoring data into iMapInvasives, PIPWR project members are able to view specific invasive species locations and

treated areas within the designated project sites at the park. This data can then be shared with other project partners and be viewed by the general public, thereby increasing awareness of this important work.

Title: Fish Surveys in Restored Priority Wetland Habitats on Presque Isle State Park, Erie, PA

Authors: Amber Stilwell, Sean Dalton, and Jeanette Schnars (Regional Science Consortium)

Encroaching invasive plant species can have numerous negative effects if left unopposed in priority wetlands for both fish and amphibian species, ultimately leading to the displacement of the animals. These priority wetland areas are critical fish spawning habitat. Using mesh seining transects, hoop nets, fyke nets, and fish traps, these surveys were conducted at five priority wetland habitat restoration areas distributed across Presque Isle State Park in Erie County, PA where treatment for invasive plants has been applied. Surveys were conducted both before and after native replanting efforts by Go Native, Erie two-three times per week from May to October. The surveys seek to catalog the change in native fish biodiversity in these restored habitats.

Title: Fish and Amphibian Surveys in Restored Priority Wetland Habitats on Presque Isle State Park, Erie, PA

Authors: Sean Dalton, Amber Stilwell, and Jeanette Schnars (Regional Science Consortium)

Encroaching invasive plant species can have numerous negative effects if left unopposed in priority wetlands for amphibian species, ultimately leading to the displacement of the animals. Using field observation methods, collection transects, as well as overnight recordings, surveys were conducted at 5 priority wetland habitat restoration areas distributed across Presque Isle State Park in Erie County, PA where treatment for invasive plants has been applied. Recordings were conducted three nights per week using Wildlife Acoustics Song Meter SM4s, and were analyzed using the accompanying free software Song Scope. Surveys were conducted both before and after native replanting efforts by Go Native! Erie. The surveys seek to catalog the change in native biodiversity in these restored habitats.

Title: Four Seasons of Growing: Plant Propagation for Wetland Restoration on Presque Isle State Park

Author: Jen Salem, (Go Native Erie!/Regional Science Consortium)

Despite ongoing efforts to eliminate invasive plant species from Presque Isle State Park, targeted areas are not being repopulated by native plants quickly. The absence of these beneficial plants is an invitation for invasives to move back in, creating a situation where extensive treatment is necessary. The goal of this wetland restoration project is to grow and re-populate native wetland plants in three selected areas of Presque Isle. This will include propagation directly from plants found on the Park, and continual monitoring on the selected areas. The results of this project will be used by the PA DCNR and will impact future wetland restoration projects on Presque Isle State Park.

Wednesday, October 9, 2019 2:00pm - 3:30pm

Topic TBD

Forest history for conservation: assessing forest age, land-use history, and diversity at Chatham University Eden Hall

Topic: Identifying Natural Areas for Conservation

Marion Holmes

University of Pittsburgh

Chatham University's Eden Hall campus is a former farm located in the unglaciated Allegheny Plateau. The campus includes second-growth stands that have regrown after abandonment from agriculture. Although the campus is used for ecological research, the ages, land-use histories, and community composition of most forest stands were not yet described. As stand age and land-use history are key components of the ecology of successional forest sites, I designed a study to create a stand-by-stand inventory of campus forests as part of an upper-level undergraduate forestry course. The goals of the project were: 1) to describe the history structure and composition of each forest patch; 2) to create a database of stand age, land-use history, and community attributes that will be available to researchers working at Eden Hall; 3) to test the influence of stand age and land-use history on forest biodiversity to determine which stands have the highest conservation value.

Forest age and land-use history were determined with aerial photos dating from 1938 to 2018. We described stand structure and composition in the field using the point-centered quarter method, and used the data to calculate stand density, basal area, and community composition. Relationships between stand structure, age, and land-use history were tested with generalized linear models; community composition was assessed with nonmetric multidimensional

scaling ordination and permutational multivariate analysis of variance (PERMANOVA).

We identified 11 individual natural-regrowth stands on campus ranging from 0-20 years to >120 years past canopy closure. Land-use change on campus reflects regional trends: most forest is 21-60 years old, consistent with mid-20th century afforestation following agricultural abandonment. Most other stands were >80 years post canopy closure, and, although showing signs of prior agriculture, have afforested decades prior to the earliest aerial photos. Composition and structure differed with stand age. Young stands are higher in density than older stands, and are dominated by shade-intolerant early successional species. Older stands have a higher diversity of stem sizes, lower stem density, and higher values of oak (*Quercus* spp.) and hickory (*Carya* spp.). Older stands, especially those dating to at least 120 years past canopy closure, were significantly more diverse in species composition and stand structure than forests younger than 60 years. The results and methodology discussed in this talk will be useful to land managers and conservation practitioners interested in incorporating analysis of forest history into their projects.

Harnessing citizen science to promote community stewardship, pollinator research, and habitat restoration

Topic: Pollinators in Natural Areas Management

Keri Rouse
Point Park University

Title: Harnessing citizen science to promote community stewardship, pollinator research, and habitat restoration in Allegheny County

Authors: Keri Rouse - Point Park University, Paula Ambrose - Point Park University, Matthew R Opdyke - Point Park University, Emilie Rzotkiewicz - Allegheny Land Trust

Citizen science is a research methodology that harnesses public participation to help researchers maximize the amount of data collected on a project. This methodology was applied in the 2018 development of Project Bee Watch, a project in which volunteers conduct pollinator surveys on meadow properties owned by conservation organizations in Allegheny County, Pennsylvania. Data is collected and analyzed by us before being shared with local conservation organizations and the community to guide land managers in planning and tracking habitat improvement efforts, assist homeowners in choosing beneficial wildflowers to support pollinators, and assess the status of pollinators in Allegheny County.

In Southwestern Pennsylvania, there is no baseline data on the status of pollinators to track population changes or guide conservation efforts in habitat creation and improvement. Meanwhile, worldwide declines in pollinators have been recorded. Project Bee Watch partners with conservation organizations to recruit and manage citizen scientists who help collect the volume of data necessary to fill this data gap. Volunteers graduate from a training course where they learn about the benefits of pollinators, practice using insect and plant identification tools, and learn the process of conducting surveys at their meadow site.

Surveyors use a stationary method of observation and record present wildflowers and visiting pollinators to a randomly-placed sampling plot. In the 2018 pilot study, seven citizen scientists contributed over 30 hours of volunteer time. Project Bee Watch is expanding in 2019 to include additional sites through partnerships with Allegheny Land Trust, Pittsburgh Parks Conservancy, and Latodami Nature Center. One partner organization has already used collected data to aid in selecting plant species for a meadow improvement effort. This method of utilizing citizen science to fill data gaps and promote strategic management of habitats can be applied to fit the unique needs of other conservation organizations.

Management of Pollinators in Glade and Grassland Systems

Topic: Pollinators in Natural Areas Management

Melissa Caspary
Georgia Gwinnett College

Management of Pollinators in Glade and Grassland Systems
Melissa Caspary, Georgia Gwinnett College

The remnant prairies of the Southeastern United States are known to harbor a wealth of endemic herbaceous

species and the rich community ecology associated with such diversity (Noss 2012). The purpose of this project is to survey the restored and managed grasslands and outcrops for flora and associated apian pollinators, then determine floral visitation based on pollen loads and morphology. It is hypothesized that limited distribution of botanical species will correspond to an associated rarity in insect pollinators (Burkle, Marlin, & Knight 2013). Characterized species interactions will allow us to better understand community dynamics within these outcrop grassland systems. Associate bee pollinators will be identified to highlight species associations that appear critical to the persistence of the native barren plant network. These findings will be analyzed to better understand how community behavior of pollinators translates across prairie/barren complexes. The findings from this research effort will emphasize the importance of managing for plant-insect community partners in ecological systems and increase our understanding of ecological community networks in specialized habitats.

Restoration Challenges of a Mountaintop Natural Community at Bull Run Mountains Natural Area Preserve, Virginia

Topic: Restoration of Natural Areas Qualities

Michael Lott
Virginia Department of Conservation and Recreation

Joseph Villari
Virginia Outdoors Foundation

Restoration Challenges of a Mountaintop Natural Community at Bull Run Mountains Natural Area Preserve, Virginia

Michael Lott, Virginia Department of Conservation and Recreation; Joseph Villari, Virginia Outdoors Foundation

Stewardship of mountaintop natural areas present unique challenges relating to their ecological importance, fragility and desirability for recreational access. High Point at Bull Run Mountains Natural Area Preserve (BRMNAP) is an excellent example of these challenges. The Virginia Outdoors Foundation owns the majority of BRMNAP and maintains 6.5 miles of trail in the southern portion of the preserve. High Point itself is located within a privately-owned tract. The Virginia Department of Conservation and Recreation holds a Deed of Dedication across the entire preserve. BRMNAP lies within rapidly growing Northern Virginia and is the first mountain ridge west of Washington D.C. While High Point has long been a destination for hikers, because of its spectacular views, the area saw relatively light use prior to officially opening to the public in 2010. Visitation increased exponentially following the opening, resulting in extensive damage to the vegetation and soils of the clifftops, ledges and adjacent woodland. Table Mountain pines (*Pinus pungens*) – some very old, and heath family shrubs dominate the Pine – Oak /Heath Woodland community at High Point. While this community is common on higher ridges of the Blue Ridge and Ridge and Valley provinces to the west, it is rare in the Virginia Piedmont. By 2014, access levels had become unsustainable and the High Point tract was closed to visitors in January 2015. Following closure, a monitoring and recovery plan was completed, identifying five goals: 1) evaluate and map restoration area; 2) install monitoring plots; 3) identify and map undamaged reference sites; 4) initiate monitoring protocols and establish benchmarks for assessing recovery; and 5) physically obscure social trails and restore damaged areas. Re-sampling of monitoring plots has occurred each year since 2015. Slow improvement was noted each season; however, a dramatic increase in recovery was seen in 2018. Improvements included increases in leaf litter and moss cover on previously bare ground, maturation of previous herb and tree seedlings, and an increase in vascular plant cover. Factors contributing to recovery include a reduction of open days at BRMNAP to three days/week, improved infrastructure, disguise of old trails leading to High Point, heightened staff attention, refined monitoring protocols and improved collaboration with stakeholders. Although there is more to achieve, continued collaborative efforts at BRMNAP offer promise of further restoration.

Soil carbon stock dynamics in six land use types measured over a decade at a national tallgrass prairie

Topic: Restoration of Natural Areas Qualities

Nicholas Glass
University of Illinois at Chicago

Soil carbon stock dynamics in six land use types measured over a decade at a national tallgrass prairie.

Nicholas T. Glass*, Christopher Whelan, Erika Meraz, Eduardo A. Dias de Oliveira, Miquel A. Gonzalez-Meler.

Department of Biological Sciences, University of Illinois at Chicago.

Tallgrass prairie is one of the most vulnerable ecosystems in North America due to the widespread conversion of land to agriculture. The many ecosystem services provided by tallgrass prairie, including erosion control, provision of habitat for numerous invertebrate and vertebrate species, or soil carbon sequestration, are jeopardized with the land use conversion of this once widespread ecosystem. Recently, prairie restoration has become a more common practice, thereby providing an opportunity to restore the ecosystem and its ecosystem services. Agricultural use of former prairie land has resulted in the loss of up to 60% of soil carbon stocks, and it is expected that prairie restoration can recover soil C stocks over multiple decades or centuries. However, the recovery rate as a function of land use history is not known. Here we investigate soil carbon stock dynamics in six land use types: (1) row crop agriculture, (2) pasture, (3) restored prairie (from row crop and from pasture), (4) remnant prairie, (5) old fields (unmanaged land) and (6) recently converted to cow pasture ('newly planted'). Soil cores were extracted in 2007 and again in 2018 in 40-m transects from these land use types at Midewin National Tallgrass Prairie.

Soil cores collected in 2007 indicate both soil carbon ($P = 0.004$) and nitrogen ($P = 0.01$) differ significantly with respect to land use history. A Least Significant Difference post-hoc test showed that row crop lands had significantly lower carbon stocks than all other land uses. Carbon stocks in newly planted pastures, restored prairies, and pastures contained about 1.5 times the carbon stocks as row crop lands, and did not differ significantly from each other. Old fields contained significantly larger carbon stocks than row crops, newly planted pastures, restored prairie, and pastures, but less than remnant prairie. Results for nitrogen stocks were similar except that old fields did not differ significantly from remnant prairie. In 2007, all sampled restored prairie sites were restored within 10 years prior to sampling. The 2018 soil samples represent an additional 11 years of soil development for these sites and also encompass recent prairie restoration conversions from pastures and row crops that occurred within the 2007-2018 period.

Spreading Wings and Seeds Across the Midwest

Topic: Pollinators in Natural Areas Management

Amber Barnes

Pollinator Partnership

Title: Spreading Wings and Seeds Across the Midwest

Author: Amber Barnes

Institution: Pollinator Partnership

Numerous studies from around the globe are making it clear that not only is biodiversity in decline, but we are especially seeing dramatic reductions in pollinators and other insects. The plight of the monarch is one of the most widely acknowledged examples of this reduction within the United States in what were once common and abundant organisms on the landscape. Over the last 20 years, monarch populations have fallen by approximately 90%. The causes for this abrupt decline are likely a complicated mixture of habitat conversion and fragmentation, changes to landscape management techniques, overuse and/or misuse of pesticides, climate change, disease, and other factors. While no one group or organization can necessarily address all of these factors, we can all contribute to the conservation of this and other imperiled species by adopting pollinator friendly practices and enhancing our lands to support their needs.

To this end, Pollinator Partnership, with funding from the National Fish and Wildlife Foundation, and a large coalition of core and satellite partners has been working in the Midwest (AR, IL, IN, OH, MI, MO, PA, and WI) over the last three years to develop a trained regional seed collection network and engage with private land stewards and public land managers to increase and enhance monarch and other pollinator habitat on the landscape. Through our recently completed Monarch Wings Across the Eastern Broadleaf Forest (MWAEBF) initiative and our fledging Project Wingspan, Pollinator Partnership and our dedicated team of volunteers and partner organizations are impacting tens of thousands of acres through commitments to improved management practices, education, and providing much-needed, regionally appropriate, native milkweed and forage plants to natural areas and other conservation projects throughout our target states.

Through these innovative activities, collaboration with our dedicated volunteers, program partners, and diverse array

of landowners and managers have led to the tremendous accomplishments of the MWAEBF program. As we continue to build these unique partnerships and expand these innovative efforts, we expect this positive trajectory to continue through Project Wingspan. Though many lessons have been learned along the way, there is no doubt that our collective achievements will pay dividends for the plants and wildlife utilizing these enhanced areas. It is only through diverse and dynamic partnerships that critical landscape-level conservation of this kind is possible. We welcome you to join us in learning how you, too, can help with spreading wings and seeds across the Midwest.

Wednesday, October 9, 2019 2:00pm - 3:30pm

Using Data and Technology to Advance Conservation Speed Learning

Analysis of impact of Emerald Ash Borer on an Indiana on old-growth forest using GIS and aerial imagery

Topic: Using Data and Technology to Advance Conservation

John Taylor
Ball State University

Emerald Ash Borer (*Agrilus plannipennis*) (EAB) invaded east central Indiana in 2011. Ginn Woods, the largest and one of the last remaining old-growth forests in Indiana, presented an opportunity to study the long-term effects of EAB on forest community structure and species composition. In summer 2012, canopy trees were mapped and a geographic database was developed before large numbers of ash trees were infested. In summer 2018, aerial imagery was collected to identify locations of canopy trees that died between 2012 and 2018. In summer 2019, the 2012 tree map will be tested to confirm observations from 2018 aerial images. An assessment of mortality rates for ash and other canopy species of interest will be presented along with the updated tree map.

CHANGES IN THE AREAL EXTENT OF WHITE OAK FORESTS BETWEEN 2005 AND 2015 IN KENTUCKY AND TENNESSEE, USA

Topic: Using Data and Technology to Advance Conservation

James F Rosson Jr
USDA Forest Service; Southern Research Station

CHANGES IN THE AREAL EXTENT OF WHITE OAK FORESTS BETWEEN 2005 AND 2015 IN KENTUCKY AND TENNESSEE, USA

James F. Rosson, Jr.; USDA Forest Service, Southern Research Station, Forest Inventory and Analysis, 4700 Old Kingston Pike, Knoxville, TN 37919; 865-862-2067. jrosson@fs.fed.us

Concerns have been raised about the health and future of the white oak (*Quercus alba* L.) forests in eastern North America. Declines can be traced to maturing forests (succession), species replacement after disturbance, cutting, ineffective fire management, and oak decline issues. Changes in forest structure over time can serve as indicators of ecosystem decline. I used USDA Forest Service, Forest Inventory and Analysis (FIA) data to look closely at the white oak forests in Kentucky and Tennessee, a region of best development for the species. Highest densities of white oak occur on the Cumberland Plateau in Kentucky and again on the Cumberland Plateau plus the Highland Rim in Tennessee. Comparisons of the areal extent of these forests were made on plots measured in 2005 and re-measured in 2015. There were 5.01 million ha of total forest land in Kentucky and 5.62 million ha in Tennessee in 2015. In the 2005 measurement period, white oak >2.54 cm dbh occurred on 4.42 million ha across the two states. By the time of the 2015 measurement period, the forest area was 4.25 million ha, a 171.0 thousand ha decline. Parsing out the different types of white oak forest metrics revealed more specific areas of white oak changes. In contrast to the overall white oak forest decline, forests where white oak was the number 1, 2, or 3 canopy dominant increased in Kentucky (from 956.8 to 1,291.1 thousand ha) and remained unchanged in Tennessee, about 1,130.0 thousand ha. This is because of the maturing of the white oak resource, further evidenced by the increase in forest land that had white oak trees >38 cm dbh. In Kentucky, these types of forests increased from 2,193.7 to 2,478.6 thousand ha while in Tennessee this type of forest land increased from 2,246.1 to 2,455.7 thousand ha. The decrease in white oak forest land mostly occurred in the advanced regeneration phase. In these sapling-sized forests, with white oak as the number 1, 2, or 3 sapling dominant, forest land area decreased by 162.5 thousand ha

across the two states. These types of monitoring efforts are important in helping policy makers and managers plan for the sustainability of the white oak resource. This preliminary analysis shows the mid- to advanced succession levels of white oak stands improving but points out the need for improving the accumulated advanced regeneration of white oak in Kentucky and Tennessee.

Characterizing forest fragments with modern UAV technology

Topic: Management Planning to advance the Conservation of Special Species/Natural Communities

James Whitacre

Carnegie Museum of Natural History

I will discuss best practices and current methodology for using UAV (drone) technology to capture and characterize forest fragments at the level of entire stands.

Finding Maine's Smallest Wetlands: Remote Sensing, LiDAR, and the Elusive Vernal Pool

Topic: Using Data and Technology to Advance Conservation

Justin Schlawin

Maine Natural Areas Program

Finding Maine's Smallest Wetlands: Remote Sensing, LiDAR, and the Elusive Vernal Pool

Justin Schlawin, Ecologist, Maine Natural Areas Program

Vernal pools are small, ephemeral, and ecologically important wetlands, defined partly by their habitat value to unique indicator species. They can exist as isolated leaf bottom pools under a forest canopy, as small open emergent or wooded wetlands, or as portions of much larger wetland complexes. Remote detection of vernal pools has traditionally required detailed visual examination of aerial imagery. Very small vernal pools and pools nested within other wetlands are often missed using this approach. Recently, high resolution remote sensing data has made automated detection of vernal pools possible. In this project, we combine field data, a suite of geospatial variables, and LiDAR derived elevation models using Random Forest, a supervised learning algorithm for classification and regression, to predict potential vernal pool locations in southern Maine. Our automated methods for detection yielded accuracy levels (~80%) comparable to previously published analog methods.

Plecoptera of Indiana: using museum data to determine spatial distributions and conservation need

Topic: Identifying Natural Areas for Conservation

Evan Newman

University of Illinois

We used over 5000 records of Plecoptera from more than 2000 unique collection sites to build a list of known species from the state of Indiana. Many of these species have not been collected for many years, likely due to human caused changes in water quality and habitat degradation. We set out to answer three questions: First, what is the conservation status of all species in the state (using NatureServe criteria). Second, how are species distributed throughout the state? Third, what are the causal agents of differences in diversity across unique watersheds? Our analyses show 92 species recorded from the state, with 8 presumed extirpated, 3 possibly extirpated, 17 critically imperiled and a further 26 imperiled. We found greater Plecoptera species richness in unglaciated regions of the state when compared to glaciated regions.

Strengths and Weaknesses of Assessing Amur Honeysuckle Infestations Using UAV-Captured Imagery

Topic: Using Data and Technology to Advance Conservation

Kevin Rohling

University of Illinois Extension Forestry

Nick Seaton

River to River Cooperative Weed Management Area

Title: Strengths and Weaknesses of Assessing Amur Honeysuckle Infestations Using UAV-Captured Imagery

Authors: Kevin Rohling, University of Illinois Extension Forestry
Nick Seaton, River to River Cooperative Weed Management Area

Invasive species pose a threat to the ecological integrity of the forest, reducing diversity and interrupting soil biotic communities. Several invasive-exotic species, such as Amur honeysuckle (*L. maackii* (Rupr.)), are successful because of their ability to use resources at times of the year when native species are dormant. These invaders photosynthesize during the late fall months when most native species have lost their leaves, and in the spring their leaves emerge approximately 2-3 weeks earlier, capturing light resources for a longer period than native competitors. This study evaluates the use of an Unmanned Aerial Vehicle (UAV) for Amur honeysuckle surveys during late fall and early spring when they are most visible beneath the forest canopy. We evaluated the strengths and weaknesses of using UAV surveys and image processing services to rapidly identify infested areas on private and public lands in southern Illinois. Image processing and identification of infested areas using UAV imagery were compared with traditional on-the-ground surveys for efficiency, effectiveness, and potential cost-savings. Assessments will be used to assist land managers, foresters, private landowners and contractors in prioritizing treatment areas more efficiently.

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