NAC2019

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.

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.

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

Assessing the Ecological Integrity of Natural Areas: from Site to Regional Climate Scales 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 ÃƒÂ¢Ã¢â€šÂ¬' Landscape Context, Condition and Size. Each general feature incorporates more specific factors ÃƒÂ¢Ã¢â€šÂ¬' 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.

Rapid Assessment and Monitoring of the Ecological Integrity of Terrestrial Natural Communities: a Missouri Case Study

Topic: Identifying Natural Areas for Conservation

Mike Leahy
Missouri Department of Conservation

In Missouri for years we have utilized modified methods from the landmark Illinois Natural Areas Inventory to evaluate terrestrial natural community condition and assign natural community element occurrence ranks for the Missouri Natural Heritage Database. In recent years we have begun to investigate methods of better quantifying natural community condition in the field that are still rapid and efficient but short of intensive plot sampling. These methods that we call natural community health indices have many similarities to NatureServe's ecological integrity assessments.

Components of natural community health indices include landscape context and size of the natural community, composition of the plant and animal species, vegetation structure, critical ecological dynamics (e.g., fire), and negative impacts (e.g., invasive species). Rather than conduct a full botanical species list for an assessment area or plot sampling, we focus on conducting a very modified floristic quality assessment, limited to identification of characteristic and conservative species that are readily identifiable vegetatively by resource managers and field staff after training and study. The trade-off here is that we lose resolution with our floristic analysis but gain the ability to sample many more sites state-wide. Animal data are also incorporated as available.

As a natural community site or even a reconstruction develops and changes through time, resource managers can track which components of the community are improving or declining by using a community health index. This can help with allocating management resources. Managers can also compare sites of similar size to determine the highest quality communities they manage. Inventory biologists can use the indices to better quantify their assessment of priority sites for conservation action. This presentation will discuss the development and deployment of natural community health indices in a variety of Missouri natural communities including tallgrass prairies, oak-hickory woodlands, and glades. The pros and cons of this rapid approach will be discussed in the context of the variety of methods available for natural community assessment.

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

Communication and Management of Emerging Forest Pests and Pathogens 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

Managing Urban Natural Areas: Finding Practical Solutions to Complex Problems 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.

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

Partnerships in Nature and How Energy Corridors Can Help 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 - 4:30pm

Protecting and Managing Conservation Lands and Waters for Climate Resilience Syposium

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 with Examples from the South Mountain Landscape of Southcentral Pennsylvania. Roy Brubaker and Meredith Malone, PA Department of Conservation and Natural Resources.

Abstract: DCNR will discuss the process of implementing the Pennsylvania DCNR Climate Change Adaptation and Mitigation Plan statewide on state forest land and regionally on one of DCNR's seven Conservation Landscapes, South Mountain, in southcentral Pennsylvania. Statewide plan implementation within the Bureau of Forestry requires an evaluation of climate change considerations on a programmatic level and coordination among twenty district offices and five other DCNR bureaus. In the South Mountain landscape, Michaux State Forest is using the Big Pine Flats Biological Diversity Management Area Plan, produced by the Pennsylvania Natural Heritage Program, as a constructive framework to address climate change adaptation goals on a landscape scale. Michaux's district manager will discuss the conception and implementation of the plan, as well as how the experience has informed ecological management and climate change adaptation planning across the region.

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.

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
Penn State University

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

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.

Analysis of results of prescribed burning on species composition in five community types at Cabin Creek Raised Bog, Rand

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

Don Ruch
Ball State University

Cabin Creek Raised Bog, designated a National Natural Landmark in 1974, is a 6?7 ha wetland complex located in Randolph County, Indiana. A floristic survey conducted from 2004 to 2012 documented 478 taxa at the site, including several rare to endangered species. This study was undertaken to determine if prescribed burning could enhance floristic quality. Five transects, each with 20 - ½ m2 plots, were placed in five different plant communities, i.e., open (graminoids) sedge meadow, shrubby sedge meadow, herbaceous sedge meadow, marl run, and moist prairie. Species composition and cover was determined for each transect plot for pre-burn, one-year post-burn, and three-years post burn analysis. An assessment of results will be presented. It is predicted that the burn will enhance native species number and cover. Preliminary results support this prediction.

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 successionally 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 â€' and ultimately conservation â€' 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.

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 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 give 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 (DENA), 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. DENA 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 DENA, 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 - 10:00am

Monitoring Conservation Initiatives

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.

"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.

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.

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

Emily Rauschert
Cleveland State University

Functional diversity of restored meadows

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

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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 though 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. Glucosoidase 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 glucosoidase 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 possesses 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.

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 riverscour, 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. Riverscour 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 riverscour obligates and share a disjunct distribution pattern, also occurring in riverscour in the Cumberland Plateau, Ridge and Valley, and other Ecoregions. Recent mapping efforts used GIS to analyze aerial imagery and map riverscour 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 Session A

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 Krause1,2, 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 (1.5 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 habitat characteristics.

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

Flexible tools to increase the effectiveness and scale of land conservation

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’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 - 12:30pm

Integrating Education into Conservation Planning to Foster Stewardship 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

Marijke Hecht
University of Pittsburgh Center for Learning in Out of Schoo

Dr. Becky Thomas
Slippery Rock University

Transforming Lands and Lives: Diversity, Equity, and Inclusion in Conservation

Jennifer Layman, Student Conservation Association

Nature in America's national parks, refuges, and protected spaces is a profusion of color: from the purple-pink rhododendrons in the Great Smoky Mountains to the palette of reds, tans, and oranges on the south rim of the Grand Canyon, from the steel blues and grays of Glacier Bay to the thousand varieties of green at Olympia.

There is one aspect of our national green spaces which remains far less diverse, however: the people. Of the 300 million-plus park visitors every year, only 22 percent identify as racial minorities, although these groups make up 37 percent of the U.S. population. African Americans are especially underrepresented, comprising only seven percent of park visitors (in contrast, they represent 13 percent of the population). As people of color are expected to become the majority by 2044, this under-representation not only deprives millions of Americans the opportunity to participate in a cornerstone of our national heritage, it also threatens the existence of the park system itself.

There's never been a better time to work in the environmental sciences. The field is in rapid expansion, with average salaries of $68,910 per year, nearly double the median annual wage, and employment in the sector is projected to continue to grow by some 11% through 2024. 'Heightened public interest in the hazards facing the environment,' says the Department of Labor, 'as well as the increasing demands placed on the environment by population growth, is expected to spur demand for environmental scientists and specialists.'

But are these opportunities available to everyone? Is the door to the world of the environmental sciences fully open for women and people of color? And if not, what can be done about it? If certain groups are denied, not only are they denied access to the higher salaries and prestige of this sector, but it's also bad for the environment: we need all people to be invested in saving the planet. In today's piece, we'll explore the vital issue of access for all to the fields of environment and conservation.

According to the seminal report The State of Diversity in Environmental Organizations, sponsored by the Green 2.0 working group and covering mainstream NGOs, foundations, and government agencies, there exists a 'green ceiling' for minorities: despite increasing racial diversity elsewhere, minority employment in environmental organizations has held steady around 16% for decades. And of those minorities who are hired, most remain in the lower ranks of these organizations, with less than 12% of leadership positions held by people of color. Of the largest conservation and preservation organizations in the U.S., not one is led by an ethnic minority. And where diversity gains have been made, the benefits have gone disproportionately to white women.

The discrepancy is not isolated to leadership. When it comes to the membership of the organizations surveyed, the numbers are equally problematic. Of a total of 3.2 million organization members, nearly six out of ten are males and the representation of minorities among members or volunteers is very low. And although environmental organizations have expressed an interest in diversifying their boards and staff, few have diversity managers or a diversity committee, and cross-race and cross-class collaborations with other organizations are still uncommon.

The report outlines several reasons for this failure to increase minority representation. The first is that environmental jobs are still being advertised in ways that introduce unconscious bias. Recruitment for new staff still frequently occurs informally, through word-of-mouth, which makes it hard for anyone outside of the existing 'club' to find out about and apply for jobs. Outreach to minority-serving gatherings and institutions is insufficient. Moreover, organizations have failed to capitalize on their internship pipeline to hire new staff. While minorities make up 22.5% of interns at NGOs and government agencies, and 36.4% of foundations, the percentage of minority staff hired in the past three years is half that.

For decades, the Student Conservation Association (SCA) has been committed to expanding access to both green spaces and to environmental education and careers and we know there is even more work to be done in this area. Fostering an ethic of conservation and stewardship among younger generations is a critical mission of the SCA and that mission must include people from all backgrounds. To that end, the SCA has taken a series of steps both to open programming to a more diverse population and to bring conservation opportunities to underserved communities.

SCA currently offers several programs designed to increase access for people of color. Our Career Discovery Internship Program (CDIP), in conjunction with U.S. Fish and Wildlife Service, works with minority college students to place them in SCA internships and on an eventual career path. Our Community Crews provide conservation opportunities for urban youth right in their own neighborhoods. We are also expanding our outreach to the first-nations community; current programs include our Native American community crews in Alaska, and an all-Navajo community crew in Arizona's Canyon de Chelly. Additionally, SCA is partnering with 16 Girl Scout councils across the country to field interns to build and deliver outdoor programming to Girl Scouts as well as the Pennsylvania Office of Vocational Rehab to offer paid work opportunities for youth and young adults with disabilities, including inclusive crew programming for high school students on the Autism spectrum. Meanwhile, the Urban Tree House Program provides free environmental education programs for K-12 urban youth in cities ranging from Washington DC to New York (Governor's Island, Manhattan) to Chicago to Houston. Through hands-on conservation projects, participating youth have an opportunity to establish a relationship with the environment and have fun at the same time.

While courageous people of color are paving the way for others to follow, the onus should not be on individuals alone to effect widespread change. Indeed, it is also the responsibility of conservation organizations and land to make sure that as diverse a population as possible knows of opportunities for both recreation and careers in the outdoors Ã¢â‚¬' and feels welcome, motivated, and informed enough to seize them. Not only is it the right thing to do morally, but the future of our national conservation areas and green spaces may also depend upon it.

This session will feature a sampling of DEI initiatives SCA has undertaken both internally and externally through programming and partnerships, aiming to both challenge and inspire the audience to either start their own initiatives or take what they have already done to the next level.

Connecting research & practice: Exploring naturalist learning pathways
Marijke Hecht, University of Pittsburgh Center for Learning in Out of School Environments
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. This presentation will explore how interest in nature is sparked and then develops into a naturalist identity. We begin by examining retrospective life histories of 18 adult naturalists to consider how their recollected experiences supported early interest in nature and a deep, lifelong naturalist identity. Drawing on interest and informal learning literature, 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 then consider implications for how environmental educators might conceptualize and support informal learning pathways that involve deep engagement with and connections to nature in order to develop future naturalists.

Relevant, engaging and reciprocal: Fostering a diverse learning community through meaningful work
Taiji Nelson, Pittsburgh Parks Conservancy; Nyjah Cephas, Pittsburgh Parks Conservancy

Engaging teenagers in meaningful ecological work can teach them personal and professional skills, but when the experiences are designed to be relevant, engaging and reciprocal, they can also provide entry into a community of peers and mentors who help students explore their interests and identities. By placing a strong emphasis on trust, respect and familiarity, mentors can facilitate deep connections between people of different backgrounds, abilities and perspectives.

Mentors and role models who recognize teens as whole people -- not just learners -- create an environment that is inclusive and responsive to the unique strengths and needs of the group. These relationships both enable and require us as mentors to be reflective and transparent about our own passions, perspectives, abilities and limitations.

Young Naturalists is a 5-week summer internship for high school students through the Pittsburgh Parks Conservancy

that uses paid research and restoration work to build community among high school students who share an interest in nature, the environment, and the outdoors. Exploring these interests together in a safe, fun and welcoming environment allows students from all parts of Pittsburgh to develop skills, make a positive impact, and find common ground through diversity.

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.

Helping People and Nature Thrive: Education and Engagement as a Habitat Restoration Tool
Adam Schmutte, Keep Indianapolis Beautiful
Like many cities, Indianapolis faces an ever-growing list of ecological challenges, including stormwater management, habitat loss, and invasive species. Keep Indianapolis Beautiful (KIB) has leveraged organizational partnerships, volunteers, community education, and youth development programs to vastly expand its efforts to restore habitat, create greenspace, and plant trees in a rapidly changing urban environment. The Urban Naturalist program utilizes youth development and job training to manage invasive species and green infrastructure through collaborations with the Partners for the White River and Citizens Energy Group, the Indianapolis water utility. The Partners for the White River initiative seeks to restore water quality and riparian habitat and improve public perception and engagement with the river that flows throughout Indianapolis and provides drinking water to most of the city. Additionally, KIB works with Citizens Energy Group to mitigate stormwater with strategically located rain gardens and tree plantings as part of a long-term management approach. Creative tactics such as these can translate into useful, actionable solutions for positive ecological impact in urban areas throughout the country.

Transforming Lands and Lives: Diversity, Equity, and Inclusion in Conservation

Topic: Urban Natural Areas and Green Infrastructure

Jennifer Layman
Student Conservation Association

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percent of the U.S. population. African Americans are especially underrepresented, comprising only seven percent of park visitors (in contrast, they represent 13 percent of the population). As people of color are expected to become the majority by 2044, this underrepresentation not only deprives millions of Americans the opportunity to participate in a cornerstone of our national heritage, it also threatens the existence of the park system itself.

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Helping People and Nature Thrive: Education and Engagement as a Habitat Restoration Tool

Topic: Urban Natural Areas and Green Infrastructure

Adam Schmutte
Keep Indianapolis Beautiful

Helping People and Nature Thrive: Education and Engagement as a Habitat Restoration Tool

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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. Rauschert1,2, 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 Wooly 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

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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 forests 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.

Managing Dynamic Forest Restoration Blocks for Climate Resilience and Long-term Habitat Health

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

Scott Bearer
Pennsylvania Game Commission

Jeffrey Larkin
IUP/ABC

Benjamin Jones
Ruffed Grouse Society/American Woodcock Society

Since 2018, the American Bird Conservancy, the Ruffed Grouse Society, the Pennsylvania Game Commission, and others have partnered to initiate a series of landscape-level habitat management projects. These landscapes, known

as Dynamic Forest Restoration Blocks, are focused on improving long-term habitat health and resilience to a changing climate through active forest management. In this presentation, we review our approach to managing large landscapes to achieve landscape forest health and resilience, and discuss the successes and issues with implementing large-scale restoration and resilience efforts.

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, Northhampton, 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.

Understanding successional pathways to conserve serpentine grasslands

Topic: Restoration of Natural Areas Qualities

Roger Latham
Continental Conservation

Serpentine grassland in temperate eastern North America is a globally rare ecosystem with high priority for conservation. It covers a small fraction of the area in the Piedmont and Blue Ridge ecoregions underlain by rare outcrops of ultramafic rock, mainly serpentinite. Diversity of herbaceous plants and specialist-feeding insects is exceptionally high. Many occur as isolated populations, disjunct from the species' main ranges to the south, in Midwestern prairies, and on the Atlantic Coastal Plain.

The State Line Serpentine Barrens-a string of 8 sites dotted across 12 miles of the serpentinite belt along the Mason-Dixon Line in Pennsylvania and Maryland-include much of the serpentine grassland remaining in the eastern U.S. The natural heritage programs of the two states have identified nearly 100 plant and animal species of high conservation need there, with additional discoveries expected. Serpentine grassland declined drastically during much of the 20th century due to fire exclusion and suburban development. The Nottingham Barrens in Chester County, Pennsylvania, has one of the largest remaining areas of serpentine grassland but analysis of historical aerial photographs shows that it dwindled by 43% in just a few decades after fire was excluded. Grassland was replaced mainly by pine-oak forest with low plant species diversity and a dense understory of the thorny liana Smilax rotundifolia (common greenbrier).

In a 10-year study we tested hypotheses about serpentine grassland succession and potential restoration methods in a series of controlled and replicated experiments in areas formerly in savanna (grassland with scattered trees) that had succeeded to forest. We conducted 8 artificial disturbances: tree-thinning followed by herbiciding to reduce Smilax; tree-thinning followed by mowing to reduce Smilax; tree thinning followed by low-intensity burning; clearcutting and low-intensity burning followed by goat browsing; clearcutting followed by high-intensity, low-severity burning; clearcutting and drought simulation (sheltering plots with temporary greenhouses for 2½ months) followed by high-intensity, high-severity burning; clearcutting and mechanical removal of the top layer of soil organic matter; and low-intensity burning from grasslands across the forest-grassland ecotone. Our experiments addressed the questions of (1) how savanna might naturally arise on sites seemingly irreversibly dominated by Smilax and (2) how savanna restoration might be achieved practically and effectively where forest has invaded.

Ten years' growth in plots where we removed organic matter supported our hypothesis that only high-severity fires during severe droughts historically renewed grassland vegetation after invasion by trees and Smilax. Drought simulation followed by high-severity fire reduced organic matter substantially and charred Smilax rhizomes to a far greater degree than the highest-intensity burns without drought.

Our research and that of others have enabled us to create a descriptive model of serpentine grassland dynamics, predict the outcomes of various conservation strategies, and propose how our predictions might be tested experimentally as part of adaptive management programs throughout the range of serpentine grasslands. There appears to be no simple 'magic bullet' to reverse serpentine grassland decline. Effective restoration and maintenance of this unique community requires a judicious combination of drastic forest canopy thinning and regular prescribed burning, supplemented in selected locations by augmentation planting using locally collected seed, mechanical removal of Smilax and soil organic matter, and spot-herbiciding invasive tree and shrub species.

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

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NY Natural Heritage Program
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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.

Natural and Nature-Based Features for Reservoir Shoreline Management

Topic: Urban Natural Areas and Green Infrastructure

Safra Altman
US Army Engineer R&D Center

Natural and Nature-Based Features for Reservoir Shoreline Management

Todd Swannack, Candice Piercy, Safra Altman, Brook Herman, Mary Bryant, Todd Bridges
US Army Engineer Research and Development Center

Natural and Nature-Based Features (NNBF) such as wetlands and submerged aquatic vegetation have been used for decades to support a variety of objectives in fluvial and coastal systems, as well as the Great Lakes. Elements of NNBF are commonly utilized in living shorelines to prevent erosion along waterfront properties. However, the application of NNBF in reservoir settings to prevent erosion and attenuate waves, including boat wake waves, has not been fully explored. Reservoirs have a special set of issues that can exacerbate natural erosion and impose additional requirements on any shoreline stabilization approach including fluctuating water levels, heavy recreational boat traffic, and essential control structures. Shoreline restoration projects supporting wetlands, submerged aquatic vegetation, and other habitats have been undertaken to restore ecosystem functions; however, the engineering functions of these vegetated habitats has not been fully realized. We examine the mechanisms by which vegetated NNBF provide shoreline stabilization and wave attenuation functions as well as applicable settings for use and some examples of applications in a variety of settings.

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 11:00am - 12:30pm

Using Data and Technology to Advance Conservation Session B

Pennsylvania Wildlife Action Plan Conservation Opportunity Area Tool

Topic: Identifying Natural Areas for Conservation

Catherine Haffner
Pennsylvania Game Commission

Christopher Tracey
PA Natural Heritage Program

Diana M. Day
Pennsylvania Fish & Boat Commission

The 2015-25 Pennsylvania Wildlife Action Plan is the Commonwealth's conservation blueprint for Species of Greatest Conservation Need and associated habitats. Jointly administered by the Game Commission and Fish & Boat Commission and developed with input from partners and the public, the vision is to achieve healthy, sustainable native wildlife populations, natural communities and habitats in Pennsylvania through Plan implementation. A web-based map application, called the Conservation Opportunity Area Tool, was developed to facilitate conservation efforts that have Species of Greatest Conservation Need interests in mind. Conservation opportunities for these species exist nearly everywhere across Pennsylvania, yet effective conservation will be realized where the species occur. This tool allows users to generate a report of Species of Greatest Conservation Need, habitats, and conservation actions within a user-defined area of interest (up to 2500 acres). It also facilitates a statewide view to explore needs at a broad scale. This presentation will showcase the Pennsylvania Wildlife Action Plan as a foundational conservation framework, illustrate Conservation Opportunity Area Tool development, and provide a demonstration of this publicly-accessible web application.

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.

Using Camera Traps to Inform Protected Area Planning and Management

Topic: Using Data and Technology to Advance Conservation

Jason Scullion
McDaniel College

Protected area planning and management can be improved with field-based data on local wildlife, but collecting and integrating wildlife data into park planning and management can be difficult, particularly in national protected areas that are large and remote. To develop a simple and scalable approach to integrate field-based wildlife data into park planning and management and conduct a baseline biological survey of medium-to-large mammals, we conducted a pilot study using remote camera traps in Peru's Condor National Park (Parque Nacional Ichigkat Muja - Cordillera del CÃ³ndor). In the first year of a three-year study, researchers and park guards deployed 24 camera traps in a grid system in the reserve for 100 trap nights. This study identified 17 mammal species in the protected area, including the South American tapir, jaguarundi, and a melanistic black jaguar. Further analysis revealed the presence of wildlife hotspots, locations of hunting pressure, and areas of low wildlife diversity and abundance. Initial results of this study show that camera trapping is a low-cost and relatively simple method to conduct biological inventories in large and remote protected areas when supported by park guards. Camera trap research can also support improved protected area planning and management, including enhanced law enforcement efforts and refined park zoning.

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

From pollinators to carbon, a toolbox for management and restoration

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.

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.

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.

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.

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

Dan Engel
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

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.

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

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.

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.

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

Restoration and Management of Urban Natural Areas

Urban Stream Restoration in Pittsburgh's Four Mile Run Watershed (Aka M29 Sewer shed)

Topic: Urban Natural Areas and Green Infrastructure

Robert Stewart
Civil and Environmental Consultants

Timothy Nuttle
Civil and Environmental Consultants

Nathan Ober
Civil and Environmental Consultants

The Four Mile Run Watershed in Pittsburgh is an urbanized area comprised of mixed land use including highly impervious university campuses and forested parks, all 2,332 acres of which eventually flows through the combined sewer system. During urbanization most of the streams in Four Mile Run where converted to combined sewers and

buried underground with the exception of streams located in the historic 456 acre Schenley Park. Combined sewer overflows, basement backups, and loss of park trail systems necessitated stream restoration/daylighting to help preserve cultural resources and create healthy flood prepared communities. Challenges that faced restoration included a network of roads and railroads along with utilities ranging from a 50' water main to 10' buried electric lines and other infrastructure to numerous to list. This presentation illustrates the design methodology and unique solutions used to restore Four Mile Run within the constraints of a highly urbanized and altered watershed (Aka M29 Sewer shed).

Restored stream networks in the park system were designed to function with existing stream flow and to accommodate additional storm water to be disconnected from the sewer system. A multi-stage channel approach was utilized to reduce shear during floods while increasing flow depth during low flow for aquatic habitat. Stream and trail restoration designs work symbiotically to reduce sediment inputs, attenuate peak flows, and accommodate multiple competing uses for space within the project area.

In high gradient narrow valleys, trail grading is placed along the floodplain extents to buttress landslide prone slopes and modulate floodplain expansions/contractions thereby reducing valley slope sediment inputs and instream scour potential.

In low gradient wide valleys, trail grading is strategically placed in the valley bottom to create constrictions and off channel wetlands to detain floodwaters during high flow events while creating an intimate interaction between park visitors and the restored ecosystem. A through trail was designed along the low gradient valley wall to reduce landslide potential and facilitate commuter traffic through the project reach.

The Four Mile Run project will consists of many thousands of feet of restored and day lighted streams in a highly urban watershed.

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
Department of Biological Sciences
Towson University

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 potamodrous 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.
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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

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

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!/Regonal 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 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

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

R. Edward DeWalt
Illinois Natural History Survey

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.

Thursday, October 10, 2019 7:00am - 7:01am

Posters

The Poster Reception will be Tuesday evening, Oct. 8 at 6 p.m. in the Exhibit Hall located in the ballroom behind registration. Posters will remain up for the duration of the conference.

A failure to thrive: How abundant deer and acid deposition may be changing forest plant and soil communities.

Topic: Restoration of Natural Areas Qualities

David Burke
Holden Arboretum

Sarah Carrino-Kyker
Holden Arboretum

Jean Burns
Case Western Reserve University

A failure to thrive: How abundant deer and acid deposition may be changing forest plant and soil communities.

David J. Burke1, Sarah R. Carrino-Kyker1, and Jean H. Burns2

1 The Holden Arboretum, Research Department, Kirtland, OH, 44094

2 Case Western Reserve University, Cleveland OH, 44106

Many forests in eastern North America are affected by high levels of white-tailed deer (Odocoileus virginianus) herbivory, which can have large effects on forest plant community composition and regeneration. However, in some forests, exclusion or reduction of deer herbivory has little effect on plant community composition or plant growth suggesting that factors other than herbivory may contribute to low plant community diversity and regeneration in forests. One such factor may be a legacy of acid deposition, the result of fossil fuel combustion, that can lead to reductions in soil pH and nutrient availability. To examine how high levels of deer herbivory and acid rain may interact to affect forest plant communities, we established an experiment in a mature hardwood forest in northern Ohio where deer were excluded for 14 years and soil was amended to increase pH and phosphorous availability beginning in spring 2015 (4 years). Our preliminary data showed that deer had few effects on plant communities after 14 years of exclusion. In 2015, we planted 750 Jack-in-the-pulpit (Arisaema triphyllum) plants into plots and began monitoring plants for survival, growth and reproduction. Jack-in-the-pulpit is not a plant deer prefer to eat, but they will consume the plant if available, making it an ideal plant to use to test the effects of herbivory and acid deposition of plants. We found that soil chemistry was affected by our treatments two years after chemical treatment, with plots receiving limestone and wollastonite (CaSiO3) having pH of approximately 6.2 whereas unamended plots had pH of approximately 4.8. We also found that available P was 3x higher in plots that received triple super phosphorus fertilizer. These changes resulted in significantly different soil fungal communities, including mycorrhizal fungi that form beneficial relationships with plant roots. Preliminary data suggest that increasing available P may have reduced seedling germination in our test plots. We will discuss plant performance data collected after the 2019 spring census. Our work suggests that forest plant community composition may be affected by a number of interacting factors, and even in areas with high levels of deer herbivory other factors may be at work in limiting plant diversity, recruitment and growth. Land managers may need to take a holistic view to forest plant management, and active restoration of plant populations, and alteration of soil chemistry as a part of that restoration, may be needed to insure long-term success of some forest plant species.

A Geologic Study of Piping Plover (Charadrius Melodus) Habitat Loss at John E. William's Nature Preserve

Topic: Using Data and Technology to Advance Conservation

Henry Saarinen
University of St. Thomas

The endangered Piping Plover shorebird nests on vegetation-free gravel patches. The Nature Conservancy's John E. William's Nature Preserve (JWNP), of the central ND prairie pothole region, has ideal plover habitat with many gravel beaches around its shallow alkaline lakes. Habitat loss due to vegetation encroachment has been monitored for decades (Root and Ryan, 2004; Root 1996) but its causes are not fully understood. While vegetation encroachment along shores is likely controlled by water levels (Bennett, this volume), there are gravel patches far from shores (upper beach) that are becoming variably vegetated. By looking at historical aerial imagery, we note that periods of drought wipe out most vegetation on all upper beaches, but during wet periods, vegetation returns differently. By studying vegetation presence, sediment size and sorting, soil and water chemistry, and geomorphological features, we are working to understand the processes as to why some patches remain open while others have become vegetated.

We sampled the upper 6 inches of soil from numerous categories of groundcover: unvegetated patches of varying sediment size and patches with different vegetation communities. Surface and underlying sediment size and sorting were noted. We tested the underlying soil for pH and conductivity using the methods of Moss (2015). Initial results indicate that conductivity values vary by vegetation type whereas pH values don't. In other words, there is a range of pH values for every category of groundcover, whereas upper beach gravels have a higher average conductivity than any vegetated area. Upper beach gravel patches are dominantly composed of granitoid and gneisses with some sedimentary clasts. Some patches are poorly sorted with boulders and cobbles while others are better sorted with cobbles and sand. Field observations show that upper beach patches are often underlain with a pure clay layer. Presumably, this layering is a combination of glacial retreat, paraglacial processes, and frost heave. We observed that

areas with the purest clay layers deter the growth of vegetation.

By better understanding underlying processes associated with habitat loss, we hope to offer suggestions to The Nature Conservancy staff as they work to maintain habitat for the Piping Plover.

Acoustical Monitoring of Overflight Noise on the South Rim at Grand Canyon National Park

Topic: Restoration of Natural Areas Qualities

Hannah Chambless
Grand Canyon National Park

Margaret Holahan
Grand Canyon National Park

Acoustical Monitoring of Overflight Noise on the South Rim at Grand Canyon National Park

Hannah Chambless, Margaret Holahan, and Michael Kearsley, Grand Canyon National Park

In 1975 the Grand Canyon National Park Enlargement Act recognized natural quiet as a resource and therefore requires studies on the impacts of overflights on the park's natural quiet. Subsequently, the 1987 Overflights Act required the 'substantial restoration of natural quiet' to be defined as 50% of the Park achieving natural quiet (no aircraft audible) for 75 to 100% of the day, as noise from aircraft has a significant adverse impact on natural quiet, wildlife interactions, and visitor experience. Therefore, protecting the natural soundscape is important for reducing these negative impacts and providing the 6.5 million annual visitors in the park with access to the valuable resource of natural sounds and quiet. As of 2015, there are approximately 150,000 flights over Grand Canyon annually consisting of air tours, additional flights by air tour operators, and general aviation. We present results from collecting ambient sound pressure level and audio data at three stations focused on two air tour corridors at the South Rim during high and low use periods (i.e. summer and winter). The data then processed from these stations measures the duration, frequency, and type of overflight events for a sample of 8 days out of the 30 day monitoring period. The program used to process and analyze these data is the Sound Pressure Level Annotation Tool (SPLAT), created by the National Park Service Natural Sounds and Night Skies Division. From these data, we calculate overflight sound level above the natural ambient, the percent time that aircraft are audible, and other metrics. These findings will be used to validate a park-wide noise model and inform future recreation planning for the park's developed, backcountry, and proposed wilderness areas.

Assessing the conservation status of Baptisia australis var. australis in Pennsylvania through natural history and metap

Topic: Native Plant Conservation Initiatives

Cheyenne Moore
Bucknell University

In Pennsylvania B. australis var. australis (L.) R. Br. (Fabaceae) is comprised of two metapopulations along four waterways: the Allegheny River, Youghiogheny River, Clarion River, and Red Bank Creek. Despite the location of these watersheds within the greater Ohio River drainage, there is still considerable distance between the metapopulations. Because of its limited distribution and small number of extant populations, B. australis var. australis is considered state-threatened in Pennsylvania. In addition, the riparian prairie habitat that Pennsylvania Baptisia australis var. australis is restricted to is also in decline and considered vulnerable in the state. My work carries with it two main objectives: 1) Better understand the ecology and natural history of these state rare metapopulations, including assessment of the status of the species in the state, and 2) What is the genetic structure of known native populations and how does it relate to the spatial structure of subpopulations? This research utilizes tools such as aerial imagery, field surveys, and herbarium collections in to examine the natural history of the species. Field collected fruits are dissected to determine if frugivory is occurring in Pennsylvania populations, a threat not previously considered in conservation assessments. In addition, ddRAD is used to collect genetic data for use in population

genetics analyses. I plan to synthesize these data to gain insight into the metapopulation dynamics of this riparian system. My research will inform the conservation status of Baptisia australis var. australis in Pennsylvania, as well as clarify lingering uncertainties about gene flow in riparian plant populations.

Cancer-root: a two-year population ecology study at Blossom Hollow Nature Preserve in central Indiana

Topic: Native Plant Conservation Initiatives

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Cancer-root: a two-year population ecology study at Blossom Hollow Nature Preserve in central Indiana

Cancer-root, Conopholis americana, is a non-green parasitic plant on oak trees found throughout the eastern half of North America. The plant has a coefficient of conservatism of 8, indicating it grows in areas reminiscent of pre-European settlement and does not tolerate disturbance well. The short plant (12-20 cm) produces white to pale yellow, tubular flowers (8-14 mm), with approximately 55 flowers above ground and 2 below ground. The purpose of this research is to determine the population size of cancer-root in a newly designated nature preserve, including number of individuals, reproductive potential, and host tree associations. Blossom Hollow is a 45-ha unglaciated, hardwood forest. Metrics from the 2019 growing season will be compared to the 2018 growing season, including number of flowers, fruits, and seeds per capsule as well as the number of individuals. It is important to obtain long-term reproductive information so we predict the effects of climate change using the NatureServe Vulnerability Index. Understanding the population ecology of this highly conservative focal species may be useful in monitoring the ecosystem health at BHNP and it may be possible to predict the impact of global climate change on this high-quality nature preserve by closely analyzing the reproduction of cancer-root, which may be an effective indicator species for the site.

Comparing the efficacy of management strategies for a natural green ash tree population using modeling

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

Rachel Kappler
Bowling Green State University

Comparing the efficacy of management strategies for a natural green ash tree population using modeling

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Ecological modeling is a useful tool for predicting what could result from land management actions. We developed a stage-based stochastic model to simulate changes in a green ash (Fraxinus pennsylvanica) floodplain population after a primary mortality event from emerald ash borer beetle (Agrilus planipennis, EAB). Parameters were developed from data collected annually from 2010-2017 in Northwest Ohio. The model contained a catastrophe condition, which was defined as a year with reduced ash survival from an EAB outbreak. We assumed future EAB population oscillations would occur. Therefore, there was an increasing probability of a catastrophe occurring over ten years, and over the following 9 years after a catastrophe ash survival gradually increased to simulate a decline in EAB impacts. Management actions modeled included: introduced parasitic wasps; removed ash competitors; protected size classes; and planted EAB-resistant ash trees. We found the population growth rate was very sensitive to fecundity changes. Removal of ash competitors and introduction of parasitic wasps provided an improvement for the

population, reducing probability of extinction and decline, whereas protection for individual size classes did not. Planting EAB-resistant trees allowed for a slower population recovery. While conservative, these models indicate that the more resistant ash is to EAB the better the recovery, and that fecundity is important to the persistence of future populations. This approach provides future predictions to aid in land management of natural populations affected by an invasive pest species or similar dynamic impact.

Contrasting Patterns of Ground Spider and Beetle Activity Across a Japanese Knotweed Dominated Riparian Buffer

Topic: Invasive Species Management and Prevention

David Matlaga
Susquehanna University

Contrasting Patterns of Ground Spider and Beetle Activity Across a Japanese Knotweed Dominated Riparian Buffer

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It is unclear the extent to which arthropod distributions across riparian ecotones are determined by abiotic tolerances or biotic interactions. Invasive species such as Fallopia japonica (Japanese knotweed) influence abiotic microhabitat conditions and potentially arthropod distributions. We quantified ground spider and beetle activity across a Japanese knotweed dominated riparian buffer using 5 months of pitfall trapping data. Formal choice tests were then used to quantify relative effects of litter complexity, light level, moisture level, and kairomones from beetles or spiders on space use of the common beetle (Harpalus pensylvanicus) and wolf spider (Tigrosa helluo). Results from pitfall samples suggest that spider and beetle activity is heightened at opposite ends of the ecotone, with lower activity within the knotweed stand. Two-choice lab tests suggest that both abiotic factors and kairomones may mediate species distribution.

Dendroecological analysis of xeric, upland, Quercus-dominated old-growth forest within the Ridge and Valley Province MD

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

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Dendroecological analysis of xeric, upland, Quercus-dominated old-growth forest within the Ridge and Valley Province of Maryland, USA.

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Abstract:
Mesophytic species invasion and the loss of oaks from previously oak-dominated forest communities are two well-documented changes currently affecting the deciduous forests of the Appalachian Mountains. Several previous assessments of these changes prescribe active management to maintain oak. Currently, historically white oak (Quercus alba L.) dominated, mesic stands documented in both the Allegheny Plateau and Ridge and Valley regions show increasing dominance of mesophytic species such as red maple (Acer rubrum L.) and black birch (Betula lenta L.). We describe a unique near xeric, 72-ha tract of old-growth forest within the Ridge and Valley Region. This upland oak-pine, formerly oak-chestnut community, has maintained oak dominance without silvicultural management, despite being greatly impacted from the loss of American chestnut (Castanea dentata (Marshall) Borkh.), fire suppression, high deer densities, and European gypsy moth (Lymantria dispar L.) defoliation. A dendroecological analysis of these two-hundred-year-old stands shows persistence of oak through centuries of documented disturbances. These unmanaged old-growth stands have resisted mesophytic species invasion and therefore may provide insight into future compositional patterns and changes of similar upland and ridgeline forests within the Ridge and Valley. The combination of low site quality of ridgelines and ecological disturbances such as defoliation events, which may act as a moderate basal area reduction, allows oaks to persist and maintain dominance without silvicultural intervention. However, fire is recommended for the maintenance of co-dominant fire-dependent species such as Table Mountain pine (Pinus pungens Lamb.) and herbaceous diversity along these ridge forests.
Results:
All surveyed old-growth areas contained a substantial number of very old trees, many which established before 1800. Age structure analysis resulted from 140 complete (non-rotted, bark-to-pith) core samples from 93 trees inside the confirmed old-growth sample plots. Sampled plots displayed a wide range of tree ages. The oldest trees in the surveyed stands were Table Mountain pines, with individuals that established in 1678, 1750, and 1766; chestnut oaks, with individuals that established in 1718, 1726, 1733, 1752, and 1766; and white oak, with one individual that established in 1747. Most other trees in the stand recruited between 1850 and 1940, with the exception of chestnut oak and Table Mountain pine that recruited consistently from 1700-1900. White oak recruitment substantially decreased after 1900, as peak recruitment of northern red oak and pignut hickory occurred between 1920 and 1950. Chestnut oak recruitment became consistent again from 1930 to 1960. The data show no correlation between tree age and tree diameter.Table Mountain pine species consistently established from 1678 to 1963. While individuals represented a diversity of ages, ranging from 53 to 338 years, they never reached diameters of over 60.0 cm. Table Mountain and pitch pines most frequently dominated the canopy in patchy clusters in the rockiest, steepest areas of the stands. The slow growth of these trees is likely due to a combination of biological characteristics and responses to poor site quality. A lack of both pitch pine and Table Mountain pine regeneration in the understory, indicative of increased establishment difficulty for these species after 1975, suggests an overall decreasing trend of pine dominance in these stands over time.
Many of the trees on Dans Mountain established in the 1640s and 1730s and are older than those found in many other studies of old-growth forests in the east (Lorimer 1980; McCarthy and Bailey 1996; Abrams et al. 1998; Abrams and Copenheaver 1999). Senescence patterns and the prevalence of heart rot in many individuals of chestnut oaks over 200 years inhibited our ability to obtain complete cores from many of the initially sampled trees in our study. This biological limitation of the dataset, resulting in stand age data gaps, may potentially be reconciled in the future by cross-dating snags and downed woody debris from these sample plots.

From 1800 until 1870, low annual variability in ring widths of chestnut oaks indicates a combination of relatively undisturbed growth and suppression due to competition in the upper canopy. However, because our sample size is inadequate for this period, future work extending the sample depth of the earlier half of the chronology prior to 1890 would strengthen these claims. The first major release after 1890, occurring in 1898, is the start to a pattern of highly variable ring width indices over the next 120 years. Though the absolute cause of the 1898 disturbance in the canopy cannot be determined, the notable recruitment of fire-dependent pines following 1880 suggests that fire may have been a contributing factor. The period of 1900 to 1930, marked by a high frequency of minor to moderate disturbances, exhibited high recruitment of multiple species of oak. The pattern of releases coupled with subsequent periods of oak establishment support the notion that, especially on poor-quality sites, the chestnut oak component thrives under an active disturbance regime. The 1940 major release was likely influenced by environmental factors

but was also likely in partial response to localized losses of American chestnut from the canopy. Historic records indicated that Dans Mountain, along with much of the Ridge and Valley portion of the central Appalachians, experienced peak chestnut mortality from 1928-1935 (Buckley 2010). Ring width values for chestnut oaks display a series of releases and sharp peaks in annual growth increment starting in the mid-1930s through the 1940s. In the years following peak chestnut mortality, the release events seen in chestnut oak cores suggest that canopy gaps created by this disturbance enabled chestnut oak to succeed in filling upper canopy gaps created by the demise of American chestnut. The 1930 to 1940 peaks in the chestnut oak chronology also coincide with the 1930-1950 increased establishment of understory chestnut oak and hickory. Thus, our data somewhat support the Keever (1956) hypothesis that codominant overstory species replaced American chestnut, and, because of the gaps created in the canopy, understory species such as hickory exhibited release.

The most dramatic and wide-spread release event occurred in 1992. One likely factor influencing the release beginning in 1992 was the oak defoliation in the eastern deciduous forests by European gypsy moth in the three years prior (1989 and 1990) at Dans Mountain (US Forest Service Gypsy Moth Defoliation Maps 1972-2007). As oaks are the preferred host plant of the gypsy moth, highly exposed oak-dominated ridge forests are among the most susceptible to mortality resulting from sporadic gypsy moth outbreak (Liebhold et al. 1997). Poor site quality, which acts as a contributing factor to low species richness in the upper canopy, indirectly increases stand susceptibility to negative impacts of gypsy moth defoliation (Davidson et al. 1999). Impacts on oaks include tree mortality, loss of tree growth, and temporary loss of mast for years in which heavy defoliation occurs (Fajvan et al. 2008). Our chronology shows drastic ring width increase for an average of five years immediately following two years of defoliation-induced growth suppression. The year 2002 was documented as another high defoliation year for Dans Mountain (US Forest Service Gypsy Moth Defoliation Maps 1972-2007). This high defoliation year also coincides with a sharp decrease in ring widths visible in our chronology. Reduced annual ring widths in high defoliation years, coupled with sharp increases in wood volume within the next three to five years following defoliation events, is consistent with ring width patterns of similar studies (Kucherov 1991; Muzika and Liehbold 1999; Fajvan et al. 2008).

Fire may also factor into the historic disturbance regime of Dans Mountain. The relatively high dominance of fire-dependent Table Mountain pine (Zobel 1969; Brose and Waldrop 2006) eludes to some historic fire activity on Dans Mountain that allowed the Table Mountain pine to establish within and adjacent to the oak-dominated old-growth stands on Dans Mountain. A combination of establishment patterns and inadequate regeneration of fire-dependent pines, as well as thick ericaceous vegetation in the understory, suggest that the ridge forests on Dans Mountain are potentially experiencing the negative impacts of fire exclusion. This negative effect of fire exclusion has been well documented throughout the region (Nowacki and Abrams 1992; Signell et al. 2005; Fei et al. 2011). However, without a comprehensive fire history of Dans Mountain, it is impossible to directly measure any change to fire regime in the area.

A combination of regional and localized disturbances has greatly affected the historic and current compositional trajectory of the ridge forests on Dans Mountain. Disturbances act as long-term ecological drivers, and the impacts of these high mortality events widely differ in complexity and variability. As such, disturbance regimes warrant consideration when analyzing historic and future successional pathways.

The data show that both chestnut oak and the fire-dependent pine present today on Dans Mountain were present prior to European settlement. The high relative importance value of chestnut oak on Dans Mountain support the findings of multiple studies conducted immediately following regional peak chestnut mortality, (Korstian and Stickel 1927; Augenbaugh 1935; Keever 1953; Good 1968; Stephenson 1974; McCormick and Platt 1980) which show blight-killed chestnuts in the canopy being primarily replaced by co-dominant oaks. Nearly a century after peak chestnut mortality, our results indicate that the dominant overstory canopy layer is still dominated by chestnut oak, followed by northern red oak. In agreement with Mackey and Sivec (1973), the percentage of chestnut replacement by oaks was highest on particularly xeric sites of Dans Mountain. However, in contrast to the Keever (1956) hypothesis, on xeric sites where there was once a chestnut component, hickory only played a minor role in canopy ascension following the demise of American chestnut. As succession is a long-term process, our study provides valuable insight into the chestnut replacement debate from a unique location and time of study. Our study, which occurred nearly 90 years since the functional extirpation of American chestnut in the Ridge and Valley province, contributes to understanding the legacy of American chestnut in the eastern deciduous forests of North America.

Although one of the region's greatest current concerns is the decreased dominance of oaks and the increased presence of mesophytic species in later succession stages, our study shows little indication of this change in species composition in response to high-mortality canopy disturbances. The pre-European distribution of red maple in the

Ridge and Valley province of the eastern region has been documented to comprise approximately 12% of stems (Abrams and McCay 1996; Abrams 1998). The trend of increasing presence of red maple throughout the Ridge and Valley province is well documented (Lorimer 1984; Abrams 1998; McEwan and Muller 2006; Nowacki and Abrams 2008). However, the high elevation ridge forest on Dans Mountain appears to have resisted this increasing trend, as is evident from the low importance values of red maple, American basswood, and black birch in the overstory and the low mesophyte sapling counts in the understory layers. A commonly cited explanation for the competitive success of chestnut oak over mesophytic species is that the combination of low site index and thin soils that do not allow moisture-limited mesophytes to adequately establish (Abrams et al. 1997). We suspect that low site quality acts as an advantage, allowing the oak component of this disturbance-prone forest to persist throughout time by outcompeting mesophytic species in post-disturbance canopy gap utilization. While the implications of regional studies suggest management techniques such as prescribed burning and selective harvest to encourage oak regeneration, the high oak sapling stem counts and SILVAH 7 plot data suggest that oak have successfully regenerated for the past 300 years without active management. The poor-quality, understocked sites on Dans Mountain are characterized by open canopies that actively support oak regeneration. On near-xeric sites, characterized by low site indices and active disturbance regimes, oaks-dominated stands have a competitive advantage that allows them to persist due to successful regeneration and avoidance of mesophication. Examining past and current disturbance regimes is beneficial to understanding forest successional and compositional pathways.

Drone Imagery and Vegetation Mapping of Piping Plover (Charadrius melodus) Habitat at John Williams Nature Preserve

Topic: Using Data and Technology to Advance Conservation

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The Nature Conservancy's (TNC) John E. Williams Nature Preserve (JWNP) in North Dakota is home to the Piping Plover (Charadrius melodus), a threatened species of shorebird. JWNP has one of the highest concentrations of Plovers because they nest on the open gravel shores of the preserve's alkaline lakes. The Plover population and nest success at JWNP have been in decline. One of the main causes is habitat loss due to the encroachment of vegetation (Root and Ryan, 2004; Root, 1996). North Dakota's climate includes drought-deluge cycles, typically decadal in length. One past hypothesis is that vegetation is wiped out during periods of drought when lakes dry up and salt and sediment blow onshore, and that climate change may be affecting the length and intensity of these cycles. Environmental science and geology students at the University of St. Thomas set out to better understand these processes by investigating changes in shoreline vegetation, in plover nesting success, in lake and groundwater levels, and in soil and water chemistry. As part of this larger project, we collected drone imagery of shoreline vegetation in 2017, 2018, and 2019 to map changes in plant communities and available gravel. This imagery, along with historical imagery, is providing insight into near-shore changes caused by changing lake water levels.

Imagery suggests that as water levels dropped, more near-shore beach was exposed, allowing for vegetation to encroach into valuable Plover habitat. This imagery also shows, however, that during periods of deluge, water levels rose, effectively killing off vegetation and opening up new areas of beach habitat. Initial results suggest that the timing of precipitation during a growing season is also a significant factor. Late summer rains bring the level of the lake up and this lake level is tied to vegetation encroachment the following spring. We believe lake levels in late summer may affect seeding and rhizome location as plants reproduce, which in turn affects the location of vegetation growth the following year. Thus, both drought and deluge processes seem to contribute to the maintenance of open habitat. We are also exploring how changes in surrounding land use and in precipitation due to climate change may be altering lake levels. Our goal is that these imagery, data and hypotheses help TNC staff to preserve the open habitat needed by the Plovers.

Effect of herbicide type, herbicide concentration and timing of application on control of Lesser Celandine

Topic: Invasive Species Management and Prevention

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Effect of herbicide type, herbicide concentration and timing of application on control of Lesser Celandine

Kendra Cipollini, Anna Foote, Mallory Hill O'Dell and Sarah Young, Wilmington College

Lesser celandine, Ranunculus ficaria, is an invasive species on which little research has been performed to date. In a field experiment, we studied methods of R. ficaria control and the effects of different control methods on the response of the native understory. In a fully factorial study, we used two different types of herbicide (glyphosate or imazapyr), two different concentrations of herbicide (1.5% or 3% v/v) and two different times of herbicide application (pre-flowering in mid-March, flowering in early April, or post-flowering in early May). Treatments were applied in 2 x 2 m plots in heavily invested riparian areas (100% cover of R. ficaria in each plot) at three different sites in southwestern Ohio. Treatment combinations were replicated three times per site. One year later, plots were measured for percent cover of R. ficaria and percent cover of native species.

We found that there were differences among sites in efficacy of control and in the effects on native species, which are likely related to differences in original conditions at each site. Imazapyr was most effective in reducing R. ficaria regardless of application time. In comparison, the effectiveness of application of glyphosate decreased over the season. Higher concentrations of herbicide led to slightly more control of R. ficaria, but also had much greater impacts on native species. Application in early May had the greatest negative impact on native species, followed by application in mid-March. Taking all factors into account, including differences between sites, we recommend using imazapyr during the flowering period (early April), followed by glyphosate or imazapyr during pre-flowering period (mid-March) using concentrations of 1.5%.

Effects of winter applications of indaziflam upon pre-emergence control of Japanese stiltgrass in a state park

Topic: Invasive Species Management and Prevention

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Japanese stiltgrass [Microstegium vimineum (Trin.) A. Camus], a non-native invasive annual warm-season grass, is a facultative species which can suppress native vegetation producing monostands in suitable areas. The use of post-emergence herbicides in natural areas can be an issue by damaging native species during the summer growing season. Indaziflam is a pre-emergent herbicide with a long residual which may be effective in providing season-long control of Japanese stiltgrass with just one herbicide application. Tishomingo State Park currently uses glyphosate, a non-selective herbicide, during the summer season which can damage native plant species and requires multiple applications. This study was initiated to evaluate indaziflam for pre-emergent control of Japanese stiltgrass. Indaziflam (Esplanade) at three rates (3.5, 5, and 7 oz product/A); indaziflam plus rimsulfuron at three rates (3, 4.5,

and 6 oz product/A); indaziflam (5 oz/A) plus sulfometuron (Oust XP at 2 oz/A), or pendimethalin (Prowl H2O at 2.2 qt/A) were soil applied on 27 Feb 2018 and indaziflam at three rates (3.5, 5, and 7 oz product/A) or pendimethalin (Prowl H2O at 2.2 qt/A) were soil applied on 11 December 2018 to evaluate control of stiltgrass during the 2018 and 2019 growing seasons, respectively. Visual cover and control ratings were recorded monthly following application and data was analyzed using ARM software with means separated by the least significant difference. Following the 27 Feb 2018 applications, indaziflam was more effective at higher rates and the addition of rimsulfuron or sulfometuron increased stiltgrass control during the 2018 growing season. Still, some stiltgrass was observed in these treatment plots near the end of the season and some treatments were not significantly better than the untreated plots. The 11 December 2018 application was not as effective during early spring germination of stiltgrass. Additional 2019 growing season results will be discussed.

Intercontinental convergence between Floristic Quality Assessment and analog European indicator systems

Topic: Identifying Natural Areas for Conservation

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University of Illinois at Urbana-Champaign

Expert-based vegetation indicators are indispensable tools for scientific and conservation applications. Floristic Quality Assessment (FQA) is a primarily North American system to assess the relative quality of natural areas through species-based values called Coefficients of Conservatism. Three European systems; hemeroby scales, Borhidi naturalness indicator values, and Ellenberg indicator values, have considerable yet unrecognized similarities with the philosophy and methods of FQA. Based on a systematic literature review, we summarized the four systems and found analogous principles, applications, and underlying ideologies, as well as similar criticisms leveled at these systems. Despite these similarities, we predicted that FQA authors in North America have not cited these European analogs. To test our prediction, we performed a bibliographic coupling analysis using 880 source documents. A bibliographic coupling analysis assesses the overlap of references in source documents, and then generates a citation network to identify linked papers and topics. We found a pronounced insularity of citations in the FQA literature, but stronger exchanges among documents in the three European systems. We describe how this insularity is a missed opportunity for FQA users. Specifically, mutual awareness can lead to novel methods for FQA users, reveal shortcomings and limitations of the system, and suggest conceptual improvements to its application.

Lithologic influences on forest carbon storage, uptake and community composition of forests in the Ridge and Valley, PA

Topic: Advances in State Forest Management

Warren Reed
Penn State University

Lithology influences forest carbon storage and productivity over complex terrain. The role of bedrock geology on these processes has often been overlooked in forests of the eastern United States, despite its potential influence on this large and important carbon sink. This research explores the influence of two common lithologies of the Ridge and Valley physiographic province in the Appalachian mountains, shales and sandstones, on live aboveground carbon storage, carbon uptake, forest community composition and their interrelationships. In this study, we couple forest inventory data from Pennsylvania state agencies with a suite of GIS derived landscape metrics including measures of climate, topography and soil physical properties to identify biotic and abiotic drivers of live forest carbon dynamics in relation to lithology.

Data from 565 plots in forests spanning 21 – 200 years in age demonstrate that forests growing above shale bedrock store more live aboveground carbon compared to forests above sandstone when controlling for stand age. Furthermore, forests in the dominant age classes store more live aboveground carbon (108.1 Mg/ha vs. 86.5 Mg/ha) and uptake live aboveground carbon at a faster rate (1.32 Mg/ha/yr vs 0.85 Mg/ha/yr) on shale compared to sandstone respectively. Overall forest communities on both lithologies of interest are dominated by oaks (Quercus spp.), however northern red oak (Quercus rubra) is more dominant at shale sites compared to chestnut oak (Quercus

prinus), which is dominant on sandstone. Faster growth rates of northern red oak above shale bedrock are significantly higher than on sandstone counterparts and likely drive differences in carbon pools and fluxes across the landscape. Tree species richness was higher in sites associated with shale bedrock, but biodiversity-productivity relationships within lithologic classifications failed to account for differences in forest productivity. Modeled live aboveground carbon storage between lithologies points to the importance of topography (elevation and aspect) and soil physical properties (% clay and available water capacity) in forest productivity in the region. These results highlight that lithification processes over hundreds of millions of years can contribute to modern day forests and their ability to uptake and store atmospheric carbon.

Place Meaning and Place Attachment Ascribed to Appalachian Geopark: A Case Study in West Virginia State, USA

Topic: Identifying Natural Areas for Conservation

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West Virginia Univeristy

In the area of natural resources conservation and protection, a recent approach, a 'Geopark' is emerging globally. Since the 1990's geoparks have been developed with a focus on geological heritages and a holistic concept of protection, education and sustainable development. The geopark network has been institutionalized globally by United Nations Education, Sciences and Cultural Organization (UNESCO). Currently there are 120 Global Geo-parks in 32 countries in the world. There is not any officially designated geopark in the United States till date; however, there are two aspiring geoparks in the country- Michigan's Keweenaw Peninsula and West Virginia's southern coalfields (Appalachian Geopark). While designating an area as a certain type, it is very important to assess how different stakeholders are associated with, and value any landscape/geological heritage (place) as they are benefited or impacted differently. Review of literature reported that place meaning and place attachment greatly depends on two dimensions: place identity and place dependence. Place identity is more related to cognitive connection, an individual's personal relation to the physical environment, more emotional ties, feelings, beliefs, preferences, etc. Place dependency explains conative and functional utility of the setting, how well a setting serves for achieving a goal. Place dependent respondents are less inclined to perceive other settings as viable alternative, less sensitive to adverse consequences. This study has been developed to assess place meanings and place attachment individuals ascribe to an Appalachian Geopark located in the southern part of West Virginia State. The Appalachian Geopark covers Raleigh, Fayette and Greenbrier counties. This Appalachian region has deep gorges and ancient rivers that drove the rise of the US industrial revolution of the late 1800s – primarily through coal, timber, and from the waters of the many rivers that mark the landscape. A triangulation method will be used including questionnaire survey, focus group discussion; and site observation to collect relevant information and data which will be analyzed using different qualitative and quantitative methods.

Key words: Geological heritage, geopark, place attachment, place meaning

I am a graduate student at West Virginia University and I would like to participate in the student competition.

GPS Telemetry Collar for Neotropical Species, White-Lipped Peccaries

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

Xavier Abdullahi
University of St. Thomas

GPS Telemetry Collar for a Neotropical Species, the White-Lipped Peccary (Tayassu peccari)

Xavier Y. Abdullahi, University of Saint Thomas

Animal tracking techniques, such as radio and satellite tracking, are valuable tools in movement ecology, looking at movement as the way that animals and environments interact (Tibbetts 2017). Understanding small and large movement of organisms and populations helps to address questions about, for example, wildlife habitat requirements,

the spread of diseases and infections, changes in land use, the spread of invasive species, and biodiversity. One common tracking system used is a Global Positioning System (GPS) tag. A GPS tag uses a radio receiver to pick up signals from satellites at specific time intervals to then send those signals back to satellites. This process allows for the locations of wildlife fitted with GPS devices to be periodically logged. The recent development of small, lightweight, GPS tracking devices and small, longer lasting batteries, are providing insights into the relationship between animal movement metrics and habitat characteristics for a variety of taxa (Recio et al. 2011). These systems, however, are costly and do not work if the signal from the GPS device cannot be received or sent to satellites. The inability of GPS satellites and wildlife tags to communicate is particularly problematic in the tropics where the dense, multi-layered canopy often cause discrepancies in GPS location accuracy (DeCesare et al. 2005). We propose to address the limitations of currently available commercial units in two stages: First, we will develop an affordable wildlife GPS tag based on readily available and inexpensive open-source microprocessors and other electronics components. Second, upon successful development of the GPS tag, a small unmanned fixed-wing aircraft will then be modified to function as a data collection system in order to ensure consistency regardless of satellite interference. The GPS tag and unmanned aircraft system we propose to develop will allow for a more accessible and efficient method of collection of species' environmental movement data.

Habitat Suitability Modeling of Culturally Important Plants at Wind Cave National Park in South Dakota

Topic: Using Data and Technology to Advance Conservation

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Sitting Bull College

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Habitat Suitability Modeling of Culturally Important Plants at Wind Cave National Park in South Dakota

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Abstract:

Spatial plant habitat models have been used for several applied conservation projects including finding new locations of rare, threatened, or endangered plants and understanding the spatial distribution of plants across a specific management area. This project created habitat models culturally important plant species in Wind Cave National Park in southwestern South Dakota. We used Mahalanobis Distance (D2), Generalized Linear Models (GLMs), Generalized Additive Models (GAMs), Maximum Entropy (MAXENT), and Random Forest (RF) to discern where target plants are probabilistically located, the importance of habitat layers to plants, and to estimate of the percent of WICA that is considered suitable habitat. MAXENT models performed with greater accuracy and lower false positive rates than D2 models. As expected, more specialist plants such as blacksamson echinacea (Echinacea angustifolia DC. var. angustifolia) modeled with lower false positive rates (26%) and higher accuracy (65%) than species with more general habitat parameters such as breadroot scurfpea (Pediomelum esculentum Pursh) with a false positive rate of 40% and accuracy of 58%. Transformation of aspect was consistently the most important habitat variable in RF and MAXENT models grouped by family. We incorporated the models into a proposed Vulnerability Index which attempts to ascertain the potential risk of harvesting to target plant populations based on a variety of accessibility

factors, life strategies, and ecology specific to each plant. Vulnerability Index analysis allows for a higher specificity than documented rarity within WICA boundaries. For instance, prairie rose (Rosa arkansana Porter) ranked as significantly more vulnerable that fringed sagewort (Artemisia frigida Willd.) when both are documented as abundant. Through the combination of habitat suitability and vulnerability analysis, WICA will be able to more effectively manage important ethnobotanical resources.

Land Trusts and Birds: Partners in Strategic Conservation

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

Sara Barker Swarthout
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Ron Rohrbaugh
Audubon Pennsylvania

Ashley Dayer
Virginia Tech

Amanda Rodewald
Cornell Lab of Ornithology

Land Trusts and Birds: Partners in Strategic Conservation

Sara Barker Swarthout, Cornell Lab of Ornithology; Ronald W. Rohrbaugh, Audubon Pennsylvania; Ashley A. Dayer, Virginia Tech; Amanda D. Rodewald, Cornell Lab of Ornithology

More than 60% of the land area in the United States is privately owned, and more than 100 bird species have >50% of their U.S. breeding distributions on those lands. Unfortunately, conserving and managing private lands is complicated by both individual and institutional barriers, thus leaving birds reliant on private lands with inadequate protection and management. Land trusts are an increasingly popular mechanism to protect private lands and potentially conserve birds and their habitats. In 2013, the Cornell Lab of Ornithology used social science-based methodology to conduct a national, online survey of land trusts and their attitudes toward bird conservation. Results indicated that land trusts, if supported with science and technology, could achieve landscape-scale conservation for birds. To develop mutually beneficial collaborations between land trusts and the bird conservation community, we established the Land Trust Bird Conservation Initiative. The initiative provides: 1) access to science-based information about birds to inform strategic conservation planning, investment decisions, prioritization of easements and acquisitions, grant writing, and landowner engagement; 2) resources and tips on bird-focused funding opportunities; 3) ideas to cultivate new members and volunteers by engaging birdwatchers, bird organizations, and bird conservation advocates; 4) guidance for habitat management on fee-owned lands and resources for landowners holding easements; 5) assistance with monitoring birds and visualizing data through eBird.org; and 6) a small grant program to fund capacity building as well as management, stewardship, and restoration work for lands trusts and their partners. Our poster will showcase how the initiative is using science and outreach to conserve bird populations on private lands.

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

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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.

Promoting Pollinators at the Flight 93 National Memorial

Topic: Pollinators in Natural Areas Management

Andrea Kautz
Powdermill Nature Reserve

John Wenzel
Powdermill Nature Reserve

Powdermill Nature Reserve has been working closely with Flight 93 since 2016 on several pollinator initiatives, including bee surveys, setting up honey bee hives, and establishing pollinator forage habitat. Flight 93 is located on a 2200-acre property that was previously strip-mined. A lot of effort has gone into restoring the habitat and making it a more appropriate resting place for the victims and their families. Our goal is to promote a healthy community of pollinators at the site by providing the appropriate resources, and also engage with the public about issues surrounding pollinator health and conservation.

Oak savanna vegetation diversity and carbon sequestration: Implications for management practices

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

Jeff Heise
Grand Valley State University

Oak savanna vegetation diversity and carbon sequestration: Implications for management practices
Jeff A. Heise - Grand Valley State University
M. Megan Woller-Skar - Grand Valley State University
The savanna system is an ecotone (i.e. a barrier ecosystem) that lies between forest and grassland ecosystems. They occur across the world in various forms, but in the North American Midwest they are specifically oak savannas: systems where the open overstory is dominated by various species of oak (Quercus spp.) and the understory consists

of carbon-rich prairie grasses and forbs. This is a highly degraded ecosystem that has lost almost 99% of its former range due to agriculture and fire suppression. Since savannas are fire-evolved systems, they are maintained by and require fire as a regular disturbance to clear woody encroachment and keep the canopy open for the diverse understory. This study takes place in an oak savanna in the Muskegon State Game Area in Muskegon, Michigan. We quantified the amount of carbon that is stored in overgrown and restored plots of oak savanna, then compared the changes in carbon sequestration to other restoration goals, including understory community composition. Since this system, once restored, can store large amounts of carbon in the roots of the diverse understory, the goal of this study to determine if there is a link between two management objectives. These results provide land managers with the knowledge regarding whether oak savannas can be restored for greater species richness as well as atmospheric carbon sequestration.

Plant Communities of the South Fourche Botanical Area in Arkansas

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

Virginia McDaniel
US Forest Service Southern Research Station

Susan Hooks
Ouachita National Forest

Theo Witsell
Arkansas Natural Heritage Commission

Brent Baker
Arkansas Natural Heritage Commission

Doug Zollner
The Nature Conservancy

Plant Communities of the South Fourche Botanical Area in Arkansas

Virginia McDaniel, US Forest Service Southern Research Station; Susan Hooks, Ouachita National Forest; Theo Witsell, Arkansas Natural Heritage Commission; Brent Baker, Arkansas Natural Heritage Commission; Doug Zollner, The Nature Conservancy

The Ouachita Mountains Natural Division is located in west-central Arkansas and consists of a series of east-west trending mountain ridges and wide valleys. The South Fourche Botanical Area (SFBA) is located within the northern-most subdivision, the Fourche Mountain Subdivision, a system of high sandstone ridges that extends from eastern Oklahoma to Searcy, Arkansas. Forest cover typical of the region includes shortleaf pine (Pinus echinata) and hardwood forest and woodlands dominating low-to-mid south-facing slopes, post oak (Quercus stellata)-blackjack oak (Quercus marilandica) forests and woodlands dominating upper south-facing slopes, and more mesic white oak (Quercus alba)-northern red oak (Quercus rubra) forest dominating north-facing slopes. Pine woodlands are a unique community in this subdivision where fire has maintained widely spaced trees allowing a rich diversity of grasses and forbs in the understory. The Ouachita Mountains are also known for their number of endemic species, many of which are restricted to glades, open woodlands and 'river scour-prairies' (rocky prairie-like areas along high-energy mountain streams). The SFBA was designated by the Ouachita National Forest in 2005 because it houses many of these diverse plant communities as well as other rare communities including a hanging oxbow (one of the largest mountain channel scar wetlands in the Ouachita Mountains), a salt lick, and several ground water seepage areas. In spite of this designation, a full inventory of the botanical diversity of the SFBA has never been completed. Botanists have documented a number of rare and endemic species of state and global concern from the botanical area including the federally endangered harperella (Ptilimnium nodosum G2S2); endemics to the Interior Highlands - Ouachita blazing star (Liatris compacta, G5S3), Ouachita bluestar (Amsonia hubrichtii, G3S3) and Ouachita indigo-bush (Amorpha ouachitensis G3QS3); as well as state tracked species including Cumberland sand-reed (Calamovilfa

arcuata G2G3S1) three-way sedge (Dulichium arundinaceum, G5TNRS2S3) sticky hedge-hyssop (Gratiola brevifolia, G4S3) plantain-leaf sunflower (Helianthus occidentalis ssp. plantagineus, G5T2T3S1), perfoliate bellwort (Uvularia perfoliata, G5S3), Wolf's spikerush (Eleocharis wolfii, G3G5S3) and Kentucky lady's-slipper (Cypripedium kentuckiense, G3S3). Furthermore, SFBA has many edge of range species especially those with a more southerly (coastal plain) distribution. In this study we have documented over 500 plant species (including one state and over 20 county records) and described the diverse plant communities within the SFBA.

Prescriptive goat grazing & prescribed fire as a means to halt mesophication and promote biodiversity in Ozark Hardwoods

Topic: Restoration of Natural Areas Qualities

Gina Beebe
University of Missouri

Title: Smoke, Oaks, and Goats: Prescriptive goat grazing and prescribed fire as a means to halt mesophication and promote biodiversity in Ozark Hardwood Ecosystems.

Author: Gina Beebe, Master's Student
University of Missouri, Department of Forestry.

Abstract: The suppression of fire in the 20th century has led to a dynamic shift in woodland structure and composition in Missouri and the Eastern United States. In areas where recurrent fire disturbance was historically commonplace, fire-sensitive, shade-tolerant species are outcompeting fire-tolerant, heliophytic species; woody stems are encroaching the mid-story, competing with herbaceous ground flora for available nutrients and suppressing biodiversity due to increased canopy cover and homogenous light conditions. Woodlands in this ecoregion have capacity to support both prairie and forest-type ground floras due to a wide array of micro-climates created from heterogeneous over and mid-story canopy conditions; mesophication threatens the localized environmental conditions needed to sustain heliophytic species.

There is a rising interest among land managers to restore and maintain woodland ecosystems. Within Ozark Hardwood ecosystems, common land management strategies include lower levels of stocking, minimal mid-stories, and diverse ground floras. Frequent disturbance is a key component of achieving these management goals and prescribed burns are often used. However, the proximity of an interstate to the research study area has complicated the use of fire due to smoke and visibility concerns.

Prescriptive goat grazing holds the potential as woodland restoration management technique; goats' capacity and preference to consume lignified plant species make them an ideal candidate to increase spatial heterogeneity by reducing the mid-story canopy and disturbing soil. This research is examining the use of prescriptive goat grazing as a supplemental and viable land management approach which, in conjunction with fire, may impede mesophication and promote ground flora. There is minimal research regarding the effects of goat grazing and seasonality as well as the combined effects of grazing and prescribed burning on woodland structure, composition, and ground flora. The goals of this study are to examine those questions.

This study is located on the Mark Twain National Forest, approximately 15 miles southwest of Rolla, Missouri. There are three grazing events during the course of this study: a dormant bud graze, a spring, and a fall graze. These are compared to a dormant season prescribed burn as well as an interaction between grazing and fire. We compared species richness and diversity, the coefficient of conservatism and floristic quality index values between treatment types. Additionally, we monitored grazing effects on woody reproduction status and vigor.

Prioritizing Protection and Recovery Efforts using Statewide Conservation Targets

Topic: Identifying Natural Areas for Conservation

Mei-Ling Feng

Illinois Natural History Survey

Prioritizing Protection and Recovery Efforts using Statewide Conservation Targets

Mei-Ling E. Feng
University of Illinois, Illinois Natural History Survey

Protected lands are increasingly isolated by highly modified landscapes and require ongoing stewardship to maintain conditions that meet site-based conservation goals. However, the finite nature of personnel and financial resources confines this work to a limited number of locations each year. Efficiently allocating these resources through prioritization is therefore critical for effective delivery of conservation actions to meet statewide goals under these constraints.

Despite the protection and recovery of Species of Greatest Conservation Need (SGCN) and Natural Communities that provide habitat being a state priority for Illinois, no formal statewide evaluation of their protection has been conducted. This project seeks to enhance the effectiveness of the Illinois Protected Lands Network for the conservation of high-quality natural community types and at-risk species. Our statewide approach involved updating State Conservation Status Ranks (sRanks) for 99 Illinois Natural Community Types and 217 SGCN. Those highly imperiled (S1 and S2) are being used as statewide conservation targets to provide a common assessment standard for prioritizing conservation efforts. The prioritization analysis will identify coverage and gaps in Illinois' protected lands network as well as key locations for stewardship and protection. We are producing statewide models identifying the coverage of conservation targets within protected lands, rarity weighted richness, and will be building a vulnerability index identifying disturbances. In combination, these resources will be informative for natural resource managers by identifying multiple components focused on statewide conservation goals to efficiently allocate resources for stewardship efforts.

Priority effects leave restorations susceptible to invasion, but only in heavily invaded sites

Topic: Restoration of Natural Areas Qualities

Katharine Stuble
The Holden Arboretum

Truman Young
UC Davis

Priority effects can be a useful tool in restoration, allowing land managers to promote target species that may be difficult to establish by planting them ahead other more dominant species. This can allow less dominant species time to establish before more dominant species are added, ultimately increasing plant diversity and successful restoration outcomes. Giving less dominant plants time to establish, however, could also leave sites vulnerable to invasion by undesired nonnative species already present in the vicinity. We developed a series of experimental restoration plots within three heavily invaded California grasslands. After removing the preexisting vegetation in our study by tilling twice, we manipulated the order the order of arrival of four native forb species and four native grass species; seeding all eight species together, seeding the forbs a full year before the grasses, or seeding the grasses a year before the forbs. The experiment was replicated identically for four consecutive years to test for variability across planting years. Results were variable across both space and time. Giving forbs priority sometimes enhanced establishment of forbs at the sites, but only if they were planted in years in which forb establishment was generally high. However, in the site with the highest background level of nonnative species, giving forbs priority by delaying the planting of native grasses left the plots vulnerable to invasion by nonnative annual grasses, apparently reducing forb success. There appears to be a tradeoff between giving forbs time to establish and creating a restoration that is resistant to invasion by nonnative plant species. This is evidence for the need for more evidence-based, nuanced, and site-specific restoration strategies in a field in which one-size-fits all approaches are often less than effective.

Quantifying Soil Erosion at an Abandoned Coal Mine Waste Site

Topic: Best Management Practices on land for Freshwater Ecosystem Integrity

Nathaniel Shaffer
Washington & Jefferson College

Quantifying Soil Erosion at an Abandoned Coal Mine Waste Site

Nathaniel Shaffer and Jason Kilgore

Biology Department, Washington & Jefferson College, Washington, PA; Environmental Studies Program, Washington & Jefferson College, Washington, PA

Abstract: The process of mining coal results in large quantities of waste material that must be removed from the mining site and stored elsewhere. One of the most common methods of storing this material is to simply create coal mine waste sites, often in areas that are more difficult to develop for other uses. These waste materials have limited ecological use and support limited plant life. The waste material is very acidic, has high heavy-metal content, and is often friable and unstable, leading to substantial erosion at steeply sloped sites, typically adjacent to stream ecosystems in Pennsylvania. We are investigating erosion at one of these many abandoned coal mine waste sites in southwestern Pennsylvania. Our primary focus is characterizing the slope and quantifying soil erosion into the creek at the base of the slope. For example, the typical slope is 35° over 25 m with clearly evident loss of eroded materials from gulleys into the creek. To quantify and characterize the waste material and water flowing off the pile into the creek, we are designing and testing methods to capture materials following rain events, which will be measured by a tipping-bucket rain gauge. While erosion pins and silt fences commonly appear in the literature for less extreme slopes, we will use these methods in combination with troughs to quantify erosion over time. Extrapolating these results to the entire site should provide a reasonable estimate for the total amount of waste mine material that is eroding off the slope and ultimately moving into the stream ecosystem. This work is important because these small, isolated piles are not targeted for remediation and could substantially contribute to the contamination of streams, thus affecting not only aquatic organisms but also drinking water quality.

Social Value of Forests and Birds in Pennsylvania

Topic: Advances in State Forest Management

Sadikshya Sharma
Pennsylvania State University

Forest management can help protect species diversity by enhancing the quality of wildlife habitat. However, the social and economic value of maintaining wildlife habitat, compared to other economically valuable forest goods and services (e.g., timber), is not well understood. The cost of mitigating exogenous pressures on forests (e.g., pollution, invasive species, climate change) are also expected to increase, necessitating that forest management actions have an economic justification. Natural resource agency leaders and conservation advocates need a better understanding of how society values wildlife and forest management to help inform policies and programs that help shape our forests.

To understand the social value of enhancing bird habitat through forest management we conducted a statewide web survey containing choice experiment questions (i.e., willingness to pay for bird conservation). Logistic regression analysis was used to estimate the economic value of generalists and specialist bird species, mature and young forests and the use and non-use benefits associated with bird conservation. Survey questions also assessed people's knowledge about forest birds, and attitudes towards wildlife and government involvement in private forest management decisions. An innovative aspect of this study was the examination of how sensory experiences may affect willingness to pay for bird conservation. This was done by including audio recordings of bird songs in some surveys using a split-plot experimental design. Findings will be used to help conservation organizations advance in their mission by justifying investment in bird conservation. Findings may also help improve stated preference measurement techniques.

Spatial variation in historical fire-regime characteristics of an oak-pine landscape, Pennsylvania, USA

Topic: Restoration of Natural Areas Qualities

Joseph Marschall
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Long-term, ecosystem-specific fire history information improves natural community restoration and management by providing a basis for scientifically-reasoned fire management prescriptions. Fire regimes can be reconstructed to sub-annual resolution using fire-scarred trees, and while such reconstructions have become increasingly prevalent across the eastern U.S., little information regarding how historical fire regimes vary at landscape scale (>10 km2) is available. Most studies report fire-regime characteristics (i.e., frequency, seasonality, and severity) at site-composite levels, commonly at 1 km2 spatial resolution. In this study, we analyze the historical spatial variation in fire-regime characteristics over the past four centuries (1620 CE - present) in a red pine/oak landscape in north-central Pennsylvania, USA. Fire event data were reconstructed based on fire scars and locations of 192 living and dead red pines. The results of this study clearly show that historical fires in this landscape most often affected a relatively small proportion of the landscape, were frequent, of low to moderate severity, and occurred primarily during the dormant season. Historical precedence exists in this landscape for fires of small to large size and low to high severity, modulated by drought conditions. Meeting landscape-level ecosystem restoration objectives will require burning across a broad range of climatic conditions and spatial extents.

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Stabilizing abandoned coal mine waste: Is little bluestem the answer?

Topic: Best Management Practices on land for Freshwater Ecosystem Integrity

Jason Kilgore
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The Appalachian region has abundant refuse left over from coal mining, including abandoned coal mine wastes that have low nutrients, high heavy metals, and high acidity. These characteristics limit plant colonization. We investigated ecophysiological responses of aC4 grass, little bluestem (Schizachyrium scoparium), already growing on coal mine waste and then established an experimental planting to determine the combination of plant species and soil amendments that best promotes revegetation of the mine waste. In Summer 2018, we measured chlorophyll content, plant height, and photosynthetic parameters associated with instantaneous responses to varying carbon dioxide (CO2) and light levels across two types of waste sites – oxidized and unoxidized – and one reclaimed site early and late in the little bluestem growing season. Vegetative stalk height was higher in June than August for the unoxidized site (p=0.009), and chlorophyll content was greater in June than August at the oxidized site (p=0.037), but there were no significant differences across sites. For all sites, Phi was higher in August (p=0.002), while ? was lower in August across all sites (p=0.016), suggesting higher photosynthetic efficiency in August. Additionally, the light saturating level for photosynthesis (Qsat) was higher in the reclaimed site than the waste sites in June (p0.001), while ? was lower in the reclaimed site for June (p0.001). Thus, photosynthetic efficiency at mid-light levels was higher in the little bluestem plants on the reclaimed site compared to the waste sites. There was no difference in Vcmax between sites or across sites between seasons (p>0.064). On the other hand, plants at the reclaimed site had a higher photosynthetic electron transport rate (Jmax) compared to the two waste sites in July (p0.002). Overall, we found little evidence that little bluestem is negatively affected by the mine waste since there was a lack of differences across sites. In Fall 2018, we established an experimental planting with combinations of plants (little bluestem, annual rye (Lolium multiflorum), strip mine seed mix, or lavender (Lavandula angustifolia and L. grosso) and soil amendments (lime, straw, mycorrhizal fungi, all, or none) on unoxidized coal mine waste. By Winter, annual rye was the only

species that had germinated, regardless of soil treatment; however, there was no detected difference in germination across treatments ($p>0.175$), although lime provided the best results with the highest mean germination. In Summer 2019, we are evaluating the germination and growth of the plants in the experimental planting.

The legacy of agricultural land use can have a long-term impact on soil biota following reforestation.

Topic: Restoration of Natural Areas Qualities

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The legacy of agricultural land use can have a long-term impact on soil biota following reforestation.

Sarah R. Carrino-Kyker, Katie L. Stuble, Sergio A. Sabat Bonilla, and David J. Burke

The Holden Arboretum, Research Department, Kirtland, OH 44094

The long-term legacy of human land use on plant communities has been well established. Less is known about how soil communities are structured by disturbance. However, the belowground impacts of past land use can have important consequences for aboveground communities. Evidence suggests that soil organisms, such as fungi and invertebrates, are sensitive to disturbance. As a result, post-agricultural forests may lack the diversity of soil mutualists that many plant species depend on for nutrient acquisition or seed dispersal, which could affect the success of restoration efforts. In order to understand how past land use can impact soil communities, including important mutualistic partners, we surveyed forested sites within Stebbins Gulch, a 334 hectare mixed-mesophytic forest at The Holden Arboretum (Ohio, USA) consisting of a matrix of high quality mature hardwood forests and mid-successional forests that were used for agriculture until the 1930s. Plots of both mature hardwood and post-agricultural forests were surveyed and we found that land use history had a large effect on fungal community structure, invasive earthworm abundance, and ant community composition. Even 80 years after disturbance, forests recovered from agriculture had lower abundances of seed-dispersing ants and ant-dispersed plants as compared to mature forests. Disturbed forests also had a higher abundance of litter-feeding earthworms and sites with a high abundance of epi-endogenic earthworms had increased leaf-litter turnover and decreased rates of ant-mediated seed dispersal. Tree community differences between disturbed and undisturbed sites correlated with fungal community changes. In general, we found higher relative abundance of fungi in the order Helotiales in forests on disturbed sites, while mature forests had higher abundances of fungi in the orders Russulales and Sebacinales. The latter orders are comprised of many ectomycorrhizal fungal taxa, while Helotiales is known to contain ericoid mycorrhizal fungi. This difference in functional group could be a legacy of past disturbance on forest fungal communities. Our data indicate that past agriculture can have long-lasting impacts on forest communities and establish differences in soil communities, including known plant mutualists. Current restoration efforts within the post-agricultural forests of

Stebbins Gulch involve planting *Maianthemum racemosum* and *Arisaema triphyllum* either in native soil or amended with soil from mature forests or a commercial inoculum. These amendments had no effect on short-term growth (one year following planting); however, plants are continuing to be monitored to explore the importance of soil communities on long-term success when reintroducing native plant species.

The Mighty Red Spruce: Using UAVs to Help Manage Recovering Populations

Topic: Using Data and Technology to Advance Conservation

Katie Biggert
Marshall University

Anne Axel
Marshall University

Red spruce, Picea rubens, was formerly a dominant species of high elevation coniferous forests in the Central and Southern Appalachians until it was decimated at the beginning of the 20th century through extensive logging and widespread fire. The red spruce stands that exist today are far more limited in size and spruce density than they once were, isolating vital wildlife habitat in small 'climatic islands'. Recovery efforts are currently underway in the form of seedling plantings and selective thinnings. Red spruce are a long-lived, shade tolerant species, so multiple shade releases are required for them to reach the forest canopy; we can periodically thin the overstory to mimic natural canopy gaps. The challenge, however, is to identify sites for thinning where efforts will make the most impact and to thin in a way that best matches natural conditions. To better understand the ecology of successful natural gaps, I am testing the use of an unmanned aerial vehicle (UAV) to identify natural canopy gaps for study. First, I am creating high-resolution orthomosaic imagery of remnant and regenerating red spruce stands within the Monongahela National Forest with a consumer UAV. I am then geolocating existing natural forest gaps from the UAV imagery and visiting a subset of gaps to conduct ground sampling of red spruce regeneration response, gap structure, and ancillary environmental variables. Ultimately, the goal is to create a predictive decision tree model based on a study of natural gaps to guide selection and manner of selective thinnings. In this poster, I describe the process of using a UAV in a forest restoration context for high-resolution mapping, gap site selection, and 3D modeling of forest gaps using Structure from Motion (SfM) technology.
With the warming climate changing the natural dynamics of our forests, it is important to understand how species will respond in order to manage them. This project will highlight the ease and affordability of managers use of UAV technology in their ongoing forest restoration efforts.

The vascular flora of the Boone Fork headwaters within Grandfather Mountain State Park, North Carolina

Topic: Native Plant Conservation Initiatives

Ethan Hughes
Appalachian State University

The vascular flora of the Boone Fork headwaters within Grandfather Mountain State Park, North Carolina
Ethan Hughes and Zack Murrell
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Department of Biology

Grandfather Mountain (GM) is a site of exceptional biological diversity in the Southern Appalachian Mountains of western North Carolina. Long known for its unique assemblage of natural communities and rare and endemic species, GM has been a site of scientific research for many years. GM produces headwater streams for two river drainages: the Watauga and the Catawba River watersheds. The Boone Fork headwaters (BFH) originate on the northeastern slope of Calloway Peak within Grandfather Mountain State Park (GMSP) and represent an area of high natural quality significance. The BFH drain into the Catawba River watershed and represent an area within GMSP for which there is little plant species or natural community data. My project will investigate the flora of the BFH and describe all vascular plant species and epipetric mosses occurring within the roughly 1000-acre study site. I will also describe the natural

communities of the BFH following the Carolina Vegetation Survey method proposed by Peet et al. (1998). This data will provide critical insight for management of sensitive rare plant populations and natural communities within GMSP. The continued conservation of the BFH will provide high-quality, clean headwater stream habitat for various taxonomic groups occurring at GMSP.

U.S. Army Corps of Engineers Invasive Species Traveling Trunk

Topic: Invasive Species Management and Prevention

Tara Whitsel
US Army Corps of Engineers

Jeremy Crossland
US Army Corps of Engineers

Title: U.S. Army Corps of Engineers Invasive Species Traveling Trunk

Author: U.S. Army Corps of Engineers Invasive Species Leadership Team

Abstract: The U.S. Army Corps of Engineers Invasive Species Leadership Team has developed a Traveling Trunk, an interactive product for use in educating the public about invasive species. The USACE Natural Resource Management and Planning Communities recognize that prevention is the goal in invasive species management. The Traveling Trunk provides an interactive display and other learning tools for use in Visitor Centers and other instructional venues by USACE Rangers and environmental staff to attain the goal of educating the general public - from kids to adults - on invasive species, negative impacts they have, and management approaches. This poster presentation explores the development of this project, the success it has had, and suggestions for how attendees could apply lessons learned to their own outreach efforts.

What's happening in the understory? A prelude to forest future without white ash

Topic: Native Plant Conservation Initiatives

Dawlton Nelson
Washington & Jefferson College

Title: What's happening in the understory? A prelude to forest future without white ash

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Abstract: Emerald ash borer (EAB, Agrilus planipennis) has decimated ash (Fraxinus spp.) in the eastern hardwood forests of North America since its discovery in Michigan in 2002 and was detected in the Allegheny National Forest (ANF) in 2013. In 2010, 193 plots across a range of ash densities were established on the ANF to monitor white ash (F. americana) decline and mortality. In 2015 and 2018, 20 randomly selected ash trees in each of 27 3.24-ha plots were treated by injection of the insecticide emamectin benzoate to evaluate associational protection for untreated trees. Over four years (2018-2021), we are measuring canopy cover, shrub and small stem density, and cover of understory vegetation across treated and untreated plots with low, medium, and high ash densities. Effects of treatments and ash density are evaluated by two-way ANOVA (?=0.05) on data pooled by plot. For Summer 2018, mean canopy cover did not differ by treatment (p=0.170) or ash density (p=0.183); since no interactions were significant (p>0.05), only main effects are reported. Mean small stem and shrub densities did not differ by treatment

(p=0.523 and 0.531) or ash density (p=0.147 and 0.634). Ash treatment and density were not significant in explaining mean overall understory (p=0.338 and p=0.856), nonvascular (p=0.062 and 0.10), and monocot (p=0.871 and 0.811) cover. However, ash density affected forb cover (p=0.002), which was higher in high ash density, while woody seedling cover (p=0.055) was lower in high ash density; ash treatment effects were not significant (p=0.108 and 0.853). Although ash decline was visible for untreated trees in both treated and untreated plots, any effects of preserving ash trees with insecticide were not detected in the understory. However, in stands with high ash density, forbs may prosper, at the expense of woody seedlings, with the loss of ash. We are quantifying differences in vegetative reproduction via sprouting in Summer 2019. This monitoring will continue through Summer 2021 and could reveal changes in species composition and structure.

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