

Southeastern Partners in Plant Conservation

2020 Conference Abstracts

Keynote speakers

Anthropocene Era & the 6th Extinction: Our Reality

Dr. Pamela S. Soltis, Founding Director of University of Florida Biodiversity Institute,
Distinguished Professor and Curator at the Florida Museum of Natural History

We are living in a new geological era, termed the Anthropocene, in reference to human impact on our planet. This impact has led to extinction rates that are 1000 times higher than background extinction and the view that we are currently witnessing the Sixth Mass Extinction – this one caused by human activities. Climate change is forcing plants to respond to altered temperatures, precipitation, community structure, and more. Although some plant species are able to tolerate these alterations, others are being pushed closer to extinction. Successful conservation requires a multi-pronged approach, with data and tools from diverse sources. The world's herbaria house nearly 350 million specimens, collected over centuries, and together these specimens hold immense information about plant species habitats and distributions.

Through digitization of natural history specimens, this information is becoming increasingly available for modeling, computation, and other analyses. These digitized herbarium data have much to offer the field of plant conservation. For example, ecological niche modeling of rare species can help forecast future distributions and clarify potential future threats. Development of phylogenetic diversity indices for geographic regions of interest can also help identify areas that should be prioritized for conservation based on the distributions and evolutionary history captured regionally. Examples from the Florida flora will be presented to illustrate these new applications for “old” data.

Changing the Conversation About Plants

Matt Candeias, In Defense of Plants

Plants are undeniably the most important organisms on Earth and yet, so few people pay them much attention unless they are attractive or useful in some way. This phenomenon is commonly referred to as “plant blindness,” and it is one of the largest hurdles to overcome if we desire a healthier planet. For the first time since they conquered the land, plants are experiencing unparalleled rates of extinction. Faced with an uncertain future defined by massive and rapid environmental change, we can no longer afford to ignore the botanical world. To succeed in saving plants, it is important to inspire people to care about them. To do so, I believe that we must let go of utilitarian speaking points forged decades ago and instead, foster a new-found respect for plants as living, breathing, fighting organisms upon which all other forms of life depend. This, I feel, is the role of science communication. Our society does not suffer from a lack of scientists, it suffers from a lack of understanding and appreciation of science. We must strive to take our scientific understanding of the world and share this knowledge with more than just our colleagues. Distilling scientific discoveries, often only shared within the academic community, into narratives centered around biology, ecology, and evolution can inspire the public to look at plants in a whole new light. Though these narratives are often stories of

doom, gloom, and hopelessness, we must remember to also showcase conservation success stories. People need to understand that there is something worth fighting for. Plant-based conservation stories are not only interesting, they also have the power to connect people with a variety of biological interests because plants influence all forms of life on Earth. From microbes to megafauna, botany is a common thread in the narrative of life. Finally, we need to engage the public with more than just words. People need to have a stake in healthy plant communities and what better way to invoke a sense of stewardship than to let people play a role in conservation. This talk will explore my experiences with science communication through the In Defense of Plants blog and podcast including some lessons I have learned over the years.

Regional Conservation Initiatives video screening & panel

The Southeastern Grasslands Initiative

Dr. Dwayne Estes, Southeastern Grasslands Initiative

Featuring Dwayne Estes, SGI Director, and Theo Witsell, SGI Chief Ecologist. Filmed and edited by Pamela Pasco.

This 15-minute video takes you on a journey across the Southeast and through time, to learn more about the habitats that have been largely erased from society's collective memory: the incredibly diverse native grasslands of the Southeastern United States.

Be introduced to the concept of an "old growth grassland," characterized by hundreds of native grasses, sedges, wildflowers, and shrubs, as well as dozens of species of birds and countless insects. You'll learn why the myth of the squirrel that could travel from the Atlantic coast to the Mississippi River is just that: a myth that has been debunked by recent ecological and historical research.

Get introduced to the complicated and diverse mosaic of forests, woodlands, wetlands, and grasslands that once existed across the South. You'll discover that while Southern grasslands may not be as vast as their Midwestern cousins, what they lack in size is made up for by their astounding diversity. These include treeless prairies, open oak woodlands and pine savannas, rocky glades, high elevation grass balds in the Southern Blue Ridge, and open wet meadows, fens and bogs.

Learn about the importance of conservative grassland species, such as the May Prairie Aster, discovered in 2008, which occurs only in a single 10-acre prairie remnant and nowhere else in the world. These conservative species can only grow in high quality grasslands, indicating sites of conservation value.

Discover the grasslands that are hidden "in plain sight" throughout the Southeast, and find out the surprising sites on the landscape that still host many grassland plants and pollinators such as the Monarch butterfly.

Witness an unplanned grassland loss that occurred in real time during filming of this video, and learn why our native grassland remnants of just 1 to 20 acres are critical—not only as habitat for rare species such as the Northern Bobwhite—but also to any hope we have of restoring our native grassland heritage.

You'll see that native grasslands in the Southeast are still yielding amazing discoveries of new plant and animal species each year. Find out the surprising ways in which agricultural practices have been kind to our grasslands, and be assured that there is cause for hope.

Longleaf for the Long Run

Carol Denhof, President, Longleaf Alliance

The Longleaf Pine was once the dominant tree species in the southern United States, covering over 90 million acres from Virginia to Texas. Over the last 400 years, this species' abundance has decreased due to non-sustainable timber harvesting, clearing of land for agriculture and development, and exclusion of fire. However, the overall decline of this ecosystem has been halted due to a coordinated effort by landowners and partners in the southeast to restore this iconic Southern forest that is among the most biologically diverse habitats in North America.

The Longleaf Alliance (LLA) works in partnership with private landowners, federal and state agencies, other NGOs, and industry to guide the restoration, stewardship, and conservation of the longleaf pine ecosystem. This outreach video, produced by Abel Klainbaum for LLA, is intended to raise awareness of this unique native ecosystem in the general public. The information presented, through the shared perspectives of four active members of the longleaf community

Piedmont Prairie Initiative

Rua Mordicai, U.S. Fish & Wildlife Service, Science Applications

Rickie White, Ellerbe Creek Watershed Association

Carrie Radcliffe, Atlanta Botanical Garden

Jim Affolter, State Botanical Garden of Georgia

Jennifer Ceska, State Botanical Garden of Georgia

Dr. Johnny Randall, North Carolina Botanical Garden Alan Weakley, North Carolina Botanical Garden

Dwayne Estes, Southeastern Grasslands Initiative

Julie Tuttle, University of North Carolina - Chapel Hill

The Piedmont is home to one of the fastest-growing urban megaregions in the country, stretching from Raleigh-Durham to Atlanta and into Birmingham, AL. Historically, much of the region was covered in grasslands, including pine-oak savannas and open treeless prairies, maintained by frequent fire and grazing by bison and elk. Most Piedmont residents don't know that the thick upland forests they see today were very different before European arrival. This is one of the major barriers to bringing grasslands back to the region. The Piedmont Prairie Partnership is a group of non-profit, state, and federal agencies working to bring back Piedmont Prairies in an area from Virginia down to Alabama. Late in 2019 to

early 2020, the partnership created two videos to help tell the story of the past, present, and future of prairies in the Piedmont.

Conserving Medicinally and Culturally Significant Southeastern Plants

Introduction and overview

Dr. Anne Frances, Lead Botanist, NatureServe

The southeastern flora includes many medicinally and culturally significant species. Medicinal plants harvested from southeastern states comprise a multi-million-dollar industry and include well known examples like American ginseng and goldenseal. Culturally significant species comprise a large number and wide variety of plants used by Native American and other groups. Conservation of these species requires different approaches than those normally undertaken for rare species. This is because the conservation goal goes beyond preventing extinction and includes ensuring sustainable harvesting into the future. While accounting for the effects of collection and harvest is essential to determining effective conservation measures, we often lack scientific data to effectively track declines and enact conservation practices. This challenge is amplified because many medicinally and culturally significant plants are wide-ranging, increasing the cost and complexity of thorough monitoring. The sustainable use of culturally significant plants must also incorporate the Traditional Ecological Knowledge of groups using the species. Conserving medicinal plants in the commercial industry involves understanding the myriad laws, policies, and programs that govern their harvest and sale, and frequently go beyond the knowledge of plant conservation practitioners.

This session will explore different aspects of medicinally and culturally important plant conservation in the southeast, featuring partnerships that aim to bridge the gap among different stakeholder communities. Talks feature topics such as the Culturally Significant Plant Species Initiative, a collaboration between the Eastern Band of Cherokee Indians and Southern Appalachian Man and the Biosphere Cooperative, who collaboratively promote the sustainability, management, and conservation of culturally significant plant species within the southern Appalachian region. Other topics include ginseng harvesting and monitoring in Kentucky, conservation status of Trillium species, interfacing with foragers to determine ethical foraging practices, and developing genetic tools to safeguard cutleaf coneflower (*Rudbeckia laciniata*), and ramps (*Allium tricoccum*) in the Great Smoky Mountains National Park.

Developing New Approaches to Restoration of Culturally Significant Plant Species

Joanne Baggs, Brian Davidson, Mark Healy, and Mark Pistrang; USDA Forest Service

The Southeastern Region (Region 8), Southern Research Station, and the Shawnee and Mark Twain National Forest are starting a cooperative effort to promote the sustainability, management, and conservation of culturally significant plant species and habitats through restoration, education, and research. This agreement will build on the mission of the

Culturally Significant Plant Species Initiative (CSPSI) between The Eastern Band of Cherokee Indians and Southern Appalachian Man and the Biosphere. Incorporating and respecting Traditional Ecological Knowledge of indigenous peoples with deep traditions of using plants is at the core of the CSPSI. The future activities will focus on cultural and natural resource related goal and objective, especially related to the protection, conservation and education of culturally significant plants and plant communities important to native peoples and to utilize their traditional ecological knowledge. Anticipated outcomes will be discussed.

Kentucky's Forest Biodiversity Assessment Program:

A Model for Capturing Trends and Distribution of Forest Medicinals and More

Tara Littlefield, Office of Kentucky Nature Preserves

The Office of Kentucky Nature Preserves (OKNP) is the natural heritage and natural areas program for Kentucky. OKNP maintains the Kentucky rare species database, and acquires and manages natural areas and nature preserves that host high quality communities and rare species. In 2019, OKNP created the Kentucky Forest Biodiversity Program (KFBP) in order to more efficiently address conservation concerns of Kentucky's forests such as a conservation status of forest medicinal plants and other species of conservation concern, forest health, floristic quality, and increases in invasive species. OKNP conducted forest assessments at long term monitoring sites in approximately 20% of Kentucky's counties. 20% of counties will be surveyed each year, completing the state wide inventory after 5 years (2019-2023). The KFBP focuses on surveys of rare and conservative forested plant species, forest community diversity and structure, herbaceous diversity, forest medicinal plants/species of commercial concern, invasive species and other threats. With creation of new partnerships, OKNP was able to increase staff and resources to make the KFBP possible. By leveraging existing resources of several statewide projects, creating an efficient data collection standard and building a larger database for all species and communities (biodiversity database), OKNP was able to create a more comprehensive program that addresses core biodiversity questions of Kentucky's forests and meets the data needs for various partners throughout the state.

The Culturally Significant Plant Species Initiative (CSPSI): A Collaboration of the Eastern Band of Cherokee Indians and the Southern Appalachian Man and the Biosphere Cooperative

Tommy Cabe, Maria Dunlavey and Mike LaVoie Eastern Band of Cherokee Indians

Mark Healey, United States Forest Service

The Culturally Significant Plant Species Initiative (CSPSI), chartered in December 2018, is a collaboration between the Eastern Band of Cherokee Indians and Southern Appalachian Man and the Biosphere Cooperative. Its mission is to collaboratively promote the sustainability, management, and conservation of culturally significant plant species within the southern Appalachian region through restoration, education, and research. Incorporating and respecting Traditional Ecological Knowledge (TEK) of indigenous peoples with deep traditions of using plants, is at the core of the CSPSI. Here, we report on initial CSPSI efforts and plans for the future.

The Ethical Forager: A Review of Harvesting Regulations and Practices for Threatened Medicinal Plants on Public and Private Lands in the Southeast

Laramie Smith, University of Georgia

Dr. James Affolter, State Botanical Garden of Georgia and Department of Horticulture at the University of Georgia

As the herbal supplement and alternative health industries grow, foraging for wild medicinals is becoming a more common and profitable phenomenon. In addition to the financial incentive to harvest non-timber forest products (NTFPs), there is a cultural push to “return to the land.” These motivations have raised the prevalence of abusive foraging habits, such as poaching or over-harvesting, increasing the threat to certain useful plant species. Our project draws upon the literature and experiences of two stakeholder populations—foragers, and professionals in the field of resource management and conservation—to garner insights about how to improve our response to foraging abuses of threatened but profitable plant species native to the Southeast. We interviewed members from both populations and compiled a summary of their responses; compared current conservation rankings and practices to determine how well they reflected economic factors affecting plant populations; and conducted three case studies on potentially threatened native medicinal plants, assessing both alternative acquisition methods and potential therapeutic substitutes. While the project is on-going, initial results reveal three themes: conservation practices and policies do not adequately address plants that are at risk due to targeted collection for economic benefit; stakeholder populations (resource managers and foragers) do not interface effectively or frequently, but there is potential to work together based on a shared value set; viable alternatives exist for many threatened native medicinal plants, but these are understudied and only folklorically known. This pilot study suggests that foragers might already have the ideal tools for combating harvesting abuses within their own communities. If the foraging community and environmental regulators work in partnership, it should be possible to develop an interactive environmentalism that establishes a productive balance between use and preservation, economy and conservation. This could lead to a more integrated conservation model than those currently in place.

Developing Genetic Tools to Safeguard Harvested Species in the Great Smoky Mountains National Park

Dr. Matt Estep, Appalachian State University

Jennifer Rhode Ward, University of North Carolina at Asheville

Many plant species are being driven towards rarity due to exploitation for food, medicine, or the nursery trade. Land managers in the Smoky Mountain National Park are particularly concerned about two plant species: cutleaf coneflower / Sochan (*Rudbeckia laciniata*), and ramps (*Allium tricoccum*). Both of these species are traditionally foraged for food and ceremonial use by the Eastern Band of Cherokee Indians, and parklands will soon open to limited collection by EBCI members. To ensure the health and vitality of these species, a combination of demographic and genetic data are being collected. These will be used to assess baseline genetic diversity and prioritize populations for conservation. Developing novel molecular tools for monitor imperiled plant species is one avenue towards safeguarding their futures, as these tools can be used to identify problematic reductions in genetic diversity over time.

Three petals, three partners, three genera: Results of an innovative partnership for Trillium conservation

Clayton Meredith, ABQ Bio-Park

In a partnership between the IUCN Species Survival Commission (IUCN SSC), NatureServe, and ABQ BioPark, conservation status assessments and comprehensive species action plans are being developed for select medicinal plant taxa. This effort is part of a larger collaboration between zoos, gardens, and aquaria and the IUCN SSC, which aims to build a more robust Red List, thereby strengthening the first component in the Assess-Plan-Act model. A recent assessment of the conservation status of the genus *Trillium* in North America demonstrates the potential outcomes of such partnerships and the role public gardens can play in conservation initiatives. In 2019 this collaborative effort sought to generate IUCN Red List assessments, update NatureServe global ranks, and develop a comprehensive conservation plan for the genus *Trillium*.

Through the assessment process, major threats to the genus and areas where additional research is needed were identified. Overabundance of white-tailed deer and habitat degradation caused by feral pigs are the most pervasive threats to the genus, but minor threats were identified at a regional scale which warrant investigation in other parts of the genus' range. The southern Appalachian region is the center of *Trillium* diversity and is also at the confluence of several major threats to the genus. However, threats can be further distinguished based on habitat type and impact with respect to reproductive biology, which allows for targeted conservation initiatives. This approach maximizes the efficiency of these plans and allows for resources to be used effectively to promote plant conservation. This supra-species level approach has the potential to streamline conservation initiatives and build partnerships for large scale programs reducing extinction risk for large numbers of species simultaneously.

Kentucky's American Ginseng (*Panax quinquefolius*) Management Program

Anna Lucio, Kentucky Department of Agriculture

The annual American ginseng (*Panax quinquefolius*) (ginseng) harvest is rooted with deep cultural and economic value in communities not often touched with conventional agriculture programs. Authorized under Kentucky statute and regulation, the Kentucky Department of Agriculture administrates the ginseng program for Kentucky. The requirements for this program come from necessity in order to have legal trade access on the international market as a species listed on Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) which the United States has ratified as part of 50 CFR Part 23.

The general assembly established Kentucky's program in 1982 with the latest updates in 2010. This presentation will outline the management of the current Kentucky program in terms of the processes in place to ensure a future ginseng harvest.

Plant Conservation Alliances workshop

Meet your Agency & Natural Heritage Network Botanists

Joanne Baggs USDA Forest Service Southern Region

Kelly Bibb U.S. Fish & Wildlife Service

Dr. Anne Frances NatureServe & The Natural Heritage Network

Dr. Mincy Moffett Georgia Department of Natural Resources, Wildlife Conservation Section, State Heritage Programs and SWAPS – Southeastern U.S. Overview

Federal and state agencies partnered with museums, universities, and NGOs to coordinate the Southeastern Partners in Plant Conservation (SePPCon) inaugural conference November 2016, hosting partners from 22 U.S. States and Territories to focus on At-Risk and Listed Species and develop a regional network for plant conservation. Unexpected, yet positive, outcomes for this SE region plant conference included the removal of 10 plant species from the Federal Petition species list from the Center for Biological Diversity. Since 2017, several states started their own plant conservation networks. Currently there are 12 states and micro-regions collaborating, mentoring, and twinning to foster the development of their own PCA's with the prime emphasis on recovery of plant species and communities on public lands. Because the recovery plant species and their communities requires long term commitments, often requiring decades of ongoing collaboration, monitoring, and management, best practices for recovery of species is firstly targeted on protected lands like federal lands, including National Forests, Department of Defense lands, National Parks, DOT rights of way, and state lands like state parks and Wildlife Management Areas. Plant conservation networks throughout the SE US have valued and sought partnerships like this.

Promoting Plant Conservation: Species of Greatest Conservation Need in State Wildlife Action Plans

Mincy Moffett, Jr., Georgia Department of Natural Resources, Wildlife Conservation Section

State Wildlife Action Plans (SWAPs) are multi-year strategies in which every U.S. state and territory assesses the health of its wildlife and lays out steps for conserving it over the long term. These plans establish a framework for conservation efforts that aim to protect species before they are endangered, with each plan custom-fitted to its jurisdiction's unique needs and priorities. One of the eight (8) required elements for a U.S. Fish & Wildlife Service approved plan is the identification of Species of Greatest Conservation Need (SGCN) within each jurisdiction.

Unfortunately, most states have not included plants among their SGCN, with only 18% (8 of 56) of states/territories doing so in the 2005 plan, and 34% (19 of 56) in the 2015 revision. Among the states/territories within the SePPCon footprint, 17% (3 of 17) included plants in 2005, and 53% (9 of 17) in 2015. Reasons given for this include: 1) state wildlife agencies charged with the development of SWAPs not having regulatory authority for plant conservation; 2) agencies not having botanical technical expertise on staff; and 3) plants being excluded from the federal definition of 'wildlife' under the State and Tribal Wildlife Grants program and, therefore, ineligible for direct funding. One goal of SePPCon (and a future Southeastern Plant Conservation Alliance [SEPCA]), will be to encourage and support the inclusion of plants as SGCN in SWAPs by all regional members. The next SWAP revision for most states is due in 2025, with preparations beginning in the next few years.

Alabama: Patrick Thompson, Auburn University Davis Arboretum

Mid-Atlantic: Amy Highland, Mt. Cuba Center

Florida: Houston Snead, Jacksonville Zoo and Gardens

GEORGIA: Jennifer Ceska, State Botanical Garden of Georgia

Kentucky: Tara Littlefield, Office of Kentucky Nature Preserves

Mississippi: Dr. Toby Gray, Mississippi State University

North Carolina: Michael Kunz, North Carolina Botanical Garden, University of North Carolina at Chapel Hill

PENNSYLVANIA: Kristi Allen, Pennsylvania Department of , Conservation and Natural Resources

SOUTH CAROLINA: April Punsalan, US Fish & Wildlife Service,

Tennessee: Cooper Breeden, Southeastern Grasslands Initiative, Austin Peay State University

Plant conservation networking on a regional scale: Southeast plant conservation alliance coordinators conference calls build camaraderie, leverage knowledge and facilitate beneficial plant conservation work throughout the region and beyond

David Lincicome, Division of Natural Areas, Tennessee Department of Environment and Conservation

Plant conservation networking on a regional scale: Southeast plant conservation alliance coordinators conference calls build camaraderie, leverage knowledge and facilitate beneficial plant conservation work throughout the region and beyond. A bi-monthly conference call was started in December 2017 to increase communication among the coordinators of plant conservation alliances (PCA) or similar entities in the Southeast United States. As Tennessee was organizing its PCA in 2017 we leaned heavily on our neighbors in Georgia and Alabama for help and guidance. Several other states in the Southeast were also pursuing the formation of a PCA. Initially, the intent of the call was to provide an opportunity for those with established PCAs to share their conservation networking experience with those states in pursuit of a PCA, and for everyone to share conservation successes and challenges with their peers in other states on a regular basis. For each call a state guest has also been invited to participate. The intent of the state guest participation has been to provide the PCA coordinators with additional insight into what has been occurring within their neighboring states, and for the state guest to gain additional insight into what has been happening throughout the region regarding plant conservation efforts. In addition to the state guest, occasionally a special national level guest has been invited to participate in the calls. These guests have come from the Center for Plant Conservation, the Native Plant Conservation Campaign, NatureServe and the U.S. Fish and Wildlife Service. Similarly, the intent of the national guest participation has been to provide the PCA coordinators with additional insight into what has been occurring at the national level, and for the national guest to

learn about what has been happening throughout the Southeast region regarding plant conservation efforts. Ultimately, the bi-monthly call has helped create a more cohesive and effective plant conservation network throughout the Southeast and beyond.

Developing Conservation Opportunity Areas for Arkansas: The Importance of Recognizing Partners in the Landscape

Dr. Toby Gray, Mississippi State University

The Association of Fish and Wildlife Agencies (AFWA) recommends the identification of Conservation Opportunity Areas (COAs) as a best practice for State Wildlife Action Plan (SWAP) revisions. Of the ten southeastern states of the US Fish and Wildlife Region 4, seven have incorporated some version of COAs into their plan. In 2018, the Arkansas Game and Fish Commission convened a team of stakeholders charged with developing COAs for the state of Arkansas. Partners included the U.S. Fish and Wildlife Service, the Arkansas Natural Heritage Commission, The Nature Conservancy, and Pheasants Forever. The team reviewed the Southeast Blueprint developed by the Southeast Conservation Adaptation Strategy (SECAS) and versions of COAs developed by neighboring states, then decided on a process that would evaluate habitat condition, species distribution, and conservation opportunity as distinct important elements guiding the selection of geographical areas. Habitat condition information was derived from the inputs to the mid-south region's latest contribution to the Southeast Blueprint. Species distribution data came primarily from Heritage Commission records and included plant species not identified in the SWAP. Conservation opportunity was measured by a "partner density" map, an overlay of eleven different sets of areas of interest identified by a diverse selection of state, federal, and non-governmental conservation partners. The three elements (habitat, species, and opportunity) were used to prioritize the landscape into three classes (high, medium, and low quality), resulting in 27 unique combinations of classified landscape ranks. Using the landscape ranks as a guide, the set of twenty-one draft COAs were developed through six workshops with the team of conservation partners. This is a case study of partner inclusion in a state-level development of a conservation support tool.

RECOVERY IS POSSIBLE

INTRODUCTION & OVERVIEW

Kelly Bibb, U.S. Fish & Wildlife Service

Geoff Call, U.S. Fish & Wildlife Service

David Lincicome, Natural Heritage Program Manager, Tennessee Department of Environment and Conservation (TDEC)

Andrea Bishop, Natural Heritage Program Botanist, TDEC - Retired

Effective partnerships guided by shared goals, such as recovery criteria, make it possible to recover endangered and threatened species of plants. For species listed under the Endangered Species Act (the Act), recovery plans provide measurable criteria for determining when they should be considered for delisting. These plans identify threats affecting listed species and describe actions that should be taken to understand the biology and ecology of those species and to reduce threats to the point that listing is no longer needed – i.e., to achieve recovery criteria. From the decision to list a species, to the development of a recovery plan, to the ultimate goal of delisting species, partnerships are vital for carrying out the purposes of the Act. The Service relies on recovery actions carried out by partners in State and Federal agencies, academia, private citizens, or – in the case of plants – botanical gardens. We also rely on data to demonstrate the effectiveness of those recovery efforts. The importance of reliable data in bearing out the effectiveness of recovery efforts cannot be overstated. The Service publishes rules to delist or reclassify species only after multiple levels of review, beginning in our field offices and ending with our headquarters in Arlington, Virginia. Biologists in Service field offices rely on data from our partners in preparing compelling rules that withstand careful scrutiny.

Section 6 of the Act is titled Cooperation with the States, and cooperation between the Service, State conservation agencies, and many other partners has been a key factor in Tennessee's plant conservation successes. Tennessee's first federally listed plant, *Echinacea tennesseensis*, was listed as endangered in 1979. The state currently has 21 federally listed species of plants. Over the years there have been significant conservation successes. In 2002, *Scutellaria montana* was down-listed. In 2005 *Helianthus ergertii* was successfully recovered followed by the recovery of *E. tennesseensis* in 2011, 32 years after it was first listed. Plant conservation and recovery does not occur in a vacuum, especially when endangered and threatened species are at stake.

In the early years of Tennessee's Section 6 plant recovery program much of the work focused on recovery of *E. tennesseensis*, despite minimal coordination with the Service. During this time, Tennessee's botanists forged partnerships with a community of plant conservationists in academia, NGOs, Federal agencies, and botanical gardens. By 1998 a closer relationship had developed between the local Service staff and the state botanists conducting recovery work, with the Service becoming a more active partner in Tennessee's plant conservation community. Annual recovery coordination meetings between the Service and the state were more productively guiding conservation efforts. About the same time the state's Natural Areas Program was rapidly building on its own successes in protecting significant conservation lands. The inertia gained from the two programs and close working relationship between the Service and the state led to the recovery successes in the 2000's. As a result another endangered species is close to being considered for recovery. Still more plant conservation work remains and through conservation networking, shared goals and priorities, and leveraged resources a broad-based partnership is emerging in Tennessee to effectively conserve all of the state's imperiled plants.

Science in Recovery

Life History of *Euphorbia telephoides*, a Threatened Species Endemic to the Florida Panhandle: Are These Data Useful to Evaluate Conservation?

Dr. Vivian Negrón-Ortiz, U.S. Fish & Wildlife Service

Ms. Melanie Kaeser, U.S. Fish and Wildlife Service

To protect and manage species listed under the U.S. Endangered Species Act requires the use of the best available science. Field-based studies on topics such as demography, reproductive biology, and seed ecology have provided sound conservation strategies for many imperiled plants. Unfortunately, understanding of relevant biology is still lacking for numerous rare species. Such biological information was lacking for *Euphorbia telephoides*, a threatened species primarily endemic to pineland flatwoods in the Florida Panhandle. This species is a perennial herbaceous plant that has suffered from the effects of habitat loss, degradation, and fragmentation throughout the entire range of its distribution in Florida. This is the primary threat identified in the Recovery Plan of 1994, and remains the main threat to date. As part of a long-term study to understand the conservation requirements for the recovery of *E. telephoides*, three distinct populations were studied across the range of this species. We established one permanent plot in each population, and investigated size and reproduction, response to fire, and in situ seed germination and seedling survival from 2010-2014. *Euphorbia telephoides* plants are long-lived and survived fire by resprouting. This species is composed of males, females, and monoecious individuals with labile sex expression, a system that has the effect of ensuring outcrossing and thus contributing to genetic variability, but also guarantees pollination in the absence of cross-pollination. To minimize exposure to seasonally stressful conditions, both adults and seedlings exhibited obligate winter dormancy and facultative non-synchronized summer dormancy as well as prolonged vegetative dormancy. Seeds survive < 1 year, denoting that there is no persistent soil seed bank that can be relied on to maintain populations in the face of environmental stochasticity. However, once seedlings are established in the soil, they resprout back after fire, favoring a hypothesis that seedlings contribute to *E. telephoides* persistence. In conclusion, *E. telephoides* displays traits that are part of a life history that is adaptive in the fire-prone habitats where this species occurs. Implications for in-situ and ex-situ conservation programs will be discussed.

How Pollination Ecology Can Improve Recovery of the Southeast's Threatened Flowering Plants

Gavin Shotts, Department of Biological Sciences, Auburn University

Bashira Chowdhury, Department of Entomology & Plant Pathology, Auburn University

Producing seeds is critical to maintaining sustainable populations and adaptive genetic diversity for the Southeast's threatened flowering plants. Seed production often depends on adequate pollination, which is a frequent concern for threatened plants, and addressing pollination problems will improve recovery outcomes. We present a framework for applying insights from pollination ecology to species recovery, specifically how patterns of pollen movement and dependency on animal diversity can inform recovery actions. We use available data on breeding traits, mating systems, and pollinator diversity to produce targeted goals achievable under common strategies like outplanting or in concert with

insect conservation actions. To provide context for this framework, we review the pollination ecology of federal and state-listed endangered and threatened plants in Alabama, Georgia, and Tennessee, highlighting three species (*Apios priceana*, *Spigelia gentianoides*, and *Geum radiatum*) that exemplify how floral and insect data can support recovery goals.

Pollination Biology of Venus Flytrap Throughout its Range

Laura Hamon, North Carolina State University, Department of Applied Ecology/Department of Entomology & Plant Pathology), **Elsa Youngsteadt** (North Carolina State University, Department of Applied Ecology), **Rebecca Irwin** (North Carolina State University, Department of Applied Ecology), **Clyde Sorenson** (North Carolina State University, Department of Entomology & Plant Pathology)

As part of informed conservation management, it is crucial to understand the factors that limit reproductive success in rare plants. Animal pollination is essential for sexual reproduction in most flowering plants, but the pollination ecology of many rare plants remains unknown. In this study, I examined the basic pollination biology of Venus flytrap (*Dionaea muscipula*), including its mating system, phenology, and most effective pollinators. To do this, I supplemented pollen, monitored flowering, and recorded pollinator visitation to *D. muscipula* in the field. In addition, I supplemented pollen to individuals across a gradient of latitudes and population densities as part of an effort to quantify pollen limitation throughout the range of *D. muscipula*. The results of this study will provide insight into the variables that affect reproductive success in *D. muscipula*, which is currently under consideration for listing under the Endangered Species Act.

Reproductive Ecology of a Rare Florida

Endemic Mint, *Macbridea alba*

Brenda Molano-Flores, Illinois Natural History Survey, University of Illinois: Urbana-Champaign, Sara Johnson, Department of Natural Resources and Environmental Science at University of Illinois: Urbana-Champaign, & **Janice Coons**, Eastern Illinois University

Macbridea alba (Lamiaceae) is a federally threatened and state endangered perennial herbaceous mint. It is endemic to grassy pine flat woods and occupies a range of conditions from wet savannas and sand hills, to disturbed roadsides. Several studies have been conducted to assess genetic diversity, pollinators, breeding system, and seed germination in *Macbridea alba*. In addition, work associated with seed banking and flowering in relation to fire has only been published in abstract form making replicability difficult and most of this work has been limited to a few populations. Results from these studies point to: 1) low levels of genetic diversity, 2) need for pollinators such as *Bombus spp* to facilitate gene flow and fruit/seed production, 3) seed germination is high, 4) vivipary occurs, 5) seeds have limited long-term storage capacity and a lack of dormancy, 6) and flowering may decrease as time since fire increases. However, two areas that have not been fully explored are the reproductive success (i.e., fruit set, seed set, and germination) and pre-dispersal seed predation across multiple populations and their role in the long-term persistence of *Macbridea alba* populations. In 2019, seven *Macbridea alba* populations within Apalachicola National Forest were visited to better understand the reproductive

ecology of the species. At each site, infructescences were collected and fruit set, seed set, herbivory, and pre-dispersal seed predation were documented.

Also, information about vivipary, i.e. premature germination of the seed within the calyx, was gathered. Lastly, collected seeds were used to assess seed germination. Our preliminary results are showing variation among populations for all the metrics that have been measured. Based on these findings, we can better understand the life history strategies and reproductive ecology of this rare plant for conservation both in-situ and ex-situ in the future.

The Role of Fruits and Fires in the Germination of a

Rare Subshrub, *Amorpha georgiana* (Fabaceae)

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

Wade A. Wall, US Army Corps of Engineers, Engineer Research and Development Center

Matthew G. Hohmann, US Army Corps of Engineers, Engineer Research and Development Center

Plants utilize multiple strategies in the recruitment of new individuals to maintain populations over time and space. Seed dormancy is one such strategy that has evolved to ensure germination occurs under favorable environmental conditions, maximizing possible recruitment success. Understanding species-specific requirements needed to break dormancy and induce germination can provide insight into ecological processes, effects of changing environmental conditions, and potential conservation actions. *Amorpha georgiana* (Georgia indigobush, Wilbur) (Fabaceae), is a rare subshrub of conservation concern found in fire-maintained longleaf pine habitats in the southeastern United States. We sought to identify the mechanistic and ecological factors that lead to the successful germination of *A. georgiana*. We conducted two experiments: one on both seeds and whole fruits (pods) to test methods of dormancy release, and a second on seeds only to test germination response to varying temperatures and seasonality of dormancy release. Regardless of treatment, seeds have low germination when remaining in their pods. Indehiscent pods appear to present a physical barrier to successful germination, but are not the cause of physical dormancy. Both mechanical scarification and heat shock at pyrogenic temperatures (>80 °C) produced significantly higher germination than all other treatments. Although a small percentage of seeds are non-dormant, indicating a seed polymorphism that would facilitate germination during inter-fire intervals, *A. georgiana* can be classified as having obligate pyrogenic dormancy release. We also found the season of dormancy release likely affects successful germination rate. Therefore, we suggest pulses of heat from periodic growing season fires are likely necessary to promote recruitment and maintain populations of this rare species.

Seed Dormancy and Soil Seed Bank

Persistence in the Federally Endangered

Short's Bladderpod (*Physaria globosa*)

Noah Dell, Missouri Botanical Garden

Geoff Call, United States Fish and Wildlife Service

Matthew A. Albrecht, Missouri Botanical Garden

Short's bladderpod (*Physaria globosa*) was recently listed as federally endangered due to population decline across its range in Tennessee and Kentucky. However, little is known about the biology of the species and the potential mechanisms underlying range-wide declines. In short-lived mustards, seed dormancy and seed bank persistence can play an important role in regulating population dynamics and response to disturbance. To address the recovery plan objective of enhancing knowledge of Short's Bladderpod to facilitate the development of scientifically sound management plans, we conducted laboratory experiments and a seed burial study to examine what environmental cues promote dormancy break and whether or not seeds form a persistent seed bank. A majority of seeds are in primary dormancy when dispersed in summer. Germination percentages are generally low, and long cold stratification times are needed to break dormancy. Seeds that were cold stratified at 2°C for 12 weeks and then incubated in a 20/10°C alternating temperature regime achieved the highest average germination percentage (24%). Warm stratification with or without alternating wet/dry cycles did not improve germination percentages over cold stratification treatments. However, constant imbibition in warm temperatures may have promoted viability loss, as germination percentages were lower than seeds kept at warm temperatures with alternating wet/dry cycles. Results from the seed burial study were consistent with those in laboratory experiments and indicate a cold stratification requirement for dormancy-break. Germination of buried seeds was greater in light than darkness and varied seasonally: 0% and 1% in dark and light conditions, respectively, in October following dispersal, 7% and 21% in January, 23% and 36% in March, 9% and 10% in June, and 4% and 8% in October in the year following dispersal. Seeds that afterripened in ambient indoor conditions for up to one year germinated to low (< 2%) percentages, indicating dry storage does not substitute for cold stratification in breaking seed dormancy. The germination niche of *P. globosa* can be defined by physiological dormancy, a long cold stratification period at low temperatures for dormancy break, formation of a persistent soil seed bank, and annual dormancy/non-dormancy cycling in buried seeds. Results from this study shed light on Short's bladderpod regeneration biology and have implications for population management.

***Varronia bellonis* (Cordiaceae) as a Model for Plant**

Conservation in Puerto Rico and the Virgin Islands

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Varronia bellonis (Cordiaceae) is a threatened plant species endemic to Puerto Rico. Prior to our work, little was known about the status of natural populations, the species phenology, pollinators, seed dispersal or its habitat requirements with no investigations into its genetics or pollination syndrome. An international group is working to resolve the species

taxonomic placement and determine the biogeography and genetic diversity of populations to develop management strategies for the species recovery. Before this study, around 40 collections lodged in herbaria since the species discovery in 1884 with deficient data on locality and phenology. The IUCN Red List assessment for the species in 2014 as Critically Endangered estimated only 47 mature individuals remaining in the wild based on available literature.

Desk-based studies pulled together available resources into a GIS, including all available occurrence records, land cover maps from cloud-free Landsat imagery and surface geology data from the US Geological Survey. Field-based activities have been undertaken in and around the three historic locations known to have supported populations, including presence/absence survey, sampling for genetic analyses, camera trapping for plant-animal interactions and collection of habitat, phenological and morphological data. We found extant populations in and around the Maricao, Rio Abajo and Susúa State Forests and have documented several previously unknown locations in Arecibo, Lares, Sabana Grande, San German and Utuado. The current estimate ~ 300 is mature individuals, plus seedlings. A strong correlation between the species recorded locations and specific geology and land cover types was observed suggesting the importance of habitat preference. We have secured ex-situ collections with seed stored in the seed bank at the University of Puerto Rico, Mayagüez campus and initiated trials to develop germination protocols to support future propagation and reintroduction efforts. Camera trapping has revealed many animals interacting with the plant suggesting the importance of forest remnants for the species conservation. Our work is providing baseline information for developing a sound recovery plan based on the species population genetics and the conservation status of remnants of preferred habitat. The project provides a framework for the collaboration on the conservation of regional endemics and for prioritizing the research needs of these species.

Ecology and Conservation of the Federally-Listed Coastal Cactus *Harrisia aboriginum* in SW Florida

Shawn C. McCourt, Sally M. Chambers, and Bruce K. Holst, Marie Selby Botanical Gardens

The genus *Harrisia* (Cactaceae) comprises 20 narrowly endemic species of night-blooming cacti with two widely separated geographic ranges, including South America south of Amazonia, as well as the West Indies and southern Florida. Commonly known as aboriginal prickly-apple, *H. aboriginum* is a sprawling, multi-stemmed, columnar cactus endemic to ancient native American shell mounds, as well as coastal berms, coastal grasslands, and maritime hammocks in four counties along the southwest coast of Florida. This federally-listed species is in steep decline, primarily due to the development of beachfront property, invasive species dominance, and the erosion of coastal barrier islands. Some populations have disappeared entirely. Researchers at MSBG have been conducting an inventory of extant populations, assessing the health of each population, and determining what genetic variation (if any) occurs across the species' geographic range. When possible, a small portion of seed has been collected for seed banking and to grow plants for the augmentation of shrinking populations and introduction to ecologically suitable sites situated above projected rises in sea level. To date, we have visited nine sites and collected detailed demographic data for 89 plants. Spines were collected from all 89 plants for DNA extraction and the testing and developing of microsatellite loci. Seeds from seven fruits were collected from three sites. Data presented represent the preliminary findings of our work, which has a focus on the importance of maintaining genetic diversity in ex situ collections for the purpose of rare plant conservation.

**Examining Morphological and Habitat Variation within
Stenanthium gramineum (Eastern Featherbells, Melanthiaceae)**

Hannah Cook, M.S. Candidate, Biology, Western Carolina University

Stenanthium gramineum (Ker. Gawler) Morong, commonly known as “Eastern Featherbells” is a perennial herb that occurs in the Southern Appalachians and more broadly throughout the midwestern, southwestern and eastern U.S. Historically, this species has been under-studied, and is taxonomically unclear. Currently, two varieties are recognized, distinguished in part by habitat differences. *Stenanthium gramineum* var. *gramineum* is considered a rock-outcrop species throughout its large range of the southwestern, midwestern and eastern U.S., but also occurs on grassy balds and serpentine barrens of the Southern Appalachians. *Stenanthium gramineum* var. *robustum* (S. Watson) Fernald is said to be found in bogs and wet meadows; it is listed as endangered and threatened throughout its native range of the eastern U.S., causing need for special attention. A third variety, *S. gramineum* var. *micranthum* Fernald, is not currently recognized, but was described on the basis of its unique granitic dome rock outcrop habitat. It appears to be extremely rare, and seems to be exclusive to a small range within the eastern U.S. In sum, each of these varieties occupy unique, sensitive habitat, and potentially could be recognized as separate species, as they may display discrete differences in morphological characteristics. The goal of this project was to investigate morphological and ecological characteristics of the three *S. gramineum* varieties in order to clarify their taxonomy and aid conservation. During the summer and fall of 2019, I located seven flowering populations of two taxa (var. *gramineum* and var. *robustum*) in the Southern Appalachians, measured morphological and environmental characters in the field and collected samples for morphological, leaf anatomical and pollen analysis. To expand the dataset, I measured multiple morphological characters on herbarium specimens from throughout the ranges of each taxon. Multivariate analysis will be performed to determine whether two or more distinct entities can be discriminated based on these data. This study should clarify the taxonomic status of var. *robustum* and identify the most reliable characters used to define it, and should facilitate identification and conservation of this rare taxon.

Assessment of Science Needs for Rare Plants of Conservation Concern in Southeastern Grasslands

Dr. Reed Noss, Southeastern Grasslands Initiative, Florida Institute for Conservation Science and Southeastern Grasslands Initiative (Contractor)

Jennifer Cartwright, U.S. Geological Survey Dwayne Estes, Southeastern Grasslands Initiative

Theo Witsell, Southeastern Grasslands Initiative

Grasslands of the southeastern United States are considered “endangered ecosystems,” with many grassland types having been reduced by more than 90% since European settlement and some types approaching 100% loss. Many southeastern grassland ecosystems and the rare species they support are now facing additional threats from climate change, invasive species, and other habitat changes. Recently, grassland managers and researchers from state and federal agencies, NGOs, and universities collaboratively held a regional workshop to identify key science needs for the conservation of southeastern grassland ecosystems and species. The workshop focused on identifying the types of scientific information needed to support the U.S. Fish and Wildlife Service and state agencies in the development of Species Status Assessments (SSAs) for grassland species listed as endangered or threatened under the U.S. Endangered Species Act (ESA) or under consideration for such listing. Because SSAs provide a unified, official resource for species’

biological information pertinent to all ESA-related decisions (e.g., listing, permitting, Habitat Conservation Plans, and recovery planning), it is critical that they be informed by the best available science. However, research and data are often limited for rare plant species, especially related to potential future climate-change effects on habitat and population trajectories. This presentation addresses some of the major findings from the needs-assessment workshop and discusses possibilities for future research projects to help fill key knowledge gaps identified by workshop participants. Collectively, this needs assessment will help guide the development of collaborative research projects targeted at addressing the most pressing scientific needs for conserving southeastern grassland species of conservation concern.

CONSERVATION GENETICS

How Genomic Data Can Help Land Managers;

Needs Identified by Hawaiʻian Land Managers

Working with Endangered Lobelioids

Dr. Jeremie Fant, Chicago Botanical Garden

Many land managers are aware of the value of genetic data for making important decisions for the management of rare species. In the ever-expanding world of Genomics, practitioners now have access to more comprehensive and accurate data. However, the speed of change can make it hard to keep up to date with the technology and to appreciate what it offers, not to mention how to access this technology. After hosting a workshop on genomics tools in Hawaiʻi, it became clear that there can be a large gap between needs and access. After the workshop, we surveyed the needs of Land Managers working on the restoration of Lobelioid species – one of the most endangered taxonomic groups in Hawaiʻi. The aim of the survey was to 1) identify common needs, 2) clarify what genomics can offer (potential and limitations), and 3) develop ideas for the best ways of moving forward. This presentation will cover the lesson learned from this survey and hopefully help other land managers identify how they can too incorporate genomics into their management plans.

Global Conservation Consortia:

Coordinating Collections for Exceptional Species

Christina Carrero, The Morton Arboretum

Emily Coffey, Atlanta Botanical Garden

Patrick Griffith, Montgomery Botanical Center

A 2019 study by Griffith, et al. showed that gardens must collaborate to conserve genetic diversity, especially for exceptional species whose seeds cannot be properly seed banked. This process of capturing the genetic diversity of exceptional species in ex situ collections requires a tailored strategy for each species, emphasizing the need for a coordinated effort by botanic gardens. By working through networked consortia, botanic gardens can implement

innovative solutions to safeguard these species in a changing world. We highlight a new initiative to conserve genetic diversity of exceptional species through a coordinated effort of gardens, using oak, magnolia, maple, and cycad consortia as case-studies. We outline the challenges and opportunities of conserving exceptional species within these distinct plant groups, providing solutions and recommendations that can guide collection efforts for other groups. The audience will gain a better understanding of exceptional plant species, conservation challenges, and innovative solutions. Participants will be provided with the tools and framework to join or create a consortium as a way to contribute to the conservation efforts of threatened exceptional plants. Our hope is that these presentations will gain new consortium members, growing a diverse, coordinated network of institutions and experts who will advance our goal in preventing the extinction of the world's exceptional species. Ultimately, by working through networked consortia, the sum of our efforts is greater than its parts.

Conserving Genetic Diversity of Southeastern Oaks and Magnolias in Botanic Gardens: How Much is Needed?

Dr. Sean Hoban, The Morton Arboretum

Taylor Callicrate, Species Conservation Toolkit Initiative, Chicago Zoological Society

Susan Deans, Plant Biology and Conservation Program, Northwestern University

Michael Dosmann, The Arnold Arboretum of Harvard University

Jeremie Fant, Chicago Botanic Garden

Oliver Gailing, University of Göttingen

Kayri Havens, Chicago Botanic Garden

Andrew Hipp, The Morton Arboretum

Priyanka Kadav, Michigan Technological University **Andrea Kramer**, Chicago Botanic Garden

Matthew Lobdell, The Morton Arboretum Tracy Magellan

Abby Meyer, Botanic Gardens Conservation International

Emma Spence, Center for Tree Science, The Morton Arboretum

Patrick Thompson, Auburn University

Raakel Toppila

Seana Walsh, National Tropical Botanical Garden Murphy Westwood, The Morton Arboretum

Jordan Wood, Illinois Natural History Survey

M. Patrick Griffith, Montgomery Botanical Center

Ex situ collections such as botanic gardens inspire and educate the public, provide material for scientific study, and produce material for ecological restoration. The challenge for an efficient and effective collection is safeguarding high genetic and ecological diversity in as few samples as possible, due to the relatively small resources available for conservation. A botanic garden might have resources to maintain a few to a few hundred plants of priority species in conservation collections, but not the thousands that seed banks can preserve. Providing scientifically grounded recommendations for the number of individuals that need to be conserved, and how to collect from the wild and manage collections over time, is a pressing need. Previous work using case studies and modeling of important biological traits has established the fact that some species must be sampled differently, and that widely used standard sample sizes

might not be optimal practice for capturing the maximum diversity. We present here a comparative study of ex situ gene conservation in three southeastern oaks (*Quercus georgiana*, *oglethorpensis* and *boyntonii*) and two magnolias (*M. pyramidata* and *ashei*). Specifically, we use genetic datasets and resampling algorithms to: quantify how much genetic diversity has been captured in a global network of botanic garden collections currently, resample the wild population genetic datasets to determine how much genetic diversity could be captured by varying sample sizes, determine minimal sampling needed to capture 70% and 95% of the genetic diversity, and use a diminishing returns method to calculate optimal stopping points- when additional collection effort no longer provides sufficient gains. Between 62 and 72% of genetic diversity is currently safeguarded for the oaks, and about 80% is conserved for the magnolias. The recommended collection size depends on key decisions by curators about the type of genetic diversity that is valued, but may range from approximately 50 to 200 individuals. We hope that these findings motivate future seed collections from wild provenances for botanic garden collections and stimulate discussion on ex situ gene conservation goals and outcomes.

Genetic Diversity Within and Among Populations of the Endangered Southeastern North American Plant Species, *Tiedemannia canbyi* (Apiaceae) and its More Common Congener, *T. filiformis*

Dr. Dorest Trapnell, Department of Plant Biology, University of Georgia

J.L. Hamrick, Department of Plant Biology, University of Georgia

Lisa M. Kruse, Wildlife Conservation Section, Wildlife Resources Division, Georgia Department of Natural Resources

Insights into levels of genetic diversity and spatial partitioning of that variation within and among populations of rare and endangered plant species are critical for the successful reestablishment or augmentation of its populations. Canby's Dropwort (*Tiedemannia canbyi*, Apiaceae) is an endangered Southeastern U.S. coastal plain species whose natural range extends from southwestern Georgia to southeastern North Carolina with a disjunct ($\approx 600\text{km}$) population in Maryland. *T. canbyi* currently consists of approximately 40 known populations. Levels and distribution of neutral genetic diversity within and among 14 populations of *T. canbyi* and 8 populations of its more common and widespread congener, *T. filiformis*, were assessed using 30 nuclear allozyme loci. While *T. canbyi* exhibited relatively high levels of genetic diversity ($H_e = 0.185$), the more widespread *T. filiformis* had significantly higher diversity ($H_e = 0.284$). Genetic differentiation among populations of both species was similar ($G_{ST} = 0.250$ and 0.254).

Patterns of genetic variation observed for these two *Tiedemannia* species are consistent with different groups of populations having originated from genetically discrete glacial refugia. Populations of *T. canbyi* formed two genetically distinct groups, southwest and southcentral Georgia vs. eastern Georgia, South Carolina, and Maryland. The two regions differ in among-population genetic variation within each region. Populations in the more northern region have moderate to low levels of genetic differentiation while populations in southwest Georgia region are genetically heterogeneous and may have been derived from separate and genetically different refugia. The disjunct Maryland population of *T. canbyi* had the lowest overall level of genetic diversity ($H_e = 0.089$) and all the characteristics of a population founded by long-distance founder event. Six of the eight *T. filiformis* populations from southern and coastal Georgia and coastal South Carolina formed one genetically similar group while an inland population from Georgia and an inland South Carolina

population were genetically distinct from each other and from the six coastal populations. In the context of population augmentation or restoration, this knowledge informs what actions are biologically appropriate to improve the probability of the species' preservation and long-term survival.

Conservation Applications of Recent Genetic Diversity Findings for the North American Plant Species, *Tiedemannia canbyi* (Canby's dropwort)

Lisa Kruse, Georgia Department of Natural Resources, Wildlife Conservation Section

Dorsett W. Trapnell, Dept. of Plant Biology, University of Georgia

J.L. Hamrick, Dept. of Plant Biology, University of Georgia

We have documented significant patterns in geographic partitioning of genetic diversity in *Tiedemannia canbyi* (Canby's dropwort). Populations of *T. canbyi* formed two genetically distinct groups, southwest and southcentral Georgia (S GA) and eastern Georgia, South Carolina, and Maryland (Atlantic Coast). The two regions differ in among-population genetic variation, with the S GA region having greater differences among populations.

In the context of population augmentation or restoration, this knowledge is critical to determine what actions are biologically appropriate to improve the probability of the species' long-term survival. In Georgia, we have prioritized habitat protection and restoration in the *T. canbyi* conservation strategy. For sites where habitat is marginal, safeguarding of seeds has occurred. Some *T. canbyi* populations have declined to where population augmentation or restoration into protected high-quality habitat is now the best option for conservation. We will present how the genetic patterns resolved in this study will be incorporated into the conservation strategy for *T. canbyi*. Other critical factors to this strategy for *T. canbyi* are population size, landowner relationships, funding availability, feasibility of habitat restoration, and climate change.

The Ecology of Hybridizing Pitcher Plants in Isolated Mountain Bogs

Dr. Rebecca Hale, University of North Carolina, Asheville

Wayne Morgan, UNC Asheville Biology Elise Powell, UNC Asheville Biology

Leila Beikmohamadi, Western Carolina University, Psychology

Mara Alexander, US Bureau of Land Management

Caroline Kennedy, UNC Asheville Biology

Jennifer Rhode Ward, UNC Asheville Biology

Pitchers of the purple pitcher plant, *Sarracenia purpurea*, are distinctly shorter and broader than those of other *Sarracenia*, which allows them to hold pools of rainwater. These phytotelma are subsequently colonized by a diverse invertebrate and microbial community, which appears to influence plant growth and reproductive effort. *S. purpurea* readily hybridizes with congeners to produce rosettes with morphologically intermediate pitchers, which are colonized by a similarly diverse, but less dense, community. Here, we tie together two aspects of our research investigating the ecology of hybrid

pitcher plants. We show that morphology of hybrids is intermediate between that of their parent species, *S. purpurea* var. *montana* and *S. jonesii* (mountain sweet pitcher plant). We also show that phytotelma community diversity and number of colonists varies with pitcher morphology. Finally, we related these data to recent analyses that link phytotelma communities to plant growth and reproductive effort, and consider the implications for the conservation of co-occurring, rare pitcher plants.

Safeguarding our Future

Recognizing the Significant Role *Ex Situ* Conservation Collections Play in Preventing Plant Extinctions

Wesley M. Knapp, North Carolina Natural Heritage Program

Preventing extinction is the lowest bar for conservation success we can set and the roll of ex situ conservation efforts in preventing extinction is becoming more significant. Continued work to document the extinct plants of North America north of Mexico has resulted in the discovery that up to 7 plants are extinct in the wild (EW). While these extinct plant taxa have no naturally occurring populations, they are still found in ex situ collections at botanical gardens. These collections may have issues in having full conservation value. Many collections were taken from few or single individuals and not necessarily intended to prevent the extinction of a species, but now represent the last known individuals. Some species reported as present in seed banks or botanical gardens are incorrectly identified. Additionally, botanical gardens having the last known individuals of a species are not necessarily aware of the significance of these collections. Evidence suggests a species has gone extinct while at a botanical garden because the specimen was destroyed before the significance of the collection was recognized. A prioritization of ex situ conservation efforts, using the best data is critical to prevent future extinction events. Single site global endemics or species of extremely narrow geographic distributions are the most susceptible to extinction. I will discuss a collaboration with NatureServe to identify global single site endemics that we hope will help prioritize seed banking and ex situ collections for these species following best practices to ensure quality/genetic diversity of collections. Additionally, an ongoing collaboration with the North Carolina Botanical Garden to prioritize the rarest plants in North Carolina for ex situ conservation efforts has already seen significant results.

Do Seedbanks Help Prevent Extinction?

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

Dr. Johnny Randall, North Carolina Botanical Garden, University of North Carolina at Chapel Hill

Misty Buchanan, North Carolina Natural Heritage Program

Wesley M. Knapp, North Carolina Natural Heritage Program

Dale Suiter, US Fish and Wildlife Service

The continued and increasing loss of biodiversity is one of the most significant conservation challenges we face as ecologists and conservationists. Preventing these losses must come from multi-faceted approaches working in concert, including protecting species and populations *ex situ*. Seed banks are a proven, highly effective and cost efficient way of preserving genetic diversity. In order to maximize the diversity of *ex situ* collections, best practices suggest collecting seed from throughout the species' range, including small, peripheral, and isolated populations. However, there is a far too common paradigm to only collect from large, healthy populations in effort to minimize unintended harm to geographically restricted species or those with already small or declining populations. Here, we will use over 30 years of seed bank data from the North Carolina Botanical Garden along with records from the NC Natural Heritage Program to explore the importance of comprehensive *ex situ* conservation. We will show how seed collections have conserved the diversity of species and populations that have significantly declined or become locally extirpated and discuss the conundrum of collecting from small populations. Finally, we will suggest ways in which we can work as partners to set priorities to further our plant conservation efforts

Range-wide *Ex Situ* Seed Conservation and Population Genetic Architecture Analysis in Venus Flytrap (*Dionaea muscipula*)

Dr. Johnny Randall, North Carolina Botanical Garden

Technology and Data Sharing in Support of Collaborative Plant Conservation: A Case Study from California's Regional Seed Banking Effort, California Plant Rescue.

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California is home to one third of the globally rare plant species in the United States. To secure this incredible flora, ten botanical institutions in California have joined together to form the seed banking collaborative, California Plant Rescue. By sharing our accession data and integration of combined dataset with our natural heritage database, we created a suite of tools in support of seed collections. These tools include a web-based accessions database, a mapping application for collections targeting, and a web-app that prioritizes species for collection based on location, conservation status, and phylogenetic diversity. From our dataset, we also conducted a gap analysis of current collections in order to direct our seed strategy moving forward. Our analysis evaluated the spatial, phylogenetic, landownership, and ecological patterns of seed collections in California. Some patterns were intuitive: Our seed collections were heavily biased toward Southern California where the majority of our permanent seed banks, including our most prolific collector, is located. Ecological

patterns were somewhat less intuitive: despite high interannual variation in population size, annuals are more likely to be represented in seed collection than perennials perhaps owing toward larger seed set and lower incidence of recalcitrance. Finally, our landownership analysis demonstrated that the greatest potential for seed collection in California is on US Forest Service land, which has the highest density of extant rare plant occurrences. We identified five specific National Forests which are home to 20 or more uncollected rare species, an insight that will be crucial for prioritizing permitting and relationship building with agency collaborators. In 2019, California Plant Rescue was awarded \$3.6 million by the State of California to seed bank the remaining 650 rarest plant species in California. We will leverage these tools and insights to take full advantage of this exciting opportunity.

The Ichauway Seed Bank: Results from the Inaugural Year of Seed Collecting

Lisa Giencke, Joseph W. Jones Ecological Research Center at Ichauway

In the first year of seed banking at Ichauway (a 29,000 acre ecological research center located in southwest Georgia), we developed a priority seed bank species list using the Georgia Department of Natural Resources Biodiversity Portal. Of the 783 rare plant species in Georgia we selected 36 species from 22 plant families – those that are vulnerable, imperiled, or critically imperiled in Georgia and are found on Ichauway. Using herbarium records and long-term monitoring data, we created maps of all known occurrences of these species on Ichauway as well as a tentative flowering/fruiting calendar to guide our collecting efforts throughout the year. Our goal for the first year was to be able to collect seed from 5-10 species from our priority list. Using our historical records we were able to exceed our goal by locating and collecting from 23 of the priority species. Over the course of the first year, we obtained 182 seed collections, representing 97 accessions of 29 species (23 from the priority species list), including 1 and 18 maternal lines of the two federally endangered species at Ichauway (*Lindera melissifolia* and *Schmalbea americana*, respectively). Individual accessions ranged from 1 seed to >10,000 seeds. We were unable to relocate 8 of the 36 priority species this year. Finding those species will be one of the priorities for next year's seed banking efforts.

Building and Maintaining an *Ex Situ Torreya taxifolia* Seed Nursery

Dr. Annabel Renwick, Laura Daly, Maegan Luckett, Sarah P. Duke Gardens

In November 2017 Sarah P Duke Gardens received around 100 *Torreya taxifolia* seedlings from Atlanta Botanical Garden with the goal of creating an ex situ seed nursery. A suitable site for the nursery was located in Duke Forest, within five miles of Sarah P Duke Gardens. The nursery was constructed ensuring protection from deer and rabbits, at the time not considering the presence of voles! Each plant had then to receive additional protection against voles. The growth of the seedlings is being measured and recorded each November. The presentation will briefly cover selection of the site and the resource required to build and maintain this tree nursery throughout the past two years.

Citizen Scientist-led Efforts to Save a Species: Safeguarding the Running Glade Clover, *Trifolium calcaricum*

Margi Hunter, Tennessee Naturalist Program

Cooper Breeden, Southeastern Grasslands Initiative
Austin Peay State University, Tennessee Plant Conservation Alliance

The lack of funding and resources necessary to conserve many of our most imperiled species and communities is a ubiquitous problem. In the absence of traditional support, more grassroots and citizen-led efforts are essential to ensure the survival of rare populations and habitats. In Tennessee, one citizen science-initiated and -led project has demonstrated the impact these grassroots efforts can have on our rare flora. We will present on the safeguarding efforts surrounding the running glade clover, *Trifolium calcaricum*. It is only known from 6 populations, only 1 of which in Tennessee is protected. With encouragement from the Tennessee Division of Natural Areas, a citizen volunteer initiated contact with a private landowner, secured permission to propagate plants from the site, and established 18 different reintroduction sites in nearby parks and state natural areas. In addition, a subset of plants were given to a local botanic garden to create an interpretive rare plant display. Future plans for this project include a suite of ecological and experimental studies to examine the effect of multiple factors on *Trifolium calcaricum* demographics on both introduced and natural populations.

Fringed Campion: Conservation and Reintroduction of a Federally Endangered Species

Heather Bowman Cutway, Christian Blasko, Derek Cotton, Mauricio Farinacci, CJ Allen, *Mercer University*

Fringed campion (*Silene catesbaei*) is one of 16 federally listed endangered plant species found in Georgia. Protection of existing populations should take precedence in conserving a species, however there are challenges and opportunities that may make reintroduction of fringed campion a worthwhile option. We worked with DNR and the National Park Service to reintroduce a population of fringed campion to Ocmulgee Mounds National Historic Park in Macon, GA. Using plants from our propagation studies, we planted approximately 80 plants and monitored them for one year. Based on what we learned from a year of monitoring, we added 40 more plants in locations that had the highest survival. In addition to establishing a new population at Ocmulgee Mounds, we have also augmented a naturally occurring population of *S. catesbaei* impacted by invasive species, English ivy in particular. Using plant material from the same location, we have planted fringed campion in the hopes of stabilizing a population which has shown decline. This pilot study also explored the likelihood of fringed campion reestablishment after invasive species removal. This spring, we will begin pollination studies of naturally occurring and planted populations.

Evaluating Translocation Successes and Challenges: Case Studies of Federally Listed Plant Species of the Lake Wales Ridge, Florida

Stephanie Koontz, Archibold Biological Station

Cheryl L. Peterson, Bok Tower Gardens

Valerie C. Pence, Cincinnati Zoo and Botanical Garden

Eric S. Menges, Archibold Biological Station

Translocations are an increasingly utilized tool for rare plant conservation. Urbanization along the Lake Wales Ridge, in southcentral Florida, has led to 85% loss of native Florida scrub and sandhill. The few remaining intact patches hold a plethora of endemics. Our program has translocated several species from unprotected to protected parcels. All translocations are monitored post-outplanting and demographic data used to evaluate success. Here we present case studies for three federally listed species and discuss the challenges in restoring rare plants.

Ziziphus celata has few remnant, mostly unprotected populations. Further contributing to its rarity is slow growth and limited sexual reproduction. We implemented 10 translocations between 1998 and 2012. Analyses of vital rates through 2016 determined annual survival of both wild and translocated plants is high (>90%), but growth of transplants is 1/10th the rate of wild plants. Many wild plants flower annually, yet <3% of transplants have reached reproductive maturity. Setting benchmarks for translocation success is challenging when dealing with a slow-growing, reproductively challenged species.

Crotalaria avonensis has two protected and one unprotected site. Fruit set is low, requires insect pollination, and seedlings are rare. In 2012, we introduced genetic material from the unprotected site to a protected parcel. Transplants have thrived and expanded through clonal and seedling recruitment, from 84 original transplants to 208 plants in 2019. Germination of sown seeds was also a success (47%) with many surviving, flowering and fruiting. The first decade of this translocation may qualify as a success, but the ultimate test comes in long-term population responses to land management activities and climate change.

Dicerandra christmanii has <10 sites, only one is protected. It relies on periodic fire to maintain open sandy gaps within the scrub matrix and persists from post-fire seedling recruitment. We have augmented (2010) and introduced (2012) populations. Both translocations grew exponentially, but the question remained, were populations demographically viable. Using long-term demographic data from wild plants and integral projection models, we determined vital rates and predicted population trajectories were similar between wild and translocated populations. Wild populations provide a priori knowledge of a species' basic biology and ecological requirements to inform more successful translocations.

Experimental Reintroductions and Adaptive Management Improve Recovery Outcomes in the Federally Endangered, Pyne's Ground-Plum (*Astragalus bibullatus*)

Dr. Matthew Albrecht, Missouri Botanical Garden

Geoff Call, United States Fish and Wildlife Service Noah D. Dell, Missouri Botanical Garden

David Lincicome, Tennessee Department of Environment and Conservation

Quinn G. Long, Missouri Botanical Garden

The recovery of imperiled plant species often requires the successful reintroduction of populations to protected habitat. However, reintroduction outcomes are highly variable and recovery programs face much uncertainty due to a poor understanding of the biology of rare species. In a collaborative partnership between the Missouri Botanical Garden, Tennessee Department of Environment and Conservation, and United States Fish and Wildlife Service, a long-term science-based recovery program is underway to improve restoration and management outcomes with the federally

endangered, Pyne's ground-plum (*Astragalus bibullatus*). Pyne's ground-plum is a long-lived perennial legume limited to a few populations and narrowly endemic to limestone cedar glades in the Central Basin of Tennessee. At five sites in Tennessee natural areas, we conducted experimental reintroductions in an adaptive management (AM) framework to determine how demographic performance was affected by habitat type (mesic vs. xeric ecotones), founder size, herbivory by small mammals, and rhizobia inoculation. In mesic ecotones, thinning woody encroachment, planting in multiple microhabitat types, and increasing founder size did not increase population viability relative to historical reintroductions that failed to persist. However, transplant survival and fruit production were much greater in xeric compared to mesic ecotones. At xeric sites, small mammal herbivory significantly decreased growth and flowering rates, which were up to 80% greater inside than outside exclusion cages. In subsequent reintroductions to xeric sites, short-term survival rates (>80%) improved over previous reintroductions. Rhizobia inoculation had only minor effects on survival, growth, and reproduction. Although seed production has occurred at all five reintroduction sites, seedling recruitment has not been observed. However, recruitment lags are expected given that seeds exhibit strong physical dormancy and form a long-lived seed bank. Our program highlights the importance of a structured and long-term monitoring program to evaluate recovery outcomes. Overall, the experimental reintroduction program has made measurable progress towards achieving the criteria for reclassifying the species to threatened, improved our understanding of the species biology and habitat requirements, and identified management actions that can be applied to improve future recovery efforts.

Linking Monitoring, Forecasting and Management

Safeguarding to Recovery: Georgia Rockcress Case Study

Dr. Michele Elmore, US Fish & Wildlife Service

Lindsay Dombroskie, Texas A & M University, Natural Resources Institute

Georgia rockcress (*Arabis georgiana* Harper) is a short-lived perennial plant of the mustard family (Brassicaceae) endemic to Alabama and Georgia. In 2014, this species was listed by the U.S. Fish and Wildlife Service (Service) as "Threatened" under the Endangered Species Act due to ongoing threats from development that either destroys or degrades habitat, and facilitates the invasion of nonnative species. The Service is currently conducting a 5-Year Status Review of the species and will develop a formal Recovery Plan. To support the 5-Year Status Review and development of the Recovery Plan a Species Status Assessment (SSA) was conducted. The SSA considers what the species needs to maintain long-term viability by characterizing the status of the species in terms of its resiliency, redundancy, and representation (together the 3Rs). Population resiliency was measured by population size, and habitat suitability, degradation and protection. Species redundancy and representation was measured by the number of populations and how they are distributed across genetic groups. In situ safeguarding has the potential to contribute to all 3Rs via population augmentations, reintroductions, and introductions. Safeguarding projects by the Georgia Plant Conservation Alliance has preserved genetic stock from several Georgia populations which has contributed to multiple experimental in situ safeguarding efforts to further conserve the species. Success of these in situ conservation efforts, when combined with

habitat protection and management, may prove to be essential to prevent further decline of the species in the wild and ultimately lead to recovery (delisting) of the species. We will discuss several future scenarios from the SSA that included protection, management and in situ safeguarding. We will explore next steps that include development of a range-wide Georgia rockcress Recovery Plan and recovery strategy where we consider how to move from experimental in situ safeguarding to species recovery.

Restoring Lost Ecosystems: From Recovering White Fringeless Orchid Populations to Restoring and Connecting Seeps and the Upland Pine Oak Barrens

Tara Littlefield, Senior Botanist/Plant Conservation Section Manager, Office of Kentucky Nature Preserves

It all started with a monitoring study of a declining White fringeless orchid (*Platanthera integrilabia*) population in 2007 at a State Nature Preserve in the Cumberland Plateau of Kentucky. This talk will outline this long term monitoring study of the white fringeless orchids and the associated seep communities and how they responded to management of the associated habitat. In addition, status survey trends of all WFO populations in Kentucky, partnerships with the forest service on recovery of populations on forest service lands, in situ and ex situ conservation strategies, as well as the importance of restoration and connection of the adjacent upland pine oak barrens will be discussed. Topics of partnerships, life history studies, seep and habitat management, seed and mycorrhizal banking, propagation, surveys and trends will be highlighted in this white fringeless orchid recovery and seep restoration talk.

Natural Areas Designations with the Nantahala & Pisgah NFs Plan Revision: An Evolving Process with the NC Natural Heritage Program + An ecological prescribed burn model for the Nantahala and Pisgah NFs

Gary Kauffman, National Forests of North Carolina

US National Forests (NF) revise their forest plans every 15-20 years. Currently the Nantahala and Pisgah NFs (NPNF), 1 million plus acres, are in plan revision. As part of the process, management areas are reassessed including designated sites. Special Interest Areas (SIAs) are designated to denote special features across the landscape. The majority are based on natural features or elements such as rare species, rare habitats, or high-quality plant communities. The NC Natural Heritage Program (NCNHP) delineates natural areas (NHNAs) across NC, including 230,000 acres across the NPNF. It denotes these with five classifications from the highest, exceptional, to the least, general. Of these, the NCNHP requested all the exceptional NHNAs, about 115,000 acres, be designated as SIAs. In the draft plan revision, the number of SIA acres has been doubled to around 103,000 acres. The discussion will describe the evaluation process and the continuing evolving process on assessing the undesignated and other classified acres as a USFS-NCNHP team.

As part of the Nantahala and Pisgah NFs plan revision, an assessment was completed for the prescribe burn program. A critical question was whether we were burning in the right places, both for ecological benefit as well as fuel reduction. Neighborhood modeling in a GIS was used to derive ecological fire prioritization areas. The model used six separately weighted fire adapted ecological zones as well as fire adapted rare species (federally listed, endemic, and state rare with different weights). The same process was used to assess fuel reduction and community protection needs with incorporation of rankings from the southern wildfire risk assessment report. The discussion will look at the overlap

between these two separate models as well as prescribe burns and or wildfires during the last 12 years within any of these areas.

Coordinated Flatwoods Restoration and Monitoring in the Eastern Florida Panhandle: Traditional Plots and Experimental Terrestrial lidar Scans

Brian Pelc, Restoration Project Manager, The Nature Conservancy-Florida. Coordinator of the Apalachicola Regional Stewardship Alliance.

Chad Anderson, Ecologist, Florida Natural Areas Inventory

Wet and Mesic Longleaf Pine Flatwoods (and structurally comparable longleaf ecosystems) play a critical role in maintaining the high biodiversity of southeastern forests. Previous flatwoods work has identified as many as 191 vascular plant taxa as well as >1500 plant species endemic to the North American Coastal Plain. This broad region of the southeastern continental United States is home to a gradient of native flatwoods habitats that once covered upwards of 90 million acres from Virginia to Texas. However, the vast majority of these native pine ecosystems were converted to off-site pine plantations and fire excluded in the last century, greatly reducing plant diversity and leaving land managers and biologists uncertain how best to implement and measure restoration efforts within a legacy of ecological mismanagement. Flatwoods restoration approaches in the last decade have resulted in very few successes, largely due to low survival of pine seedlings grown under an uncharacteristically dense and resilient shrub layer. To address this uncertainty and reverse the pattern of failed efforts, a partnership in the eastern portion of the Florida Panhandle is coordinating an effort to test various canopy conversion and fire re-introduction efforts on a meaningful scale and using a common monitoring protocol. The end goal will be a suite of clearing, site preparation, planting, maintenance and monitoring regimes that efficiently restore forest function and facilitate increased biodiversity over time. After identifying knowledge gaps for flatwoods longleaf pine establishment as a significant and high priority obstacle to large scale flatwoods restoration, the steering committee of the Apalachicola Regional Stewardship Alliance (ARSA) identified funds to 1) develop a monitoring protocol useful and comparable across the region and a variety of canopy thinning strategies and 2) install permanent plots in (at least) three partnership properties that span the east-west breadth of the partnership region (~ 100 miles.) Speakers will describe the baseline monitoring effort as well as plot level comparison between traditional vegetation monitoring data and data collected by terrestrial lidar scans. This project will require as much as decade to realize the full suite of tools for reconversion and associated impacts on flatwoods function and biodiversity. However, early successes can inform other projects and refine the suite of available tools.

Habitat Suitability Models as a Conservation Tool for a Rare Mint, *Macbridea alba*

Sara Johnson, Department of Natural Resources and Environmental Science at University of Illinois: Urbana-Champaign

Brenda Molano-Flores, Illinois Natural History Survey, University of Illinois: Urbana-Champaign

Janice Coons, Eastern Illinois University

Many rare and at-risk species exhibit a paucity of research, leaving gaps in the knowledge required to conserve them. *Macbridea alba* Chapman (White birds-in-a-nest, Lamiaceae) is a federally threatened and state endangered herbaceous mint restricted to a narrow distribution in the longleaf pine ecosystem of the Florida panhandle. Habitat conversion and destruction are among the primary reasons for *Macbridea alba*'s decline. Populations are highly fragmented by plantations, clear cuts, or development resulting in extirpation in some areas. Whereas known *Macbridea alba* populations are primarily found within Apalachicola National Forest, it is uncertain exactly how many exist, and few are documented outside of protected areas. There are many unknowns regarding the ecology of this species; however, previous research suggests that microhabitat differences and disturbance play an important role in its reproduction and survival. Habitat suitability models are a useful tool for gaining insight into the potential drivers of species distribution and persistence on the landscape. These models can define the environmental predictors of occurrence and facilitate the discovery of previously unknown populations. Additionally, these models can guide conservation of areas for potential reintroduction based on habitat conditions and proximity to known source populations. We have created preliminary habitat suitability models using known occurrence records for *Macbridea alba* as well as open sourced environmental spatial data to identify new areas of potentially suitable habitat. In 2019, field surveys were conducted for the purpose of model verification resulting in the discovery new populations. In the future, models using a disturbance variable such as fire season or time since fire, will be used to determine if the models could be improved.

The results from the improved models will help us understand the specific role of fire management and fire frequency on the persistence and survival of this species. Additionally, it will assist us in defining range limits and environmental parameters for *Macbridea alba*'s distribution and whether it is a candidate for reintroduction or ex-situ conservation efforts.

Historic Vegetation and Harper's Beauty in the Apalachicola National Forest

Amy Jenkins, Florida Natural Areas Inventory

Chad Anderson, Florida Natural Areas Inventory

Jason Drake, United States Forest Service

Understanding the historic conditions and habitats in a region is a vital first step to planning restoration and management activities. With our partners, US Forest Service, Florida Forest Service, and the Florida Fish and Wildlife Conservation Commission, the Florida Natural Areas Inventory (FNAI) used aerial photography from as far back as the 1930's, coupled with current photography, soils data, LiDAR elevation data, rare plant occurrences, and GPS'd ground-truthing points, to develop an historic vegetation map of several large contiguous conservation lands in the Apalachicola region. These maps cover a large portion of the region and are an important baseline for ecological and hydrological restoration efforts by managers across property boundaries. Additionally, historic vegetation maps can be used on a smaller scale when planning silvicultural projects, targeting specific habitats for rare plant surveys, or to identify areas where fire has long been absent. This map has been a vital tool when studying rare plant species such as Harper's beauty (*Harperocallis flava*). Harper's Beauty is a critically imperiled, federally endangered plant that is endemic to the Florida panhandle and grows in the species rich pitcherplant prairies of the Apalachicola River lowlands. FNAI has been documenting its populations for more than a decade. Harper's beauty thrives in a fire dependent habitat that in recent

decades has seen a reduction in the fire application and hence an increase of woody vegetation cover and some populations have been reduced or lost. Most recently we established monitoring plots to attempt to quantify its habitat conditions, especially in relation to fire. Preliminary data analysis has provided valuable insight to help guide management.

Demographic Analysis of a Dioecious Threatened Plant and the Consequences of Not Having Complete Data

Natali Ramirez-Bullon, Florida State University, Department of Biological Science

Dr. Vivian Negron-Ortiz, U.S. Fish and Wildlife Service

Dr. Alice A. Winn, Florida State University, Department of Biological Science

The number of studies that use structured demographic models to answer conservation questions has increased in the past four decades yet few assess endangered or threatened plant species. One reason may be that there are not clear guidelines available to conservation managers to collect appropriate demographic data, particularly for plants with complex life cycles. Consequently, managers often collect or only have access to data from mature individuals, which are easier to identify and detect than other stages (e.g. seedlings and juveniles). Assessing population dynamics without data on all life cycle stages may be especially difficult for species with longer or complicated life cycles. We quantified the consequences of assessing population dynamics with incomplete demographic data for three populations of a threatened dioecious perennial herb, *Euphorbia telephioides*. Previous counts of reproductive individuals suggested that these populations were stable. We constructed and analyzed stage structured demographic models for three populations, we estimated population growth rates using data from randomly marked plants representing the whole life cycle and compared them to population growth rates projected from a subset of the data that excluded juvenile plants.

Population growth rate estimates using data for all stages of the life cycle indicate that these populations are projected to decline (stochastic population growth rates significantly less than 1). Deterministic Lambda estimates excluding juvenile individuals were significantly greater by 3% to 6% in Bay and Franklin County than estimates that based on a random sample of marked individuals that included all life cycle stages. Moreover, at all populations, using data generally available for managers (adults only) resulted in $\lambda > 1$, meaning the population was projected to grow, which can be misleading when compared to the assessment using complete data. For these populations, excluding juvenile plants overestimated survival probabilities, which resulted in greater estimates of population growth rates. This case illustrates the importance of incorporating data from all stages of the life cycle when assessing population growth rates of endangered and threatened long-lived plants.

Gulf Coast Atlantic White-Cedar Recovery Post Hurricane Disturbance

Clayton W. Hale, Mississippi State University

Joshua J. Granger, Mississippi State University

The number and severity of Gulf Coast hurricanes is increasing, resulting in intensified disturbance on coastal forest communities. Atlantic white-cedar (*Chamaecyparis thyoides* L.) grows no further than one hundred miles from the coast,

making the species particularly vulnerable when hurricanes collide with the coast. Occurring primarily along the Atlantic Coast from Maine to Florida, the species does form isolated stands along the Gulf Coast regions of Florida, Alabama, and Mississippi. In Mississippi and Alabama, the species is considered imperiled and vulnerable, respectively, according to NatureServ. Atlantic white-cedar is imperiled and is at risk of extirpation from the Gulf Coast by extreme weather events, altered disturbance regimes, changes in hydrology, and management. This study evaluates the recovery of an Atlantic white-cedar stand fourteen years post Hurricane Katrina. Pre- and post- Hurricane Katrina data were compared with recent data to determine how Gulf Coast stands of Atlantic white-cedar recover post disturbance. Understanding the long-term recovery of Atlantic white-cedar stands after a hurricane allows land managers and conservationist to more effectively manage these systems for the perpetuation of the species on the Gulf Coast.

Identifying Drivers of Orchid Population Dynamics: An Example in the Federally-Listed Threatened Orchid, *Isotria medeoloides*

Melissa K. McCormick, Dennis F. Whigham, Rachel Rock-Blake, Hope E.A. Brooks

North American Orchid Conservation Center (NAOCC) and Smithsonian Environmental Research Center (SERC)

Orchids are widely threatened and endangered worldwide, but efforts to conserve and restore them has been limited by not knowing about the pollinators and fungi they need to grow and reproduce. The absence of appropriate mycorrhizal fungi can limit where orchids grow, but little is known about how the abundance and diversity of appropriate mycorrhizal fungi can affect orchid growth and population dynamics. Light availability is also expected to affect population dynamics, but with orchid life stages occurring predominantly above- or below-ground it seems reasonable to hypothesize that different life stages would be driven by above- or below-ground factors. In particular, emergent, green, above-ground stages would be most impacted by light, while seed, protocorm, and dormant stages would be most affected by mycorrhizal fungi. We hypothesized that the distribution, abundance, and emergence of the globally rare temperate, terrestrial orchid, *Isotria medeoloides*, would be driven at least partly by their mycorrhizal fungi. We combined the use of specific PCR primers, quantitative real-time PCR, and spatially nested soil samples to measure the distribution and abundance of mycorrhizal fungi that associate with *I. medeoloides* and measurement of light availability and orchid growth in three distinct studies. We found that *I. medeoloides* distribution and emergence were affected by the distribution and abundance of their mycorrhizal fungi in the soil. In contrast, plant growth during the growing season and the likelihood of flowering the subsequent year were more affected by light availability. We conclude that orchid conservation and studies of the drivers of orchid population dynamics need to consider both the mycorrhizal fungi and light resources they require.

Monitoring At-Risk Species in the Southeastern U.S. Can Be Improved with an Ensemble Habitat Modeling Approach

Dr. Carlos Ramirez-Reyes¹, D. Todd Jones-Farrand³, Garret Street^{1,2}, Francisco Vilella⁴, Kristine O. Evans^{1,2}

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Effective conservation planning requires reliable information on the distribution of species, which is often incomplete due to limited availability of data. Species distribution models (SDMs) and associated tools have proliferated in the past decades and have proven valuable in evaluating suitability and critical habitat for species. However, conservation practitioners have not fully adopted SDMs to inform surveys and other monitoring efforts. Instead, most efforts rely on expert knowledge and other traditional methods to locate extant populations. In particular, the Species Status Assessment (SSA) initiative of the U.S. Fish and Wildlife Service would benefit from incorporating SDM approaches to facilitate conservation decisions. Here, we describe an SDM approach for at-risk species that could be considered for SSA and similar species monitoring efforts. We applied 4 modeling techniques (generalized additive, maximum entropy, generalized boosted, and weighted ensemble) to recent monitoring data for 4 at-risk plant species (*Scutellaria ocmulgee*, *Balduina atropurpurea*, *Rhynchospora crinipes* and *Torreya taxifolia*) in the Southeastern U.S. Our results showed that ensemble distribution models reduced uncertainty caused by differences among modeling techniques and improved the predictive accuracy of fitted models. These models highlight areas with high habitat suitability for a particular species and therefore candidates for additional monitoring and survey efforts. We suggest that this approach could be adopted into the SSA framework to develop more robust and efficient assessments of at-risk species.

Conservation Applications of Species Distribution Models: Case Studies in Model-Based Sampling and Reconstructing Biogeographic History

Dr. Jessica Allen, Atlanta Botanical Garden

Species distribution modeling (SDM), the practice of using species occurrences and environmental covariates to model the probability of a species presence across a landscape, has diverse applications in research, management, and conservation. In this presentation I will discuss two case studies on the application of SDMs for conservation. The first study used model-based sampling to guide field searches for previously undiscovered populations of the endangered pale-belly frost lichen (*Physconia subpallida*) in Ontario. Two modeling algorithms were compared, Maxent and Non-Parametric Multiplicative Regression (NPRM), and each was ground-proofed over the course of two field season. Maxent model based searches led to the discovery of one new population consisting of one individual, while NPRM model based searches resulted in the discovery of six new populations consisting of 36 individuals. The second case study focuses on the conservation genetics and biogeography of the lungwort lichen (*Lobaria pulmonaria*) throughout North America. In this study SDMs were used to reconstruct the distribution of the lungwort lichen back to the Last Glacial Maximum to directly inform interpretation of population genetic data. The genetic data strongly support that eastern and western North American populations form two distinct gene pools with very little gene flow, and the historical SDMs suggest that the two gene pools of the lungwort lichen have not been geographically connected since the last glacial maximum. While these two case studies illustrate the utility of SDMs in conservation, the full potential of these methods are not yet realized.

Policy & Advocacy

Regional and National Conservation Initiatives

Dr. Jon Ambrose, Georgia DNR, Chief of Wildlife Conservation

All state wildlife agencies in the Southeast have developed State Wildlife Action Plans, strategic plans for conservation of rare or declining species and their habitats. Some states have included plants as species of greatest conservation need, and others are considering doing so in the next revision of their plans. In recent years, states have recognized the need to focus additional resources on landscape scale conservation planning and implementation. The Southeast Conservation Adaptation Strategy (SECAS) is a regional conservation initiative that spans the Southeastern United States and Caribbean. SECAS emerged as a response to the unprecedented challenges facing our natural and cultural resources, including urban growth and climate change. Participating states and organizations have contributed to the development of the Southeast Conservation Blueprint, a dynamic spatial plan that identifies the most important areas for conservation and restoration across the region. The shared vision of SECAS is a connected network of lands and waters that supports thriving fish and wildlife populations and improved quality of life for people as well as a goal of 10% or greater improvement in the health, function, and connectivity of southeastern ecosystems by 2060. In addition, SEAFWA states recently collaborated on a project to develop a list of regional species of greatest conservation need from the very large number of species identified as priorities in fifteen State Wildlife Action Plans. This list, which serves as a complement to the Southeast Conservation Blueprint, will facilitate prioritization of conservation projects and collaboration among states within the region. Developing and implementing conservation plans across landscapes and suites of species requires financial resources well in excess of those currently available to state agencies and partner organizations. Recovering America's Wildlife Act (HR 3742), introduced in July 2019, would allocate a total of \$1.4 billion annually to state and tribal agencies to address the full range of conservation needs articulated in State Wildlife Action Plans. A national coalition of organizations is working for passage of this landmark federal bill, which will provide critical funding for conservation of native species and natural communities throughout the country.

Regional Species of Greatest Conservation Need: Plants in the Southeastern U.S.

Dr. Elizabeth Crisfield and **Karen Terwilliger**, Strategic Stewardship Initiative

State boundaries have always been invisible to biota. But now, as climate change shifts climatic regimes over the landscape, as more invasive species become established, as people move native and exotic species from place to place – regional collaborative conservation across state lines is needed more than ever to provide effective stewardship of native biodiversity. In concert with other regional conservation initiatives, one way to specifically communicate shared priorities for rare plants is by creating a list of Regional Species of Greatest Conservation Need. These are species for which the 17 states and territories comprising the SePPCon footprint represent more than 50% of the plants' native range and whose populations are in decline. In some cases, threats responsible for species' declines are shared in the region and can be mitigated collaboratively. In other cases, genetic diversity in the SePPCon region can be studied to support stronger conservation programs. The Regional Species of Greatest Conservation Need list can help communicate shared priority species between colleagues in agencies, academia, and non-profit conservation partners. The list can also facilitate

inclusion of plants in the 2025 revisions of the State Wildlife Action Plans, as well as being referenced in grant proposal justifications to demonstrate the importance of research and other activities. In this presentation, we will explore the opportunity to develop a Regional Species of Greatest Conservation Need list for plants in the SePPCon geographic area.

Native Plant Conservation Campaign – a National Native Plant Society for the United States

Dr. Emily B. Roberson, National Plant Conservation Campaign

Plants are second-class conservation citizens. People often overlook or ignore plants in their environment, even in natural areas where animals tend to receive the "lion's share" of attention. Sadly this problem is widespread among policymakers. Even many environmental groups often overlook native plants in their work. As a result, plants are discriminated against in every aspect of law, policies, staffing 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 350,000 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 2020 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 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 support conservation and restoration of native plant communities when they learn that it can save \$100s of millions in hurricane damage, \$billions in water treatment costs, improve public health and save lives.

Strategies for Plant Conservation: Progress Since 2011 and Targets for 2030

Abby Meyer, Botanic Gardens Conservation International, U.S.

Botanic Gardens Conservation International (BGCI) mobilizes the global botanic garden community to conserve plant species. BGCI reports to the United Nations on progress made toward the Global Strategy for Plant Conservation (GSPC). The GSPC, as well as the North American Botanic Garden Strategy for Plant Conservation, serve as road maps to guide effective plant conservation across countries, and are composed of a series of

outcome-oriented targets aimed at documenting, conserving, sustainably using, educating and building capacity for plant diversity. Both strategies will need to be renewed at the end of 2020, and BGCI and partners have been assessing global progress and potential new GSPC targets. In North America, BGCI-US and the American Public Gardens Association have developed a Plant Conservation & Biodiversity Benchmark tool that connects conservation actions to strategy targets. We are working in 2020 to represent every garden in our dataset, in order to guide the next targets of the North American strategy.

Southeastern Partners in Plant Conservation: 2016 Conference Successes

Carrie Radcliffe, Atlanta Botanical Garden

The Southeast Multi-Species ESA Listing Petition Turns 10: An Update on the Campaign to Gain Protections for Imperiled Freshwater Species

Tierra Curry, Center for Biological Diversity

The southeastern United States harbors an incredible diversity of flora and fauna but growing threats include urbanization, agricultural intensification, fossil fuel development, and escalating drought and flood events due to the global climate crisis. In the midst of increasing extinction threat, plants receive far less attention and protections than other groups. Protection under the Endangered Species Act is an effective means of saving species, but the process of getting a species on the list can take decades and face political opposition. Even after listing plants receive less protection than animals as they are not protected from take on private lands which allows pipelines and other developments to degrade their habitat. In light of the freshwater extinction crisis occurring in the Southeast, in 2010 the Center for Biological Diversity submitted a petition to the U.S. Fish and Wildlife Service to protect 404 aquatic, riparian, and wetland species from the southeastern United States under the Endangered Species Act including 82 plants. In a related action, in 2011 the Center entered into an agreement with the Service to get concrete dates for listing decisions for the 251 species on the candidate waiting list as of 2010 which led to listing for 20 southeastern plants. Of all the plant and animal species in the 2010 petition, 23 have gained protection but none of the plants have been listed yet. Based on input from scientists and state agencies, 25 plants have been withdrawn from the petition. Two plants have received negative findings. Of the remaining plants in the petition, 55 are still awaiting “12-month” findings a decade later. The Center filed a notice of intent to sue in November 2019 to gain set dates for listing decisions for 21 of the plants awaiting protection that had been scheduled for a decision date under the Obama administration. Thirty-four of the petitioned plants remain in limbo.

At-Risk Species Workshops, Reflections, and Responsibilities

Ephemeral Wetlands Management Workshops in Florida and North Carolina Restoration and Fire in Ephemeral Wetlands

Dennis David, National Wildlife Refuge Association; **Chuck Hunter**, US Fish & Wildlife Service; **Duke Rankin**, US

Forest Service; **Joanne Baggs**, US FS; **Carrie Sekerak**, US FS; **Jeff Hall**, NC Wildlife Resources Div.; **Pierson Hill**, Florida Fish & Wildlife Conservation Com.; **Greg Titus**, FWS; **Amy Jenkins**, FL Natural Areas Inventory; **Lesley Starke**, NC Plant Conservation Program; **Jeff Beane**, NC State Museum of Natural Sciences; **Andy Walker**, Croatan & Uwharrie National Forest; **Megan Keserauskis**, FW; **John Dunlap**, FS; **Jorge Guevara**, FS; **Janna Mott**, The Nature Conservancy of FL; **Jeff Marcus**, TNC of NC; **Thomas Crate**, NC State Parks; **Chris Jordan**, NC Wildlife Resources Commission; **Jennifer Fawcett**, Prescribed Fire Work Group at NCSU, **Vernon Compton**, Longleaf Alliance, **John Matthews**, FS; **Dan Frisk**, FWS; **Chris Petersen**, DOD Navy; **Jeff Talbert**, Atlanta Botanical Garden at Deer Lake; **Jennifer Ceska**, GA Plant Conservation Alliance; **Jenny Cruse-Sanders**, State Botanical Garden of GA; **Carrie Radcliffe**, Atlanta Botanical Garden

During the At-Risk Workshop series 2015 to 2016, an interagency status review identified habitat degradation caused by fire exclusion as the primary reason for decline of more than 114 Southeastern wetland species now trending towards Federal listing; this critical disturbance regime has also been recognized as essential for the recovery of Federally Threatened and Endangered wetland-dependent guilds of taxa. In 2019, two workshops funded jointly by the US Fish and Wildlife Service and the US Forest Service and coordinated by the National Wildlife Refuge Association were held, with the main objective of strategizing getting more fire into isolated ephemeral wetlands to help at-risk species. Over 130 conservation professionals from more than 40 agencies and organizations from the SE US contributed knowledge of tools and restoration techniques used to manage ephemeral wetlands. Local subject matter experts, biologists, fire practitioners, ecologists and land managers convened to discuss and share best restoration and management practices for ephemeral wetlands to address at-risk species management (plant and animal) with a focus in the longleaf ecosystem in the Coastal Plain. Carrie Sekerak, Deputy District Ranger, Ocala National Forest will present on the state of these isolated wetlands, the current issues in isolated wetland management, and a snapshot of best practices being applied.

Rights of Way Management

Remnant Prairies and Sun-Loving Plant Communities

in Southeastern Rights of Ways

Dr. Dwayne Estes, Southeastern Grasslands Initiative

Plant Conservation Issues on Roadsides and Right of Ways in Alabama

Patrick Thompson, Coordinator Alabama Plant Conservation Alliance

Alfred Schotz, Botanist Alabama Natural Heritage Program

Michelle Reynolds, Administrator Southeastern Roadside Defenders

Patrick Daniel, Collaborator Southeastern Roadside Defenders

Alabama has a diversity of habitats, species, ideologies and challenges. Private lands management is a place where these things all come together. On the roadsides, this is especially true. The most heartening thing about the condition of

Alabama's roadside plant communities is the fact that they have voices speaking up for them. The Southeastern Roadside Defenders is a place for voices to come together.

The goals of the Southeastern Roadside Defenders Facebook page is to gather and share information on good vegetation management plans, share herbicide regulatory info, promote examples of good programs and success stories, while building a network of allies. We believe in grassroots activism. By sharing good examples as well as the bad, we think we can connect the dots and build a broad network to help combat the overuse of herbicides and the subsequent destruction of plant communities that provide important eco-services along our roadways. We believe roadside wildflowers play a role connecting people, land, communities, and tourism.

We use before and after photos to demonstrate harm to plants, erosion caused by the lack of plants, and harm to the environment and stormwater infrastructure from the erosion and sediment. We focus on these points in discussion with officials: public health, aesthetics, connectivity, environment, water quality, and road/shoulder degradation. We partner with allies and meet with officials and municipalities to help align their comprehensive goals with best practices in vegetation management. By mirroring language written by city, county, and state planners, we strive to find common ground and help to develop policy.

This approach has been slow but steady. We encourage others to speak and act locally by arming them with information and talking points. Steam is building.

There are real problems in this state. *Phlox pulchra*, an S1G1 species with only 6 occurrences has been sprayed with herbicide at two roadside locations. The conversations with people concerned about roadside vegetation management across the region have shown us that our problems are not unique. Alabama looks forward to pointing to the successful work being done in North Carolina, Kentucky, Georgia, Tennessee and our other southeastern states to hold our vegetation managers to these higher standards. Alabama's roadside species will benefit from all of your efforts to raise the bar, and we thank you for that.

Georgia's New Roadside Aesthetic

Meg Hedeem, State Environmental Liaison, Georgia Department of Transportation

The Georgia Department of Transportation has a number of initiatives underway aimed to allow roadside maintenance to include an environmental aesthetic. We are currently coordinating nationally on the Monarch Butterfly Candidate Conservation Agreement with Assurances, for which we will commit to revising our roadside maintenance regime to encourage nectar plants to grow on the backslopes. In addition, we are now requiring that only Georgia grown native trees and shrubs be used for any needed replanting, for state-funded roadway construction projects. We lastly, we are collaborating with other GPCA partners to better safeguard imperiled populations that are located on our roadsides.

Rare Plant Recovery in Roadway Rights-of-Way

Sujai Veeramachaneni (GDOT), Felicity Davis (GDOT), Chris Goodson (GDOT), Anna Yellin (WRD), Meg Hedeem (GDOT), Carrie Keogh (Emory University)

Protected plant species that prefer open and forest edge habitats can find unexpected homes in regularly maintained transportation rights-of-way. Avoidance and minimization of these resources is a critical goal for the Georgia Department of Transportation (GDOT) during design and construction of proposed transportation projects. When protected plant surveys identify protected plant populations in rights-of-way which can be avoided by proposed projects, GDOT designates an Environmentally Sensitive Area (ESA) to be signed and maintained in perpetuity. While designating ESAs is not a new practice, GDOT desired a consistent tracking system for, sometimes historic, ESA records. Only a couple known ESA sites had dedicated management plans, another challenge for conservation of these important plant populations. Starting in 2018, GDOT partnered with the Georgia Department of Natural Resources – Wildlife Resources Division (WRD) and Fish and Wildlife Service (USFWS), as well as Emory University, to assess current practices and develop a plan for tracking and managing ESA sites across Georgia.

Tracking, management and recovery development efforts involved contributions from and coordination between many parties both external and internal to GDOT. Existing practices and proposals for improvement were developed by Emory University students participating in a service learning course. WRD provided element occurrence data that intersect existing

rights-of-way, while existing ESA locations continue to be identified by GDOT District personnel and consultants surveying for proposed transportation projects. A template ESA management plan was developed to help record site information for tracking and recovery efforts, including site-specific management actions that will be easily accessible for GDOT District Maintenance personnel. Development of this tracking and maintenance system is on-going, but the future of rare plant recovery in roadway rights-of-way seems bright.

Improved Data Collection Measures for Identification of Protected Plants on Proposed Transportation Projects

Hannah Held (GDOT), Tom Patrick (WRD), Carrie Straight (USFWS), Chris Goodson (GDOT)

The Georgia Department of Transportation (GDOT) assesses habitat for and conducts seasonal surveys for over 100+ state and federally listed plant species across Georgia prior to construction of proposed transportation projects. With an annual \$2 billion transportation budget, there is no shortage of projects to assess and a corresponding number of protected species surveys to conduct. Prior to 2019, survey methodologies for GDOT projects had only been developed for 10 plant species, requiring project-by-project approval of survey methodologies for the remaining 90+ species. This process delayed project advancement and resulted in inconsistent data collection from the many practitioners.

In coordination with the Fish and Wildlife Service (USFWS) and Georgia Department of Natural Resources – Wildlife Resources Division (WRD), GDOT began to develop survey methodologies that would cover all 100+ state and

federally listed species assessed for transportation projects. Survey methodologies were divided into Phase I, habitat assessment, and Phase II, seasonal survey, protocols. Instead of individual species methodologies, Tom Patrick (WRD) took the lead in grouping survey methods by botanical regions, adapted from the “Field Guide to Rare Plants of Georgia” by Linda Chafin. Habitat types, referencing those described in “The Natural Resources of Georgia” by Edwards, Ambrose, and Kirkman (2013), within each botanical region were outlined and each listed all relevant protected species for which that habitat type is suitable. This approach shifted the paradigm of GDOT surveyors assessing numerous species to one of assessing individual habitat types, then identifying associated species. With approval by USFWS and WRD, GDOT has begun to utilize these new methodologies and has seen improvement in project delivery and consistency of data collection with newly adapted data collection forms. Data forms double as reporting forms and were developed for streamlined review, as well as to easily transfer data into the NatureServe database. With consensus between agencies based on the best available science, GDOT hopes these improved data collection standards contribute to protected plant identification and conservation in the State of Georgia.

Roadside Remnant Communities and Rare Species Conservation in Kentucky: Can We Work with State Transportation Agencies to Identify, Manage and Conserve Important Botanical Areas Along Roadside Right of Ways?

Tara Littlefield and **Tony Romano**, Office of Kentucky Nature Preserves

Roadsides are increasingly recognized for their potential importance in conservation planning. Roadsides are generally less threatened by development than surrounding areas and are maintained in an open condition. Because of these factors, roadsides in Kentucky are one of the few areas that contain remnant native grassland communities. These roadside grasslands often support rare plant species and provide important habitat for pollinating insects including monarch butterflies and native bees. If these resources are not identified and incorporated into management plans, they can be highly vulnerable to harmful management actions and rapidly degrade. Since 2015, the Office of Kentucky Native Preserves (OKNP) and the Kentucky Transportation Cabinet (KYTC) have worked collaboratively on several plant conservation projects including natural areas acquisition, restoration and planting recommendations, seed collection, and management coordination for several high quality roadside grasslands. In 2019, OKNP, in partnership with KYTC and Daniel Boone National Forest (DBNF), updated inventories of remnant grasslands and rare plants along roads in the national forest. To expand on these surveys, OKNP partnered with the Kentucky Native Plant society to create an iNaturalist citizen scientist project where volunteers can contribute their observations of roadside habitats in the national forest. These projects were important for building positive collaboration between ONKP and KYTC, and we are now implementing a broader Pollinator Conservation Strategy to address the conservation needs along our roadsides. In 2020, OKNP is initiating a 5-year statewide survey of Kentucky’s roadsides to establish a baseline of data.

This program will document remnant natural communities, rare plants, and high quality pollinator habitat. These surveys will inform coordination with KYTC districts and help prioritize conservation and management of important roadside habitats. This program will develop trainings for KYTC staff and incorporate citizen scientists to expand our reach. We still have a lot of hurdles to cross for roadside plant and pollinator conservation, but partnerships and communication is possible and can provide a path towards achieving conservation goals.

Documenting and Protecting Grassland Communities Along Highway ROWs in Tennessee

Cooper Breeden and **Dwayne Estes**, Southeastern Grasslands Initiative / TPCA

In Fall 2019, conservation partners from across the southeast began to convene on a monthly call to discuss how to tackle the complex problem of improperly managed roadsides—roadsides that are either being sprayed or mowed to death to the detriment of rare and unique plant species and communities. This update will include a summary of roadside protection efforts in Tennessee. We will briefly review recent changes in the state’s management policy and its implications on conservation. In addition, we will review a new project we have started in partnership with the Tennessee Department of Transportation. This project includes a status assessment of roadside pollinator and grassland habitat, the development of a roadside management plan, and the installation of a demonstration prairie.

Plant Conservation Programs of the Georgia Power Company

Jim Ozier, Environmental Specialist, Environmental and Natural Resources, Georgia Power Company

The Georgia Power Company is an investor-owned utility that generates, delivers, and markets electricity throughout most of the state. The company is one of the state's largest private landowners; conservation attributes of these lands include a refuge for the world's only population of Georgia alder (*Alnus maritima georgiensis*) and federally designated Critical Habitat for Georgia rockcress (*Arabis georgiana*). Georgia Power also manages the vegetation on thousands of miles of powerline corridors to ensure safe and reliable power delivery. This is generally accomplished through an integrated approach of mowing every 6 years and targeted backpack spraying of woody encroachment every 2 years in-between. Incidentally this maintains valuable open habitat needed by many grasses and forbs. Sites known to harbor rare species are designated for management using only hand tools as needed. Examples include several pitcherplant (*Sarracenia spp.*) bogs and habitat for the federally endangered hairy rattleweed (*Baptisia arachnifera*). Additionally, Georgia Power is a partner in a Candidate Conservation Agreement for the Georgia aster (*Symphyotrichum georgianum*) and conducts surveys, monitoring, and special management for this species, which appears to be doing well on company lands and rights-of-way.

Managing Rights of Way for Resource Benefit

Allyson Read, Natural Resource Specialist, Chattahoochee River National Recreation Area, National Park Service

The Chattahoochee River National Recreation Area stretches along 48 miles of the Chattahoochee River from Buford Dam at Lake Lanier to Peachtree Creek in the city of Atlanta. The federal park includes the river plus 16 land units that provide almost 70% of the region’s greenspace offering diverse recreational opportunities and ecosystem diversity within the urbanized environment. The river corridor in this rapidly growing metropolitan area includes many utility rights of way that pre-existed the park in addition to the constant expansion and improvement of local infrastructure. In an effort to minimize resource injury yet allow the utility companies full access to their lines for maintenance, repair, and rehabilitation, CRNRA has created a program to ensure the utilities maintain structure integrity while protecting the park resources. An integral part of the program are several management tools that when used with existing agreements and resources makes the program easily transferable and available for use on most utility corridors. Collaborative efforts

among local and national utilities, botanical gardens, non-profits, and individuals have facilitated the ability to promote the utility corridors as locally critical early-successional habitat. The result has been a decrease in resource injury and an increase in the botanical and biological diversity within these corridors and within the urban environment.

Private Lands Conservation

Partnerships and Private Lands: The Key to Longleaf Ecosystem Restoration

Carol Denhof, Longleaf Alliance

The Longleaf Pine was once the dominant tree species in the south, covering over 90 million acres from Virginia to Texas. Over the last 400 years, the abundance of this species has decreased due to non-sustainable timber harvest, clearing of land for agriculture and development and exclusion of fire. As this ecosystem was diminished, many of its associated plants and animals have become federally threatened or endangered, state-listed or, at best, rare. At the low point in the 1990's, it was estimated that less than 3 million acres remained. Today, because of the work of The Longleaf Alliance and our partner NGOs, state and federal agencies, and private landowners we are making progress, and now estimate the extent of the resource at 4.7 million acres.

An increasing number of landowners that are restoring longleaf to their lands are becoming interested in using a whole ecosystem approach to longleaf restoration. In addition to the traditional interest in longleaf timber production, they have come to appreciate the value in managing forests that support plant and animal diversity as well as the overall health of the ecosystem. Having this diversity in place is essential to achieving their objectives as landowners. It also contributes to true restoration of the South's great longleaf forest. With the majority of longleaf-suitable lands existing on private lands, the importance of engaging these landowners to support ecosystem restoration and conservation is more important than ever.

It is also important to work in partnership with other groups to reach long-term restoration goals. The Longleaf Alliance is working in conjunction with other partners that are members of the Longleaf Partnership Council (LPC) to achieve the restoration goals established by America's Longleaf Restoration Initiative. Restoration of the longleaf pine ecosystem and the species associated with it is a high priority for all 33 members of the LPC. The LPC has set an ambitious goal of increasing the acreage of longleaf pine to 8 million acres by 2025. Members include federal agencies including US Forest Service (USFS), US Fish and Wildlife Service (USFWS), Natural Resources Conservation Service and the Department of Defense, state agencies, NGO's, and private landowners.

Pathways to Private Landowner Plant Stewardship

Robert Smith, Wildlife Mississippi

When "rare", "uncommon", "seldom seen", "unusual", and similar descriptors are used to describe plants occurring on a private landowner's property, strong negative or positive responses are usually elicited. A widespread plant that is

seldom seen, may often be described as “endangered” by the landowner who has been introduced to it. A lot of land management professionals fail to recognize these types of plants, so it should be no surprise that private landowners are even more poorly informed. Identification of plants that occur on private lands is not a common thing.

Education of private landowners generally elicits either a fear of regulation or a sense of stewardship in regard to plant conservation. Many landowners are introduced to plants and plant management through an interest in wildlife, often white-tailed deer, northern bobwhite, wild turkey, or waterfowl. They often come from a “what can I plant perspective” and are slowly acclimated to managing native habitats. A similar pathway follows for many landowners interested in longleaf pine as they grow into stewards interested in restoring and managing understory diversity.

I'll share some anecdotes about understory plant conservation attitudes that I've observed while spending almost 30 years working with mostly private landowners. Some of those will be private conservation foundation, developers, commercial hunting operations, and several different non-industrial private forest landowners. Floral surveys/plant identification, education, pathways to stewardship, financial incentives, and strategies for long-term protection will be noted as appropriate.

Reversing Declines of Grasslands Biodiversity with the Regional Conservation Partnership Program in the Interior Low Plateau Ecoregion

Jeremy French and Brittney Viers, Quail Forever/Southeastern Grasslands Initiative

The southeastern region of the U.S. was one of the most diverse grassland regions of North America, yet more than 99% has been lost due to such factors as conversion to row crop agriculture, forest succession, and wetland drainage. Reversing the decline in grassland biodiversity will require a regional effort with a multitude of partners. Our objective is to use NRCS-RCPP (Regional Conservation Partnership Program) funds to conduct a multifaceted conservation program that will complement existing efforts, especially near protected landscapes. This RCPP is led by the Central Hardwoods Joint Venture (CHJV) and the American Bird Conservancy (ABC). Our RCPP includes efforts needed to recover populations of grassland bird species deemed in need of conservation attention by Partners in Flight, as well as the native biodiversity associated with the historic grassland landscapes of the Interior Low Plateaus ecoregion of Tennessee and Kentucky. Habitat improvements for the bird species of concern, which are more dependent on vegetation structure than on species composition, can be accomplished by opening up suppressed native grasslands with removal of woody cover and prescribed fire, reconversion of cropland or fescue pastures to native grasses, increasing forb-to-grass ratios, changing grazing intensities, and altering haying regimes. We are also focusing on imperiled grasslands simply in need of management practices to restore them back to their natural conditions. This strategy will be employed in cases where higher native plant diversity is important to maximize benefits to a wider variety of organisms. Three species of grassland-breeding birds were designated as priorities for the CHJV in the 2016 Landbird Conservation Plan: Northern Bobwhite, Henslow's Sparrow, and Eastern Meadowlark. The CHJV region supported an estimated 6.5 million-acres of native grasslands (prairies, savannas, barrens, glades) at the time of European settlement, but nearly all of it has been lost or degraded due to conversion to row-crop agriculture or non-native pasture grasses, succession to woodlands and forests, and urban development. As a result, it is critical that we work with NRCS and

other partner agencies and organizations to implement farm bill programs that favor grassland restoration, either through biodiverse focused conservation practices or establishing native warm season grass pastures that mutually benefit livestock and native grassland species.

U.S. Fish & Wildlife Coastal and Partners Programs

April Punsalan, U.S. Fish & Wildlife Service

The “Bog”Shed: The Importance of Headwaters to Species Protection

Brenda L. Wicchman, North Carolina Natural Heritage Program

Chris Stoeihrel U.S. Forest Service, Cherokee National Forest

Caitlin Elam Tennessee Natural Heritage Program, Division of Natural Areas

Some of the rarest wetlands in the southeastern United States are the non-alluvial wetlands of the Blue Ridge region. Many of these wetlands are current conservation areas or priorities and these wetlands, colloquially known as bogs, harbor many rare and endemic plant species as well as globally rare plant communities. Targets for conservation priority have traditionally been the lower reaches of these systems which contain the concentrated rare species occurrences, while not considering the sources of hydrology, the headwaters. We will discuss a non-profit, federal, and state partnership approach to enhancing the resiliency of these systems through holistic ecosystem protection in North Carolina and Tennessee.

Working with Private Landowners to Conserve Critically Endangered Plant Species

Juliet Rynear, Florida Native Plant Society Executive Director

The Florida Native Plant Society (FNPS) is working with private landowners to help conserve critically endangered plant species. Two of our projects represent the importance and value of this work: the Warea Partnership Project and the TorreyaKeepers Project.

Warea amplexifolia (clasping warea) is a federally-listed endangered plant species endemic to central Florida and only 2 large populations remain (greater than 500 plants). The largest population resides entirely on private lands and many of those are small parcels that resulted from a failed subdivision in the 1960's. By partnering with private landowners, FNPS has been able to assist in land management (population and habitat monitoring, fuel reduction and prescribed fire). FNPS has also acquired and assisted in the acquisition of parcels for conservation by working with local land trusts, private foundations, and nonprofit organizations.

The Florida Panhandle is home to the most endangered conifer in North America: *Torreya taxifolia* (Florida torrey). *Torreya taxifolia* is a Federally Endangered tree that only occurs in the ravines east of the Apalachicola River in Liberty and Gadsden counties. Since the 1950's, *Torreya taxifolia* populations have declined to fewer than 1,000 mature trees, as the species is infected with a deadly fungal pathogen. Most known trees are on State lands, including Torreya State Park which is named after this iconic species. FNPS is working to: 1) reach out to property owners in the known range of

Torreya taxifolia, 2) document and monitor confirmed trees, 3) collect genetic material, and 4) advise on best management practices.

Rare Plant Habitat Protection on Butler Conservation Fund's Black River, SC Private Lands: *Macbridea caroliniana* on a Fire-Managed Disturbed Site, *Stewartia malacodendron* and *Collinsonia sp.* on Remnant Levee Patches, and *Isoetes hymenalis* on a Road

Butler Conservation Fund (land owner), **USFWS** (affiliate), **Cecelia Dailey**, M.S. Candidate, The Citadel; **Dr. Richard D. Porcher**, **Dr. Joel Gramling**, **Dr. Jean Everett**, **Dr. Timothy Callahan**, **Michael Kunz**, **April Punsalan**, **Dr. John Nelson**, **Keith A. Bradley**, **Dr. Brian Scholtens**, **Dr. Jay F. Bolin**, **Peter Schafran**, **Steve Bowling**, **Dana Beach**, **Jonathan Keyser**, **Nathan Platt**, and **Kevin Lloyd Hill**.

Butler Conservation Fund of Great Neck, NY owns 2 tracts of land on the Black River, SC with diverse habitat and several rare plants. The two most spectacular are Carolina bogmint, *Macbridea caroliniana* (blooming July-September) and silky camellia, *Stewartia malacodendron* (found blooming in April and October). The diminutive *Isoetes hymenalis* (quillwort) was discovered on a powerline cut and an old road, and identified using DNA Flow Cytometry. A *Collinsonia sp.* (thought to be *C. tuberosa*) is growing twice as large as typically observed, indicating that the location might be nutrient-rich or calcium-rich, found near the *Stewartia* site. Educating about threatened plants (especially the less-than-spectacular), gaining insight into their communities and biogeography, and providing management recommendations is a part of Dailey's job for the Butler Conservation Fund.

A large population of *Macbridea caroliniana* (Carolina bogmint) was discovered in 2019 and Dailey performed a seed collection project separated by maternal line for UNC Chapel Hill Botanical Garden, and USFWS for propagation and study of seed biology at Bears Bluff Fish Hatchery greenhouse. Plants grown will be installed for public access, with education signage. This disturbance-loving species is usually found in light gaps in the swamp, mowed areas, and ditches, but the Black River hosts the only population known to be managed with fire. Dailey has applied for a USFWS grant to document populations in South Carolina, collect seed, and study the habitat including plant community, groundwater, and soil attributes. The pink-striped flowers are large for a mint, an exciting floral display in the summer heat. Dailey has also found a white flowering plant (a rare variation).

Stewartia malacodendron discovered was reported by Porcher to be the largest he'd seen in his 50-year career, found on a slope in a patch of remnant levee formed by the Black River. Study of the population and propagation by rooting is underway. With saucer-sized white flowers and purple stamens pointed toward the sky, this native understory shrub has innate beauty to the human eye.

The Butler Conservation Fund working in association with Dana Beach (retired head of the Coastal Conservation League) hosts canoe trips and group events. Creation of hiking trails and additional plans for public access are progressing through 2020. Challenges and successes of private land conservation will be discussed.

Restoring Federally Endangered Plant Species *Oxypolis canbyi* and *Schwalbea americana* and Their Habitats on Two Private Conservation Properties in South Carolina

Dr. Jeff Glitzenstein, Tall Timbers Research Station

John Brubaker, South Carolina Native Plant Society

Sudie Thomas, USDA-NRCS

Joe Cockrell, USDI-USFWS

Kathy Boyle, SC Heritage Program

Linda Lee, Savanna River Ecology Laboratory

Lisa Lord, Longleaf Alliance

April Punsalan, USDI-USFWS

Trenton Miller, SC Botanical Garden

Patrick McMillan, SC Botanical Garden

Beginning in 2003 we have been restoring the federally endangered *Oxypolis canbyi* and its habitat at South Carolina Native Plant Society's 52-acre Lisa Mathews Memorial Bay near Bamberg, SC. The LMMB preserve consists of a beautiful diverse Carolina Bay wetland that encompasses the *Oxypolis* population, as well as surrounding uplands. When the property was acquired by SCNPS the uplands were infrequently burned dense loblolly pine plantation with little native groundcover; furthermore, wetland transitions had been invaded by dense stands of wetland hardwood trees and overly dense pondcypress. Restoration activities included removing the planted loblolly pine stands, logging the ecotones, thinning out shrubs and small trees within the wetland, and planting container grown plugs of longleaf pine, wiregrass and other native groundcover herbs. Repeated prescribed burning coupled with mechanical brushcutting has largely restored the herbaceous character of the understory and planted species, including wiregrass, have proliferated across the site. The first *Oxypolis canbyi* count in October 2005 found 217 stems. The present population numbers in the tens of thousands. The large increase is likely attributable to our restoration work. We have also been restoring wetland and upland vegetation on a 50-acre parcel at McAlhany Nature Preserve in Dorchester County, SC, owned and managed by the Charleston Natural History Society. Prior to restoration this parcel consisted of disturbed old field abandoned agricultural land. As at LMMB longleaf pine and wiregrass were planted along with other native grasses and forbs. Included among the plantings were two federally endangered species, *Oxypolis canbyi* and *Schwalbea americana*, propagated from locally collected seed at SC Botanical Garden. Recent *Schwalbea* plantings at McAlhany Preserve have been partially successful and there are now 58 well established individuals including five that flowered this spring after a January fire. *Oxypolis canbyi* were grown as containerized plugs which were planted into an ex-situ habitat at SCBG wherein they increased rapidly and produced a dense mass of stems with several clones intermixed. An approximately 50 cm x 50 cm square of this *O. canbyi* "sod" consisting of ~ 100 stems was removed from SCBG and planted into the edge of the McAlhany wetland following the January fire. An inspection in May indicated good early survival but long-term success of planted *O. canbyi* is not yet certain.

Natural History and Population Status of a Rare Shrub, the Miccosukee Gooseberry, on Private Land in North Florida

R. Todd Engstrom, Tall Timbers Research Station and Land Conservancy

The Miccosukee gooseberry (*Ribes echinellum*) was discovered in on private land in Jefferson County, Florida, in 1924. A second population was located in McCormick County, South Carolina, in 1957, but this is a study of the Florida population only. The species was classified as federally threatened in 1985. A portion of the Florida population was monitored from 1992 to 2001 by The Nature Conservancy and intermittently from 2010 to 2016 for the USFWS. Florida Natural Areas Inventory ecologists mapped the general distribution of *Ribes* in Jefferson County in 1985. A re-survey of the same area in 2016 determined that gooseberry still occurs to the same extent 31 years later. *Ribes* appears to thrive in tree fall gaps. Some of the most productive plants, in terms of the number of fruit produced, and some of the densest patches of gooseberry occurred along trunks of large fallen trees. Fruit production in the gooseberry is rare (median number of clumps with fruiting stems was 1.4% for the two subpopulations from 1992-2001), but the species is still common in the small area where it was first described. In 2010 I estimated that there were 8600 gooseberry clumps in the two largest subpopulations, but how clumps relate to genets is unknown. The population trend of gooseberry in one of the two largest subpopulations indicated by transects declined by 14.2% from 2011 to 2013, and nearly every transect in the subpopulation declined from the 10-year average collected from 1992 to 2001. Recent genetic studies revealed low genetic variation suggesting an increased risk of extinction or population decline, and another recent study indicates that seed predation by a mouse could have a significant negative effect on seed dispersal. One hypothesis for local declines of *Ribes* is rapid growth of extremely dense stands of laurel cherry (*Prunus caroliniana*).

Abandoning Risky Agriculture and Leveraging Natural Capital: A County-Level Method for Identifying Conservation Opportunity

Dr. James Luken, College of Science, Coastal Carolina University

Marginal land now devoted to growing harvested crops may be better suited to other land uses such as biodiversity enhancement and carbon sequestration. However, farmers are not encouraged to explore the development of these opportunities due largely to subsidized federal crop insurance (FCI). This study examined FCI outcomes from 2013-2017 in 69 Coastal Plain counties of North Carolina and South Carolina. The loss ratio (total crop indemnities paid/total insurance premiums paid) was used to identify 21 counties with high-risk agriculture. Then an index of conservation opportunity was calculated for each county using the loss ratio, insurance subsidy and an estimate of natural capital (i.e., renewable or nonrenewable natural resources the can provide benefits to humans). Where marginal farmland is surrounded by forest and natural capital is high, the index will identify counties currently supported by FCI that more quickly and completely incorporate the full range of ecological dynamics and biological diversity when farming is abandoned. The top 10 counties for conservation opportunity, with the exceptions of Scotland County, NC and Marion County, SC., were located in the outer Coastal Plain or coastal zone where natural capital is high. Transitioning land use from harvested crops to biodiversity enhancement or carbon sequestration will require bold changes in agricultural policies and subsidies so that income streams to farmers are maintained while novel ecological targets are met.

Poster Abstracts

***Amaranthus pumilus* (Seabeach Amaranth) Restoration on Atlantic Coast National Wildlife Refuges**

Dale Suiter (U.S. Fish and Wildlife Service), **Erin King** (U.S. Fish and Wildlife Service) and **Michael Kunz** (North Carolina Botanical Garden)

Amaranthus pumilus (Seabeach amaranth) is a federally threatened species endemic to the Atlantic coast from South Carolina to Massachusetts. This fugitive annual species is vulnerable to climate change, sea level rise, development of beachfront property and increased beach use such as foot and vehicular traffic. Range-wide, the species declined by 99.5% between 2002 and 2013. The main goal of this project was to establish self-sustaining populations on natural beaches at six National Wildlife Refuges (NWR) and two nature preserves that are less vulnerable to man-made threats and are more resilient to climate change and sea level rise. A secondary goal was to collect seeds for ex situ storage in approved seed banks to further protect the species from extinction. In 2017, we planted 12,730 *A. pumilus* seeds in 83 seed plots at six NWRs and two conservation reserves from SC to MA. Total germination among all plots was 37.4%. Many seed plots were flooded or buried by tropical storms and nor'easters before senescence, resulting in a loss of reproductive individuals. Of the 4,756 seeds that germinated, at least 1,478 (31.1%) plants across all sites flowered and 770 (16.2%) fruited. In 2018, recruitment was observed at five of the six NWR beaches and one plant was found at one of the two private preserves on Nantucket. In 2019, recruitment occurred at only three NWR beaches and neither private conservation property on Nantucket. These restoration activities have established short term populations of this fugitive annual species and added to the seed bank, but additional work is still needed to ensure long-term viability. We will continue to monitor for new recruitment into the future. The seed increase resulted in a surplus of approximately 78,000 seeds which have been placed in long-term storage and the North Carolina Botanical Garden and the National Laboratory for Genetic Resources Preservation.

Assessment of the Resiliency and Status of Endangered Apalachicola Rosemary, *Conradina glabra* Shinnery (Lamiaceae)

Amber Rittgers, Student at the University of North Georgia

Lauren Eserman, Atlanta Botanical Garden

Apalachicola rosemary (*Conradina glabra* Shinnery) is a rare perennial shrub endemic to the xeric sandhills east of the Apalachicola River in Liberty County, Florida. *Conradina glabra* is federally endangered due to habitat destruction and modification resulting from incompatible forest management practices that further impact this species' narrow distribution. Currently, there is only one known 1,000 ha area population recorded. To assist species recovery, the U.S. Fish and Wildlife Service and the Atlanta Botanical Garden aim to maintain a reproductive and genetically diverse population. One outstanding question is whether *C. glabra* is primarily clonal or is reproducing sexually in situ. Using population genetic analysis, we are testing for clonality and the extent and structure of genetic diversity in *C. glabra* so that targeted conservation efforts may be applied. Individual plant samples (n=745) were collected from 15 restoration zones in Torreya State Park utilizing two sampling schemes in March of 2019. We isolated genetic material from each

sample for genotyping by RADSeq technique. Future analysis of single nucleotide polymorphisms (SNP) may provide insight on *C. glabra*'s genetic diversity and species resiliency by characterizing variation and clonality.

A Big Year for Plant Conservation in Georgia's Transportation Rights-of-Way

Brian Davis (GDOT), **Bradley Daugherty** (GDOT), **Hannah Held** (GDOT), **Sara Kuhn** (GDOT), **Sujai Veeramachaneni** (GDOT), **Chris Goodson** (GDOT)

From in situ and ex situ safeguarding projects to improvement of survey and management practices, the Georgia Department of Transportation (GDOT) has had a landmark year working closely with partners from the Georgia Plant Conservation Alliance (GPCA), along with federal and state agencies towards plant conservation in Georgia. GDOT assesses habitat for and conducts seasonal surveys for state and federally listed plant species across Georgia for proposed transportation projects. Based on newly developed survey methodologies, 2019 was a big year for identification of previously unknown protected plant populations within transportation rights-of-way across Georgia. New guidance for demarking these Environmentally Sensitive Areas and site-specific management plans offers a unique opportunity for protected plant recovery within publicly maintained transportation rights-of-way.

Census and Reassessment of the Critically Endangered Alabama Canebrake Pitcher Plant, *Sarracenia alabamensis*, 24 Years Later

Noah D. Yawn, Donald E. Davis Arboretum, Auburn Univ. Dept. of Biological Science; **Ron O. Determann**, The Atlanta Botanical Garden, Dept. of Conservation and Research; **Patrick Thompson**, Donald E. Davis Arboretum, Auburn Univ. Dept. of Biological Sciences; **Debbie R. Folkerts**, Auburn University Dept. of Biological Sciences; **Jessica D. Stephens**, Salve Regina University Dept. of Biology and Biomedical Sciences

The Alabama Canebrake Pitcher Plant, *Sarracenia alabamensis*, is an extremely endangered species extant at only eleven total occurrences in two counties in central Alabama. This Alabama longleaf pine hills endemic species is notable for its current and historic rarity, as well as unique soil composition and habitat, occurring predominantly on nutrient-poor sandy and gravelly permanent seepage slopes within the Tuscaloosa Formation. Though many sites are monitored and managed to a degree, recent population data across the species range is scarce, with the last census occurring in 1995. The main objective of this study was to collect comprehensive population data on all existing populations, record detailed floristic inventories, conduct soil analysis, and develop an updated, thorough, and consistent survey methodology for the species. This methodology includes determining genet size class and quantity, flowering ability, sexual reproduction, and successful seedling recruitment. Additionally, the fertility relationship of each site was determined through seed viability and germination tests across original and out-planted colonies. These data were then compared to the last population census to examine how populations, their associate plant communities, soil composition, and health has changed over the past twenty-four years. This study provides much clearer insight into the species' current habitat and is extremely relevant to its conservation. Results from this work will be used to determine extirpated site quality and reestablishment potential, existing population augmentation, establishment of new sites, and long-term monitoring and management objectives. This methodology can be used for other endangered and threatened

Sarracenia populations, including *Sarracenia oreophila* and *Sarracenia jonesii*, due to their similar scarcity and unique nature.

Collaborate for success in conservation: partnership with USFWS and Para la Naturaleza to protect threatened dry forest plant species in Sierra Bermeja mountains, Puerto Rico

Omar Monzón-Carmona¹ Omar Monsegur-Rivera² & Nahira Arocho-Hernández³ Para la Naturaleza¹, US Fish and Wildlife Service², EnviroSurvey, Inc.³

The establishment and management of protected areas are one of the main tools for biodiversity conservation. To this initiative, privately protected areas (PPA), governed by universities, private companies, and nonprofits; complement the worldwide network of Protected Areas commonly governed by governmental agencies. In Puerto Rico, a local example of privately protected areas in the neotropics has been the protection and management for fifty years of approximately 35,492 acres in 64 PPA initiated by the Puerto Rico Conservation Trust

(PRCT), and currently delegated through its nonprofit unit Para la Naturaleza (PLN). The local non-profit organization was established in the 1970 through a Memorandum of Understanding between the United States Department of the Interior and the Government of Puerto Rico. Para la Naturaleza's goal is to integrate society at large in the conservation of natural ecosystems, in order to increase the amount of protected lands in Puerto Rico, from the actual 16 percent, to 33 percent by the year 2033. Para la Naturaleza seeks to provide each person and each community with transformative experiences that can inspire and motivate concrete actions for nature, such as doing volunteer work, donating money and land, or establishing conservation easements. Since 2013 PLN protects the Sierra Bermeja mountains located in the southwestern tip of the island containing one of the oldest rocks in the Caribbean and considered Key Biodiversity Area. Sierra Bermeja mountains contains two PPA, El Conuco Protected Area, and María Luisa Conservation Easement which safeguarded 7 of the 8 species of flora of conservation concern in the Sierra Bermeja, such as *Eugenia woodburyana*, *Aristida chaseae*, and *A. portoricensis*. In 2019, seedlings, saplings and adults with flower and fruits of *Trichilia triacantha* and *Catesbea melanocarpa* were found in El Conuco Natural Protected Area.

Furthering PLN's conservation actions, in partnership with the U.S. Fish and Wildlife Service, restoration of degraded areas has been initiated, an inventory of these populations will be completed in 2020, and additional measures are proposed to reduce threats to these species such as fires and invasive species. Collaborative efforts between different sectors (governmental agencies and NGOs), are pivotal to achieve the conservation of nature, collectively, by building on organizations' strengths, experience and expertise.

Connect to Protect: Linking Plants, Pollinators, and People One Small Garden and Pocket Prairie at a Time

Heather Alley, Conservation Horticulturist, State Botanical Garden of Georgia; **Jennifer Ceska**, Conservation Coordinator, SBG; **Lauren Muller**, Conservation Outreach Coordinator, SBG; **Jenny Cruse-Sanders**, Director, SBG; **Jim Affolter**, Dir. of Research, SBG; **Cora Keber**, Director of Education, SBG; **Mincy Moffett**, Botanist, GA

Department of Natural Resources, Wildlife Conservation Section; **Becky Griffin**, Community and School Garden Coordinator, Pollinator Health Program Associate, UGA-Georgia Mountain Research and Education Center.

Connect to Protect is a program that combines beautiful public displays of native plants from the built to the restored with educational materials to foster an understanding of the role that native plants play in maintaining biodiversity in urban, suburban, rural, and right-of-way landscapes of Georgia. The program is offered through the State Botanical Garden of Georgia, a unit within University of Georgia, Public Service and Outreach and reaches actively across the state selecting native plants for each province of Georgia that are great horticulture selections with ecological relevance. Healthy ecosystems rely on native plants. Plants and insects form the base of the animal food chain. Reptiles, amphibians, birds, fish, and mammals all require insects in their diet to survive. Insects require native plants to eat and native plants need insect pollinators. Without native plants woven into all Georgia landscapes, biodiversity declines at all levels from bees to birds to butterflies and lizards. The good news is that studies have shown adding regionally appropriate native plants to neighborhoods does positively support birds and other biodiversity in urbanized areas. Biodiversity gardens can range in size from pots and planters to full-sized gardens to roadside restorations and plantings. While we encourage homeowners to implement the Connect to Protect philosophy in their own yards, gardens in the Connect to Protect network require a suite of commitments ranging species selection, chemical management, and education value.

Conservation of Chapman's Fringed Orchid (*Platanthera chapmanii*) in Southeast Georgia and Northeast Florida

Emma Neigel, Atlanta Botanical Garden; **Houston Snead**, Jacksonville Zoo; **Matt Richards**, Heinz

Since 2009, Atlanta Botanical Garden (ABG) has been conducting roadside surveys and habitat management for Chapman's fringed orchid (*Platanthera chapmanii*). Chapman's fringed orchid has a G2/S1 rarity status in Georgia and Texas and in 2017 was listed as state endangered in Florida. The species is listed as vulnerable on the IUCN red list and faces risk of extirpation due to its narrow range and many threats including roadside mowing, herbicide spraying, and heavy machinery usage in right-of-ways (Richards and Sharma 2014). The pine flatwoods populations in public forestland are threatened by logging, ditching, and recreational vehicles such as ATVs.

Harmful land management practices also include untimely mowing and suppression of fire, allowing hardwoods and vines to overgrow prime habitat areas. Jacksonville Zoo has partnered with ABG since 2016 to survey Florida which lead to its listing as endangered. In August 2018, partners surveyed the Apalachicola National Forest and private landowner property, discovering populations that had previously been unvouchered. Through partners in conservation, such as local government, utility companies, private landowners, Florida Department of Agriculture, US National Forest Service, and Florida Forestry Commission, Chapman's fringed orchid native range can be preserved with proper habitat management, and ex situ and in situ conservation horticulture.

Developing Conservation Opportunity Areas for Arkansas: The Importance of Recognizing Partners in the Landscape

Toby Gray, Mississippi State University; **Todd Jones-Farrand**, US Fish and Wildlife Service

The Association of Fish and Wildlife Agencies (AFWA) recommends the identification of Conservation Opportunity Areas (COAs) as a best practice for State Wildlife Action Plan (SWAP) revisions. Of the ten southeastern states of the US Fish and Wildlife Region 4, seven have incorporated some version of COAs into their plan. In 2018, the Arkansas Game and Fish Commission convened a team of stakeholders charged with developing COAs for the state of Arkansas. Partners included the U.S. Fish and Wildlife Service, the Arkansas Natural Heritage Commission, The Nature Conservancy, and Pheasants Forever. The team reviewed the Southeast Blueprint developed by the Southeast Conservation Adaptation Strategy (SECAS) and versions of COAs developed by neighboring states, then decided on a process that would evaluate habitat condition, species distribution, and conservation opportunity as distinct important elements guiding the selection of geographical areas. Habitat condition information was derived from the inputs to the mid-south region's latest contribution to the Southeast Blueprint. Species distribution data came primarily from Heritage Commission records and included plant species not identified in the SWAP. Conservation opportunity was measured by a "partner density" map, an overlay of eleven different sets of areas of interest identified by a diverse selection of state, federal, and non-governmental conservation partners. The three elements (habitat, species, and opportunity) were used to prioritize the landscape into three classes (high, medium, and low quality), resulting in 27 unique combinations of classified landscape ranks. Using the landscape ranks as a guide, the set of twenty-one draft COAs were developed through six workshops with the team of conservation partners. This is a case study of partner inclusion in a state-level development of a conservation support tool.

Developing a Mississippi Plant Conservation Alliance

Dr. Toby Gray, Mississippi State University; **Scott Wiggers**, US Fish and Wildlife Service; **Melinda Lyman**, The Nature Conservancy; **Eli Polzer**, US Army Corps of Engineers

Despite Mississippi's comparatively young surficial geology, the state features an array of rare plant communities and unique assemblages within its distinct landscapes, including barrier island beach dune herbland, blackbelt prairie, Jackson prairie, longleaf pine savanna, pitcher plant bogs, swamp forests, and many others.

With encouragement and assistance from the Southeast's burgeoning regional conservation network, Mississippi is now in the formative stages of developing a cohesive, statewide plant conservation organization responsible for bolstering the protection of nearly 500 species of concern and over 100 designated "watch" species. To that end, Mississippi PCA members have been actively working with other regional plant conservation organizations, such as the Alabama PCA, and botanical groups, such as the MS Native Plant Society, to develop a solid foundation firmly rooted in floristic conservation principles and practice.

Core members participated in an inaugural meeting in August 2019, attracting 17 people from 12 organizations, through which fifty-eight organizations and sixty-five individuals were identified as likely partners. These lists continue to grow as

Mississippi PCA remains focused on identifying, recruiting, and engaging a critical mass of researchers, practitioners, and partners that understand Mississippi's plant conservation needs, limited resources, and unique challenges. Mississippi PCA members will soon form a steering committee, articulate state-specific goals and priorities, enhance the website, and cultivate a social media presence for education and outreach, thereby broadening the reach of its important work of plant conservation.

Deer browsing, native vegetation, and camphor tree invasion on a Georgia barrier island

Dessa L. Dunn, PhD student at the University of Georgia, Odum School of Ecology

Elizabeth G. King, PhD. University of Georgia, Odum School of Ecology and Warnell School of Forestry and Natural Resources

The camphor tree (*Cinnamomum camphorus*) was introduced from Asia to the subtropical portions of the southeastern United States over 100 years ago and is naturalized in many areas. In recent decades, however, it has become increasingly abundant on Jekyll Island, an Atlantic Ocean barrier island in Georgia. Native white-tailed deer (*Odocoileus virginianus*) populations have also increased during this period. We sought to explore whether deer herbivory is affecting native understory vegetation cover, camphor seedling abundance and growth, and abundance of native hardwood tree seedlings. We established 22 6x6m plots in a 40ha area with heavy camphor proliferation, of which 11 were fenced to exclude deer and 11 were not. Each plot was subdivided into 25 1x1 m quadrats. In April 2018, in each quadrat we counted, tagged, and measured height and leaf number of each camphor seedling. We also recorded total herbaceous vegetation cover, cover by species, and abundance of hardwood tree seedlings.

Plots were re-measured in July 2018, September 2018, and May 2019, also tagging and measuring newly emerged camphor seedlings at each census. Deer herbivory was associated with decreased native herbaceous vegetation cover and decreased abundance of native tree seedlings, while camphor seedling abundance, growth, and turnover varied with herbivore treatment, site, and other environmental covariates. We examine the relationships between herbivory effects on camphor versus native species and discuss the implications for efforts to control camphor invasion and support native tree recruitment.

Evolutionary Relationships in the Euglossine Bee Pollinated Orchid Genus, Stanhopea

Chazz Jordan, Becky Brinkman, Emily E. D. Coffey PhD, Lauren A. Eserman PhD, Atlanta Botanical Garden

Over the years, the survival rate of the orchid genus, Stanhopea, has dwindled and as a result, its trade is restricted by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Its restriction in trade means that the genus, Stanhopea, is vulnerable and conservation efforts are necessary for its long term survival. The Stanhopea genus is distributed in Mexico, Trinidad, and Central and South America; however, for conservation purposes, out of the 66 species and 46 hybrids, the Atlanta Botanical Garden has 90% of this genus in its living collection. This genus is significant because of its unique floral fragrances used to attract Euglossine bees and its obligate pollination relationship. For my project, I am using phylogeny to understand similar and dissimilar characteristics between species. Currently, there is no fully resolved phylogeny for this genus, so my undergraduate project is adding

several chloroplast genes to the data for this genus. In my undergraduate research, the phylogenetic trees were based on similar DNA sequences for the *rbcL* and *matK* genes that were isolated from the chloroplast genome. The *rbcL* gene is used to see conserved characteristics while the *matK* gene shows genetic variability between different species. I aimed to use the *ycf1* gene to see more genetic variability between species. However, for some genus' the *ycf1* gene is too variable. The next stage of this research is to look at chloroplast intergenic spacers and single-copy genes on the *Stanhopea* chloroplast genome. The basic genetic work involves DNA isolation, Qubit, PCR, Gel Electrophoresis, and DNA sequence analysis. By focusing on specific genes, using isolated DNA from the chloroplast genome, and creating phylogenetic trees, the relationships between species of *Stanhopea* can be better understood. I also hope that this research will help answer the broader question of what gene is the most suitable for the DNA barcoding of monocots.

The First Plant Species Projects Funded by Section 6 Grants in Alabama

Wayne Barger, Natural Heritage Section, Alabama Department of Conservation, State Lands Division; **Alfred Schotz**, Alabama Natural Heritage Program, Auburn University Museum of Natural History; **Patrick Thompson**, Auburn University Davis Arboretum, Alabama Plant Conservation Alliance

This poster highlights the first 9 projects to be funded by grants funded through Section 6 of the Endangered Species Act in the state of Alabama. The species addressed in these projects areas follows: *Platanthera integrilabia*, *Sagittaria secundifolia*, *Sarracenia oreophila*, *Spigelia gentianoides*, *Apios priceana*, *Clematis morefieldii*, *Helianthus verticillatus*, *Lilium iridollae*, and *Schmalbea americana*. For each project, the poster includes the species name and photo, title, researchers, objective, and expected results. The poster also includes a list of all AL plant species eligible for section 6 grants.

Georgia's Arthropod Diversity Featured in Georgia Biodiversity Portal

Anna Yellin, Wildlife Conservation Section, Georgia Department of Natural Resources Greg Krakow, Wildlife Conservation Section, Georgia Department of Natural Resources

Abbie Abouhamdan, Wildlife Conservation Section, Georgia Department of Natural Resources Katie O'Shields, Wildlife Conservation Section, Georgia Department of Natural Resources

The Wildlife Conservation Section of Georgia DNR is attempting to reach the public through the new Biodiversity Portal (<https://georgiabiodiversity.org/>). In the past year, we have contracted specialists to write about some of the diverse species that are less commonly known or are in decline. These species are found on the link:

<https://georgiawildlife.com/conservation/species-of-concern>

As stated in the recent update of the State Wildlife Action Plan (SWAP), "Terrestrial invertebrates are the most diverse taxon to be considered ... but the most poorly understood. Most species of terrestrial invertebrate lack fundamental information on abundance, range, population trend, threats, or protection needs." These species include a wide variety such as the Federally listed *Bombus affinis* (Rusty patched bumble bee), a significant native buzz pollinator that was once abundant and *Fernaldella georgiana* (Ohoopee Narraga), which is an endemic moth local to the Georgia sandhills. These species are essential to the ecology of many native plant species in ways that are still being discovered.

This poster will introduce how the Wildlife Conservation Section (WCS) obtains information regarding species presence and translates the information to the public through descriptions, photos and range maps. These 'species treatments' are presented for plants and animals across the taxa. Information included in our profiles includes: Description, Similar Species, Habitat, Diet, Life History, Survey Recommendations, Range, Threats, Georgia Conservation Status, Conservation Management Recommendations, and References. The information is used by students, researchers, land managers, and agencies such as the Fish and Wildlife Service to determine what species should be further examined for protection. The display will show how to access and use the Biodiversity Portal.

Huntsville Botanical Garden's Native Plants Teaching Garden: Replacing invasive species with natives and making native plant collections more accessible via web maps

Tracy Cook is the curator of plant collections at Huntsville Botanical Garden (HBG). For 5 years, she has been increasing documentation quality using a geographic information system (GIS) aiming at collections-driven research and dissemination of information from wild-collected taxa of known provenance. She also serves as a board member for the Alabama Invasive Plant Council and a project lead with the Alabama Plant Conservation Alliance for *Clematis morefieldii*.

Peter Hannah is the Geospatial Information & Services Manager for Redstone Arsenal Garrison U.S. Army Installation. Peter has 25 years of experience in multiple facets of the GIS industry. He has piloted fixed-wing aircraft for aerial image surveys, compiled and performed quality assurance/quality control on planimetric data from aerial imagery, and collected and processed Global Positioning System (GPS) data. For 2.5 years, he has volunteered over 1000 hours to help HBG utilize GIS to manage the assets of the garden better.

Public gardens are a bridge between the urban and natural environments and both native and exotic species may add value to a landscape. A problem arises when introduced plants begin displacing desirable species and causing management headaches in both manicured landscapes and in surrounding natural areas. The Tennessee Valley region of north Alabama is currently experiencing a multitude of challenges related to exotic plant escape and invasion, and residents look to Huntsville Botanical Garden to provide solutions to their landscape problems. To this end, we renovated a highly visible garden space that contained a legacy planting of invasive plants and transformed it into a native plants demonstration border. Interpretive signage, educational programming, and a web-based mapping application allow us to share the plant collection information and pollinator and bird interactions with visitors in an interactive format. Since public engagement in horticulture is often driven by the exhibition of display gardens, this is a well-placed venue to offer community education about conservation issues and engender pro-conservation attitudes among our visitors. The Native Plants Teaching Garden is a no-admission outreach garden providing inclusive opportunities to engage demographic groups that are under-represented in garden membership. It is our aim to raise awareness of the ecological harm of invasive plant species on native plant communities and grow new generations of people committed to conservation of the natural world.

The Ichauway Seed Bank: Prioritizing Species for Future Seed Collections

Sara Carey Smith, Lisa M. Giенcke, The Jones Center at Ichauway, Newton, GA

In 2019, the Plant Ecology lab at The Jones Center at Ichauway (a 29,000 acre ecological research center located in southwest Georgia) began a seed bank project focusing on the flora of the longleaf pine ecosystem. For the first year of collection we focused on a set of priority species which we defined as those listed as vulnerable, imperiled, or critically imperiled species in Georgia and are found on Ichauway. We were able to collect seed from 23 of the 36 species. Moving into our second year, we would like to expand our species of interest for our seed bank. With more than 1,100 species known from Ichauway, it can be difficult to prioritize which species to add to the seed bank project. Here we lay out a system for ranking future seed banking efforts by creating filters that give priority status to rarity and endemism, as well as species that are good candidates for future ecosystem restoration projects that are not currently commercially available from a local seed source.

Introducing CPC Rare Plant Academy – An Online Community of Practice for Training the Next Generation of Plant Conservationists

Katie Heineman and **Joyce Maschinski**, Center for Plant Conservation & San Diego Zoo Institute for Conservation Research

With more than 4400 plant species in the U.S and Canada facing extinction, there are too few trained professionals devoted to making and maintaining rare plant collections with the highest possible curation standards. For botanical institutions seeking to expand their conservation programs, uncertainty of correct methodology and fear of doing harm to rare species poses a barrier to engagement in vital plant conservation work. The Center for Plant Conservation (CPC) is a community of practice, comprised of 43 participating institutions, dedicated to ensuring stewardship of imperiled native plants and securing all plant species in North America from extinction. For more than 35 years, CPC scientists have collaborated to generate CPC Best Practice Guidelines for seed collection, curation, and reintroduction; these form the basis of sound plant conservation practice worldwide.

To make these guidelines more accessible and relevant to the broader botanical community, CPC is introducing the CPC Rare Plant Academy (formerly known as Plant Nucleus). This IMLS-funded online platform presents the best practice guidelines as webpages integrated with video tutorials and questions from a community forum. Our goal is to present the CPC guidelines as an interactive learning opportunity that can address questions both general and specific. Every rare plant poses unique conservation challenges that fall outside a set of generalizable guidelines. Our goal is to recruit experienced conservationists to contribute their invaluable conservation expertise to this platform, and encourage newcomers to leverage the CPC network's brain trust as a training ground. Web analytics data already indicates that web-based protocols and videos receive orders of magnitude more engagement than print guidelines alone. We invite conservationists at SePPCon to join the Rare Plant Academy and collaborate with CPC on our production of video tutorials for the next generation of plant conservationists.

Modeling Habitat Suitability for *Stewartia ovata* Using Maximum Entropy Techniques: A Framework Using Citizen Science and Natural History Records for Rare Plant Conservation

Clayton Hale, Dr. Joshua J. Granger, Dr. Qin Ma, and Dr. Jia Yang, Mississippi State University, Department of Forestry

Modeling species habitat suitability has become a critical first step in conserving rare or threatened plant species. These models allow conservationists to locate previously undocumented populations and prioritize populations and habitats for conservation. Mountain *Stewartia* (*Stewartia ovata* (Cav.) Weatherby) is a rare shrub or small tree endemic to the piedmont and mountains of Georgia, Tennessee, and Alabama with isolated populations occurring in Kentucky, North Carolina, South Carolina, Virginia, and Mississippi. The species often goes miss identified or overlooked by land managers and conservationists. As a result, *Stewartia* habitat niche descriptions and distribution data is insufficient for restoration and conservation use. Presented is the habitat suitability of the species across its natural range. Herbarium records (36), research grade iNaturalist observations (43), and other author identified locations (10) were used with 10 environmental layers to develop a maximum entropy model (MaxEnt). The 10 environmental layers included, elevation, aspect, soil type, forest type, mean maximum temperature, mean minimum temperature, mean maximum vapor pressure deficit, mean minimum vapor pressure deficit, precipitation, and topographic wetness index. A cross validation MaxEnt model was ran 83 times, and was determined to be statistically significant with an AUC of 0.943 and a standard deviation of 0.118. A jackknife test to evaluate the importance of the input variables found soil type and elevation contributed 33.2% and 31.9% to the model, respectively. The resulting probability map was classified into bins of 10% of habitat suitability for spatial analysis. 2,370 km² (585,615 acres) were designated within the top 10% tier of which 641 km² (158,317 acres) is public, protected land. The presented model will allow plant conservationists to potentially locate new populations of mountain *Stewartia* and identify suitable areas for the establishment of new populations. This approach provides a framework for using citizen science and natural history records for the modeling of other rare plant species with limited occurrence data.

Networking for Conservation - the Georgia Plant Conservation Alliance

Jennifer Ceska, Conservation Coord., State Bot. Garden of GA; **Jim Affolter**, Dir. of Research, SBG; **Heather Alley**, Conservation Horticulturist, SBG; **Jenny Cruse-Sanders**, Director, SBG; **Malcolm Hodges**, Ecologist, TNC of GA; **Lisa Kruse**, Sr. Botanist, GA DNR; **Mincy Moffett**, Botanist, GA DNR; **Jacob Thompson**, Botanist, GA DNR; **Nathan Klaus**, Sr. Biologist, GA DNR; **Eamonn Leonard**, Biologist, GA DNR; **Jimmy Rickard**, Forest Bot/Ecol, Chat-Oconee National Forests, US Forest Service; **Carrie Radcliffe**, Restoration Coord., Atlanta Bot. Garden; **Emily Coffey**, VP for Cons & Res., ABG; **Henning Von Schmeling**, Sr. Dir. of Operations, Chattahoochee Nature Center; **Don Imm**, Field Supervisor, US Fish & Wildlife; **Michele Elmore**, Ecologist, US FWS; **Lisa Geincke**, Ecologist, The Jones Center at Ichauway; **Meg Hedeem**, State Environmental Liaison, GDOT; **Jeff Killingsworth**, Nursery Manager, Beech Hollow Farms; **Christine Patrum**, Director, GSU Native Plant Bot. Garden; **Stefan Bloodworth**, Director, Columbus Bot. Garden

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. GPCA began its work in 1995 with the goal of preventing plant extinctions in Georgia. 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. We have lessons learned and stories gathered working with over 50 organizations and 200 conservation professionals who are passionate, driven, dedicated, and well and truly busy. We all have more to do than we can do. But we find that working together profoundly helps. We believe networking to be a powerful tool for conservation. There are thoughtful choices we made from the beginning to stay project driven. Networking for conservation comes with extra time pressures, the dire needs of critically imperiled species, the workloads carried by conservation professionals, the mirth of the seasons trying to collect and increase viable material, and the slow recovery of plants and their habits requiring years of commitment and repeated actions and treatments. The work is daunting, and the work is doable. By working together, we leverage limited resources of equipment, effort, energy, and time. And along the way we move from colleagues to friends to conservation family. Since SePPCon 2016, we have made changes in our work partnering with sister states, recovering plant communities and their insect cohorts, training ever more students, and developing new policies on hog impacts and technology safety checks.

North Carolina Natural Heritage Program

Wesley M. Knapp & Brenda L. Wichmann

The North Carolina Natural Heritage Program is located within the Division of Land and Water Stewardship, which is housed in the North Carolina Department of Natural and Cultural Resources. The Division of Land and Water Stewardship provides science to support conservation, planning, and business decisions and foster partnerships which inform and result in the conservation of natural areas and the building of resilient communities in North Carolina. This mission involves the public, governmental agencies, private organizations, and landowners in efforts to: maintain functional ecosystems, biological diversity and working landscapes through the stewardship of land and water resources; conserve and restore the State's natural heritage and sustain a healthy life for all North Carolinians and visitors. The Division of Land and Water Stewardship includes the Clean Water Management Trust Fund.

The Natural Heritage Program is mandated by the state Nature Preserves Act of 1985 and the associated administrative rules, (1) to effectively identify through systematic research and recommend for conservation the natural areas which best exemplify North Carolina's natural heritage, (2) to facilitate development of a statewide system of protected natural areas in public and private ownership, (3) to formulate and disseminate rare species management recommendations, (4) to influence private individuals, corporations and public agencies which own natural areas to protect those areas, (5) to provide interpretation of biological information, and coordinate with and advise other agencies, (6) to involve and inform citizens and landowners, and increase public environmental awareness, and (7) to maintain information regarding the distribution and status of rare species to support designation under the Endangered Species Act. The N.C. Nature Preserves Act requires the preparation of a biennial Natural Heritage Protection Plan which identifies protection priorities for natural areas throughout the state.

Partnering to Advance Conservation of Non-Orthodox Seeded Tree Species

Pamela Allenstein, American Public Gardens Association; **David Pivorunas**, Endangered Species Program, U.S.

Forest Service; **Helen Cortes**, Forest Health Protection, U.S. Forest Service

American Public Gardens Association and the United States Forest Service are working together to establish living gene

banks of tree species at risk. Efforts focus on non-orthodox seeded taxa native to U.S. forests which cannot be conserved through traditional seed banking methods. Our Tree Gene Conservation Partnership annually awards matching funds to Association members to support collaborative scouting and collecting trips, propagation, and distribution among public gardens for safeguarding in living collections. Launched in 2015, the Partnership is contributing to the conservation of nearly 30 tree species in 18 states and Puerto Rico. Diverse collaborations among 60+ public gardens, state and federal agencies, universities, forest industry, and conservation alliances have participated in this partnership to date.

Partners for the Recovery of Smooth Coneflower, *Echinacea laevigata*

Heather Alley, Conservation Horticulturist, State Bot. Garden of GA; **Jennifer Ceska**, Conservation Coord., SBG; **Jenny Cruse-Sanders**, Director, SBG; **Jim Sullivan**, Botanist, Georgia Forestry Commission; **Jimmy Rickard**, Forest Bot/Ecol, Chat-Oconee National Forests, US Forest Service; **Mike Brod**, Staff Officer for Fire and Natural Resources, Chat-Oconee National Forests, USFS; **Carrie Radcliffe**, Restoration Coord., Atlanta Botanical Garden; **Mincy Moffett**, Botanist, GA DNR; **Cindy Wentworth** and **Jim Wentworth**, **Doug Watson**, retired, US Forest Service.

Stephens County (NE Georgia), *Echinacea laevigata*, Smooth Coneflower, Listed Endangered State and Federal, G2/S2: A beautiful, tall, and elegant wildflower, Smooth Coneflower was dwindling to extinction on Georgia's roadsides where seed heads were regularly poached from the wild and roadside plants were accidentally scraped off during roadside maintenance. With her Master's thesis in 1999, demonstrating that endangered plants could be carefully and successfully grown from wild sourced seeds and replanted in safeguarding sites away from annual threats, Heather Alley changed the way plant conservation was executed on protected lands in Georgia. Now there multiple safeguarding sites (introductions and augmentations) on protected land owned and managed by the US Forest Service where Smooth Coneflower is growing and thriving. We have planted over 1,000 Smooth Coneflower plants and sown 3,700 seeds directly, so far and documented high survival. This recovery work is not possible without the long term commitments of partners in the Georgia Plant Conservation Alliance and led by the restorations actions of state and federal agencies, the US Forest Service Chattahoochee National Forest and the Georgia Department of Natural Resources, Wildlife Resources Section. The recovery for this species is on-going with annual outplantings of indexed material, hand thinning and other woody species treatments, prescribed fire, and annual monitoring. Partners have documented significant recovery of the understory flora along with recovery of other rare species signature to the Oak-Woodland habitat including *Symphytotrichum georgianum* (G3/S2), *Lysimachia fraseri* (G3/S1), and for the first time in nine years of active looking, a North Georgia specimen of *Pituophis melanoleucus* (S3, Georgia Threatened), Pine Snake. Future plans include significant expansion of the Oak-Woodland grassland plant community as part of the US FS Foothills Landscape Plan.

The Piedmont Prairie Partnership: Progress so far and future directions

Rua Mordecai, U.S. Fish and Wildlife Service

Rickie White, Ellerbe Creek Watershed Association

Carrie Radcliffe, Atlanta Botanical Garden

Jim Affolter, State Botanical Garden of Georgia Jennifer Ceska, State Botanical Garden of Georgia

Dr. Johnny Randall, North Carolina Botanical Garden

Alan Weakley, North Carolina Botanical Garden
Dwayne Estes, Southeastern Grasslands Initiative
Julie Tuttle, University of North Carolina - Chapel Hill

The Piedmont is home to one of the fastest-growing urban megaregions in the country, stretching from Raleigh-Durham to Atlanta and into Birmingham, AL. Historically, much of the Piedmont was covered in grasslands and open tree savannas maintained by frequent fire. Now, after decades of fire suppression and rapid population growth, most of the Piedmont has either been converted to agriculture or subdivisions, or has grown into dense mixed forests. The recently formed Piedmont Prairie Partnership is now working range-wide to bring back native Piedmont grasslands (www.segrasslands.org/piedmont). Anyone is welcome to join.

Current projects include developing short videos on Piedmont Prairies, creating a traveling educational exhibit, surveying the public to assess understanding of Piedmont Prairie issues, and compiling spatial data on Piedmont Prairies. The partnership is tightly linked to major conservation partnerships including: the Southeastern Grasslands Initiative, Southeast Conservation Adaptation Strategy, and South Atlantic Landscape Conservation Cooperative.

Plant Protection Program

Hale, Tyler C., Mata, Marisol M., American Public Gardens Association; **McCarthy, Rachel L.**, (National Plant Diagnostic Network

The Plant Protection Program is one of three major programs within the American Public Gardens Association. The Plant Protection Program is focused on providing resources, information, and communication pathways to position public gardens as leaders in the battle against invasive and significant plant pests and diseases. Through several cooperative agreements with USDA APHIS PPQ and USFS, the Plant Protection Program provides a variety of opportunities for public garden professionals to leverage their horticultural knowledge to make early detections of significant pests. We also provide materials that take advantage public gardens' large visitor audience to increase awareness of significant plant pests.

Plant Heroes & Forest Health Education: this cooperative agreement with USFS provides funding for a suite of youth education materials, as well as interpretive signs for a more mature audience, all focused on major pests of forest trees.

Sentinel Plant Network: started in 2011, this project funded by USDA APHIS funds professional development opportunities for public garden professionals on issues of plant health and significant pest detection.

Public Garden Surveys: this newest Plant Protection Program initiative takes the Sentinel Plant Network one step further, and provides funding for strategically located public gardens to trap and survey for significant pests.

Potential for Hybridization and Competition between Sarracenia Species in Sympatry

Kristen Hillegass, University of North Carolina Asheville

Jennifer Rhode Ward, University of North Carolina Asheville Rebecca Hale, University of North Carolina Asheville
Caroline Kennedy, University of North Carolina Asheville

Restoration of *Sarracenia jonesii* (Jones' pitcher plant), a federally threatened species, sometimes requires transplanting it to sites where its congener *Sarracenia purpurea* var. *montana* (mountain purple pitcher plant), a federal species of concern, grows. However, anecdotal evidence, and grey literature from breeders, suggests that species distinctions within *Sarracenia* are maintained primarily through allopatry. Recent observations of phenotypic hybrids at sites where these species co-occur, and subsequent genetic confirmation of hybrid parentage, has led to concern about maintaining species separations under field conditions. In summer 2019, we monitored *S. jonesii* and *S. purpurea* var. *montana* in two sympatric western North Carolina field populations. Parental species and their phenotypic hybrids were visited weekly during the flowering season to monitor plant phenological stages and to collect anthers for pollen viability analysis; ovaries were collected after floral senescence to analyze seed production, seed viability, and seed germinability. Results revealed significant overlap in flower production and receptivity, and showed that pollen from both species maintained high viability even after anthers were shed. Parental species and their hybrids all produced large numbers of seeds, many of which appeared viable. These data demonstrate the potential for hybridization between two species of conservation concern under field conditions, and suggest that interventions such as floral bagging should be undertaken to restrict gene flow across these permeable species boundaries. Future investigations will compare parental species' seed production in sympatry vs. allopatry, and will attempt to discern parental versus hybrid status of the seed generation.

Production of *Picea rubens* for Southern Appalachian Restoration Initiatives

Lauren M. Garcia Chance, Southern Highlands Reserve; **M. Holdbrooks**, Southern Highlands Reserve

The spruce–fir (*Picea rubens* and *Abies fraseri*) forests of the southern Appalachian Mountains once dominated the upper elevations of the southeastern United States. Today, however, these

mountain-top communities only occur at seven locations in the Southeast. Causes for this widespread decline have been traced to stress factors such as logging, acid rain, attacks from invasive insects [e.g., balsam wooly adelgid (*Adelges piceae*)], and alteration of the environment due to climate change. Targeted initiatives have been developed, including the Southern Appalachian Spruce Restoration Initiative (SASRI), to restore and replant *Picea rubens* in appropriate locations in the Southern Blue Ridge. However, procurement of *Picea rubens* for restoration has been difficult, as the success of young life stages of plants, such as tree saplings, is critical to establishment. *Picea rubens* saplings have distinct physiological and morphological differences compared to adult plants, such as increased photosynthetic capacity, carbon allocation, and unique xylem considerations. As a result, juvenile age classes are generally considered more sensitive to environmental stress than mature trees and difficult to produce. Therefore, a propagation and production system were developed by Southern Highlands Reserve to increase both production and transplant success. Spruce cones were collected throughout the Southern Appalachians in early September and stored in brown paper bags until they matured and dried. Seeds were removed from the cones and germinated in a propagation flat. Following germination and root development, seedlings are transplanted into a 2" Rootmaker® 32-count tray with a bark-based substrate and grown for an additional six to nine months until roots are fully developed. Finally, seedlings are transplanted into 1gal.

Rootmaker® pots utilizing bark-based substrate and top-dressed with slow release fertilizer. Plants are grown in full to part shade for an additional one to two years until 12 to 18 inches tall. Utilizing this system, production and restoration have a 90% reported success rate. Other contributing factors include elevation, topography, and climate of the production site, mimicking conditions at final restoration sites, and thereby reducing transplant shock. Further research into production techniques and population genetics-based hardiness of *Picea rubens* would further elucidate the production and restoration process.

Reasons for rarity? Using a common garden approach to investigate the response of rare *Pityopsis ruthii* (Ruth's golden aster) to potential habitat change

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Braley Gentry, University of Tennessee at Chattanooga

Diana Lee, State Botanical Garden of Georgia, University of Georgia Holly Odell, University of Tennessee at Chattanooga

Jared Odell, University of Tennessee at Chattanooga Thomas Wiegand, University of Tennessee at Chattanooga

Derrick Platero, State Botanical Garden of Georgia, University of Georgia Mia Rochford, State Botanical Garden of Georgia, University of Georgia Jill T. Anderson, University of Georgia

Jennifer Boyd, University of Tennessee at Chattanooga

Jennifer M. Cruse-Sanders, State Botanical Garden of Georgia, University of Georgia

Pityopsis ruthii (Small) Small (Ruth's golden aster) is a rare, federally endangered terrestrial herb endemic to the Ocoee and Hiwassee Rivers in Polk County, TN. In total, ~12,000 total individuals of this species occur within 57 discrete occurrences along the Hiwassee River, while ~1,000 total individuals occur within nine discrete occurrences along the Ocoee River. In each occurrence, *P. ruthii* is generally found rooted in narrow cracks and crevices of large exposed boulders located between the river edge and forest or within the river channel. It has been suggested that *P. ruthii* is shade intolerant and a poor competitor and that a lack of natural scouring of its habitat downstream of dams could allow competing vegetation to encroach and impact the light environment in ways that *P. ruthii* may not be able to tolerate. We used a common garden approach at the State Botanical Garden of Georgia to investigate the response of *P. ruthii* individuals propagated from seed collected from two natural occurrences of this species from each river to light availability throughout two growing seasons. Specifically, we compared the growth, reproduction, and physiology of *P. ruthii* grown in fully sunlit or 70% shaded plots with consideration of differences between individuals from distinct occurrences and rivers. Propagation success and survival were both very high for plants in all treatments.

Shade significantly and negatively influenced growth and underlying physiology in *P. ruthii* individuals similarly regardless of river of origin. Although reproductive effort was not influenced similarly by light availability, flowering did differ dramatically between *P. ruthii* individuals from different rivers as well as from distinct occurrences along the same river. In contrast, local differences in growth and photosynthesis were limited and more minimal. Our results suggest that shade associated with encroaching vegetation could negatively impact this species through reduced growth. Management of *P. ruthii* habitats aimed at reducing competing vegetation while providing for stability of multiple sites will benefit the

species. We also suggest that inherent local variability in flowering could be furthered explored as influential to the dynamics of specific occurrences. Leveraging heavily flowering occurrences for successful propagation of *P. ruthii* ex situ could provide opportunities for safeguarding this species at multiple conservation locations to reduce its extinction risk.

Reproductive Effort and Output Within and Between Two Species of Pitcher Plant (*Sarracenia*)

Kristen Hillegass, Jennifer Rhode Ward, Rebecca Hale, Caroline Kennedy, University of North Carolina Asheville

Sarracenia jonesii (Jones' pitcher plant), a federally threatened species, is sometimes outplanted into sites where its congener *Sarracenia purpurea* var. *montana* (mountain purple pitcher plant), a federal species of concern, grows. However, anecdotal evidence, and grey literature from breeders, suggests that species distinctions within this genus are maintained primarily through allopatry, and that plants in sympatry hybridize readily. Observations of phenotypic hybrids at sites where these species co-occur, and genetic confirmation of hybrid parentage, led us to ask about the potential for, and realization of, interspecific breeding. In summer 2019, we monitored *S. jonesii* and *S. purpurea* var. *montana* at two sympatric western North Carolina field sites. Parental species and their phenotypic hybrids were visited weekly during the flowering season to assess plant phenological stages and to collect anthers for pollen viability analysis; ovaries were collected after floral senescence to analyze seed production, seed viability, and seed germinability. Results revealed significant overlap in flower production and receptivity, and showed that pollen from both species maintained high viability even after anthers were shed. Parental species and their hybrids all produced large numbers of seeds; viability of these seeds is being assessed. These data demonstrate the potential for hybridization between two species of conservation concern under field conditions, and suggest that interventions such as floral bagging should be undertaken to restrict gene flow across these permeable species boundaries. Future investigations will compare parental species' seed production in sympatry vs. allopatry, and will discern parental versus hybrid status of the seed generation.

Seed dormancy and soil seed bank persistence in the federally endangered Short's bladderpod (*Physaria globosa*)

Noah D. Dell, Missouri Botanical Garden

Geoff Call, United States Fish and Wildlife Service Matthew A. Albrecht, Missouri Botanical Garden

Short's bladderpod (*Physaria globosa*) was recently listed as federally endangered due to population decline across its range in Tennessee and Kentucky. However, little is known about the biology of the species and the potential mechanisms underlying range-wide declines. In short-lived mustards, seed dormancy and seed bank persistence can play an important role in regulating population dynamics and response to disturbance. To address the recovery plan objective of enhancing knowledge of Short's Bladderpod to facilitate the development of scientifically sound management plans, we conducted laboratory experiments and a seed burial study to examine what environmental cues promote dormancy break and whether or not seeds form a persistent seed bank. A majority of seeds are in primary dormancy when dispersed in summer. Germination percentages are generally low, and long cold stratification times are needed to break dormancy. Seeds that were cold stratified at 2°C for 12 weeks and then incubated in a 20/10°C alternating temperature regime achieved the highest average germination percentage (24%). Warm stratification with or without alternating wet/dry cycles did not improve germination percentages over cold stratification treatments. However, constant imbibition in

warm temperatures may have promoted viability loss, as germination percentages were lower than seeds kept at warm temperatures with alternating wet/dry cycles. Results from the seed burial study were consistent with those in laboratory experiments and indicate a cold stratification requirement for dormancy-break. Germination of buried seeds was greater in light than darkness and varied seasonally: 0% and 1% in dark and light conditions, respectively, in October following dispersal, 7% and 21% in January, 23% and 36% in March, 9% and 10% in June, and 4% and 8% in October in the year following dispersal. Seeds that afterripened in ambient indoor conditions for up to one year germinated to low (< 2%) percentages, indicating dry storage does not substitute for cold stratification in breaking seed dormancy. The germination niche of *P. globosa* can be defined by physiological dormancy, a long cold stratification period at low temperatures for dormancy break, formation of a persistent soil seed bank, and annual dormancy/non-dormancy cycling in buried seeds. Results from this study shed light on Short's bladderpod regeneration biology and have implications for population management.

Seedy Business: Trillium Conservation through Collections and Seed Propagation for Sale at Juniper Level Botanic Gardens

Zac Hill, Plant Records Specialist/Taxonomist; **Jeremy Schmidt**, Grounds and Research Supervisor; and **Amanda Wilkins**, Garden Curator

Juniper Level Botanic Gardens possesses the largest ex-situ collection of *Trillium* in the United States, if not the world. We have been intensively collecting and propagating *Trillium* for the last ten years and have amassed more than 1,700 specimens, representing approximately 40 species and species complexes and populations from 16 states. We've learned a lot over the years, including how known species compare to unpublished species and how to best grow *Trillium* from seed so there is less pressure for poachers to get them from the wild. We'd love to highlight the diversity of our collection; how our collection has had an impact on the overall understanding and conservation of the genus *Trillium*; and share our seed propagation efforts and show how they produce beneficial economic and conservation results.

Silviculture of the American Chestnut in the Cumberland Uplands of Tennessee

H. Crawford, J. Graddock, Department of Biology, Geology, and Environmental Science, University of Tennessee at Chattanooga

Castanea dentata growth and reproduction in the forest ecosystem is limited by the light made available through canopy gaps. Artificial and existing canopy/light gaps can be used for *C. dentata* seedling establishment for restoration efforts. However, the lack of blight resistant planting material has limited what is known about the silvicultural requirements of *C. dentata*, including establishment in light gaps. During the 2019 season, we studied the survival and growth of 724 American Chestnut Foundation (TACF) seedlings in 35 various sized light gaps in the Cumberland Uplands. A hemispherical photograph taken at each seedling allowed calculation of percent canopy openness. We compared canopy openness to the growth rate and survival of the saplings. Two of the study sites were previously planted by the Tennessee Chapter of TACF: the private conservation easement at Eagle Point Railroad (Cumberland Plateau) and the Starr Farm (Eastern Highland Rim). We established a new site near Barker Pounds trailhead at North Chickamauga Creek Gorge State Natural Area (Cumberland Plateau) with 9 light gaps: 3 small, medium, and large (open field). We

measured height, root collar diameter, and survivorship in April/May 2019 and late September/October 2019. Results indicate that canopy openness is a significant predictor of vertical growth for seedlings at Eagle Point Railroad and the Starr Farm. Vertical growth increased with the age of the seedlings, but is also site dependent. There was no significant difference in vertical growth between the B3F3 hybrid and the American chestnut seedlings. At Barker Pounds, first season mortality was 73.1%, and subsequent soil samples tested positive for *Phytophthora cinnamomi* which causes a root rot in *C. dentata*.

State Botanical Garden of Georgia Learning by Leading™

State Botanical Garden of Georgia Learning by Leading™ Staff Mentors

Learning by Leading™ provides students a combination of leadership skills and real-world experience to help address the earth's most important environmental issues. Students will have the opportunity to get experiential learning credits, get involved with service learning projects, gain leadership skills, lead teams and work together to solve real world challenges based on the student's interest. Students will work with a staff mentor on projects relating to science, conservation, environmental education and horticulture.

A Success Story: Protecting Trillium reliquum Along I-20

Hannah Held, GDOT Sr. Ecologist

In 2017, ecologists discovered a population of over 9,000 individuals of *T. reliquum* while surveying for an upcoming bi-state project between GDOT and SCDOT. In many ways, the population did not “play by the rules”—portions of the population were found amongst high amounts of woody invasive species, and in other areas the population even spread beyond the forest and into grassy rights-of-way (ROW). The surprising discovery of the federally endangered plants introduced roadway design challenges, a multitude of inter-agency and bi-state coordination efforts, and a couple of “firsts” including signage installation implementing seasonal maintenance restrictions along SCDOT ROW. South Carolina Department of Parks, Recreation, and Tourism (SCDPRT) also seized the opportunity to not only work with GDOT ecologists to protect the species at the SC Welcome Center via implementation of a new Trillium-friendly maintenance plan, but SCDPRT also erected educational signage to showcase the beauty of *T. reliquum* and demonstrate the ability of rare species to contribute added appeal and value to a property. Ultimately, after constructive collaboration with willing partners and a few revisions in the project design, the entire population was avoided. Lessons learned from this population, such as “suitable” habitat encompassing more than “preferred” habitat will be taken forward into future habitat assessments on GDOT projects in order to ensure increased species protection across the *T. reliquum* range.

USDA Forest Service

Joanne Baggs, USDA Forest Service

The USDA Forest Service manages the National Forests and Grasslands for sustainable multiple-uses to meet the diverse needs of people, ensure the health of our natural resources, provide recreational opportunities, manage wildlife, guard against invasive threats, and work with State and private landowners, cities and communities, and international

cooperation. Over 220 botanist and numerous plant ecologists as well as other specialists administer the various programs of the botany program on our nation's national forests and grasslands. The botany program focuses on conservation and management of rare plants, vegetation inventories, native plant materials, ethnobotany, and pollination. Our partners include Federal, State, and local agencies, Tribes, conservation organizations, universities, the business community, landowners, and other public groups. The Forest Service intends to set up a table at the poster session to share information on the Forest Service botany program, partnership and volunteer opportunities, and opportunities in the Forest Service.

U.S. Fish and Wildlife Service (Service) - Recovery Program

Kelly Bibb, Scott Wiggers, Vivian Negron-Ortiz, Dale Suiter, April Punsalan, Service

The mission of the U.S. Fish and Wildlife Service (Service) is working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people. Working with partners the Service uses a range of conservation tools to “recover” endangered and threatened species – to ensure that they are able to survive on their own in the wild. These tools include restoring and acquiring habitat, removing invasive species, conducting surveys, monitoring individual populations, and growing species to reintroduce them into their historic range. Collaborative efforts are critical to recovery success. Our partners include Federal, State, and local agencies, Tribes, conservation organizations, universities, the business community, landowners, and other concerned citizens. As a result of these efforts, the Endangered Species Act has been credited with saving plant species such as the Tennessee purple coneflower, White haired goldenrod, Robbin's cinquefoil, Colorado butterfly plant, and Eggert's sunflower. The Service intends to set up a table at Weds poster session that we intend to staff (rotating throughout the night) with Botanists/Recovery Leads, Regional Recovery Coordinator, and Diversity personnel. The table will have pamphlets and educational material. We intend to have a variety of staff who are able to talk to all attendees about: high priority plant recovery actions in the South, grant programs and opportunities, our agency itself and opportunities in it, helping attendees get involved or contact a species recovery lead in recovery programs, explain recovery work under the ESA like 5-year reviews and recovery plans, etc.