2023 Northeast Natural History Conference
Oral Abstracts

Listed in alphabetical order by first-listed author/presenter. Code at the bottom of each abstract indicates when in the conference schedule the presentation will be given: Day-Session-Room-Presentation # (thus, for example, Sun-AM2-B-4 indicates the presentation will be the 4th presentation in Room B in the Sunday Morning II concurrent session time slot).

Looking to the Past to Protect the Future: Farmers in the Marsh and "SMARTeams"

Susan C. Adamowicz (US Fish and Wildlife Service, Rachel Carson NWR, ME), Geoffrey Wilson (Bear Creek Sanctuary, MA), and David Burdick (Jackson Estuarine Laboratory, University of New Hampshire, NH)

Abstract - Building on the work of Sebold and others, we have used historic documents to identify a system of alterations used by salt marsh farmers. Beginning in Maine, we have since reliably found these signatures south to the mid-Atlantic. We review the incentives farmers had for altering salt marshes, as well as some of the techniques used to achieve those ends. Today these features appear on a spectrum from readily visible to exceptionally subtle. For this presentation, we focus on the more visible "late period" (1800s) embankments and show examples of such signatures from both aerial imagery and in the field. Further, we review current marsh expression and its relationship to these alterations. Salt Marsh Adaptation and Resiliency Teams (SMARTeams) is an effort to increase the capacity for restoration efforts using these historical insights and innovative restoration techniques. Motivation for this approach stems from increased sea levels, the 18.6-yr lunar cycle, and declines of the at-risk *Ammospiza caudacuta* (Saltmarsh Sparrow).

Sat-PM1-E-2

Blacklegged Tick Density and *B. burgdorferi* Infection Vary with Elevation in the Green Mountains, VT

David Allen (Middlebury College, Middlebury, VT)

Abstract - The distribution of *Ixodes scapularis* (Blacklegged Tick) has expanded dramatically over the last 30 years. This tick is the predominant vector for Lyme disease in eastern North America; as such, there has been a concordant range expansion in Lyme disease cases. It is difficult to determine the driver of this tick range expansion, though a number of possibilities have been suggested: climate change, changes to tick host populations, changes to in land-use practices, or other factors. Elevation gradients offer a useful tool to monitor potential climate-change based changes. Here I report 7 years of sampling for the Blacklegged Tick and testing it for the Lyme disease agent, *Borrelia burgdorferi,* along an elevation gradient (126–693 m) in the Green Mountains, VT. I found a significant reduction in tick density and infection with elevation. Although tick density fluctuated year-to-year, the reduction in density with elevation was seen across years. These results provide a baseline for future comparison. If climate is a major driver of tick range expansion, we expect to see increases in high-elevation tick populations with future warming.

Sat-PM2-F-2

Accounting for Undesirable Ambient Noise During Surveys Increases Avian Population Size Estimates

Emily Anderson (Vermont Center for Ecostudies [VCE], Norwich, VT), Pete F. Kerby-Miller (North Branch Nature Center, Montpelier, VT) , Julia M. Pupko (VCE, Norwich, VT), Nathaniel R. Sharp (VCE, Norwich, VT), Kevin S. Tolan (VCE, Norwich, VT), and Jason M. Hill (VCE , Norwich, VT)

Abstract - Ambient noise is an integral component of natural environments but also creates challenges for avian monitoring programs. Ambient noise can mask bird vocalizations from observers during point counts, which may lead to systematic undercounting and underestimation of birds in noisy environments. Here, we estimated detection probability and local population size in models that either accounted for or omitted the influence of ambient (i.e., background) noise and overall soundscape volume. We used data for 4 bird species from 2228 point counts conducted during the 2019 Mountain Birdwatch field season. Community scientists assessed ambient noise using a simple, subjective 1–10 scale and measured soundscape volume (dBA) via a specific smartphone app. Despite generally quiet ambient noise conditions (mean = 2.48) and soundscape volume (mean = 40.27 dBA), our information theoretical approach favored N-mixture models with detection functions that incorporated ambient noise for all 4 species and soundscape volume for all but 1 species. Accounting for ambient noise in our models modestly increased the local population size estimates for all 4 species between 0.42% and 6.03% (mean = 2.95%); including soundscape volume increased local population estimates for 3 species between <0.01% and 4.79% (mean = 1.97%). An increase of 10 dBA in overall soundscape volume (i.e., a doubling of the perceived loudness to humans) resulted in a mean reduction across 3 species in detection probability of 5.28% (min–max = 2.28% to 8.00% per individual species). Following our approach, other researchers can easily incorporate ambient noise and soundscape volume assessments into their field protocols and analyses, with minimal costs or added complexity, to increase the comparability of avian surveys conducted across different acoustic environments.

Sat-PM1-A-3

Glorious Birds; The Herring Gull/Cormorant Project and Seabird Conservation in the Northeastern United States

John Anderson (Island Research Center, College of the Atlantic, Bar Harbor ME), Katherine R. Shlepr (Island Research Center, College of the Atlantic, Bar Harbor ME), Wriley Hodge (Island Research Center, College of the Atlantic, Bar Harbor ME), and Liam U. Taylor (Yale University, New Haven, CT)

Abstract - Public and scientific perceptions of Larids (Gulls) have varied enormously over the past 150 years. In the late 1800s, gulls, along with many other birds, were harvested indiscriminately for sport or for the fashion industry. So great was the killing that by 1900 gulls in the northeastern US were on the edge of local extinction, and the young Audubon Society established a fund to protect surviving breeding colonies. Gulls were lauded for their aesthetic beauty, their role in cleaning polluted harbors of organic refuse, and as "sentinels and watchmen" that protected other species. Within 20 years, the gull population had grown to a point where gulls were transformed into a perceived nuisance in some coastal communities, and by the 1930s, Alfred O. Gross launched a massive campaign to reduce gull numbers. Over the course of the next 20 years, Gross and his associates destroyed over 800,000 *Larus argentatus* (Herring Gull) eggs and over 152,000 *Nannopterum auritum* (Double crested Cormorant) eggs. The initial justification for control efforts was the mess from gull guano and the supposed impact of cormorants on the fishery. Subsequently, with the arrival of nesting *Larus marinus* (Great Black Backed Gull) the argument shifted to the impact of gulls on other species. This massive management undertaking briefly affected gull population dynamics, eliminating some gull colonies and having limited effects on others. We argue that a more important consequence of this effort established gulls as suitable villains in subsequent conservation schemes. Coast-wide egg destruction ended ca. 1953. Subsequent increases in gull numbers and the decline and/or movement of *Sterna* (terns) led to calls for resumed culling in the 1960s, and starting in the 1980s, gulls were removed from targeted islands in order to encourage species that are more popular with the public. Both the impact of gulls and the mechanisms of that impact have shifted in accordance with managers' particular foci. We suggest that seabird management efforts may benefit from the examination of multiple working hypotheses, rather than focusing on simplistic single-taxa explanations for extremely complex dynamics.

Sat-PM1-C-3

Selected Highlights of the Vermont Reptile and Amphibian Atlas: 28 Years and Still Going

Jim Andrews (Coordinator of the Vermont Reptile and Amphibian Atlas, Salisbury, VT)

Abstract - The Vermont Reptile and Amphibian Atlas is an effort begun in 1994 by the Reptile and Amphibian Scientific Advisory Group for the Vermont Endangered Species Committee. The Atlas project initially began as an effort to gather data for use by this committee. Data were needed in order to make informed recommendations regarding the appropriate status and conservation of these species. Since then, the goals have widened to incorporate education, citizen involvement, and dissemination of information (see VtHerpAtlas.org). The ultimate goal of the Atlas is to gather and disseminate data on the reptiles and amphibians of Vermont in a way that involves and informs Vermont individuals and organizations so that they will become more informed and effective stewards of wildlife habitat. The Atlas has grown since its inception in 1994 to involve over 7000 volunteers and 35 private organizations and government agencies that have contributed close to 120,000 records. Records include 8 species that have been listed as threatened or endangered in Vermont (out of 40), 1 species that appears to have been extirpated, 2 species that may be added to our list of native species in the near future, and a variety of introduced species, including 1 that could become invasive.

Sat-PM2-A-2

Barn Swallow Colony Relocation in Western Massachusetts

Jonathan L. Atwood (Mass Audubon, Lincoln, MA), Andrew C. French (Silvio O. Conte National Fish and Wildlife Refuge, Sunderland, MA), and Jeffrey D. Ritterson (Mass Audubon, Lincoln, MA)

Abstract - Populations of *Hirundo rustica* (Barn Swallow) have declined throughout northeastern North America from 1970 to 2014. Modern farming techniques, reduced insect populations caused by pesticide exposure, and mortality associated with climate changes have all been postulated as possible causes of these declines. There is little evidence that loss of nesting sites has caused regional population declines. Nonetheless, removal by the US Fish and Wildlife Service of an unused horse stable that supported a substantial breeding colony raised questions regarding how to mitigate loss of this locally important nesting site. We describe a relocation process spaced over a 2-year period. In 2019, when the horse stable that was planned for demolition was still occupied by an active 40-pair breeding colony, we enhanced an existing nearby structure that had previously been occupied by 5 pairs by using vocalization playbacks, installing artificial nest supports, and placing seed nests that had previously been harvested from the stable. Prior to the 2020 breeding season, we deployed additional seed nests, collected during the stable demolition, within the alternate nesting site. By 2021, the number of pairs present in the alternate site was ~80% of the original colony size. There was no evidence that the reproductive efforts of pairs that were forced to relocate were impacted: comparison of clutch sizes, number of second broods, body weights of both sexes, and year-to-year returns of banded birds showed no differences between the original stable nesting site used in 2019 and the alternate nesting site used during 2020 and 2021.

Sat-PM1-F-1

Transmission of *Avipoxvirus* by Mosquitoes in Maine

Natalie Barrett (University of Southern Maine, Portland, ME)

Abstract - *Avipoxvirus* is a pox lesion-causing virus related to smallpox, that affects wild and domestic avian species worldwide. It causes significant ecological harm to egg production and increases flock mortality. It has 3 described transmission routes, including transmission via the mosquito vector. Mosquitoes are currently thought to be a mechanical vector, and it is debated whether they can transmit the virus from feeding sites other than directly from pox lesions. To address this issue, we attempted to isolate *avipoxvirus* DNA from pox lesions of deceased *Meleagris gallopavo domesticus* (Turkey). We then sought to amplify the poxvirus specific DNA by polymerase chain reaction (PCR). We also analyzed sera samples from *avipoxvirus* infected *Gallus gallus domesticus* (Chicken) and Turkeys. Virus was successfully amplified in 1 Turkey serum sample. We will also test pooled samples of *Culex* spp. mosquitoes from the same location for *avipoxvirus* presence. We may perform antibody testing on current samples, as well as collected from specimens harvested during the spring 2023 hunting season, to survey the presence of previous *avipoxvirus* infections in the *Meleagris gallopavo* (Wild Turkey) population.

Sun-AM1-C-3

Inspiring Environmental Stewardship in an Urban Landscape by Increasing Science Accessibility and Building Community

Tohmi Barrett (New York Botanical Garden, Bronx, NY), Lydia Paradiso (New York Botanical Garden, Bronx, NY), and Brian Boom (New York Botanical Garden, Bronx, NY)

Abstract - New York City is home to immense biodiversity. The New York City EcoFlora Project is an attempt to comprehensively document the diverse, ever-changing ecology that remains embedded within the city. By using iNaturalist, an online social network that engages the public in the documentation and identification of wild species, this project combines traditional outreach activities with technology to enable public contribution to scientific data. This data helps to build species checklists, track emerging invasive species, make detailed observations of rare or potentially undescribed species, and generate a plethora of open source biodiversity data. The project also aims to amplify the role of community members in order to inspire connection to urban wildlife biodiversity, foster a sense of communal stewardship, and increase accessibility to scientific sources. Every observer and identifier, trained or amateur, is included as a contributing citizen scientist. To date, over 30,000 observers have made more than 890,000 observations of almost 7500 species of plants, animals, and fungi in NYC. The NYC EcoFlora is a real-time, ongoing checklist of organisms, whose populations exist in an incredibly dynamic hotspot of human activity. The result is a growing resource for conservation planning as well as for New Yorkers who seek to increase their awareness about the more-than-human world. In this talk, we will share experiences and insights working with New Yorkers and iNaturalist to document biodiversity in a bustling urban landscape. Whether you have the resources of an institution like a botanic garden or university, or are a community-based, volunteer-run organization, we hope to continue to provide inspiration and support to similar initiatives to involve the community in the conservation of local and global biodiversity.

Sat-AM1-A-2

Polyploidy in New England Ferns: What We Know and What We Have Yet to Learn

Dave Barrington (Pringle Herbarium, University of Vermont, Burlington, VT)

Abstract - New England hosts 67 ferns, including both eusporangiate and leptosporangiate species. Of these 26 (39%) are known to be polyploid, i.e., have chromosome numbers higher than the lowest number known in their genus. Here I provide a current perspective on our knowledge of the geography, reproductive biology, and evolutionary origins of these polyploids. Geographically, the majority are North American in distribution; our understanding of their origins, largely through hybridization and chromosome-doubling, is best known for this group. Polyploids with circumboreal distributions are prominent; their origin stories are diverse and poorly understood. The current understanding of 6 evolutionary histories from across the sample provides insight into what we do not know and can learn. We now have a fully resolved North American origin story for our own *Adiantum viridimontanum* (Green Mountain Maidenhair Fern). On the other hand, *Dryopteris semicristata*, the inferred progenitor of 2 New England *Dryopteris* tetraploids and 1 hexaploid, remains unidentified and is likely extinct. *Dryopteris intermedia* (Intermediate Woodfern), a progenitor of 2 New England tetraploids, is in fact an aggregate of 4 taxa, the other 3 in Macaronesia; the role of these lineages in the polyploids is unresolved. *Polystichum braunii* (Braun's Holly Fern), an older polyploid, likely has 2 extinct progenitors, one North American and the other East Asian, that encountered one another in Beringia. The newly described *Phegopteris excelsior* (Tall Beech Fern) is an allotetraploid derived from the circumboreal autotriploid *Ph. connectilis* (Northern Beech Fern) and an unknown second species; both are apomictic. Field botanists in New England must beware the backcross.

Sat-PM2-D-4

The Devil is in the Details: Managing Data in Camera Trapping Studies

Erika L. Barthelmess (St. Lawrence University, Canton, NY) and Brett Ford (Embark Veterinary, Inc., Ithaca, NY)

Abstract - Camera traps are excellent tools for wildlife research, yet their use also comes with many challenges. One significant challenge is managing the large volume of data that is collected. In this presentation, we will discuss the workflow we have developed for data management in the North Country Wild project. Our project, which shares data with both the Snapshot USA and AIM (Adirondack Inventory and Monitoring) projects, seeks to understand more about the diversity, density, and distribution of mammals in the St. Lawrence River watershed area of northern New York State. For the last several years, we have deployed game cameras throughout public and private lands in St. Lawrence County, NY, and have amassed tens of thousands of game-camera images. We have been building a workflow that combines python scripts, the Zooniverse platform, and R code to automate and reduce errors in steps such as renaming and resizing images, preparing image manifests, associating images with image classifications, etc. A design criterion for this workflow has been usability by undergraduate students with various levels of computer proficiency. During the talk, we will present the workflow and share some of the lessons we have learned along the way.

Sat-AM2-A-2

Thermal Acclimation Across the Active Season of Wild, Free-living Eastern Red-backed Salamanders

Elizabeth Bastiaans (SUNY Oneonta, Oneonta, NY), Richard Jones (SUNY Oneonta, Oneonta, NY), Bryanna Mangual (SUNY Oneonta, Oneonta, NY), Samantha Hall (SUNY Oneonta, Oneonta, NY), Alexandra Gomez (SUNY Oneonta, Oneonta, NY), Amanda Nicolaides (SUNY Oneonta, Oneonta, NY), Louise Tichy (SUNY Oneonta, Oneonta, NY), Keesha Dubuisson (SUNY Oneonta, Oneonta, NY), and Daniel Stich (SUNY Oneonta, Oneonta, NY)

Abstract - Rising global temperatures due to climate change pose a threat to a wide variety of organisms, but ectotherms such as amphibians may be particularly vulnerable. Many ectotherms exhibit a relatively narrow range of temperatures at which they can remain behaviorally and reproductively active, and some species operate near the upper limits of that range, making them vulnerable to increasing average temperatures and temperature variability. Previous research has shown that amphibians acclimate to changing temperatures in captivity, with their critical thermal minima or maxima changing after exposure to constant temperatures for days or weeks. However, amphibians in the wild experience substantial temperature variability on both seasonal and daily time scales, and it is less clear to what extent thermal acclimation occurs under those conditions. We investigated whether wild, free-living *Plethodon cinereus* (Eastern Red-backed Salamander), become acclimated to changing temperatures throughout their spring and fall active seasons. We measured the critical thermal maximum (CTmax) and critical thermal minimum (CTmin) of Eastern Red-backed Salamanders under field conditions over several months in the spring and fall. We found that CTmax increased significantly over the course of the spring active season and decreased significantly over the course of the fall active season. CTmin, in contrast, did not vary significantly over the course of either season. We also found that body size had a significant effect on salamanders' CTmin, but not CTmax, with larger salamanders tolerating lower temperatures.

Sun-AM2-A-2

Natural History Collections Facilitate Independent Learning in an Undergraduate Course

Emily M. Beasley (University of Vermont, Burlington, VT), Lily Duerr (University of Vermont, Burlington, VT), and Sara Helms Cahan (University of Vermont, Burlington, VT)

Abstract - Natural history collections provide a valuable opportunity for participatory learning in undergraduate curricula. Recently, the Biology department in the University of Vermont has developed a natural history course that facilitates independent learning and skill building through work in the Zadock Thompson Zoological Collections. The course has 3 learning goals: (1) become familiar with the range of skills and tasks associated with natural history collection curation, management, and outreach; (2) work independently in a museum environment; and (3) articulate the value of natural history collections to scientific community, policymakers, and the public. The instructors assist the students in accomplishing these goals through a weekly seminar series, independent projects in the collections, and an optional field trip. In the weekly seminar series, scientists who work with natural history collections deliver talks or workshops about some aspect of their work in natural history. Internship projects typically consist of teams of 1–3 students and may include specimen inventory, specimen preparation, geolocation, morphometric analysis, or data curation. The students also write a description of their projects on the course website as part of public outreach. Lastly, the course includes a field trip to a natural history museum where students learn how the research and educational sides of natural history museums complement one another. In this presentation, course GTA Emily Beasley will discuss the benefits of the course, share student feedback, and discuss the challenges associated with offering a natural history collections course in the undergraduate curriculum.

Sun-AM2-B-5

Using Passive Acoustic Monitoring to Assess Chorus Activity and Health in Green Frogs

Catherine R. Bevier (Colby College, Waterville, ME)

Abstract - Global decline and extinction of amphibian populations are attributed in large part to emerging infectious diseases caused by pathogens including the chytrid fungus, *Batrachochytrium dendrobatidis* (Bd), and ranavirus. Some species, such as *Rana clamitans* (Green Frog), do not usually succumb to infection or develop chytridiomycosis. Green Frogs, then, may serve as a model to better understand disease vulnerability and resistance or tolerance. Resistant species, however, may be vulnerable to sublethal effects of pathogen infection that may be exacerbated by environmental stressors. We have monitored populations of male Green Frogs over 5 years in 3 locations in Maine that vary in habitat quality and land use. Isolated island populations are not infected with either pathogen and have relatively low levels of innate immune defense. Inland populations from areas with variable degrees of residential development and agricultural activity test positive for both pathogens, and harbor Bd-inhibitory skin bacteria and Bd-inhibitory skin secretions. We are evaluating morphological, immunological, and behavioral characters, including calling activity, to determine if males in these populations exhibit signs that could compromise immune defense or reproductive fitness. Calling activity, in particular, is easy to monitor using passive sound recorders, and we are using these data to explore the relationship between general infection status and chorus activity for each population. We made 15-min recordings each hour for 72 hours at the height of the breeding season (June–July), and analyzed each cut for number of calls, noting multi-note call production and estimating number of males calling. Preliminary results suggest that populations differ in these characters among the 3 locations, and, on an individual basis, infected males have lower call rates than uninfected males. Additional data analyses and results will be discussed.

Sat-PM1-A-1

Target Enrichment Sequencing Uncovers Cryptic Diversity in the Widespread *Athyrium filix-femina* (Athyriaceae) Complex in North America

Bertrand Black (University of Vermont, Burlington, VT) and Michael Sundue (Pringle Herbarium, University of Vermont, Burlington, VT)

Abstract - *Athyrium filix-femina* (Lady Fern) is distributed across the temperate regions of the northern hemisphere and montane regions of the neotropics. In the Americas, this fern forms a species complex with multiple taxa that are geographically distinct but difficult to distinguish using morphology alone. As a result, the circumscription of the American taxa still varies from 1 to 7 species, and a satisfactory taxonomic treatment has remained elusive, regardless of several previous studies. Despite being one of the most common ferns in temperate North America, they have yet to be placed in a phylogenetic context using a range-wide representative sample. To address this, we sampled herbarium specimens from across the Americas and Eurasia for next-generation sequencing using a targeted enrichment approach. In addition to molecular data, we used morphological and climate data to explore patterns of speciation, introgression, and reticulate evolution. Our phylogenetic results indicate the existence of 4 morphologically and geographically distinct clades in North America and 1 in South America. In addition, a previously unrecognized set of clade-specific traits were identified and used to characterize the 4 major North American lineages by their morphology, ecology, and geographic distribution. Unexpectedly, European taxa previously thought to be conspecific with the American taxa were recovered as monophyletic and nested in an entirely American clade, providing preliminary evidence for an American origin of this globally widespread species complex.

Sat-PM2-D-3

Have Asian Shore Crab Populations in Southern New England Gone Bust?

Christopher P. Bloch (Bridgewater State University, Bridgewater, MA), Nick Loonie (Bridgewater State University, Bridgewater, MA), Cory Partida (Bridgewater State University, Bridgewater, MA), Eva Rando (Bridgewater State University, Bridgewater, MA), Franchesca Rolon (Bridgewater State University, Bridgewater, MA), and Matt Santos (Bridgewater State University, Bridgewater, MA)

Abstract - Invasive species generally increase rapidly in abundance after invading a new habitat and attain densities higher than observed in their native ranges. Often, however, these invaders later experience a conspicuous decline in abundance. This phenomenon is known as boom–bust dynamics. Introduced to North America in the 1980s, *Hemigrapsus sanguineus* (Asian Shore Crab) is currently the most abundant brachyuran in rocky intertidal habitats throughout most of New England and the Mid-Atlantic. Recent evidence from a few sites in New York and Massachusetts, however, suggests that the Asian Shore Crab may be experiencing a bust phase. To test this hypothesis, we examined data collected by quadrat sampling from 10 cobble beaches in Massachusetts and Rhode Island between 2014 and 2022. At most sites, abundance of Asian Shore Crabs showed no consistent increasing or decreasing trend over time. This indicates that the Asian Shore Crab is no longer experiencing rapid population growth in southern New England. Indeed, low population densities at some sites are consistent with the conclusion that it may have reached a bust phase in its population dynamics. It is unclear whether this represents an equilibrial situation or whether Asian Shore Crabs will in the near future re-enter a boom phase, initiating a second boom–bust cycle. Regardless, additional, long-term observations will be necessary to confirm the observed patterns, to establish potential causes of boom–bust dynamics in Asian Shore Crab, and to investigate the potential for recovery of populations of native or resident species that have declined because of the activities of Asian Shore Crabs.

Sat-AM1-F-1

Effect of Decreased Snowpack on a Rare Butterfly's Host Plant

Rachael E. Bonoan (Providence College, Providence, RI), Breelyn Gilbert (Providence College, Providence, RI), Isabelle Heron (Providence College, Providence, RI), and Caitlin McHugh (Providence College, Providence, RI)

Abstract - The most well-known aspect of climate change is global warming. Among other things, Earth's warming temperature has caused less snow to fall, and snow to melt earlier in the spring. Early melting has been shown to alter the phenology, the timing of life-history events, of spring organisms. Phenological shifts caused by climate change can vary considerably between taxa, which can lead to mismatches between interacting species. *Callophrys irus* (Frosted Elfin) is a spring-flying butterfly in the Eastern United States, and is listed a species of concern in 11 states. As host plant specialists, Frosted Elfins only lay eggs on small *Baptisia tinctoria* (Yellow Wild Indigo) and *Lupinus perennis* (Wild Lupine), and are especially vulnerable to climate-induced mismatches. To simulate the impact of global warming on Erosted Elfin host plants, we conducted a snow-removal experiment at Gavins Pond (Foxboro, MA) where small Yellow Wild Indigo is abundant, but the Frosted Elfin population is declining. In December 2021, we set up 5 plots of each of 3 treatments: snow removal (shoveled), trample control (plot walked on with snowshoes), and control (untouched). In each plot, we tracked temperature and timing of indigo leaf out/development relative to the current Frosted Elfin flight season and larval developmental period (April–July 2022). Beyond shifts in physical presence of plants, phenological shifts may also affect the nutritional content of the larvae's sole food source. We also sampled leaves from each treatment for carbon and nitrogen analysis.

Sat-AM1-D-2

Undeveloped Barrier Spit Evolution and Inlet Migration: Nauset Inlet, Cape Cod, Massachusetts

Mark Borrelli (Center for Coastal Studies, Provincetown, MA, and University of Massachusetts, Boston, MA), Michael Low (University of Massachusetts, Boston, MA), and Daniel Solazzo (Center for Coastal Studies, Provincetown, MA)

Abstract - Coastal areas are among the most densely populated in the world. The Nauset barrier system is entirely undeveloped and sits within Cape Cod National Seashore. No human alteration is permitted, allowing investigators the opportunity to study the natural evolution of these landforms. The Nauset barrier system sits along a mixed-energy open-ocean coast. One tidal inlet provides a conduit between the lagoon and the open ocean. Historical topographic sheets from 1844 to 1972 (n = 7), aerial imagery from 1938 to 2021 (n = 17) and Light Detection and Ranging (LiDAR) datasets from 1998 to 2021 (n = 7) provide insight into barrier and inlet evolution over the last 177 years. The barrier has generally kept pace with sea-level rise over this time period as the barrier has migrated landward largely during overwash events. The inlet migration rate was very low from 1844 to 1838 (1.46 m/yr). The inlet migration rate increased substantially to 56.6 m/yr between 1938 and 1997, and then increased further to 68.6 m/yr from 1997 to 2021. The continued landward migration of the barrier and inlet evolution are reflective of the drivers of these changes such as waves and tide, rising sea levels, and storm activity. After a long period of relatively little inlet migration, the inlet began to migrate northward. Previous work in the peer-reviewed literature has hypothesized that the northern movement is evidence of updrift inlet migration. Our data analysis shows supporting evidence of a change in the net direction of longshore sediment transport along the Nauset barrier system, which refutes the conventional hypothesis regarding inlet migration. This talk aims to identify the mechanisms responsible for this inlet migration and the barrier evolution seen within the Nauset barrier system over the last 177 years.

Sun-PM2-C-1

Long Island's Terrestrial Mammals: History and Survey Effort

Mike Bottini (Seatuck Environmental Association, Islip, NY)

Abstract - This presentation will include a brief history of changes in Long Island's terrestrial mammals (species, numbers, and distributions), a summary of the last mammal survey on Long Island, NY, by Paul Connor in the 1960s, and an overview of current survey effort launched in 2022.

Sun-AM1-E-3

Mapping a Greener Future

Marie Bouffard (University of Vermont, Burlington, VT)

Abstract - Urbanized areas around the world are facing numerous environmental pressures, from rising temperatures to stormwater runoff to poor air quality. Traditionally, these challenges were addressed through "gray" solutions, such building new water-treatment plants or expanding transportation networks into the suburbs. Our mapping efforts have mirrored the solutions; data on structures, roads, and property boundaries are typically excellent in the developed world. With water treatment plants at maximum capacity, multi-hour commutes from the suburbs getting longer, and summer after summer of record temperatures, it is clear that the limits of "gray" solutions are being reached. The world's cities also find themselves in an era of intense global competition to host the most successful companies and attract the brightest minds. Cities are making investments in their "green" infrastructure to provide ecosystem services to their citizens and make the urban environment more livable in the push towards sustainability. Despite massive investments in geospatial data and technology, most cities know little about their green infrastructure—how much they have, who owns it, who cares for it, and how it changes over time. The USDA Forest Service's Urban Tree Canopy (UTC) Assessments are changing the status quo. Using advanced artificial intelligence to extract green intelligence from vast amounts remotely sensed data, UTC Assessments provide communities with the information they need to chart a greener future.

Sun-AM1-D-1

"Wait? We're Going Outside Today?" How Using Natural Phenomena Can Bridge the Classroom to the Outdoors

Carly Brown (Science Teacher, Champlain Valley Union High School, Hinesburg, VT)

Abstract - This session will explore how teaching natural history in a public school can reach ALL students, you just have to convince them that it's exciting first! I am a high school science teacher and a UVM Field Naturalist Program Alum. I will share challenges and successes in teaching natural history to 9th graders in a public school, and how using phenomena opens up opportunities for students to build curiosity, deep understanding, and the skills of scientists.

Sun-AM2-B-4

Rewilding Our Narratives

Kate Burnaby Wright (NGAI Creative, Bozeman, MT)

Abstract - The stories we tell ourselves, the "truths" we absorb from peers and parents and popular paradigms, hold deep power. As an ecologist, experiential educator, resilient systems advocate and UVM Field Naturalist alum, I will share tales from my career path, then facilitate a brief interactive inquiry into the role field ecologists can play in rewilding the narratives that influence our communities.

Sun-AM2-B-1

Black Ash: Managing a Culturally Significant Tree in the Midst of the Emerald Ash Borer Infestation

Charlotte Cadow (University of Vermont Field Naturalist Program, Burlington, VT)

Abstract - With support from the Vermont Urban and Community Forestry Program and members of Vermont's Abenaki communities, I've endeavored to better understand and protect Vermont's population of *Fraxinus nigra* (Black Ash). Bearing both ecological and cultural significance, Black Ash trees face a number of challenges. Chief among them is *Agrilus planipennis* (Emerald Ash Borer), to which Black Ash has shown no resistance. Our initial and ongoing efforts include building a Black Ash network, establishing long-term monitoring plots on state lands, and making management recommendations. Our hope is to facilitate a resilient socio-ecological system that will maintain viable populations of Black Ash for generations to come.

Sun-AM2-C-1

The New York Mammal Survey

Camilo A. Calderón Acevedo (SUNY-College of Environmental Science and Forestry [ESF], Syracuse, NY), Co-authors: Joshua P. Twining (Cornell University, Ithaca, NY), Melanie C. Berger (SUNY-ESF, Syracuse, NY), Amanda Cheeseman (South Dakota State University, Brookings, SD), Matthew Schlesinger (New York Natural Heritage Program, Albany, NY), and Jacqueline Frair (SUNY-ESF, Syracuse, NY)

Abstract - The New York Mammal Survey (NYMS) is a statewide project assessing the distribution and status of New York's terrestrial and freshwater mammals. The NYMS is a collaboration between the New York Department of Environmental Conservation, SUNY-College of Environmental Science and Forestry, the New York Natural Heritage Program, and the New York Cooperative Fish and Wildlife Research Unit at Cornell University. The project started in 2018 and will extend into 2025. NYMS uses novel integrated modelling techniques to combine new data sources with biological records from existing public repositories (e.g., GBIF) and historical mammal records to determine the distribution of the mammals of New York. For small mammals, we employ a standardized trapping method, combining pitfall, snap traps, and Sherman live-traps. In addition, on-going survey work includes species-specific camera trapping and acoustic detection methods targeting difficult-to-identify species such as weasels and flying squirrels. We have been able to detect 47 (67%) species, raising concerns about changes in the distribution of the ones that have gone undetected. One of the primary goals of NYMS is to guide environmental planning and conservation efforts for species that are endangered or in decline. Its findings on the distribution, natural history, and habitat requirements of New York's mammals will inform the next State Wildlife Action Plan and ongoing revisions to the state's endangered species list.

Sun-AM1-E-1

Crepidomania: An Appeal to Botanists to Spend More Time Under Rocks

Matthew Charpentier (Oxbow Associates, Inc., Boxborough, MA)

Abstract - *Crepidomanes intricatum* (Weft Fern) is an enigmatic member of the Hymenophyllaceae known only from its gametophyte form. Weft Fern has been considered rare in the northeast, but is it really just that people rarely go crawling around under rocks looking for it? In this presentation, I will share tips for identifying Weft Fern and will discuss habitat characteristics with the intent of arming attendees with the know-how to get out and search for yet-to-be-documented populations.

Sat-PM1-D-3

Either Far Out or In Deep: An Inter-Island Comparison of Herring Gull Nesting Colonies on Great Duck Island and Mount Desert Rock, Maine

Rosie Chater (Island Research Center, College of the Atlantic, Bar Harbor ME), Marina Scnell (Island Research Center, College of the Atlantic, Bar Harbor ME), Asher Pannikian (Island Research Center, College of the Atlantic, Bar Harbor ME), and Wriley Hodge (Island Research Center, College of the Atlantic 105 Eden St. Bar Harbor ME)

Abstract - We analyzed clutch sizes and fledging success of *Larus argentatus* (Herring Gull) between the Edward McC Blair Research Station on Mount Desert Rock (MDR) and Alice Eno Field Station on Great Duck Island (GDI). MDR is a 1.2-ha island located 40 km from shore, home to a nesting colony of 290 breeding pairs of Herring Gulls, and the furthest offshore point of land in Maine. GDI is a 91-ha island located 11 km from shore with 2 colonies of nesting Herring Gulls totaling ~1200 breeding pairs. Herring Gulls have been nesting on GDI for at least 150 years, whereas MDR is a relatively young colony that re-established after active culling that ended in the 1990s. The sample on MDR focused on 40 nests, while the GDI sample focused on 53 nests. We weighed chicks in each sample and monitored for mortality each day. We banded chicks throughout our study to keep track of individual development. Chicks were considered fledged at 700 grams (about 20 days old), after which we saw reduced mortality. This study compares clutch size distribution in each colony, fledging success in each sample, and fledging success by clutch size and hatch sequence in our samples. The average fledging success of the MDR sample was 1.6 chicks per nest, and the average fledging success of the GDI sample was 1.67 chicks per nest. Over the past few decades, gull colonies throughout the western North Atlantic have declined rapidly. The colonies on these 2 islands are not decreasing like other colonies in the Gulf of Maine. Our results suggest a productive year in terms of fledging success for both colonies, and continuing this study would contribute to a greater understanding of the population dynamics of Herring Gulls in the Gulf of Maine.

Sat-AM2-C-5

Combating Invasive Stiltgrass (*Microstegium vimineum*): A Cost–Benefit Analysis of the Efficacy of Four Organic Management Methods

Michael Clarke (Mianus River Gorge, Bedford, NY)

Abstract - Stiltgrass (*Microstegium Vimineum*) is an invasive C4 annual grass currently depleting resources in deciduous forest ecosystems across eastern North America. The purpose of this study was to assess the cost and efficacy of various organic management regimes throughout the growing season, aiding land managers to combat the detrimental effects on ecosystems. Plots at 10 different sites in New York State were each organized with 1 row for 3 months in the growing season (June–August) and 8 columns for the different methods: control, pulling, cutting, 3–5-second burn, 8–10-second burn, full burn, 10% acetic acid herbicide, and 20% acetic acid herbicide. Early August was determined to be the optimal time for application of mechanical and burn treatments as it is before stiltgrass seeding, resulting in the greatest elimination of stiltgrass. In contrast, the optimal time for application of herbicides was early June. When considering cost and efficacy, 10% acetic acid herbicide was a low-cost, low-impact, and effective treatment; cutting and burning for 8–10 seconds were also viable solutions. Herbicides are likely best applied in small- to large-sized land management areas, burns in mid- to large-sized areas, and cutting in small- to mid-scale areas. These results can inform land managers on what strategies for combating invasive stiltgrass may be most optimal (based on efficacy and price per area). Future studies could investigate how many seasons of consecutive treatments are required to deplete the seedbank of stiltgrass, and how planting native understory species could outcompete stiltgrass.

Sat-AM1-F-2

A Low-Labor, Non-Invasive Method for Characterizing Small-Mammal Communities

Kate Cleary (State University of New York at Potsdam, Potsdam, NY), Glenn Johnson (State University of New York at Potsdam, Potsdam, NY), Bridget Amulike (State University of New York at Potsdam, Potsdam, NY), Vincenzo Bonaiuto (State University of New York at Potsdam, Potsdam, NY), and Jessica Rogers (State University of New York at Potsdam, Potsdam, NY)

Abstract - Small-mammal communities are often not well understood because they require prohibitive amounts of on-the-ground field work to study. Yet small mammals play a critical role in ecosystem functioning, driving predator population changes, and are hosts for more than 80 zoonotic diseases globally, including hantavirus, anaplasmosis, and Lyme disease. We have developed and tested a method for inventorying and monitoring small-mammal populations, the BucketCam. The BucketCam consists of a 7 gallon plastic bucket with entrance/exit holes cut out and a game camera strapped to the bottom, plus several other modifications. In summer 2022, we conducted a pilot study to test the efficacy of this method against 3 established and widely used methods: Sherman traps, pitfall traps, and track plates. We deployed trapping arrays consisting of all 4 trap types for 10 nights at each of 14 sites in St. Lawrence County, NY. Preliminary data analysis shows the BucketCam detected more total species than the other trap types, but fewer shrews than Sherman or pitfall traps. Detection frequency and detection rate of common species (e.g., *Peromyscus*) was similar between BucketCam and Sherman traps, and higher than pitfall traps and track plates. The BucketCam cannot provide individual identifications for small mammals, but is a useful option for researchers aiming to reduce the human labor involved in large-scale studies of the composition and distribution of small-mammal communities.

Sat-AM2-A-1

Enhancing the Edibility of New England's Landscapes with Native Species

Russ Cohen (Naturalist, Wild Edibles enthusiast, Native seed collector, and Native species propagator and planter, Arlington, MA)

Abstract - There's an increasing inclination to utilize more native species in home landscaping and in parks and other conserved landscapes, thanks to books like Doug Tallamy's *Bringing Nature Home*, which extol the virtues of native plants over exotic ornamentals for attracting and sustaining beneficial insects. Yet, for some property owners/managers, this alone may be insufficient motivation to "go native". The "you can eat it too" attribute of many native species offers a powerful incentive for people and organizations to "go native" in their landscaping that were insufficiently swayed to do so by the ecological rationale alone. The berries of *Amelanchier* spp. (juneberries or shadbush) for example, are equally edible by songbirds and people. The taste of the ripe fruit is like a cross between cherries and almonds. Edible wild plants offer opportunities for people to connect to nature via their taste buds, thereby building their enthusiasm and public support for adding edible native plants to their home landscaping, as well as for conserving other lands that host edible wild plants. Adding native edible plants to a landscape can boost biodiversity as well as "spice it up" (literally as well as figuratively—i.e., we can have our acorn cake and eat it too). This presentation will cover at least a dozen of the tastiest native species the Northeast US region has to offer, along with successful techniques for native seed gathering/storage, propagation of native plants from seed, and adding edible native plants to New England's landscape. I will also accompany this talk with handouts and samples of foraged goodies made from native edible plants for people to nibble and sip on.

Sat-PM2-E-2

Utility of Camera Traps for Assessing Productivity in a Forest Carnivore

Stephanie A. Cunningham (State University of New York College of Environmental Science and Forestry, Syracuse, NY), Timothy Pyszczynski (New York State Department of Environmental Conservation, Watertown, NY), Timothy M. Watson (New York State Department of Environmental Conservation, Warrensburg, NY), Rachel Bakerian (New York State Department of Environmental Conservation, Warrensburg, NY), Paul G. Jensen (New York State Department of Environmental Conservation, Ray Brook, NY), and Jacqueline L. Frair (State University of New York College of Environmental Science and Forestry, Syracuse, NY)

Abstract - Camera traps are often used to monitor detection/non-detection of wildlife and, increasingly, to record critical life events, such as recruitment. For example, *Pekania pennanti* (Fisher) use tree cavities for reproduction, and cameras may be used to document a female with kits as she moves them between den trees. To effectively design a study to capture recruitment of Fisher over time requires greater information on the probability of detecting an animal with a camera array. Generally, the probability of detection should increase with the number of cameras deployed at a survey site. But how many cameras? To answer this question, we deployed 3 baited camera arrays in central New York (Happy Valley WMA) for up to 41 days during winter 2020, with each having 15 cameras set ~5 m away from the center tree and facing inward. We predicted detection probability as a function of the number of cameras using a binomial generalized linear model. We then compared these results to observations of collared females and investigated effects of movement (i.e., differences in leaving and returning to the den). Detection probability increased with number of cameras, varying from 0.21 for 1 camera to 0.85 with 6 cameras. While detection probabilities were higher for females leaving the den than for returning to the den, we observed 94% of expected kit-transfer events. Our results offer guidance to researchers in determining the number of cameras to use in observing productivity in arboreal-denning carnivores.

Sat-AM2-A-3

Let Them Eat Cake: Cooking up a Vermont Master Naturalist Program

Alicia Daniel (Field Naturalist and Director of Vermont Master Naturalist, Burlington, VT)

Abstract - After 30 years (and counting) of teaching in the UVM Field Naturalist Program, I decided to bring a slice of the Field Naturalist training into Vermont towns through the Vermont Master Naturalist Program. Using the FN design of exploring each layer of the landscape from bedrock to birds, VMN is a 9-month professional certification program that only requires that participants have a deep passion and a sustained interest in natural history and a willingness to give 20 hours of volunteer time to conservation projects in their town. Operating since 2016, VMN has conducted training in 20+ towns and is approaching 400 graduates. VMN relies heavily on Field Naturalist graduates to run VMN program chapters and lead field days. This talk will describe the evolution of the program and explore what impacts VMN is having on conservation in Vermont and whether VMN can be a model for training naturalists elsewhere.

Sat-AM2-B-2

Bard Community Sciences Lab: Building Bridges Between Academia and Place-based Realities

M. Elias Dueker (Bard College, Annandale-in-Hudson, NY)

Abstract - The Bard College Community Sciences Lab (CSL), through community-engaged classrooms, student internships, and senior theses, strives to address pressing community needs for evidence-based decision-making in the face of a rapidly changing environment. We use "sciences" in our title to emphasize our dedication to using a broad definition of science, one that includes common sense/science, indigenous science, and other ways of knowing. By making a commitment to working primarily in our "own backyard", the CSL utilizes concepts of watershed and airshed to promote the re-conceptualization of our campus as not simply an academic space, but also as part of a larger region crossing municipal boundaries while encompassing precious shared resources like clean water and breathable air. The students who participate in CSL projects and classrooms come from all areas of the college, including art, ballet, jazz, architecture, sociology, anthropology, chemistry and biology. Our community science partners include watershed groups, city governments, libraries, emergency food kitchens, riverkeepers, universities, research institutions, air-quality coalitions, and land trusts. With this connection, our classrooms and students are conducting cutting-edge water and air-quality research guided by scientific questions posed by community leaders and citizen scientists who have long experience in the region. We believe that, by centering and elevating this place-based human experience of environment, we can effectively address all environmental challenges—if we collectively are working to protect the right for all humans to drink clean water and breathe clean air, we are also working to protect the same for our non-human community members (animals, plants, earth).

Sat-AM2-E-4

Role of a National Wetland Organization in a Region Saturated with State Organizations

Dwight R. Dunk (Immediate Past President SWS New England Chapter, and Epsilon Associates, Maynard, MA)

Abstract - The Society of Wetland Scientists (SWS) is an international wetland organization to promote best practices in wetland research, education, conservation, preservation, restoration, and management. SWS has over 3000 members in more than 60 countries. SWS has members in governmental agencies, non-governmental organizations, academia and private consulting. The Society has 15 geographic based Chapters around the world and 10 subject matter Sections. New England and its neighbor New York, have active state wetland associations in 6 of the 7 states. In this region with active state organizations, what is the niche for the SWS New England Chapter? This presentation will discuss the role of the SWS New England Chapter.

Sun-PM2-F-4

Do Larger Diameter Trees Allow for More Microhabitats and Impact Bird Abundance in Managed Forests?

Monica Edgerton (SUNY ESF, Syracuse, NY), Gregory McGee (SUNY ESF, Syracuse, NY), and Stacy McNulty (SUNY ESF, Newcomb, NY)

Abstract - Sustained production of forest products and maintenance of wildlife habitat remain top priorities, and challenges, for forest managers. Commonly applied cutting guides for northern hardwood forests suggest harvest of trees by 40–45 cm diameter (dbh). However, trees >50 cm dbh offer a wider variety of wildlife microhabitats for birds and insects. Therefore, it is possible that the abundance of these tree-related microhabitat (TreMs) may be diminished in some managed forest systems if trees are regularly removed before the habitat features can develop with size and age. The lack of TreMs may be consequential for bird abundance and diversity. This study contrasts the effects of large tree retention and canopy openness on bird abundance and community composition. We hypothesize that (1) shelterwood sites with residual trees ≥50 cm dbh have more TreMs per hectare than shelterwood sites with trees ≤49 cm dbh and (2) shelterwood sites with residual trees ≥50 cm dbh have a greater abundance and diversity of birds per hectare than shelterwood sites with trees ≤49 cm dbh. For this study, we used four ~28-ha Adirondack northern hardwood forest sites: commercial shelterwood (residual tree diameter ≤49 cm dbh, open canopy), experimental shelterwood (no size limit on residual stems, open canopy), selective cut (residual trees ≤49 cm dbh, closed canopy), and old growth (no size limit on trees, closed canopy). We conducted 9 repeat-visit point counts in each site at 200-m intervals to measure bird abundance and to acquire forest structural and TreM data on an associated nested-plot cluster. By sight inspection from the ground, we counted and characterized the TreMs that are most closely correlated to bird abundance in the literature: number of cavities and large rot holes, and presence of a broken crown, crown deadwood, and exudates. We will analyze the data using repeat-visit models and an MRPP to determine the impact of tree diameter, canopy cover, and TreMs on bird abundance and community composition.

Sun-AM1-A-3

Biodiversity in the Classroom: A Campus Bioblitz and Bird-friendly Pollinator Garden

Sandra Fary (Camels Hump Middle School, Richmond, VT)

Abstract - Each year students in grades 7 and 8 of Camels Hump Middle School embark on a campus-wide fall bioblitz. The goal is to observe as many species of animals, plants, and fungi as possible within a 1-week time frame. From the collected data, students design a management plan for the campus to increase biodiversity. One recent project involved designing a bird-friendly pollinator. Students researched native plants, met with horticulturists, came up with preliminary designs, and helped to write grant proposals and donation letters. By the end of the year, an 8th grade group created a 93 m^2 (1000 ft^2) garden with over 250 plants, a meandering pathway dotted with Leopold benches, and a dozen student-made birdhouses. The garden serves as an outdoor oasis, classroom, and home to many birds, bats, bees, wasps, and butterflies that depend on the food and shelter within it.

Sun-AM2-F-3

Project-based Capping Course Addresses Environmental Concerns for Nearby Municipalities and Marist College

Richard S. Feldman (Marist College, Poughkeepsie, NY)

Abstract - During their final semester Marist College students majoring in Environmental Science and Policy engage in team projects to address environmental topics of practical concern. In this presentation, I will discuss a number of examples of these projects, including the following. In its fifth year, a collaboration with the Village of Rhinebeck strives to predict and mitigate storm events that impact the Landsman Kill. One station monitors stream flow and precipitation, to be integrated into a predictive model of flood risk and when to release water through Asher Dam. Telemetry is being perfected by a computer science capping class. New York State Department of Environmental Conservation provided saplings for floodplain planting by students and community volunteers. The second year of a collaboration with the City of Poughkeepsie addresses trash management as it impacts the Fall Kill. Rapid trash assessment of the creek identified locations of particular concern, while monitoring trash waiting for pick-up provided evidence of a source of in-creek trash. The city has already improved trash handling in response to this finding. Annual Fall Kill clean-up is organized by students with community partner organizations. The college's Fern Tor Nature Preserve receives ongoing attention to improve its sustainable use for education, research, recreation, and relaxation. Native plant species are identified for transplanting where *Fallopia japonica* (Japanese Knotweed) is under control. Trail signage informs visitors of good stewardship, and boundary marking helps to establish legal limits for student use. Management needs are identified and prioritized, followed by collaboration with administrators and grounds management to address drainage concerns, and removal of debris and fallen/compromised trees. Website development is ongoing to better represent the history, ecology, and trail system of the preserve.

Sat-AM2-E-2

Teaching What We Need to Learn

Heather Fitzgerald (Saint Michael's College and Community College of Vermont)

Abstract - There's an old saw that we tend to teach the things we most need to learn, and darned if I haven't found it to be true over and over again. Lately I have been feeling compassion for my students who want to know everything about nature instantly. I've been experimenting with giving them permission to slow down, let go of expectations that they will key out a tree in a particular way or interact with a certain number of mammals while at their sit spot, and appreciate learning small things. I will share my journey through the Valley of Rigorous Teaching to my current approach, and offer you time to explore the messages hidden in your own teaching.

Sun-AM2-B-2

The Role of Cutaneous Lipids in the Resistance to White-nose Syndrome

Craig L. Frank (Fordham University, Armonk, NY), Joseph P. Laske (Fordham University, Armonk, NY), and April D. Davis (NY State Department of Health, Slingerlands, NY)

Abstract - White-nose Syndrome is a mycosis that severely affects *Myotis lucifugus* (Little Brown Bat), *M. sodalis* (Indiana Bat), *M. septentrionalis* (Northern Long-eared Bat), and *Perimyotis subflavus* (Tricolored Bat) and is caused by an extensive cutaneous infection with the fungus *Pseudogymnoascus destructans* (*Pd*) during hibernation. Infected bats arouse more frequently from torpor during hibernation, which eventually leads to their death. *Pseudogymnoascus destructans* was first observed at a single cave in eastern New York (NY) during the winter of 2006–2007 and has since spread to 39 US States and 7 Canadian provinces. *Eptesicus fuscus* (Big brown Bat) overwintering in an eastern NY mine hibernate normally, do not develop extensive cutaneous *Pd* infections, and usually survive hibernation. The number of Little Brown Bats hibernating at the Williams Preserve Mine in eastern NY has been increasing steadily since the initial (88%) decline during 2007–2008. Our studies on the cutaneous lipids of bats from NY demonstrate that the ability of both Big Brown Bats and the Williams Preserve Little Brown Bats to reduce *Pd* infections is partially due to a greater accumulation of dietary linoleic acid in the skin during recent years. Linoleic acid cannot be synthesized by bats, it must be obtained through their insect diet. Our findings indicate that the ability of both Big Brown Bats and the eastern NY population of Little Brown Bats to resist *Pd* infections may be due in part to the composition of the insect diet consumed prior to hibernation.

Sun-PM2-D-3

Plethedon, Plates, and PCR: A Classroom Case Study of Herpetofaunal Microbiome-Diversity Patterns in Northern NY

Danielle Garneau (SUNY Plattsburgh, Plattsburgh, NY) and Nana Ankrah (SUNY Plattsburgh, Plattsburgh, NY)

Abstract - Today's ecologist may have a different set of credentials as compared to those a decade ago. Emphasis on broad training in not only field work, but also molecular ecology and geospatial analysis is growing. I aim to share a case study in wildlife research that is transferable to an undergraduate classroom. This project centers around the common northern forest species *Plethodon cinereus* (Red-backed Salamander) and emphasizes collaboration across disciplines (ecology, microbiology, genetics) with growth in both student and faculty skills alike. There are a host of known threats to herpetofauna including habitat split, pollution, climate change, and disease spread. The mucosome of amphibians is an important first line of defense against desiccation and disease. Numerous studies have shown that microbiome diversity affords many herpetofaunal species protections against fungal infection such as chytridiomycosis. During 2 consecutive years, students in SUNY Plattsburgh's upper-level Wildlife Ecology and Management course surveyed herpetofaunal species richness patterns across a variety of sites and noted forest structure and site conditions. In addition, these students swabbed the epithelial mucosome of each individual and plated these samples on sterile Petri dishes. They determined bacterial morphotype richness by species-specific and site-specific colony morphotype prior to performing molecular ecology. Students extracted microbial DNA from bacterial colonies, performed a 16s rRNA polymerization chain reaction (PCR), and employed Sanger sequencing services to identify microbial species. Students learned that herpetofaunal species richness varied across sites, forest structure, and other microhabitat conditions. Additionally, they determined that microbiome varies by herpetofaunal species and across sites and included members of the genera *Pedobacter*, *Aminobacter*, *Pseudomonas*, *Serratia*, *Pantoea*, and *Sphingobacteria*. During the semester, students networked and troubleshot issues with collaborating faculty whose expertise complemented that of their primary professor and presented their results at conferences. At primarily undergraduate institutions, faculty are often constrained logistically by resources; however, projects such as this offer an opportunity to increase the scope of student research opportunities. Interdisciplinary research projects can be embedded in courses as pedagogical modules that leverage faculty expertise, consumables, and equipment, while setting an example for students about the importance of collaboration.

Sat-AM1-E-2

Investigating Northeastern Trees' Drought Physiology: A Turgor Loss Point Perspective

Jess Gersony (Smith College, Northampton, MA), Andrew Ouimette (USFS, Durham, NH), Jack Hastings (University of New Hampshire, Durham, NH), Kaitlyn Baillargeon (University of New Hampshire, Durham, NH), Heidi Asbjornsen (University of New Hampshire, Durham, NH), Samuel Zuckerman (University of New Hampshire, Durham, NH), Matt Vadeboncoeur (University of New Hampshire, Durham, NH), and Scott Ollinger (University of New Hampshire, Durham, NH)

Abstract - In the eastern US, spring and summer droughts are becoming more prevalent. How eastern forests will respond to drought, with regards to carbon sequestration and biomass production, is poorly understood due to critical knowledge gaps and inconsistent classifications of drought tolerance for the dominant species. Here, we attempt to begin to fill in these knowledge gaps by performing a physiological survey of a key drought-resistance trait (turgor loss point [TLP]) of trees across environmental conditions in the Northeast. We selected TLP as the key trait of interest because of its close relationship to stomatal closure during drought. We performed this work to understand (1) the between- and within-species variation in this important trait, (2) potential environmental drivers of within-species variation, and (3) how TLP relates to general trends of drought responses of species reported in the literature based on whole-tree growth response. We conducted research across a range of environments including Bartlett Experimental Forest (along an elevational gradient), Thompson Farm (in Durham, NH), and Harvard Forest. We also performed measurements at both a nitrogen enrichment experiment plot and a rain-fall exclosure plot. We found large variations in TLP between and within species and are starting to uncover relationships between environmental conditions, whole-tree growth response to drought, and TLP. Through this work we are beginning to shed light on the physiology underpinning variation in drought responses of northeastern trees.

Sat-PM2-B-2

***Phegopteris excelsior*, a "New" Beech Fern, and How to Recognize It**

Arthur V. Gilman (Pringle Herbarium, Burlington, VT)

Abstract - *Phegopteris excelsior* (Tall Beech Fern) was described in 2019 as a new species. Previous to that it was known since the 1970s as a tetraploid race of *Phegopteris connectilis* (Long Beech Fern), which is normally triploid. However, it is of hybrid origin with Long Beech Fern as one parent and, being on a separate evolutionary path, meets the standard as a separate species. Interestingly, it is known only from areas north of the glacial maximum and is distributed from Nova Scotia to Ontario. Habitat is generally sloping, mesic to damp forest, often near small streams. It resembles its Long Beech Fern parent, but is taller, and displays some frond characters that allow it to be identified in the field. Spore size is an important discriminant. I will discuss the nature of Tall Beech Fern and how it was discovered and will demonstrate how to distinguish it from both the common Long Beech Fern and the rare *Phegopteris hexagonoptera* (Broad Beech Fern).

Sat-PM2-D-2

New Perspectives on Diversity of Vascular Plants in Vermont

Arthur V. Gilman (Pringle Herbarium, Burlington, VT)

Abstract - There are ~2250 vascular plants in Vermont, of which about two thirds are indigenous to eastern North America. Each year, a few additional species are added to the list, including both North American and exotic species. However, largely due to glacial activity, the region lags far behind East Asia, even though their ancient floras were similar and their climate conditions are generally similar today. It is thought, therefore, that there are many unfilled niches in our landscapes that appear to be filling in from regions to our south, and from Eurasia. Add to this our rapidly increasing knowledge of plant systematics (think "cryptic species") and plant breeding systems (think "microspecies"), and it is evident that our knowledge of plant diversity is not adequately captured by a simple list and, perhaps, our concepts of biodiversity are in need of some updates.

Sat-PM1-B-2

The Natural History and Ecology of the Leach's Storm-Petrel on Great Duck Island, Maine

Eleanor J. Gnam (College of the Atlantic Island Research Center, Bar Harbor, ME)

Abstract - *Hydrobates leucorhous* (Leach's Storm-Petrel) is a small, pelagic seabird in the tubenose order. Members of this species are cryptic at their breeding colonies, nesting in shallow burrows and returning from offshore feeding trips only at night. Leach's Storm-Petrels are abundant but declining at large colonies in the North Atlantic. The small population that breeds in the Gulf of Maine is not well understood. Great Duck Island, located 17 km (12 mi) south of Mt. Desert Island in the Gulf of Maine, is the largest colony of Leach's Storm-Petrels in the continental United States, hosting ~8500 breeding pairs. Since the mid -1900s, the colony on Great Duck Island has been the subject of a wide array of research projects and population surveys. Taken together, this body of work creates an interesting case study of a colony over time, on an island that has been subject to dramatic changes in habitat and human use. I will introduce the biology and breeding ecology of this little-known seabird, and summarize what we know of the history of Great Duck Island's colony. Then, I will present on our ongoing research and describe some of our standing questions. By using Great Duck Island as a case study, I will examine conservation concerns and management questions for this species as they apply to the broader population in the Gulf of Maine.

Sat-AM2-C-4

The Globally Rare Carnivorous Plant *Aldrovanda vesiculosa* Discovered in New Hampshire

Michael P. Graziano (Bridgewater State University, Bridgewater, MA), Donald J. Padgett (Bridgewater State University, Bridgewater, MA), and Emmi Kurosawa (University of Massachusetts, Boston, MA)

Abstract - *Aldrovanda vesiculosa* (Waterwheel Plant; Droseraceae) is a globally rare, aquatic carnivorous plant with native populations in Europe, Africa, Asia, and Australia. Despite this wide range, habitat degradation has led to a decline in nearly 90% of its historic occurrences, leaving ~50 natural sites worldwide. Deliberate introductions (or so-called assisted colonization events) have become a more recent conservation tool for *A. vesiculosa*—seemingly without regard to the potential consequences caused by this rapidly growing plant. We report here on an assisted colonization effort which has resulted in an established population of *A. vesiculosa* in southern New Hampshire, representing both its most northern station in North America and the first documented occurrence of the species in New England.

Sat-PM2-E-3

Examining the Relationship between Mercury Exposure and Infectious Disease Risk in Common Loons (*Gavia immer*)

Ericka Griggs (UVM, Burlington VT), Ellen Martinsen (UVM, Burlington VT), Lucas Savoy (Biodiversity Research Institute, Portland ME), and John Cooley (Loon Preservation Committee)

Abstract - Malaria parasites (genus *Plasmodium*) and other vector-borne parasites of the Order Haemosporidia are increasing due to climate change, making them important agents of infectious disease in birds worldwide. Mercury (Hg), a common environmental contaminant that accumulates in the tissues of vertebrates, is known to be an immunosuppressant and has been found to be significantly associated with malaria infection status in previous mammal studies. To build upon the scant knowledge of the impact of Hg on infectious disease dynamics in wild bird species, this study investigated the relationship between haemosporidian parasite infection status and blood Hg levels in *Gavia immer* (Common Loon). Through broad collaboration with loon biologists, we had access to blood samples from Common Loons from across their Maine and New Hampshire breeding range. We used light microscopy and PCR to screen 250 individual loon blood samples for haemosporidian parasite infection (including malaria parasites), and total Hg concentration was already measured by collaborators for each bird sampled. Given that malaria parasites have been recently documented to infect and kill Common Loons during the breeding season, this study aimed to shed light on the impact of environmental contamination in the form of heavy metals on infection dynamics in a bird of conservation concern.

Sun-PM2-D-2

Montpelier PLACE: Ecological Assessment, Management, and Connection in Vermont's Capital City

Erica Hample (University of Vermont, Burlington, VT)

Abstract - Through the Montpelier PLACE (Place-Based Landscape Analysis and Community Engagement) program, I applied a systems-ecology approach to landscape analysis with human interaction and education anchored in Hubbard Park and North Branch River Park, 2 naturalized city-owned parks in Montpelier, VT. I created an ecological assessment of the parks to inform a new combined management plan. Natural community mapping and ranking formed the basis for ecological interpretation within the parks. Concurrently, I facilitated community connection on topics encompassing the ecological and human landscapes of Montpelier. The combination of these 2 modalities of landscape interpretation and interaction created a depth of ecological awareness for Montpelier residents that can be propelled forward to decision-making on both the city and individual scale.

Sun-AM2-C-2

The Storytelling of Science

Thor Hanson (Author and Biologist, Friday Harbor, WA)

Abstract - This session will share practical tips "from the field" of science communication. Author and biologist (and UVM Field Naturalist Program Alumnus) Thor Hanson will tell a story and then dissect it to see what makes it tick. The focus will be on common storytelling elements that we can all use to try and improve the way we communicate our passion for natural history to a wider audience.

Sat-AM2-B-3

Miners and Nomads: Kleptoparasitism and Conservation in Two Fascinating Bee Genera

Spencer Hardy (Vermont Center for Ecostudies, White River Junction, VT), Kent P. McFarland (Vermont Center for Ecostudies, White River Junction, VT), Nathaniel Sharp (Vermont Center for Ecostudies, White River Junction, VT), Michael Hallworth (Vermont Center for Ecostudies, White River Junction, VT), Mark Ferguson (Vermont Fish & Wildlife Department, Montpelier, VT), Joan Milam (University of Massachusetts, Amherst, MA), Michael Veit (Independent, Pepperell, MA), and John Ascher (National University of Singapore)

Abstract - *Andrena* (miners) and *Nomada* (nomads) are among the most diverse genera of bees in Vermont, encompassing more than 30% of the state's bee fauna. *Andrena* are all pollen-collecting bees and the primary host genus for *Nomada*, which are brood parasites that appear to be more host specific than some other kleptoparasitic genera. Both genera present persistent identification challenges to even the most experienced taxonomists, but recent interest in photo-based identifications has shown many species to be field recognizable, which allows for deeper study of their natural history. As part of the Vermont Wild Bee Survey, we have examined over 1000 *Nomada* and 6500 *Andrena* records, resulting in novel insight into the identification, diet, and host–parasite relationships of numerous species. The specialized habitat requirements and agricultural value of many species in these groups make them a valuable lens through which to guide larger pollinator-conservation efforts.

Sun-AM2-D-1

Two Domes Diverged at a Stream Channel: A Coastal Raised Bog in Maine

Laura Hatmaker (SWCA Environmental Consultants, Portland, ME)

Abstract - In Downeast Maine, there are 2 coastal plateau bogs divided by a stream channel, giving rise to 2 similar habitats that have begun to diverge in their ecological succession, potentially driven by the influence of climate change. Through the lens of a rare butterfly in Maine, the charismatic *Plebejus idas empetri (*Crowberry Blue), this talk will explore the 2 sides of the stream channel, discussing how species composition has shifted in each and exploring potential ecological drivers for those changes.

Sat-PM1-E-3

Exploring American Chestnut Ectomycorrhizal Communities Across a Nitrogen Deposition Gradient in the Adirondacks

Molly Heit (SUNY College of Environmental Science and Forestry [ESF], Syracuse, NY), Tom Horton (SUNY ESF, Syracuse, NY), Andy Newhouse (SUNY ESF, Syracuse, NY) and Bill Powell (SUNY ESF, Syracuse, NY)

Abstract - *Castanea dentata* (American Chestnut) was decimated by a fungal stem blight in the early 1900s, rendering a once-dominant feature of the eastern hardwood forest functionally extinct. Advances in genetic engineering biotechnologies have generated blight-tolerant transgenic chestnut lines, including the Darling-58 tree developed at SUNY ESF. Planting the transgenic tree is still federally regulated; however, advances in the regulatory process have allowed the project to advance to a planning stage for expanding the tree's presence in field and restoration settings. Since American Chestnut was largely absent from the northeastern forest overstory while techniques used to evaluate ectomycorrhizal fungi (EMF) on a molecular level were in development, the tree's typical EMF community assemblage is poorly understood. Associations with EMF are critical to understand since they serve many roles supporting seedling survival and growth of American Chestnuts and other members of the hardwood forest ecosystem. One avenue of interest for planting transgenic American Chestnuts is afforestation in the Adirondack Mountains, where chestnut has not historically grown due to cold intolerance. However, as the climate warms, low-elevation areas of the Adirondacks may support American Chestnut afforestation. This study aims to evaluate chestnut performance and EMF diversity along an east–west soil nitrogen (N)-deposition gradient present in the Adirondacks; plant-available N may relieve the N-limitation conditions under which EMF typically dominate. We planted non-transgenic wild-type chestnuts in soils with inoculum from 12 sites distributed across the region (n = 190). We grew seedlings for 7 months and then harvested them for chemical and molecular analysis. We are currently assessing EMF abundance and diversity across sites via restriction fragment length polymorphism (RFLP) typing and sequencing of the fungal internal transcribed spacer (ITS) DNA sequence. We will compare average soil N, carbon (C), C/N ratio, Ca^{2+}, ammonium and nitrate at each site. Further, we will assess dry root:shoot biomass ratio and foliar nutrient composition as possible covariates with chestnut performance. Previous studies have deemed American Chestnut an appropriate species for restoration of former logging and mine sites, which are common in the Adirondacks. If American Chestnuts can find fungal partners to support their growth in the Adirondacks, this transgenic tree species may be one step closer to finding a new home.

Sun-AM1-A-2

Progress of an Ongoing Eastern Hellbender Recovery Initiative in the Upper Susquehanna River Watershed of New York

Michelle R. Herman (The Wetland Trust, Burdett, NY) and Peter J. Petokas (Lycoming College, Williamsport, PA)

Abstract - *Cryptobranchus alleganiensis alleganiensis* (Eastern Hellbender) populations in the Upper Susquehanna River Watershed (USRW) of New York declined such that by 2014 extensive surveys produced 1 adult with a nest at a historical site. We began a collaborative and experimental recovery initiative to address this decline, starting with the site occupied in 2014. We installed artificial shelters and slab rocks for site habitat enhancement and, in partnership with the Bronx Zoo, released 2 captive-reared juvenile Eastern Hellbender cohorts (n = 99 in 2018 and n = 124 in 2021) for population augmentation. Both cohorts were 3.5 years old at release and PIT-tagged before stream placement. Post-release monitoring at the enhanced site is ongoing and includes manual stream bottom scans and continuous instream tag reader systems to determine captive-reared juvenile Eastern Hellbender survivorship, movement, and habitat use. Between 2018 and 2022, captive-reared juvenile Eastern Hellbenders generally achieved and maintained high apparent survivorship within 1 year of release, moved downstream from their release point, and used atypical habitat. Relocation surveys in 2022 detected 14.4–23.8% of released juvenile Eastern Hellbenders at the enhanced site, and annual captures indicate that the remaining individuals are healthy. The artificial shelters have also attracted additional, previously undocumented wild adult Eastern Hellbenders and provide a source of eggs for future captive-rearing and reintroduction. Our results suggest that captive-reared juvenile Eastern Hellbenders are capable of establishment at an enhanced historical site, an important first step in the species' reintroduction to the USRW.

Sat-PM2-A-3

Potential Cougar Habitats and Dispersal Corridors in Eastern North America

Liz Hillard (Wildlands Network, Asheville, NC), Brianna Winkel (Southern Illinois University, Carbondale, IL), Clayton K. Nielsen (Southern Illinois University, Carbondale, IL), Ronald W. Sutherland (Wildlands Network, Durham, NC), and Michelle A. LaRue (University of Canterbury, Christchurch, NZ)

Abstract - *Puma concolor* (Cougar) have been recolonizing midwestern North America during the past 3 decades with ≥ 950 cougar confirmations east of established populations. Due to an increase in confirmations east of current breeding populations, evaluation of Cougar habitat suitability and connectivity is needed. However, few studies have assessed the habitat potential for Cougar recolonization in the eastern portion of their former range. We used various habitat quality thresholds to model potential Cougar habitats and dispersal corridors throughout eastern North America. Based on expert opinion, we used landcover, slope, human density, distance to roads, and distance to water as model variables. Least-cost path methods were used to model dispersal corridors from western populations to potential eastern habitat patches. Patches of suitable habitat ranged in size from 3868 km² (Ozark Mountains) to ≥ 2,490,850 km² (central and eastern Canada). Potential habitats were predominantly forest and shrubland, contained little anthropogenic development, and had high stream densities. Dispersal corridors were present throughout the study area. Corridors largely consisted of forested and cultivated landscapes and had higher road densities than habitat patches. Our research provides conservationists with insights into areas suitable for Cougar recolonization so they may proactively plan for potential Cougar populations east of their current range.

Sun-PM2-E-2

Vermont Atlas of Life 2013–2023: Mapping Biodiversity Now and in the Future

Susan Hindinger (Vermont Center for Ecostudies, Norwich, VT), Michael T. Hallworth (Vermont Center for Ecostudies, Norwich, VT), Spencer Hardy (Vermont Center for Ecostudies, Norwich, VT), Jason Loomis (Vermont Center for Ecostudies, Norwich, VT), Nathaniel Sharp (Vermont Center for Ecostudies, Norwich, VT), and Kent P. McFarland (Vermont Center for Ecostudies, Norwich, VT)

Abstract - The UN recently reported that current species extinction rates are unprecedented in human history, with up to a million species at risk of extinction. As human activity profoundly alters the map of life, our response requires knowledge of species distributions across vast landscapes and over long time scales. To respond effectively to climate change requires a deep understanding of the status and trends of biodiversity. A decade ago, we launched the Vermont Atlas of Life (VAL) to gather data on species in Vermont and help fill knowledge gaps. VAL couples the power of community science with traditional research and monitoring to quantify Vermont's biodiversity, now and into the future. VAL joins other institutions across the globe in curating occurrence records at the Global Biodiversity Information Facility. The VAL repository contains over 8 million primary biodiversity records representing >14,000 species. From this information, we are beginning to better understand trends, identify knowledge gaps, and project how biodiversity will change in response to a changing climate. This presentation will provide an overview of VAL and examples of how the data have been analyzed and used to inform conservation decisions.

Sun-PM2-B-4

Colony Conundrums: Factors Impacting Nesting Density and Distribution in a Colonial Seabird

Wriley Hodge (Island Research Center, College of the Atlantic, Bar Harbor, ME), Jennifer McNamarra (Island Research Center, College of the Atlantic, Bar Harbor, ME), and Asher Panikian (Island Research Center, College of the Atlantic, Bar Harbor, ME)

Abstract - Fretwell and Lucas' theory of ideal free distribution (IFD) states that nesting distribution between habitats can be understood as a product of the distribution of different resources within each habitat. The theory of ideal despotic distribution (IDD) states that "fit" individuals may exclude less-competitive individuals from high-quality habitat. In this paper, we examine the IFD and IDD in relation to colonially nesting seabirds. First, we broadly apply these theories to seabirds and their life histories. In the literature, the IFD focuses on passerines. The unique life histories of seabirds—that they are long lived, travel long distances to forage, and often nest colonially on offshore islands—may make the resources impacting nesting distribution different for seabirds than for songbirds. We then apply the IFD and IDD to results from the first year of a study looking at nesting density and distribution in *Larus argentatus* (Herring Gull) on Great Duck Island, located 12 km offshore in the Gulf of Maine. We found that nesting density varied significantly across 3 distinct habitats ($P > 0.01$), however, there was no significant difference in reproductive success between habitats. Using the framework of the IFD and IDD, we offer hypotheses to explain what resources may influence nesting density and distribution in Herring Gulls on Great Duck Island.

Sat-PM1-C-2

Practicing Applied Urban Ecology in Massachusetts

Erica Holm (Mass Audubon, Boston, MA)

Abstract - Urban ecology is a discipline encompassing a broad range of sciences and activities. So, what does an urban ecologist really do? In this talk, I'll discuss definitions of urban ecology, existing frameworks to build from, and current local approaches to practicing applied urban ecology. With examples from Mass Audubon's Action Agenda and Nature in the City program including working in the urban forests in multiple municipalities, case studies from the land protection and advocacy space, and equitable green workforce development and involvement of community members in participatory science, I will explore increasing holistic local understandings of applied urban ecology.

Sun-AM1-D-2

How to Train a Naturalist?

Evan Horne (University of Vermont Field Naturalist Program, Burlington, VT) and **David Moroney** (University of Vermont Field Naturalist Program, Burlington, VT)

Abstract - Through 40 years of experimentation, the UVM Field Naturalist Program has concluded that a field naturalist is not a generalist but a specialist in integration. Exploring landscape layers is fundamental to understanding natural history, from the bedrock beneath our feet to the birds flying overhead. But more than a deep knowledge of the layers of the landscape, including flora and fauna, is needed to make a field naturalist well rounded. Developing and sharing their ecological literacy is a fundamental skill that field naturalists must forge to be a bridge between science and the public.

Sat-AM2-B-1

Evaluating the Impacts of a Changing Climate on the Growth of Native Tree Species Along the Coast of Maine

Brett A. Huggett (Bates College, Lewiston, ME) and Neil Pederson (Harvard Forest, Petersham, MA)

Abstract - The forest habitats that line the coast of Maine represent unique ecosystems of great ecological and economical importance. Climate change and an anticipated increase in storm frequency and severity along the Maine coast may impact the productivity of our native coastal forests. While much research has looked at the ecological impact of forest loss or transition due to storm surges and sea-level rise along the southeastern and Gulf Coast of the United States, little is known regarding the recent impact of such stressors on the growth or mortality of native coastal tree species in Maine. We aim to investigate the impact of recent warming of the Gulf of Maine and past major coastal storms on tree growth to improve our understanding of how native coastal tree species in Maine respond to such abiotic stress. We sampled *Pinus rigida* (Pitch Pine), *Abies balsamea* (Balsam Fir), *Picea rubens* (Red Spruce), and *Quercus rubra* (Red Oak) trees in Maine coastal stands for dendrochronological analyses. Results indicate that recent changes in seasonal temperatures and major coastal storms are correlated with changes in growth rates of native tree species. Further analyses will specify differences in sensitivity to climate drivers of each native coastal tree species compared to inland chronologies. Ultimately, by improving our understanding of the impact of a changing climate and major coastal storms, this research will allow us to identify vulnerability among native tree species, thus informing decisions regarding land management and restoration in response to global climate change.

Sat-PM2-B-1

Breeding Success in a Declining Cliff Swallow Population

Pamela Hunt (NH Audubon, Concord, NH)

Abstract - As is the case with many populations of aerial insectivores, *Petrochelidon pyrrhonota* (Cliff Swallow) has shown a dramatic decline in New Hampshire since the 1970s, leading to it being state-listed as threatened in 2017. To determine if local conditions affected nesting success, and thus potentially population status, I initiated a breeding season study at 3 colonies in central New Hampshire in 2021. I collected data on nest contents weekly from late May to mid-August to determine the fate of each nest. The proportion of nests that successfully fledged young varied by colony and year but overall was similar in both years (74% and 68%). These numbers are comparable to those available for the species elsewhere in its range and suggest that breeding season events, at least at the study colonies, cannot immediately be implicated in local declines. Noteworthy in the study population was a high percentage of late nests (14 of 51) initiated at the end of June after most first-round nests had fledged. Subsequent work will attempt to identify the source of these birds. This study will continue for several more years, including expansion to additional large colonies in northern New Hampshire and comparisons of natural and artificial nests.

Sat-PM1-F-3

Status and Conservation of Northeastern Endemic Damselflies

Pamela Hunt (NH Audubon, Concord, NH), Virginia Brown (Barrington, RI), Ron Butler (University of Maine, Farmington, ME), Phillip deMaynadier (Maine Department of Inland Fisheries and Wildlife, Bangor, ME), Lynn Harper (Massachusetts Natural Heritage and Endangered Species Program, Westborough, MA), Laura Saucier (Connecticut Department of Energy and Environmental Protection, Burlington, CT), Robert Somes (New Jersey Division of Fish and Wildlife, Robbinsville, NJ), and Erin White (New York Natural Heritage Program, Albany, NY)

Abstract - Four species of *Enallagma* damselflies (bluets) are endemic to the area from New Jersey to the Maritime Provinces of Canada, and as a result are often considered conservation priorities at the state level. In 2018–2019, we undertook a comprehensive survey for these species in the United States portion of their ranges, including visits to historic sites and searches for new sites. We also collected data on local habitats in order to make a model of habitat associations for all species across the region. Findings vary by species and region, but in general, populations appear secure in southern New Jersey and northern New England and more vulnerable on Long Island and southern coastal New England. One species in particular, *Enallagma pictum* (Scarlet Bluet), which was formerly considered a coastal plain endemic, has expanded its range significantly into northern New England over the last 20 years. Habitat models generally support conventional wisdom regarding species' habitat associations, while also suggesting negative impacts of shoreline alteration and other anthropogenic impacts, especially in the southern portion of their ranges. In addition to updating regional status for the 4 species, we produced a conservation plan that outlines threats and proposes conservation actions that have the potential to improve habitat condition at occupied sites or landscapes.

Sat-AM2-D-3

Wetland Restoration and Habitat Management Practices to Establish Viable Populations of the Eastern Spadefoot Toad: A 12-year Case Study

Ian Ives (Mass Audubon Cape Cod, Barnstable, MA) and Jay Cordeiro (Mass Audubon Cape Cod, Barnstable, MA)

Abstract - *Scaphiopus holbrookii* (Eastern Spadefoot Toad), is a fossorial anuran typically found in sandy-soil habitats interspersed with temporary ponds. In Massachusetts, the northeast corner of its range, the species was historically widespread but has declined due to habitat loss and degradation and is listed by the state as threatened. Spadefoot Toad conservation efforts involving wetland restoration and creation as well as habitat management are occurring across the region, and managers need effective practices to support sustainable populations. It is increasingly accepted that an adaptive management approach to vernal pool creation and restoration is necessary and that the effectiveness of practices should be evaluated and refined based on conscientious long-term monitoring. In 2011, Mass Audubon Cape Cod began an ambitious undertaking to captive headstart and translocate Spadefoot Toad metamorphs into newly restored and created wetlands at the Ashumet Holly Wildlife Sanctuary in Falmouth, MA. In 2021, a milestone was reached in the first-ever documented occurrence of reproduction of a translocated Spadefoot Toad population. Both groundwater and liner vernal pools were designed and constructed utilizing techniques adapted from prior wetland restorations as well as newly developed techniques meeting the specific requirements of the Spadefoot Toad. We present a roadmap useful in determining whether to restore Spadefoot Toad wetlands on a site as part of a conservation project. In addition, we share ongoing habitat management techniques, lessons, and best practices that have contributed towards the establishment of a demographically diverse breeding population at Ashumet Holly. Adaptive habitat monitoring and management efforts going forward will be aimed at supporting and promoting reproductive effort and outcome at the site, as well as maintaining appropriate long-term upland and breeding habitat to accommodate a viable, sustainable population.

Sat-AM2-D-5

A New Estimate of Biocrust Contribution to Carbon and Nitrogen Flux in Global Terrestrial Ecosystems

Shloka V. Janapaty (Columbia University, New York, NY), Erwan Monier (UC Davis, Davis, CA), Emilio Rodriguez-Caballero (Max Planck Institute of Chemistry, Mainz, Germany), Betttina Weber (Max Planck Institute of Chemistry, Mainz, Germany)

Abstract - Biocrusts are communities of photoautotrophic organisms, such as cyanobacteria, lichen, and bryophytes, that are found ubiquitously in terrestrial ecosystems and play a vital role in regulating carbon and nitrogen fluxes at a local scale. Despite their importance, the global contributions of biocrusts to carbon and nitrogen fluxes are not well understood and estimates from over a decade ago need to be updated. This study analyzed 362 flux records from 1976 to 2021 to derive updated estimates of carbon and nitrogen uptake by biocrusts. We estimate that biocrusts absorb 3.07 Pg of carbon and 102.33 Tg of nitrogen annually, accounting for 7 percent of terrestrial primary productivity and over 50 percent of biological nitrogen fixation. We used random forest regression analysis and Landsat 8 spectral bands to identify drivers of flux with root mean square error of 4.59% and ERA5 reanalysis to predict flux for forecasted climatologies. Sensitivity analysis indicated that in-situ flux measurements are sensitive to temporal and geospatial scaling factors, with up to 86 percent error in predictions. Our findings dramatically update previous estimates of biocrust contributions to global biogeochemical cycles and highlight the need for future research to sample data from understudied ecosystems.

Sat-AM1-B-1

Rhode Island Bumble Bee Survey and Clover Establishment for Bumble Bee Species

Casey L. Johnson (University of Rhode Island, Kingston, RI), Elizabeth M. Varkonyi (University of Rhode Island, Kingston, RI), Julia J. Vieira (University of Rhode Island, Kingston, RI), and Steven R. Alm (University of Rhode Island, Kingston, RI)

Abstract - We conducted a statewide survey to assess the status of *Bombus* spp. (bumble bees) in Rhode Island. We collected bumble bees using vane traps at farms, golf courses, or residential areas from 2019 to 2021 and performed floral observations in 2020 and 2021 to document flowering-plant visitations and determine bumble bee species richness and relative abundance. We analyzed the pollen from historical and modern specimens to further establish a record of bee species' floral associations. Of the 12 historical (1900–1999) species documented from Rhode Island, we did not detect 5 species, which suggests that these species are either extremely rare or no longer present in the state. *Bombus fervidus* (Yellow Bumble Bee) is the rarest of the historically present bumble bees currently found in Rhode Island and listed as vulnerable by the International Union for Conservation of Nature (IUCN). During this study, *Bombus fervidus* visited *Trifolium pratense* (Red Clover) most often in the field, and both historical and modern *Bombus fervidus* specimens had high percentages of *Trifolium pratense* pollen. In 2022, we surveyed established plots of Red Clover, *Trifolium repens* (White Clover), *Trifolium incarnatum* (Crimson Clover), and *Prunella vulgaris* (Common Self-heal) for bees. Our preliminary results show that Red Clover and Crimson Clover had the highest bee species richness and that Red Clover had the highest abundance of foraging bees. In 2023, we will further document bee visitation to established plots of Red Clover, White Clover, Crimson Clover, Common Self-heal, and *Thymus serpyllum* (Creeping Thyme). Future research will determine how drought may impact bee visitation by assessing the impact of simulated drought conditions on nectar availability of these plant species. We will also compare 5 different methods of seed establishment in preexisting turfed areas to determine which methods and plant species are easiest and most cost-effective to establish "bee lawns".

Sun-AM2-D-3

Increased Mortality in Adult and Juvenile Wood Turtles During Drought Years

Matthew Kamm (Zoo New England, Boston, MA)

Abstract - Zoo New England's Field Conservation Team has radiotracked juvenile and adult *Glyptemys insculpta* (Wood Turtle) at several sites around Massachusetts since 2012 to learn more about movements, habitat usage, and survival of this species in a largely suburban landscape. Since 2019, we have also headstarted and released more than 70 hatchlings across all sites. Although we have found that annual survival rates overall mirror figures reported from other populations (89.7%), we have observed high mortality in both adults and headstarted juveniles during years of significant drought. Of 26 confirmed mortalities since 2019, 85% occurred during 2 severe drought years, and a comparison via Fisher's exact test between the 2 wettest and 2 driest years since the project began found a significant difference in mortality ($P < 0.05$). The likely increase in unpredictable precipitation and severe drought associated with climate change could pose a serious threat to Wood Turtle populations across the species' range.

Sun-AM2-A-3

Forest Health in the Ossipee and Waterboro Pine Barrens: Arrival of the Southern Pine Beetle

Sonya Kaufman (University of Vermont, Burlington, VT), Tony D'Amato (University of Vermont, Burlington, VT), Kevin Dodds (USFS, Durham, NH), and Ryan Hawley (University of Vermont, Burlington, VT)

Abstract - *Dendroctonus frontalis* (Southern Pine Beetle) is expanding its range north, putting globally rare, fire-dependent *Pinus rigida* (Pitch Pine) ecosystems at risk of being lost completely. As part of a regional assessment of Pitch Pine barrens across the Northeast, we conducted vegetation surveys of 2 preserves that are actively managed by The Nature Conservancy: Ossipee Pine Barrens in New Hampshire and Waterboro Barrens in Maine. We established plots in stands that we categorized into 3 restoration and stewardship options for these communities: mechanical harvest only, mechanical harvest and prescribed fire, and no management. We took tree cores from all living overstory trees (>7.5cm DBH) and determined age structure from inner-most ring dates. We applied a hazard model designed to predict intensity of Southern Pine Beetle infestations to assign hazard ratings to the sampled stands. Pitch Pine recruitment and abundance declined in areas lacking active forest management with minimal recruitment over the last several decades. Mesic species such as *Pinus strobus* (Eastern White Pine), *Acer rubrum* (Red Maple), and *Fagus grandifolia* (American Beech) increased in areas without prescribed fire. Pitch Pine regeneration was most prevalent in stands treated with harvesting and fire. Findings from this descriptive study will help to prioritize areas within the pine barrens for adaptive management to limit Southern Pine Beetle outbreaks.

Sun-AM2-C-3

A Tale of Two Forests: Comparing Primary and Post-Agricultural Forest Conditions in Northern NJ

Jay F. Kelly (Raritan Valley Community College – Center for Environmental Studies, North Branch, NJ) and Jessica Ray (Raritan Valley Community College – Center for Environmental Studies, North Branch, NJ)

Abstract - We studied the changes in forest conditions resulting from agricultural land-use history in northern New Jersey, documenting the spatial extent of forest change based on historical forest maps from the late 1800s, aerial imagery, and other sources. We also collected measurements from 72 forest stands to compare the vegetation structure, canopy composition, and soil conditions in post-agricultural forests relative to adjacent primary forests with no such agricultural history. Although forest cover increased 25% since the late 1800s overall, we found a 26% decline in primary forest cover during that time, and post-agricultural forest types now comprise at least 46% of present-day forest cover. Forest vegetation and soils were dramatically different in the 2 forest types, with significant increases in invasive shrub and liana cover , lower levels of tree regeneration, and major shifts in canopy composition in post-ag forests. Soil conditions differed across two-thirds of the variables studied, with post-ag forests having higher pH and associated base mineral concentrations (Ca, Mg) and lower nutrients (NH_4, %N), cation exchange capacity, and organic content (%C, % organic matter), and changes to soil texture (lower % sand, higher % silt and clay). Variation in these changes showed few to no relationships with geology/soils, topography, forest age, area or distance to edge, indicating the robustness of these changes across a wide variety of environmental contexts. These results underscore the importance for recognizing land-use history and distinguishing between these major forest types in the future in order to better inform ongoing efforts to preserve, manage, and restore forests in the region in the future.

Sun-PM2-A-1

Empowering Connection and Conservation through Amphibian Community Science

Pete Kerby-Miller (North Branch Nature Center, Montpelier, VT)

Abstract - Roads are ubiquitous in the Vermont landscape and pose a threat to biodiversity through fragmentation and car collision mortality. Where roads bisect amphibian habitat, collision mortality during migration can cause populations to be unknowingly extirpated. This risk is not readily evident, as many species are both nocturnal and often fossorial. To address this conservation challenge, North Branch Nature Center launched an amphibian community science program in 2018. After conducting 900 surveys that included 17,249 amphibian encounters, I have some lessons to share on community science as a tool for direct conservation and for fostering action at individual, community, and regional scales.

Sat-PM1-B-3

What First: Spring and Stream Conservation on a Half-Million Acre Ranch

Hayley Kolding (University of Vermont Field Naturalist Program, Burlington, VT)

Abstract - Using field assessments and remote sensing data, I helped the new managers of a 202,343-ha (500,000-ac) cattle ranch in Oregon's high desert answer a management question that's just as relevant here in the Northeast as it is in the west: with limited resources and diverse ecological and cultural goals, which riparian areas should we protect first—and how? I identified priority sites for assessment by factoring in remote sensing data, landowners' values, and logistical details. Then I took to the ground, analyzing vegetation, channel structure, hydrology, and disturbance patterns to diagnose and rank the ecological value and management needs of 250 stream reaches, wet meadows, and springs. The Nature Conservancy will use these recommendations to support the Oregon Desert Land Trust in managing the mesic and aquatic resources of Trout Creek Ranch.

Sun-AM2-C-4

How Can Land Trusts Protect the Unique Environments in Utility Rights-of-Way

Hayley Kolding (Connecticut Botanical Society [CBS], New Haven, CT, and University of VT, Burlington, VT) and the ROW Subcommittee of the CBS Ecology and Conservation Committee

Abstract - Unique and valuable ecological communities, including prime pollinator habitat, can exist in Utility Rights-of-Way (ROWs), such as powerline corridors. Utility companies can maintain these ROWs using approaches that vary from ecologically devastating to conducive and even restorative of biodiversity. I will present highlights from Protecting the Environment and Ecology in Utility Rights-of-Way: A Land Trust and Landowners Guide (Connecticut Botanical Society 2022), a tool empowering landowners to communicate assertively with utility companies and request the most botanically sound management strategies available where ROW corridors cross their property. I will describe vegetation-management tools for restoring several types of ecological communities found in ROWs, despite unavoidable, high-impact maintenance like pole replacement and access-road construction. Topics include protecting wetlands and existing vegetation, inspecting proposed sources of topsoil and fill for an upcoming maintenance project, and best practices for restoration, such as using native soil types. By the end of the talk, landowners and land trust stewards will know what they should be asking utility companies to do and not to do—and how to articulate those requests persuasively.

Sat-AM1-D-3

Engaging Undergraduates and Community Partners in Local Biodiversity Conservation

Mary Beth Kolozsvary (Siena College, Department of Environmental Studies and Sciences, Loudonville, NY)

Abstract - Biological diversity is being lost at unprecedented rates, largely a result of direct and indirect human actions. There are not enough "pristine" areas—away from human influence—to adequately protect biological diversity into the future, and conservation efforts need to be made to encourage biodiversity in urban and suburban areas where people live, work, and play. Furthermore, species-conservation efforts need to occur at all spatial scales—from global, to regional, to local action. Engaging undergraduates in hands-on relevant conservation planning and action helps to better connect students to biological diversity, demonstrates what they can do in their own backyards, and emphasizes the importance of taking action at the local scale. To date, Siena College students have had multiple opportunities to be involved with biodiversity conservation efforts on campus and in the surrounding community. On campus, students have developed plans to educate and engage the Siena community in learning about biodiversity, and to enhance the ability of the campus to contribute to local biodiversity conservation. In addition, we have partnered with several local and regional conservation organizations to create opportunities to involve students in mapping invasive species and determining areas of high conservation value at the local scale. Incorporating these types of meaningful experiences are integral to educating and inspiring undergraduates in the fields of environmental studies and sciences, so that students graduate with a better understanding of the importance of local efforts to advancing biodiversity and natural resource conservation.

Sat-AM2-E-3

Biodiversity Vermont: A Perfect Match for Regional, National, and Global Efforts to Conserve Biodiversity and the Planet

W. John Kress (National Museum of Natural History, Smithsonian Institution, Washington, DC)

Abstract - Following 4.6 billion years since the origin of Earth, 3.8 billion years since the early evolution of life, and 300,000 years since the appearance of humans, the last 250 years of western civilization now threatens both our planet and our biodiversity. Habitat degradation, species exploitation, pollution, the spread of invasive species and diseases, urbanization, and climate change all combine to seriously pressure our current ecological systems. Fortunately, citizens, organizations, local and national governments, and international consortia are banding together to devise effective ways to combat and reverse these major environmental challenges. The recent United Nations Conference of the Parties to the Convention on Biological Diversity held in Montreal, QC, brought together peoples from 197 countries to agree on principles and devise actions to halt and reverse biological loss and destruction. Such global actions share many common goals and strategies with other efforts to overcome these problems at every level of organization from national, to subnational, to state, to city and town, and to local jurisdictions. Biodiversity Vermont, a new conservation initiative aimed at the state-level, promises to tackle these global issues by learning from and partnering with efforts across the region, nation, and globe. The breadth of highly trained conservationists, government agencies, nonprofits, and committed private individuals centered in Vermont now seek to work in concert to document, understand, and conserve the biodiversity and wildlands of our state. This presentation will address how Biodiversity Vermont, working together across a broad spectrum of people and organizations nationally and internationally, will have a greater impact on preserving Vermont, the planet, and life on Earth.

Sun-PM2-B-1

A Case-Study Approach for Untangling Community Land-Use Challenges and Sustainable-Energy Installations

Gaytha A. Langlois (Bryant University, Smithfield, RI)

Abstract - As smaller, more-rural communities become targeted as sites for “commercial grade” solar installations, or larger municipalities envision extension of geothermal heating networks, challenges to existing or desired land-use models and zoning guidelines emerge, often unexpectedly and rapidly. Zoning variances or use-code exceptions that are addressed case by case may mask the overall impact to the community. Curriculum tools for acquainting university students with these complexities can include the development and utilization of case studies. This presentation will provide 2 examples of case studies that highlight the importance of community involvement on local and regional levels as we traverse the complicated landscape of moving into the realm of sustainable, resilient energy production in New England.

Sat-AM2-F-

Exploring the Complexity of the Nauset Harbor Ecosystem: A Multidisciplinary Approach

Bryan J. Legare (University of Massachusetts, Amherst, MA), Owen Nichols (Center for Coastal Studies, Provincetown, MA), Agnes Mittermayr (Center for Coastal Studies, Provincetown, MA), Mark Borrelli (Center for Coastal Studies, Provincetown, MA)

Abstract - Nauset Harbor, MA, is a coastal lagoon covering an area of 125 ha (380 ac) and comprising diverse habitats, including shellfish beds and salt marsh. This ecosystem is subject to variations in inlet migration resulting in shifting tides and changing access to the ocean. Ecosystem-based management seeks to maintain ecosystems in a healthy, productive, and resilient condition, providing the services humans want and need. To achieve ecosystem-based management, multidisciplinary studies and monitoring must be undertaken. This study explores the complexities of the ecosystem as a whole by integrating multiple concurrent independent surveys, including benthic microinvertebrate, video habitat assessment, and sonar survey with fishery-independent trawl/dredge sampling. Analysis of survey data creates linkages across the ecosystem, providing guidance for future monitoring and management efforts. The study utilizes non-parametric cluster analysis and machine-learning algorithms such as random forest to integrate water parameters, grain size, habitat type, and surficial benthic habitat mapping with the diversity of microinvertebrate, macroinvertebrate, and fish communities within the system. The combination of techniques allows for an understanding of the relationship between physical factors, including grain size, geoform, and water parameters, and biological factors such as micro-habitat, invertebrate, and fish communities. The results reveal hidden connections that extend beyond the primary drivers (temperature/season) in the system. These connections have implications for understanding the harbor's productivity amid inlet evolution and climate change.

Sun-PM2-C-4

Tackling Biodiversity Loss in Vermont: Lessons from Complexity Science and Healthcare

Curt Lindberg (Vermont Alliance for Half-Earth, Biodiversity Vermont, Waitsfield, VT)

Abstract - Vermont and New England face many daunting and complex conservation challenges. How to tackle them is not always clear. A similar situation exists in healthcare; daunting challenges and unclear paths to solutions. In collaboration with the Centers for Disease Control and Prevention (CDC) and leading healthcare systems, I facilitated numerous multi-stakeholder improvement initiatives to address complex quality problems. Many concerted efforts using conventional improvement and change methodologies to solve these challenges failed, leading many to believe the problems were intractable and an unfortunate, unavoidable consequence of modern medicine. With interested colleagues, we drew on principles from the emerging science of complexity to propose new approaches. The results yielded unprecedented levels of improvement, including 63% reduction in antibiotic resistant MRSA infections in the 196 ICUs in Veterans Administration hospitals, 40% of patients with uncontrolled hypertension cared for in a rural WV primary care center achieved significant reductions in their blood pressure, 54% reduction in bloodstream infections in dialysis centers participating in a national CDC collaborative, and 54% reduction in antibiotic use in a dialysis center collaborative. Intractable problems became tractable. I will describe the complexity-science principles and novel improvement methods underlying these results and suggest how they could be employed to help restore biodiversity in Vermont and address other complex conservation challenges in the state and New England.

Sun-PM2-B-2

Status of a Population of Eastern Pearlshell Mussels in Massachusetts

John P. Ludlam (Fitchburg State University, Fitchburg, MA)

Abstract - *Margaritifera margaritifera* (Eastern Pearlshell Mussel) are sensitive to environmental change but little is known about recruitment, individual growth, or survival in Massachusetts. I began a mark–recapture experiment on a single population of Eastern Pearlshell Mussels in 2018 in the Quinapoxet River in central Massachusetts using visual surface searches. In 3 randomly selected replicate 10 m x 20 m sites, I captured a total of 594 unique mussels and recaptured 246 at least once (2018–2022). Upon initial capture, I double-tagged mussels, and only a single tag loss has occurred in the study. Large mussels were most abundant, but 11% of sampled mussels were less than 50 mm, suggesting recruitment is occurring in this population. Average mussel growth was low (2.2 mm $year^{-1}$ ± 0.4, mean ± 95% confidence interval) and negatively related to body length ($P < 0.05$). Mussels were generally recaptured slightly downstream of initial locations (0.12 m $year^{-1}$ ± 0.18), and movement was not related to body size ($P > 0.05$). Additional years of sampling will allow estimates of survival, recruitment, and the proportion of mussels temporarily buried in the substrate to be related to the hydrologic and temperature regime of the river.

Sat-AM2-D-4

Changing Course: Turning Data into Laws

Nick Lund (BirdSafe MaineMaine and Maine Audubon, Falmouth, ME), Lee Foden (University of Maine School of Law, Portland, ME), Addy Smith-Reiman (BirdSafe Maine and Portland Society for Architecture, Portland, ME), and Austin Smith (Simons Architects, Portland, ME)

Abstract - Our understanding of the breadth of the problem of bird/glass collisions has grown immensely in just the past decade. The body of science has grown quickly through volunteers surveying routes in urban areas, tunnel-testing, and other means, and the environmental community is waking up to the scale of the impact that glass has on bird populations. The private sector is responding by creating more products to help keep birds safe from windows, and the public sector is beginning to respond by passing laws to require buildings to consider bird safety in their designs. The data obtained by BirdSafe Maine volunteers confirmed 2 important facts about the problem of bird strikes in Portland: (1) Birds were striking windows, and (2) Birds were more often striking buildings with a large amount of glass. With those 2 confirmations, the BirdSafe Maine team felt it had the footing to begin conversations with the City of Portland on legal protections for birds. However, politics is different than science, and the group needed to think about how to convince city officials and the area building and construction industries to go along with the plan. Work began by engaging with a local law student to research the existing body of bird-safe ordinances from around the nation to understand strategies and language. Then, partners at the Portland Society for Architecture convened a working group representing the local building community to talk through the problem and to develop solutions communally. Out of those meetings has come a draft ordinance that is currently receiving feedback from the City of Portland Planning Department. BirdSafe Maine hopes to pass the ordinance in 2023.

Sat-PM2-C-4

Documenting Bird–Building Collisions in Downtown Portland, Maine

Christine R. Maher (BirdSafe Maine and Department of Biology, University of Southern Maine, Portland, ME), Nick Lund (BirdSafe Maine and Maine Audubon, Falmouth, ME), Sonya Kahlenberg (BirdSafe Maine, Portland, ME), and Cady Netland (BirdSafe Maine and Greater Portland Council of Governments, Portland, ME)

Abstract - Collisions with buildings represent a significant source of mortality for songbirds, particularly during migration. Most studies of bird strikes and buildings have focused on large metropolitan areas with many tall structures. BirdSafe Maine, an organization consisting of volunteers, nonprofit organizations, and academic institutions, documented the extent of bird strikes with residential and commercial buildings in Maine. Beginning in Fall 2020, we systematically surveyed commercial buildings in downtown Portland during spring and fall migrations, following an established route and recording the identity, condition, and location of birds that collided with windows to determine the extent of the problem in Maine's largest city. Fall migration accounted for the majority of bird strikes, with 87% of strikes occurring during that season. Most birds that we found were dead (56%), although some birds were alive yet stunned (36%), and others simply struck a window in our presence and then flew away (8%). Passerines were the most commonly reported order of birds (91%), and the most common families were Parulidae (warblers; 34%) and Passerellidae (New World sparrows; 37%). *Geothlypis trichas* (Common Yellowthroat) and *Zonotrichia albicollis* (White-throated Sparrow) were the most common species found on the route, with each species accounting for 14% of the total birds found. A total of 4 buildings along the route accounted for 60% of bird strikes. Features common to these buildings were large amounts of glass and proximity to favorable bird habitat. Based on the recorded number of strikes and the amount of building surfaces available in the city, we estimate that 40,000–50,000 birds are killed annually in building collisions in Portland.

Sat-PM2-C-1

What Can 10,000 Plant Populations Tell Us After 40+ Years of Natural Heritage Monitoring?

Aaron Marcus (Vermont Fish and Wildlife, Montpelier, VT)

Abstract - Vermont Natural Heritage Inventory at Vermont Department of Fish and Wildlife has been monitoring rare and uncommon plants across the state for decades, with over 40 years of detailed monitoring data on the condition of 10,000+ plant populations. Now with the increase in community science and increasing capabilities of the Natural Heritage Inventory Database, trends in our plant populations are coming into sharper focus. One trend is an increase in the number of historical (undocumented for more than 25 years) vascular plant taxa being redocumented in recent years. The most well-known example of this is *Isotria medeoloides* (Small Whorled Pogonia), first reported by community scientists on iNaturalist, after being unreported for 120 years. An explosion of community science and a more expansive monitoring database have provided a framework for documenting overlooked plant populations that are persisting. Despite this trend, we are also simultaneously detecting a number of apparent declines for vascular plant species, particularly among mycoheterotrophs such as plants in the orchid family (Orchidaceae). We are also detecting some of the largest population changes among shoreline plants, where we are also documenting major hydrologic changes during the growing season. Continued collaboration and analysis is needed to help the Vermont Fish and Wildlife and other researchers focus limited resources toward priorities for management, adaptation, and further study.

Sun-AM1-B-2

Whale Communication During Widespread Systematic Noise Reduction: A Natural Experiment Amid COVID-19

Laura J. May-Collado (Department of Biology, University of Vermont, Burlington, VT, and Smithsonian Tropical Research Institute, Panama), Emma GagneDurant (Department of Biology, University of Vermont, Burlington, VT), Maia Austin Durant (Department of Biology, University of Vermont, Burlington, VT), Sawyer Bottoms Durant (Department of Biology, University of Vermont, Burlington, VT), Grace Durant (Department of Biology, University of Vermont, Burlington, VT), Jose David Palacios-Alfaro (Fundacion Panacetacea), Juan Jose Alvarado (Escuela de Biología, Universidad de Costa Rica, Centro de Investigación en Ciencias del Mar y Limnología, San José, Costa Rica), and Betzi Perez (Fundacion Panacetacea, Redpath Museum and Department of Biology, McGill University, Montreal, QC, Canada)

Abstract - Boat traffic is recognized as a major contributor of underwater noise. Increasing presence of boats in coastal habitats is predicted to have important repercussions on the communication of marine mammals. During the COVID-19 pandemic, the governments of Panama and Costa Rica went into a nationwide lockdown to limit the spread of the virus. This lockdown resulted in the closing of tourism infrastructure and limited mobility in both land and coastal areas. We used this "natural experiment" as an opportunity to study the impact of tour-boat activities on communication by bottlenose dolphins and *Megaptera novaeangliae* (Humpback Whale) by using passive acoustic monitoring data collected before, during, and after the lockdown at the study sites. Our results show that broadband underwater noise levels (dB_{RMS}) during pre-lockdown were higher ($P < 0.0001$) than during lockdown, likely due to a decrease in tour-boat presence. We also found that during lockdown the proportion of sounds from both bottlenose dolphins and Humpback Whales significantly increased ($P < 0.0001$). These results highlight the potential impact of noise associated with tour-boat traffic on marine mammal communication an important consideration given ongoing unregulated ecotourism in the region.

Sat-PM1-A-2

Comparing Camera Traps and Track and Sign Surveys for Mammal Detection: Lessons from a Community Wildlife Monitoring Program

Sophie Mazowita (Cold Hollow to Canada, Fletcher, VT)

Abstract - Cold Hollow to Canada conducted a 10-year monitoring program engaging community volunteers to survey for *Alces alces* (Moose), *Ursus americanus* (Black Bear), *Lynx canadensis* (Canada Lynx), *Lynx rufus* (Bobcat), *Pekania pennanti* (Fisher), *Martes americana* (American Marten), *Neogale vison* (American Mink), and *Lontra canadensis* (River Otter) in areas considered significant for forest habitat connectivity throughout the Northern Green Mountains. Volunteer teams walked a 2-mile transect quarterly to note track and sign of target species, plus checked camera traps stationed along each transect. Using both detection methods increased the observation rate of target species, though comparisons between survey locations were limited by differences in observer reliability and other variables. I will share survey results and offer recommendations for a paired camera trap and track and sign survey approach, highlighting the potential for monitoring mammal occurrence and the benefits of community engagement.

Sun-AM1-E-2

Microbial Dysbiosis Precedes Signs of Sea Star Wasting Disease in Wild Populations of *Pycnopodia helianthoides*

Andrew R. McCracken (Department of Biology, University of Vermont, Burlington, VT)**,** Blair M. Christensen **(**Department of Plant and Soil Science, University of Vermont, Burlington, VT)**,** Daniel Munteanu **(**Department of Biology, University of Vermont, Burlington, VT)**,** B.K.M. Case **(**Department of Computer Science, University of Vermont, Burlington, VT)**,** Melanie Lloyd **(**Department of Biology, University of Vermont, Burlington, VT)**,** Kyle P. Herbert **(**Alaska Department of Fish and Game, Douglas, AK), and Melissa H. Pespeni **(**Department of Biology, University of Vermont, Burlington, VT)

Abstract - Sea star wasting (SSW) disease, a massive and ongoing epidemic with unknown cause(s), has led to the rapid death and decimation of sea star populations with cascading ecological consequences. Changes in microbial community structure have been previously associated with SSW, but it remains unknown if SSW-associated dysbiosis is a mechanism or artifact of disease progression, particularly in wild populations. Here, we compare the microbiomes of *Pycnopodia helianthoides* (Sunflower Sea Star) before (naïve) and during (exposed and wasting) the initial outbreak in southeastern Alaska to identify changes and interactions in the microbial communities associated with sea star health and disease exposure. We found an increase in microbial diversity (both alpha and beta diversity) preceding signs of disease and an increase in abundance of facultative and obligate anaerobes (most notably *Vibrio*) in both exposed (apparently healthy) and easting animals. Complementing these changes in microbial composition was the initial gain of metabolic functions upon disease exposure, and loss of function with signs of wasting. Using Bayesian network clustering, we found evidence of dysbiosis in the form of co-colonization of taxa appearing in large numbers among exposed and wasting individuals, in addition to the loss of communities associated with naïve sea stars. These changes in community structure suggest a shared set of colonizing microbes that may be important in the initial stages of SSW. Together, these results provide several complementary perspectives in support of an early dysbiotic event preceding visible signs of SSW. While the most recent outbreaks of SSW have been reported on West Coast of North America, sea stars along the East Coast from New Jersey to New England have also been affected, including the first notable documentation of SSW in 1972 in *Asterias rubens* (Common Starfish) and more recent occurrences about 10 years ago. Thus, the findings of this research have significant implications for the marine biota of the Northeast as well.

Sun-PM2-D-1

Analysis of Invasive *Aedes japonicus* Populations and Bloodmeals in Rural, Suburban, and Urban Land-use Conditions

Catherine Miller (University of Southern Maine, Portland, ME) and Matthew Oberholtzer (University of Southern Maine, Portland, ME)

Abstract - We collected adult female mosquitoes at 6 sites with differing land-use and livestock characteristics to characterize populations and bloodmeal habits of the invasive vector mosquito species *Aedes japonicus* in southern Maine in the summer of 2021. We extracted DNA from the mosquitoes for PCR amplification of cytochrome C oxidase I (COI) mitochondrial DNA for barcoding analysis of vertebrate bloodmeals. We collected a total of 7460 adult female mosquitoes, with 444 being *Ae. japonicus* (5.6%). This result indicates an established breeding population of *Ae. japonicus* in southern Maine. The rural site adjacent to livestock had the highest yield of total mosquitoes as well as greatest catch rate (indiv./day) for both total female mosquitoes and *Ae. japonicus*. Following PCR amplification, 192 samples resulted in sequence alignments. Hits from Mammalia, Amphibia, Actinopterygii, Aves, and Reptilia were identified, with the most abundant taxa belonging to Mammalia and Amphibia. Avian bloodmeals were identified, including a sample with a high likelihood of identity as *Gallus gallus* (Domestic Chicken). Bloodmeal information is important for characterizing the zoonotic epidemiology of invasive vector mosquito species such as *Ae. japonicus*.

Sun-AM1-C-1

How Salty is Too Salty 2.0: Investigating the Salt Tolerance of *Glycine max* (Midori Giant Soybean) Under Hydroponic Conditions

Skylah Miller (University of Saint Joseph, West Hartford, CT) and Kirsten Martin Ph.D. (University of Saint Joseph, West Hartford CT)

Abstract - With the shortage of freshwater upon us, hydroponics is a simple solution, particularly using ocean water in hydroponic systems. Many different projects and research has been done demonstrating that hydroponics can cut down a large percentage of water usage. In this experiment, *Glycine max* (Soyben) will be grown in a range of salinities in hydroponic conditions. Multiple components will be measured and noted throughout the plant's life. Components include but are not limited to success rate, radical measurement, and time until true leaves form. If time is permitted bud count, chloroplast count, and height will also be measured.

Sat-PM2-E-1

Using CMECS to Create and Compare Benthic Habitat Maps in Nauset Marsh, Cape Cod, MA

Agnes Mittermayr (Center for Coastal Studies, Provincetown, MA), Bryan Legare (Center for Coastal Studies, Provincetown, MA), Owen Nichols (Center for Coastal Studies, Provincetown, MA), and Mark Borrelli (Center for Coastal Studies, Provincetown, MA)

Abstract - Benthic habitat maps are an important part of ecosystem-based management as they document biotic and abiotic resources. Integrating multiple ecosystem and environmental components is challenging, and the ability to do this is highly dependent on the methodology employed. The Coastal and Marine Ecological Classification Standard (CMECS) uses a standardized set of classifications in a hierarchical structure to create benthic habitat maps. The Nauset Marsh system is undergoing changes driven by many natural and human-induced causes. This study was designed to characterize and map the benthic habitats in 2020 and compare it to previous work done in 2014. Based on abiotic factors such as grain-size metrics and organic-matter contents of the sediment, we could explain 62.5% of benthic invertebrate species distribution in Nauset Marsh in 2020 compared to 47.9% in 2014. We noted a decrease in grain size throughout the area from 2014 to 2020 as energy regimes changed over time. Consequently, biotopes clustered differently in 2020 than in the original study in 2014. Additionally, while invertebrate diversity remained the same, significant seasonality could be detected over the course of the 2020 study.

Sun-PM2-C-2

Migration and Winter Distribution of GPS-tagged Ring-billed Gulls (*Larus delawarensis*) Breeding at Hamilton, ON, Canada

David J. Moore (Canadian Wildlife Service, Burlington, ON, Canada), Jeffrey N. Costa and Sara C. Pereira de Souza (Canadian Wildlife Service, Burlington, ON, Canada), and Lindsay M. Colyn (Canadian Wildlife Service, Burlington, ON, Canada)

Abstract - We examined the full-cycle annual movements and habitat use of 86 adult *Larus delawarensis* (Ring-billed Gull) breeding in Hamilton, ON, Canada, using GPS pinpoint tags from 2019 to 2022. Migration routes and winter locations were highly variable among individuals. During migration, individuals had 1–10 stopover sites where they frequented a variety of land types such as waterbodies, agricultural fields, urban plazas, waste management facilities and green spaces. Migratory distances varied from 250 km to >1500 km. Gulls wintered mainly on the Atlantic coast of the US from Maine to Florida, with the highest concentration found in Maryland, Virginia, and North Carolina. Some birds spent the winter further inland at sites in Kentucky, Tennessee, and Georgia. Alternately, a few individuals remained in the Great Lakes region over winter. We will assess fidelity to wintering areas for the subset of gulls (n = 10) for which we have data over 2 annual cycles. This is the first study to track full-cycle movements of individual Ring-billed Gulls in North America, and will contribute to our understanding of migratory connectivity and winter ecology of this species.

Sat-PM1-C-1

Evolutionary Trends in *Pleopeltis* (Polypodiaceae), The Resurrection Ferns

Sarah K. Morris (University of Vermont, Burlington, VT) and Michael Sundue (Pringle Herbarium, University of Vermont, Burlington, VT)

Abstract - Called the resurrection ferns for their ability to desiccate and then rehydrate, *Pleopeltis* is the largest genus in the family Polypodiaceae with 95 species and 9 named hybrids. Several adaptive traits facilitate resurrection in *Pleopeltis*, most notably the water-absorptive peltate laminar scales. These peltate-shaped scales have a disk of several empty dead cells subtended by a stalk of a single row of 4–8 living cells which connects to the mesophyll. When the leaf is wetted, capillary action moves water under the dead cells of the disk allowing it to funnel into the living cells of the stalk, and finally into the mesophyll. No other group of ferns has evolved water-absorptive scales, but morphologically and functionally similar scales are known from the Tillandsioideae subfamily of Bromeliaceae. In both groups, the scales are thought to be a key innovation allowing the plants to radiate into novel niches. Observation of these species in the field throughout Latin America show that absorptive peltate laminar scales are widespread throughout the genus; however, there is demonstrated variability in scale size, density, color, and shape. Observations from field work suggest that this variation mirrors ecological factors, with species occurring in the wettest environments having the fewest scales, and species occurring in more seasonally dry forests the most. Using phylogenetic comparative methods, we investigated the relationship between water-absorptive peltate laminar scales and ecological niche, and we estimated how historical ecological niche influenced the evolution of traits in this clade and vice versa.

Sat-PM1-D-1

Pigeon Watching: How it can Make You a Better Naturalist (Really)

Rosemary Mosco (Author and Cartoonist, Cambridge, MA)

Abstract - A good naturalist looks at the pieces of the landscape and asks, "what processes brought them here?" *Columba livia* (Rock Dove), the pigeon so commonly seen in cities, is an often-overlooked piece of the landscape that has a remarkable story to tell. A domesticated species, its history is every bit as complex and dramatic as the history of humanity. Come learn what the humble pigeon can tell us about genetics, inequality, evolution, behavior, and more.

Sat-AM2-B-4

Northeastern US Status Assessment of Stonefly (Insecta, Plecoptera) Regional Species of Greatest Conservation Need

Luke Myers (Lake Champlain Research Institute, SUNY Plattsburgh), R. Edward DeWalt (Illinois Natural History Survey, University of Illinois), Scott A. Grubbs (Western Kentucky University)

Abstract - Stoneflies are the most environmentally sensitive of aquatic insects with documented range loss, regional extirpations, and extinctions reported for the US, Europe, and anecdotally across much of the globe. The authors developed a list of 33 stonefly regional species in greatest conservation need (RSGCN) for the US Northeast states (CT, DE, MA, MD, ME, PA, NJ, NH, NY, RI, VA, VT, WV). Many of these species are known only from type localities, several are endemic to the region, and 1 is possibly extinct (*Neoperla mainensis*). Climate change and continued development in the Northeast may extirpate species from the region or lead to extinction of endemics. The US Fish and Wildlife Service funded a 4-yr project, beginning January 2023, to assess the presence of these species in historical and new locations, to model species distributions, to assess threats, and to conduct standardized subnational, national, and global conservation-status assessments for each species. This information is critical for their protection and the habitat on which they depend. In addition, a broader examination of all stonefly species in the Northeast will be conducted to determine state and regional responsibilities, to identify endemic species, and to suggest future additions to state and regional SGCN lists. We present at this venue to notify regional aquatic biologists of our efforts and to ask for your help in locating species and habitats that may contain them.

Sat-AM2-D-2

Recent Range Expansion of the Eastern Coyote in NYC and Long Island

Christopher Nagy (Mianus River Gorge, Bedford, NY), Michael Bottini (Seatuck Environmental Association), and Arielle Santos (Seatuck Environmental Assocaition)

Abstract - Given a number of new developments, an update on the range expansion of eastern *Canis latrans* (Coyote) through New York City (NYC) and Long Island, and the effort to study this event, is of interest to naturalists and wildlife managers in the Northeast. Since 2019, Coyotes have established themselves more firmly in Queens, Manhattan, Nassau County, and Suffolk County, though their densities remain low compared to mainland NY State and even the northern areas of NYC itself. In 2021, a Coyote was photographed in Staten Island, and a lone Coyote has lived in Central Park since 2018. In 2020, a pair of Coyotes raised a litter of pups in a private preserve in Nassau County, marking the first confirmed den in the County. Multiple agencies, organizations, researchers, and volunteers are collaborating to collect and follow up on sightings, run camera traps, and collect scat and roadkill to monitor the range expansion in as detailed a manner as possible across this large, complex landscape. These groups have also devoted substantial resources to studying public perceptions and work to improve coexistence between people and their local wildlife.

Sat-AM1-A-3

Assessment of Understory Vegetation Recovery After 15 Years of Deer Management in a Remnant Old-growth Hemlock Forest and Adjacent Second-growth Hardwood Forest in Southern NY

Christopher Nagy (Mianus River Gorge, Bedford, NY), Chloe Ng (Wildlife Technician Program, Mianus River Gorge, Bedford, NY), Norman Budd Veverka (Mianus River Gorge, Bedford, NY), and Mark Weckel (American Museum of Natural History, New York, NY)

Abstract - The Mianus River Gorge (MRG) Preserve is a 374-ha nature preserve in southern New York that includes an ~186-ha old-growth *Tsuga canadensis* (Eastern Hemlock) forest, with the remainder of the preserve made up primarily of post-agricultural second-growth deciduous forest. Since 2004, MRG has implemented deer management efforts and monitored 22 large vegetation plots on its ~405-ha (~1000-ac) preserve in Westchester County, NY. These 3–5-year periodic surveys monitored woody and wildflower species. After the 2019 survey, we assessed the composition of the woody understory, and, here, are also able to present information on the status of wildflower species. Overall, there was significant increase in woody stem density and species richness since 2004, but this improvement was almost entirely found in stems <90 cm tall. There were differences in woody species composition among the hemlock and deciduous forest types; notably, more invasive species were observed in the second-growth forest. *Fagus grandifolia* (American Beech) and *Betula lenta* (Black Birch) were more prominent in the Eastern Hemlock forest's understory. *Quercus* spp. (oak) and *Acer* spp. (maple) regeneration were similar in both forests, and Eastern Hemlock regeneration was minimal. Regarding wildflowers, total species richness was much higher in hardwood (22 species) than hemlock (13.5 species) forests, though there were certain rare species and fewer invasive species found in the hemlock forest. Stem counts of a set of indicator species showed declines or no change over time across both forest types, with the exception of *Maianthemum canadense* (Canada Mayflower), which increased dramatically in the hemlock forest. Going forward, the protocol established in 2004 is suitable for representative sampling of woody species but likely inadequate to monitor patchy and/or rare wildflowers. With this caveat, it seems that management efforts are facilitating woody regeneration, albeit slowly, but recovery of wildflower diversity has been less promising.

Sun-PM2-A-2

Teaching the Bird's Eye View: Piloting Elementary snd Design-School Education Initiatives to Make Maine Safer for Migrating Birds

Cady Netland (BirdSafe Maine and Greater Portland Council of Governments, Portland, ME), Sonya Kahlenberg (BirdSafe Maine, Portland, ME), Nicole Colfer (Yarmouth Elementary School, Yarmouth, ME), Nick Lund (BirdSafe MaineMaine and Maine Audubon, Falmouth, ME), Jill Osgood (BirdSafe Maine and Side x Side, Portland, ME), Addy Smith-Reiman (BirdSafe Maine and Portland Society for Architecture, Portland, ME), and Christine R. Maher (BirdSafe Maine and Department of Biology, University of Southern Maine , Portland, ME)

Abstract - Collisions with building glass are a leading cause of mortality for migrating songbirds. BirdSafe Maine, a collaborative of volunteers, nonprofit organizations, and academic institutions, is documenting the extent of this threat in Portland, ME, and leading remediation efforts across the state. In 2020, BirdSafe Maine began collating bird–glass collision observations reported by the public, and these have involved private homes, schools, and commercial buildings. Initial outreach efforts have therefore focused on homeowners, schools, and architects/builders. Goals of this effort are to (1) raise awareness about the bird–glass collision issue, (2) motivate target audiences to make windows safer for birds, and (3) facilitate remediation action by target audiences. Interest from an elementary school in Yarmouth, ME and the Maine College of Art and Design (MECA&D) in Portland recently offered opportunities to pilot education initiatives at both elementary and college levels. During the fall 2022 migration season, BirdSafe Maine designed 4 lessons for 4th graders (126 students) that were delivered as part of an in-school STEAM curriculum. Content and activities focused on wild bird observations, species identification, and migration and specifically highlighted the threat posed by window collisions. The unit culminated in a class project in which students created temporary "migration murals" on school windows to lessen the collision risk for birds. Exit surveys showed that, after completing the unit, students reported being more interested in birds (75%) and conservation (70%) and feeling like they can make a positive difference (90%). Most students (75%) were also supportive of a permanent window solution for their school. Results were shared with school administrators, who are now considering permanent anti-collision window treatments for the school's highest-risk windows. Through a collaboration with Maine Audubon, BirdSafe Maine aims to adapt this elementary curriculum in 2023 and bring it to more schools. In early 2023, BirdSafe Maine partnered with MECA&D on a project challenging a group of design students to create innovative design solutions to prevent bird collisions. The results of this course will be shared with Portland's architectural community and used to help develop additional curricula for this key audience, future building designers.

Sat-PM2-C-2

Bird Friendly Architecture in Maine: Where Research and Design Collide

Cady Netland (BirdSafe Maine and Greater Portland Council of Governments, Portland, ME), Addy Smith-Reiman (BirdSafe Maine and Portland Society for Architecture, Portland, ME), Nick Lund (BirdSafe MaineMaine and Maine Audubon, Falmouth, ME), Sonya Kahlenberg (BirdSafe Maine, Portland, ME), and Christine R. Maher (BirdSafe Maine and Department of Biology, University of Southern Maine , Portland, ME)

Abstract - Before our understanding of bird collisions grew, many people believed birds collided with windows simply because buildings interrupted their flight paths in the sky. Skyscrapers were assumed to be the ultimate danger to birds. However, collisions actually occur due to glass reflecting or being transparent to habitat, and the most dangerous part of a building is under the tree line (23–31 m [75–100 ft]) With this understanding, outreach to homeowners and architects has become equally important as outreach to large property managers. It has also become clear that glass alone is not the cause of collision, but rather that placement and location of glass in regards to surrounding vegetation matters. Working with landscape architects and building managers to consider local bird behavior and habitat is critical to creating bird-safe design. Fortunately, the range of bird-safe solutions has expanded, and innovative bird-safe designs abound. This is true in our team's home state of Maine, and we have consulted with all types of property owners: from big corporations to private universities to ski resorts. As a result, partnerships are forming in Maine around incorporating bird-safe practices. Many bird-safe initiatives have focused on post-build retrofits of existing buildings, because so few people knew about bird collisions, and therefore they were never considered in the design process. Now that knowledge of bird collisions is becoming more widespread, we have the unique opportunity to collaborate with and advise architectural firms during their design process, and to incorporate bird-safe measures more seamlessly into the project through creative design. We provide examples of what these projects look like when bird-friendly measures are incorporated into design vs. used as retrofits. Which includes landscape design. Though both are good for birds, the distinction in appearance to humans is usually different and is a high priority to owners and architects. Highlighted examples will include L.L. Bean (post-build retrofit), Saddleback Mountain Ski Resort (incorporated), and the College of the Atlantic Davis Center for Human Ecology (incorporated).

Sat-PM2-C-3

Intra-annual Distribution and Relative Abundance of Fishes and Invertebrates in Nauset Harbor

Owen C. Nichols (Center for Coastal Studies, Provincetown, MA), Agnes Mittermayr (Center for Coastal Studies, Provincetown, MA),Bryan Legare (Center for Coastal Studies, Provincetown, MA), and Ted Lucas (Center for Coastal Studies. Provincetown, MA)

Abstract - The Nauset Harbor system is currently undergoing changes driven by many natural and human- induced causes, and the understanding of those changes can better inform future management decisions. As part of a larger multi-phase interdisciplinary study, we completed subtidal and intertidal fish and invertebrate surveys in Nauset Marsh and Town Cove from November 2020 through October 2021, using a variety of fixed and mobile sampling gears supplemented by benthic grab sampling and underwater video. Additional opportunistic trap sampling began in July 2021 and continued at a long-term monitoring site from September 2021 to the present. Where practical, we conducted sampling efforts using similar methods and gears to previous studies in the same area or more recent studies in the region. Fish and macroinvertebrate community composition and seasonal patterns of abundance during this study were broadly similar to those observed during other recent studies along the eastern shore of Cape Cod, with notable exceptions. This comprehensive inventory indicated that Nauset Harbor is home to a diverse and changing assemblage of marine species, some of which utilize the bay as spawning or nursery habitat. Long-term monitoring is necessary to place our observations in the broader contexts of short-term variability and long-term change.

Sun-PM2-C-3

Climate Change Basics for College Students

Gao Niu (Bryant University, Smithfield, RI)

Abstract - College students are heavily influenced by social media, and there is a large amount of online content that disagrees with the commonly accepted evidence by the scientists. College classroom is the best platform to provide evidence-based climate-change education to compete with entertainment-based climate-change skit on social media. This talk will discuss how climate change could be introduced to the college students among classes from different disciplines. What are the pedagogical concerns, obstacles, and reflections on climate-change basics in mathematics, statistics, and actuarial science classes.

Sat-AM2-F-

Lessons from the Field: Non-herbicidal Methods to Establish a Demonstration Pollinator Meadow

Marc Nutter (NH Audubon, Concord, NH), Diane De Luca (NH Audubon, Concord, NH), T. Parker Schuerman (NH Audubon, Concord, NH), and Phil Brown (Harris Center, Hancock, NH)

Abstract - In 2021, we initiated a large-scale (0.4 ha [1 ac]) native pollinator habitat restoration project at our state headquarters in Concord, NH. We used a variety of site-treatment methods prior to fall seeding of a diversity of native plants in 2021 and 2022 to determine the most effective methods for native plant establishment in 2 successive 0.2-ha (0.5-ac) plots. Treatment methods included mowing and thatch removal, tilling and thatch removal, covering with 6-mm black silage plastic, covering with black landscaping fabric, leaving coverings for 1 growing season, and leaving coverings for 2 growing seasons, for a total of 10 different treatment plots. Results are still preliminary as we expect a full plant establishment to take up to 4 growing seasons, but are promising overall. There has not been a significant difference between the plant establishment of the first year's plots (seeded in October 2021, with first growing season in 2022), thus suggesting landowners use the most cost-effective treatment method for their situation to establish a diverse native pollinator meadow. We will review initial site conditions and site preparation methods in the context of cost- and effort-effectiveness as well as target native plant establishment success vs unwanted plant regrowth.

Sun-AM2-D-5

Invasive Species as a Conduit for Connection

Teage O'Connor (Crow's Path & Champlain College, Burlington, VT)

Abstract - The term "invasive species" often invokes a knee-jerk response of righteous indignation and a sense of paradise lost or ecological doom. But in a landscape defined by anthropogenic influence, we might better be served by shifting our focus to the immediate and accessible opportunities for profound and transformative experiences with wildness that these species can provide. In my work as a naturalist and educator, I am drawn to exploring ways we might rethink our connection to invasive species, adding nuance to our understanding of local ecosystems, and exploring the world through earth skills (e.g. Phragmites canoes, Norway Maple syrup, Common Barberry jam, Narrow-leaved Cattail sleeping mats, Norway Spruce spoons, Japanese Knotweed cosmic blow galls, and Common Buckthorn dyes).

Sun-AM2-B-3

Restoration Prioritization in the Sagebrush Sea: Geospatial Techniques and Ground Truthing

Dylan O'Leary (Field Naturalist Program, University of Vermont, Burlington, VT

Abstract - I compiled and analyzed modeled vegetation data for ~202,342 ha (~500,000 ac) of public and private land for a working cattle ranch in southeastern Oregon using GIS software to detect the abundance and arrangement of native perennial grasses and forbes relative to non-native annual grasses and forbes over the last 15 years. Additionally, I conducted 158 randomly selected line-point-intercept style vegetation plots across the study area during the summer of 2022 to test model validity. I explored 4 geospatial assessment and prioritization techniques that explicitly consider the likelihood of restoration success based on biotic and abiotic conditions, the spatial configuration of habitat patches on the landscape (i.e., defend and grow core habitat), logistical constraints, trends in vegetation composition, and climate adaptation and resilience to produce actionable maps that will assist The Nature Conservancy, Oregon Desert Land Trust, and Bureau of Land Management make rangeland management decisions at a pasture-level scale. This presentation will include discussion of how my research is applicable to the study and management of habitats found in the Northeast.

Sun-AM2-C-5

Keeping an Urban Forest Whole: The Power of Community-driven GIS-focused Participatory Science

Claire O'Neill (Earthwise Aware, Somerville, MA) and Mina Burton (Earthwise Aware, Somerville, MA)

Abstract - In Massachusetts, a community has formed around co-creative participatory science using a novel integration of land use, biodiversity, and climate documentation data to help save their forest. Earthwise Aware (EwA) has been running biodiversity and climate participatory science projects in the Middlesex Fells Reservation, a 1042-ha (2575-ac) urban forest a few miles north of Boston, since 2018. The reservation is a biodiversity refuge in a bustling and ever-expanding metropolitan area. The forest is an Important Bird Area that supports many forms of wildlife, including endangered plant and animal species, unique natural communities, and over 150 vernal pools. The Covid-19 pandemic exacerbated already-existing habitat degradation at the park due to a sharp increase in visitation. EwA's community advocated for the addition of systematic documentation of fragmentation of the forest habitats to its program to address this problem. The conservation objective of the project is to document habitat conditions at the Fells over time; to scientifically quantify and qualify recreation usage impact on the fauna, flora, and critical habitats; and to mitigate further damage. The project outreach goal is to democratize ecological science and empower local communities by providing scientific and naturalist skills and resources. This project's novel multi-dimensional approach synthesizes data from EwA's participatory science programs, such as park-usage surveys, biological-pollution surveys, informal trail assessments, natural-community descriptions, and vernal-pool documentation with existing data from governmental organizations and third parties. One result of this is an interactive GIS map that the Friends of the Fells and the Department of Conservation and Recreation use to inform conservation actions. Our data and framework can provide additional scientific value to our community and researchers in the future. This program has also had a critical outreach outcome: knowledge, impact, and recognition for its participatory scientists. Through this project, EwA and its strong community empower each other to advocate for urban forests.

Sun-PM2-A-3

Biodiversity Conservation Needs Natural History Participatory Science

Claire O'Neill (Earthwise Aware, Somerville, MA), Jennifer Clifford (Earthwise Aware, Somerville, MA), and Kathy McGlathery (Earthwise Aware, Somerville, MA)

Abstract - Earthwise Aware (EwA) seeks to make natural history science accessible to all while contributing biodiversity and climate data to local, national, and global projects. Only with the collaboration of naturalists, scientists, and trained volunteers can we closely monitor indicators necessary to ascertain the state of biodiversity across the planet, such as indicators of phenology, migratory behavior, bioindicator species, population age structure, species distributions, and habitat conditions. In addition, next-generation (data-driven) natural history participatory science is an excellent approach to filling the ecological knowledge gap prevalent in modern societies. It is a participatory science genre that fosters local ecological knowledge (LEK) and traditional ecological knowledge (TEK), and is a powerful tool to enable the decolonization of science. EwA's participatory science community plays its part. EwA runs a next-generation natural history program that supports biodiversity and climate research while advancing the democratization of science. Since 2018, EwA's participatory scientists have collected more than 270,000 dedicated phenological observations and over 130,000 biodiversity records of a great variety of animal, plant, and fungal species. The data is aggregated into open and global databases. Comprehensive annual reports tell a rich story of communities invested in understanding species diversity, their habitats, and the e ects of land use and climate change. The program empowers its participants and contributes critical information to local, national, and global projects. EwA's model is successful because it deeply connects all involved by making nature science accessible while having a great community and scientific impact.

Sun-AM2-F-4

Maine's Freshwater Peatlands: Diverse Communities, Centuries of Carbon

Nancy Olmstead (The Nature Conservancy, Brunswick, ME)

Abstract - Maine hosts a high diversity and abundance of freshwater peatlands, including some which reach their southern-most limit in the state, and some that are restricted to the coastal region. These systems are beautiful, wild places that serve many ecosystem functions and provide important habitat for rare species. Anecdotal evidence from conservation land managers indicates that where recreational access is developed, peatlands are highly visited and valued by the public. Since peatlands store an immense amount of carbon and can serve as a greenhouse gas source or sink, their importance for climate change mitigation is paramount. In this talk, I will discuss peatland regulatory protection, conservation representation, monitoring, and threats.

Sat-PM1-E-1

A Role for Aquatic Turtles in Dispersing Seeds of a Bird-dispersed Wetland Shrub

Donald J. Padgett (Bridgewater State University, Bridgewater, MA), Alexis Gouthro (Bridgewater State University, Bridgewater, MA), Michelle Adams (Bridgewater State University, Bridgewater, MA), and Thilina Surasinghe (Bridgewater State University, Bridgewater, MA)

Abstract - *Swida amomum* (Silky Dogwood) is a wetland plant that exhibits a dispersal syndrome characteristic of autumn-ripening shrubs with colorful, fleshy fruits, where attached fruits are ingested and defecated by birds while fallen fruits are consumed by ground-foraging birds and seed-predating mammals. We revealed that fallen fruits were consumed by 2 aquatic turtle species—the native *Chrysemys picta* (Eastern Painted Turtle) and invasive *Trachemys scripta* (Red-eared Slider)—and that their seeds were defecated intact. We compared germination levels between defecated seeds and 2 control seed sources (i.e., fruits collected from the pond surface and those harvested directly from shrubs). Of the 4 seed taxa identified in fecal samples, seeds of Silky Dogwood were the most numerous (106 seeds) in any sample and the most frequent (93%) among samples. Average proportion of defecated Silky Dogwood seeds germinated (85.99%) exceeded that of control seeds (from pond surface: 82.76% or shrubs: 60.24%), albeit the difference in germination success was insignificant. When analyzed using fecal samples from Painted Turtles only, the difference in germination between defecated seeds and those collected from pond or shrub became significant. Our findings suggest aquatic turtles could be an important part of a secondary seed-dispersal process influencing woody plant community composition in temperate wetland ecosystems.

Sun-AM1-F-2

A Checklist of the Spontaneous Plants of New York City

Lydia Paradiso (New York Botanical Garden/CUNY Graduate Center, Bronx, NY), Tohmi Barrett (New York Botanical Garden, Bronx, NY), and Brian Boom (New York Botanical Garden, Bronx, NY)

Abstract - The first checklist of plants of the New York City (NYC) area was published by John Torrey in 1819. In the years since, NYC has undergone radical changes, and although some of these plants and habitats are now extirpated, the city continues to harbor important biodiversity. The unique geology and ecology of the city, paired with its status as a hub of human activity, creates conditions for both native and introduced plants to thrive. The NYC EcoFlora is a community science project based at the New York Botanical Garden which aims to increase awareness of plant life and to document the spontaneous flora of NYC using the iNaturalist app. The data presented here synthesizes iNaturalist observations made by our community scientists with herbarium specimens, NYC Parks data on native plants, previously published checklists of greenspaces within NYC, and personal communications, to produce a snapshot of the current state of the city's plants. In this talk, we will discuss the checklist, which includes ~1700 taxa from 155 families of vascular plants; the changes in flora over time; and how this data can be utilized by land managers, students, ecologists, and naturalists.

Sat-AM1-A-1

Climate Knowledge Mobilization and Engagement with "Non-Major" Undergraduate Students

Robert Patalano (Department of Biological and Biomedical Sciences, Bryant University, Smithfield, RI)

Abstract - A recent survey conducted at Bryant University found that 71% of participants become anxious by the thought of taking any science course, while 42% do not feel that the sciences are relevant to their academic or professional career goals. Nevertheless, many of the respondents (62%) are familiar with ESG (Environment, Social, and Governance), as many businesses are now implementing strategies for mitigating green house gas emissions or creating sustainable products. Additionally, many respondents (76%) are interested in learning more about how businesses are impacting the climate and environment. One major issue encountered when trying to engage non-science-major undergraduate students with climate and environmental science is the development of course content that successfully meets the demand of student desire to learn about business impacts on the environment while also limiting anxiety caused by taking science courses. In-class activities, relating science course topics to everyday life, implementing new teaching technologies like VR and other data-visualization tools, and focusing on exam- or essay-alternatives like group projects and presentations and science communication outreach through social media, are common approaches to climate knowledge mobilization and increased engagement with students. In this presentation, I will discuss how the environmental science program at Bryant University is trying to engage with predominantly non-major undergraduates. Our current strategy attempts an interdisciplinary approach that incorporates climate and environmental sciences with business management, entrepreneurship, and policy, physical and mental healthcare, and technological and behavioral solutions to man-made climate change. Through such an approach, we hope to make sure all students know the relevancy of science, regardless of their majors, while fostering a student culture that does not get anxious at the thought of taking science courses but instead inspires students to become true leaders in tackling climate change.

Sat-AM2-F-

Beyond Sustainable: Enhancing Floral Resources for Insects on Farms

Matthew L. Pelikan (BiodiversityWorks, Vineyard Haven, MA, and the Betsy and Jesse Fink Family Foundation)

Abstract - I report on the first year of a planned 3-year pilot project to develop feasible, replicable methods to augment floral resources for insects (especially oligolectic bees) on farms on Martha's Vineyard island, MA. Eight farms, broadly distributed across the island, participated. Along with project staff, I installed plots containing 9 species of flowering plants at each farm in early June 2022. Project staff maintained plots with periodic weeding and watering. We monitored project plots and surrounding areas for insects visiting flowers through the end of October 2022, using direct observation, photography, and collection. We recorded plant associations for as many insects as possible. The project used the community science platform iNaturalist to "crowd source" data collection and identification; project staff also collected, pinned, and identified 138 bee specimens. Forty-one species of bees were documented overall; 315 iNaturalist observations documented 113 species of insects visiting flowers outside the project plots, 209 iNaturalist observations documented 67 species visiting flowers within the project plots. Five late-season oligolectic *Andrena* (Andrenidae) species visited only native composites, within the project plots as well as outside the project plots where such plants were present. *Helianthus* sp. (sunflower) attracted *Melissodes trinodis* and/or *M. agilis* (Apidae) at 7 of the 8 farms; we found neither bee species on any other plant. *Melissodes* visited *Helianthus* both inside and outside the project plots but showed, anecdotally, a strong preference for some sunflower varieties over others. Staff dedicated to the project used iNaturalist effectively, assisted by 92 generous iNaturalist "identifiers". However, farm staff did not contribute data to iNaturalist despite several trainings, tempering our hope to use iNaturalist to collect data from non-naturalists. The second and third years of the project will examine flower use by bees more closely and test whether established project plantings can be maintained with a level of effort that is feasible for working farms.

Sun-AM2-D-4

Determining Puma Habitat Suitability in the Eastern US and Other Recent Findings

Shelby Perry (Northeast Wilderness Trust, Montpelier, VT), Veronica Yovovich (Panthera, New York, NY and Colorado State University, Fort Collins, CO), Nathaniel Robinson (Panthera and The Nature Conservancy, Arlington, VA), Hugh Robinson (Panthera and University of Montana, Missoula, MT), Michael J. Manfredo (Colorado State University, Fort Collins, CO), Jeremy T. Bruskotter (Ohio State University, Columbus, OH), John A. Vucetich (Michigan Technological University, Houghton, MI), Luis Aníbal Solórzano (Provita, Caracas, Venezuela), Lydia A. Roe (Northeast Wilderness Trust, Montpelier, VT), Alison Lesure (Vermont Law School, Royalton, VT), Jamie Robertson (Panthera, New York, NY), Tom Butler (Northeast Wilderness Trust, Montpelier, VT), and L. Mark Elbroch (Panthera, New York, NY)

Abstract - *Puma concolor* (Puma, also called Cougars, Panthers, and Catamounts) were eliminated from most of the eastern US a century ago. In the past couple of decades, their recovery in the West has increased Puma dispersal into the Midwest, with some individuals even traveling to the East Coast. We combined published expert opinion data and a habitat suitability index in an analysis that identified 17 areas in the Upper Midwest, Ozarks, Appalachia, and New England that could potentially host Puma populations in the future. Thirteen of these were larger than 10,000 km^2 and so likely to ensure a Puma population's long-term genetic health. Further, we quantified patch size, human density, livestock density, percent public land, and a sociocultural index reflecting wildlife values for comparing patches, as well as present a summary of current legislation relevant to Puma management in the East. Our work may be useful in identifying suitable areas to restore Pumas based not only on the quality of their biophysical habitat, but also on social values conducive to Puma-human coexistence. In addition to this work, I will also briefly outline other recent findings in social science surrounding human–carnivore interactions.

Sun-PM2-E-1

Aquatic Macroinvertebrate Communities Across a Suburban Gradient in Southeastern Massachusetts

Joseph C. Pervier (Bridgewater State University, Bridgewater, MA) and Michael P. Graziano (Bridgewater State University, Bridgewater, MA)

Abstract - Pollution of wetland habitats is particularly evident in urban–suburban areas. This pollution can impact a wide variety of organisms, resulting in deleterious impacts to entire communities. Understanding these impacts is critical in wetland conservation and management. Aquatic macroinvertebrates provide an ideal organism to study the effects of wetland degradation because they are abundant, relatively easy to identify, and specific in their habitat requirements. We sampled 8 distinct wetlands in a 45-ha woodlot in Bridgewater, MA, representing a variety of hydroperiods, size, and chemical profiles to assess the aquatic macroinvertebrate community and identify variables determining differences observed in those communities. This research serves as a baseline and model for future studies looking at macroinvertebrate communities in the region, in addition to identifying which site-level features are significant in determining a high-quality wetland capable of supporting a robust aquatic community.

Sat-AM2-D-1

Red Cedar Woodlands in Vermont: An Overlooked Form of Old Growth and Potential Climatic Record

Matt Peters (Peters' Botanical and Ecological Services, Woodbury, VT)

Abstract - Red Cedar Woodlands are a globally imperiled to vulnerable (G2–G3) natural community type that occurs throughout New England (except Maine and Rhode Island) and in New York, Pennsylvania, and Ontario. Prior to this study, 12 small occurrences were known in Vermont, with existing accounts indicating that the trees appear old; however, there had been almost no data quantifying tree ages. During 2021, I cored 52 *Juniperus virginiana* (Eastern Red Cedar) in 6 Vermont Red Cedar Woodland sites to determine approximate ages and better understand the significance of these unique forests. Preliminary results confirm the substantial age of some trees at all sites, with oldest sampled individuals per site varying from 135+ to 320+ years, suggesting that most of the sites are an overlooked type of old forest. I expanded mapping of this rare community type, roughly doubling its known extent to 26 ha (64 ac) in Vermont, and also documented numerous rare species at the sites, further underscoring their importance. Drought-prone sites such as those occupied by Red Cedar Woodlands have the potential to show early indications of a changing climate while housing a potentially valuable climatic record of the past several hundred years or more.

Sat-PM1-B-4

Application of Instream PIT Tag Monitoring Systems for the Eastern Hellbender Salamander

Peter J. Petokas (Cryptobranchid Conservation, Tunkhannock, PA) and Michelle R. Herman (The Wetland Trust, New Berlin, NY)

Abstract - We designed, installed, and maintained instream passive integrated transponder (PIT) monitoring systems for the *Cryptobranchus a. alleganiensis* (Eastern Hellbender) in a tributary of the Susquehanna River. The systems were intended to monitor the activity of 3.5-year-old head-started juvenile Eastern Hellbenders that were tagged and released to restore a historic, and largely extirpated, hellbender population in the Upper Susquehanna River watershed. Each monitoring system consisted of a hairpin-loop antenna that spanned a 20-m-wide stream channel and was anchored to the stream pavement with rebar and zip-ties. A tag reader was securely mounted on a streamside post and was connected to the antenna and to a control box located 30 m landward. Each monitoring system received 24 volts of power from a bank of 4 solar storage batteries charged by a solar panel installed 30 m distant in an open field. The control box contains a removeable flash drive that holds recorded tag data and an interface used to tune the system and to change system parameters. Since Eastern Hellbenders are bottom crawlers, their tag implants are read when they walk across the antenna. The monitoring systems provided data on movements of hellbenders along 600 m of stream channel and on diel activity patterns. However, the monitoring systems posed significant challenges during installation and removal, and while operating, generally due to fast water, flood events, wildlife damage, and tag-read failure. We will share our experience installing and operating these high-cost tag-reading systems and how to deal with the challenges of operating them in dynamic, large-stream environments.

Sat-PM2-A-4

Suppression of Microbial Communities within *Sarracenia purpurea*

Lindsey A. Pett (Norwich University, Northfield, VT), Nicholas Gotelli (University of Vermont, Burlington, VT), Sydne Record (University of Maine, Orono, ME), Zac Freedman (University of Wisconsin - Madison, Madison, WI), Ben Baiser (University of Florida, Gainsville, FL), and Amanda Northrop (Norwich University, Northfield, VT)

Abstract - Microbes play integral roles in both aquatic and terrestrial ecosystems, as they control ecosystem functioning and provide ecosystem services. Through experimentation, ecologists have found that when experimental drivers such as temperature, moisture, nutrients, etc. are manipulated there are changes in the community composition, diversity, and activity of microbes, making it difficult to draw true conclusions from drivers regarding desired response variables. To mitigate microbial interaction from experimental drivers, we aimed to knockdown the microbial community within the micro-aquatic ecosystem found within the pitcher shaped leaves of *Sarracenia purpurea* (Northern Pitcher Plant). We conducted a preliminary experiment at 3 bogs, where we used broad and narrow spectrum antibiotics to dose the Northern Pitcher Plants' micro-aquatic ecosystem. We found a significant reduction in microbe abundance using Tetracycline hydrochloride in comparison to control plants (P = 0.003). The Northern Pitcher Plants dosed with antibiotics were found to not differ in the plant growth, aquatic parameters (pH, TDS, EC, DO, Temperature), or obligate Diptera abundance in comparison to control plants. These promising preliminary results will aid in future experiments on nutrient cycling, aquatic parameter alteration, predator prey dynamics, etc.

Sat-PM1-E-4

Halophyte Floristics of the Inland Salt Marshes of Central New York

Alex R. Petzke (SUNY ESF, Syracuse, NY) and Donald J. Leopold (SUNY ESF, Syracuse, NY)

Abstract - Inland salt marshes (ISMs) of the northeastern US are nontidal, brine-fed wetlands dominated by salt-tolerant plants, or halophytes. These ecosystems are rare in the US and globally and understudied relative to most other wetland types. In central New York (CNY) there are 2 centers of ISM occurrence: Onondaga Lake (OL), near Syracuse, and the Montezuma Wetlands Complex (MWC), near Montezuma. There have been no attempts to thoroughly document the halophytic flora of the ISMs of CNY in the past 40 years and no historical halophytic flora of the MWC has been compiled. An update and expansion of past work are important for understanding the present-day status of this unique flora. For this work, we inventoried halophyte species at OL and the MWC and characterized their habitat. We compiled a list of historic halophyte occurrences and summarized trait data for all species recorded. We used an "adaptive meander" to detect halophytes at survey sites and documented the first occurrence of each halophyte species encountered. For each documented occurrence, we recorded standard floristic data and collected a voucher specimen and soil sample. To compile a list of historically present halophytes we examined historical documents and herbarium specimens from local herbaria and online repositories of digitized specimens. We used the literature and online resources to collect trait data on all documented species. Initial analysis revealed halophyte species spanning 22 families, 42 genera, and 64 species. The 3 most species-rich families were Poaceae (13 species), Amaranthaceae (11), and Cyperaceae (10). Over 600 herbarium specimens added occurrence data and allowed the compilation of a historical halophytic flora of the MWC. Characterization of the halophytic flora revealed a predominance of perennials at 65.6% and of forbs at 53.1%. Documented species had an average coefficient of conservatism of 4.6. Seventy-one percent of species were native to NY, and there were 13 species of state rarity rank between S1 and S3. Our results indicate that many more data on the historical halophytic flora of CNY ISM's exist than was previously compiled and that these communities are still species-rich and diverse and support species of concern.

Sun-AM1-F-1

The Little Known Life of a Nematode

Linda S.W. Pezzolesi (SUNY Hudson Valley Community College, Troy, NY)

Abstract - Nematodes occur as both parasites and free-living organisms on every continent and in habitats as obscure as water-filled cracks in the earth's crust over 2 miles deep. As such, nematodes are among the most abundant animals on earth. Numbers of nematode species are predicted to be in the millions. Several species are significant to animals and plants including the most well-known *Dirofilaria immitis* (Heartworm) and Filarioideam, which cause elephantitis, are both vectored by mosquitoes. Although Heartworm in *Canis lupus familiaris* (Domestic Dog) is most familiar, it also occurs in wild canids, like wolves, foxes, and *Canis latrans* (Coyote) as well as cats, *Ursus americanus* (Black Bear), and ferrets. Filariasis is also found in *Bos taurus* (Cattle), horses, and dogs. As the climate shifts, the expansion of mosquito ranges brings with it the spread of nematodes.

Sat-PM2-F-1

Effects of Human Land Use and Landscape Context on Population Demographics of the Painted Turtle

Benjamin Phillips (University of New Hampshire [UNH], Durham, NH), Remington Moll (UNH, Durham, NH), Rebecca Rowe (UNH, Durham, NH), and Jennifer Purrenhage (UNH, Durham, NH)

Abstract - Habitat loss and fragmentation can negatively affect freshwater turtle populations through local and landscape factors that influence sex ratio and survival. Population sex ratios can become skewed due to changes in temperature, exposure to chemical pollutants, and female-biased mortality. Human development often removes vegetative cover, which increases ground temperatures resulting in a higher proportion of female hatchlings. Many forms of land use can lead to chemical contamination of surface waters, and exposure to endocrine-disrupting chemicals may either compound or mask temperature-mediated effects on sex ratios in aquatic species. Additionally, female turtles are disproportionately susceptible to direct mortality from vehicle collision and predators due to their annual nesting migrations. The goal of this study was to assess how land cover and land use influence freshwater turtle abundance and population dynamics in southeastern New Hampshire. This study focused exclusively on *Chrysemys picta* (Painted Turtle) because they are common, and their relatively short generation time suggests they will show a measurable response to disturbance before other turtle species. We sampled 31 ponds along a gradient of urbanization to estimate sex ratio and population density. We used a Bayesian distance-weighted smoothing model to assess the relative impact of different land-cover types and the scale (0–2000 m) at which they have an impact on turtle density. We used a generalized linear model to assess the impact of land cover and land use on sex ratio. We also assessed presence of common industrial, agricultural, and pharmaceutical pollutants in pond water and turtle blood. Our findings provide insights into the impacts of land use and land cover on the population dynamics of freshwater turtles.

Sun-AM2-A-4

New England Plant Conservation Program: Conservation Action Guided by Field Monitoring

Michael Piantedosi (Native Plant Trust, Framingham, MA)

Abstract - Since 1990, the New England Plant Conservation Program (NEPCoP) has convened New England regional botanists, ecologists, and conservationists in discussing plant-conservation priorities and goals. NEPCoP expanded in 1993 with the establishment of the Plant Conservation Volunteer (PCV) program, and is the oldest citizen science program in the country to conduct monitoring of rare plants. NEPCoP supports professional botanists and state heritage programs by gathering vital data in the field, but its impact does not end there. Habitat restoration, land protections, and research have been possible due to the extensive field data collected by the program. Guiding documents for plant conservation in the region, such as *Flora Conservanda* have been possible due to the data collected through this program, as well as impactful in situ and ex situ (e.g., seed banking) conservation actions for vulnerable plant taxa. Monitoring programs such as NEPCoP collect fundamental research to guide effective conservation actions to retain regional biodiversity.

Sun-AM1-B-1

The Conservation Strategy for the New England Cottontail (*Sylvilagus transitionalis*) and Adaptive Management

Marianne Piché (Habitat Biologist with the Massachusetts Division of Fisheries and Wildlife, Westborough, MA)

Abstract - The Conservation Strategy for the New England Cottontail (*Sylvilagus transitionalis*) was formally approved in November 2012 and consists of goals and objectives to be implemented through 2030. Formation of the Technical Committee and development of the Conservation Strategy resulted from actions taken by the US Fish and Wildlife Service to engage state wildlife agencies, other federal agencies, and conservation partners in New England Cottontail conservation. This highly coordinated adaptive approach to conservation includes objectives related to habitat management, monitoring, research, captive rearing, habitat protection, outreach, and information management that are addressed by several work groups. Major components of Technical Committee work group efforts to apply objectives and reach the goals of the Conservation Strategy are conducted in coordination with numerous partners including the University of Connecticut, the University of New Hampshire, the University of Rhode Island, State University of New York, Roger Williams Park Zoo, and the Bronx Zoo. In this presentation I will detail Conservation Strategy objectives to accomplish goals and uncertainties that require ongoing research.

Sun-AM2-E-5

Creating a New Association While Honoring the Past: VWA to VAWS

Mary Beth Poli (VAWS President and Otter Creek Engineering, Inc., Rutland, VT)

Abstract - The Vermont Association for Wetland Science (VAWS) was formed in January of 2023 by a group of about 20 professionals involved in the wetland science field in Vermont, led by a 5-member founding board. Starting back in April 2022, research was done to determine whether a wetland organization would be useful and viable over the long term in Vermont. While still in the exploratory phase, the informal group planned and held a very successful fall field workshop, focused on wetland restoration and including presenters on soil, grasses, and wildlife. Based on the enthusiasm of the group and the need to provide more Vermont-specific continuing education, the core group of organizers decided it was an idea worth formalizing. VAWS was incorporated as a public benefit nonprofit organization only a few months ago. Over the last few months, the founding board has worked together to develop our Bylaws, develop a website, accept members, and plan our first Annual Meeting. At various stages in the process, several mentors have guided the board, including the Presidents of the Maine Association of Wetland Scientists (MAWS) and the New Hampshire Association of Natural Resource Scientists (NHANRS). VAWS also benefitted from advice and past newsletters we received from those involved in the original Vermont Wetland Association, which was formed in the early 1990s but disbanded about a decade later.

Sun-PM2-F-3

Augmentation and Introduction of Populations of the Federally Endangered Jessup's Milk-vetch

Bob Popp (Botanist, Vermont Dept of Fish and Wildlife), Bill Brumback (Native Plant Trust, Framingham, MA), Michael Piantedosi (Native Plant Trust, Framingham, MA), and Chris Kane (New Hampshire Natural Heritage Bureau, Concord, NH)

Abstract - Yearly monitoring of *Astragalus robbinsii* (var. *jesupii*) (Jesup's Milk-vetch) has occurred at the 3 known populations for over 30 years. After a precipitous decline following Tropical Storm Irene, we have been augmenting 2 of the populations and have successfully introduced Jesup's Milk-vetch to a fourth site. We have also introduced plants to additional sites. While most of these have not thrived, there is evidence of onsite reproduction and establishment of plants at 2 of these sites. Jesup's Milk-vetch is restricted to rock ledges along the Connecticut River where is it subject to periodic inundation and ice scour. While dormant season events are thought to be beneficial, those occurring during the growing season like Irene can have disastrous effects on the populations. There are also uncertain impacts on the populations from upstream dams and invasives plants.

Sun-AM1-B-3

Nest Monitoring and Head Starting Eastern Spiny Softshell Turtles

Ira Powsner (ECHO, Leahy Center for Lake Champlain, Burlington, VT), Steve Smith (ECHO, Burlington, VT), Shannon Kane (ECHO, Burlington, VT), and Toni Mikula (Vermont Fish and Wildlife Department, Essex, VT)

Abstract - ECHO, Leahy Center for Lake Champlain, has collaborated with Vermont Fish and Wildlife on a head start program for *Apalone spinifera* (Eastern Spiny Softshell Turtle) since 2006. The head start program dovetails with the Vermont Fish and Wildlife Department's nest-monitoring program, an element of the Vermont Eastern Spiny Softshell Turtle Recovery Plan (2009). ECHO's head start work, which is on display to the public, includes egg incubation, supplemental care for hatchlings, and temporary neonate housing until release. Through this program, we hope to aid in the recruitment rate of Spiny Softshell neonates into the breeding population of Lake Champlain, while educating ECHO's 170,000 annual guests about environmental conservation.

Sat-PM2-A-1

Cultivating an Environmental Ethic through Community-based Linkages

Lisa Purcell (Four Winds Nature Institute, Chittenden, VT)

Abstract - Environmental issues are of critical concern in the 21st century. In the coming decades, the public will more frequently be called upon to understand complex environmental issues, recognize how individual and group decisions affect the environment, assess environmental risk, and evaluate proposed environmental solutions. Findings by L. Chawla and D.F. Cushing suggest that "nature activities in childhood and youth, as well as examples of parents, teachers, and other role models who show an interest in nature, are key 'entry-level variables' that predispose people to take an interest in nature themselves and later work for its protection." Today's students will be tomorrow's environmental decision-makers and problem-solvers. They need a high-quality environmental education that includes knowledge of the Earth as a physical system and a living environment as well as an understanding of humans and their economic and social systems; critical thinking and problem solving skills; and an understanding that individuals and groups can make a difference. Environmental education at best is a lifelong learning process that begins with parents, early childhood professionals, and young children; grows into K–12 formal and informal education; is integrated into higher education, technical education, businesses, government services, and the media; and involves whole communities. As a community-based natural science education organization, Four Winds works to connect pre-K–12 teachers with local content specialists and nearby natural spaces to investigate community environmental issues that are meaningful and relevant to students. This presentation will focus on those linkages and some of the action-based projects that students and teachers have designed and implemented. Together we will consider what factors nurture an environmental ethic and how we all can be a part of this work.

Sun-AM2-F-5

Population Decline of a New Jersey Endemic Species, *Narthecium americanum*, in Wharton State Forest

Jessica Ray (Raritan Valley Community College - Center for Environmental Studies, North Branch, NJ) and Jay Kelly (Raritan Valley Community College - Center for Environmental Studies, North Branch, NJ)

Abstract - *Narthecium americanum* (Bog Asphodel) is an endangered plant species found exclusively in New Jersey Pine Barrens riverside savannas, with Wharton State Forest (WSF) hosting 76% of all known populations. In 2004–2005, Jay Kelly conducted the first comprehensive surveys to document the extent of Bog Asphodel populations in WSF, resulting in the discovery of 24 new occurrences and increasing the known number of populations by 69% and the total area by over 74%. Although trend data for these populations was lacking, the species was removed by the USFWS from the list of candidate species being considered for federal listing under the Endangered Species Act in 2012. To gain insight into population trends, We repeated these surveys between 2018 and 2022, revealing that of the 53 element occurrences studied, 44 experienced net loss in population extent, and 6 had no plants present during recent surveys, resulting in an overall population extent decrease of 11%. We implemented photo-monitoring points and remote-sensing techniques to gauge the link between *Chamaecyparis thyoides* (Atlantic White Cedar) succession and population extent declines in Bog Asphodel. The results of these surveys raise significant questions regarding the impacts of climate change, increased groundwater use, and fire suppression on a globally imperiled wetland community.

Sat-PM2-E-4

Nurturing a Sense of Wonder in Early Childhood

Hilary Redman (Four Winds Nature Institute, Chittenden, VT)

Abstract - A growing body of research points to the many benefits of time in nature, child-directed play, and outdoor learning for children's social and emotional health and well being. Research suggests that a child's healthy development is linked to the quality of his or her experiences in nature. And yet, the decline over the past 2 decades of both outdoor time and unstructured play in young children's lives is well documented in the popular press and scientific literature. Nature-based play and learning (NBPL) encompasses a spectrum of outdoor activity ranging from child-directed unstructured play to adult-planned activities with specific learning goals. Many educators, childcare professionals, and parents have little experience or training in how to provide these sorts of developmentally appropriate learning opportunities for all youngsters. They may lack the philosophy, language, strategies, and support needed to include NBPL in their routines with children, especially if they spent little time engaged in nature-based play as they were growing up. Four Winds has provided NBPL professional development workshops and family discussion groups to hundreds of early childhood educators and families with young children over the past decade. This presentation will introduce some basic principles of NBPL that we all can engage in as we strive to nurture a sense of wonder in young children and in ourselves.

Sun-AM2-F-1

The Relative Respiration Rate Between Engorged and Non-engorged Ticks in the Deer Tick, *Ixodes Scapularis:* Ixodidae Say (Acari: Ixodidae)

Morgan Regnier (Department of Biological Sciences, University of Southern Maine, Portland, ME), Sage Tocci (Department of Environmental Science and Policy, University of Southern Maine, Portland, ME), and Joseph Staples (Department of Environmental Science and Policy, University of Southern Maine, Portland, ME)

Abstract - Previous studies describing respirometry in ticks have reported that respiratory rates vary with instar and degree of engorgement. For example, research with adult female *Dermacentor variabilis* (American Dog Tick) has shown that adult female ticks exhibit a dramatic increase in relative size and total metabolic expenditure following a blood meal, while the mass-specific metabolic rate will tend to decrease. Respiration also switches from discontinuous, in unfed females, to continuous CO_2 production in engorged females. Males, however, show little change in volume during feeding and thus tend to maintain discontinuous CO_2 output. These observations are likely due to the relatively inert nature of host blood cells in engorged ticks vs. tick-specific tissues, which must process host blood cells and fluid. This research compares the relative respiration rates between engorged and non-engorged *Ixodes scapularis* (Deer Tick). Ticks used in this study were collected from *Odocoileus virginianus* (White-Tailed Deer) at tagging stations throughout Southern Maine during the state's 2022 hunting season, September to December. Similar to results reported in other species of ticks, our observations indicate that total CO_2 in Deer Ticks increases with volume from unfed to fully engorged ticks, while CO_2 generated per unit mass decreases or remains the same. Here, we present preliminary findings from initial respirometry studies of different feeding stages of male and female Deer Ticks and offer further discussion regarding the significance of these observations regarding general life-history strategies and survival in Deer Ticks.

Sat-AM1-C-1

Carnivore Reintroductions: Before, During, and After—Variables and Case Studies to Consider for the Northeast

Christa Rose (Northeastern Puma Project and Native Species Support, Hope, NJ)

Abstract - I will discuss carnivore reintroductions in the United States that are executed, underway, and currently considered, with an emphasis on meso- and large species. I'll discuss common and unique aspects to *Ursus americanus* (Black Bear), *Canis rufus* (Red Wolf), *Lynx canadensis* (Canada Lynx), *U. arctos* (Brown Bear), *Puma concolor coryi* (Florida Panther), and *C. lupus* sp. (Gray Wolf) reintroduction programs, and what a potential *P. concolor* (Catamount) reintroduction could look like in the Northeast, in light of these programs. I'll also discuss potential ecological ripple effects in the northeastern landscape including forest regeneration and disease pathways, and potential socioeconomic effects including deer–vehicle collision rates and industry impacts. I conclude with a picture of Catamount stewardship in the Northeast going forward that includes state agency and regional management approaches, educational outreach, local policies and best management practices, human behavior, and financial instruments to consider as tools for a potential Catamount recovery plan.

Sun-PM2-E-4

Using Undergraduate Courses to Support Local Conservation: From Biodiversity to Water Quality

Michael J. Rubbo (Pace University, Pleasantville, NY)

Abstract - The Department of Environmental Studies and Science at Pace University has recently transitioned from a traditional single-student senior research experience to a practicum course where upper-level students work together in groups. The driver behind this change was to teach students how to collaborate effectively on complex research projects. The focus of these studies has been intentionally directed towards local conservation efforts. The lower Hudson Valley has a large number of conservation-based non-profits as well as municipalities that are interested in protecting their natural resources. However, there is a resource gap as both frequently lack the staff and/or tools needed to conduct ecological research. To fill this need, Pace has begun soliciting project requests from these groups for use in this course. Students have found this approach appealing as they feel they are providing a direct service to the community. To date, projects have been selected by faculty based on their expertise. However, we plan on engaging students in the selection process as this program develops. In spring 2023, students conducted carnivore surveys using game cameras and vernal-pool surveys throughout the town of Ridgefield, CT. These data were used as part of a town-wide natural resource inventory. During fall 2023, students conducted rapid ecological assessments and water quality sampling of the Peekskill Hollow Brook in Putnam County, NY. The findings of this work were used as baseline data for a larger drinking water study being conducted by the non-profit group Riverkeeper. Both projects required students to present their findings to the local communities, providing valuable experience in science communication. This approach has received strong positive feedback from students and provided much-needed data to communities; however, difficulties with managing individual responsibilities as well as assessing individual performance require further refinement of this model.

Sat-AM2-E-1

Community–School Collaboration for Natural Science Discovery, Exploration, and Experimentation

Chris Runcie (Four Winds Nature Institute, Chittenden, VT)

Abstract - The Four Winds Nature Program is a unique community–school partnership, bringing elementary school children and adults together to explore nearby nature. Four Winds' naturalist-educators train community volunteers to lead high-quality natural science lessons that involve science skills and content. In this presentation, we will use a sampling of topics, such as insect galls, bark beetle etchings, or leaf-feeder patterns, to demonstrate how focusing on discoveries in our schoolyards and backyards inspires an interest and enthusiasm for natural science in all ages. The partnership enhances both children's and adults' learning experience and helps to build an environmental ethic in our communities.

Sun-AM2-F-2

The Utility, Achievements, and Future Endeavors of the Maine Association of Wetland Scientists

Kevin Ryan (MAWS Ethics Chair and Ecological Services Division Lead, FB Environmental, Portland, ME)

Abstract - The Maine Association of Wetland Scientists (MAWS) was established in 1990 by a group of scientists who work, live, and learn in and around the great State of Maine. Its mission is to promote the profession of wetland science and further the appreciation and understanding of the ecology of Maine wetlands. MAWS membership is ~150 individuals and consists of consultants, educators, state and federal government employees, conservation practitioners, and students. MAWS hosts regular meetings and workshops to discuss changes in statute and regulation, present new scientific and technical information regarding wetlands, and to provide guidance and instruction on wetland delineation, stream surveys, plant identification, and vernal pool surveys, as well as other related topics. MAWS members provide technical assistance regarding wetlands-related issues, speak in classrooms, and attend or co-organize workshops. I will present the history of MAWS, its major professional accomplishments, and discuss the future of the organization and how it relates to preparing students and young professionals for careers in wetland science.

Sun-PM2-F-2

Evolution Beyond the Fish: *Schistocephalus solidus* in Avian Hosts

Kate L. Sheehan (Frostburg State University, Frostburg MD)

Abstract - The life histories of parasites with complex life cycles are strongly impacted by factors that promote transmission from one host to the next. For the cestode *Schistocephalus solidus*, the evolutionary consequences of host-ecology and the behavior of hosts along a spectrum of parasite maturity has been well demonstrated in the intermediate hosts, stickleback fishes. While life-cycle dynamics in the definitive avian hosts were documented over a century ago, they have been little studied by contemporary researchers. Here, we provide data from birds infected with *S. solidus* and adult parasites grown in experimental conditions that simulate the environment of the avian gut. We expand on our understanding of the life history and evolution of this parasite beyond the realm of the well-studied intermediate hosts and discuss the similarities and differences among the various groups of avian taxa that have been documented as hosts of this cestode. We find that the preliminary assessments of typical, but non-ideal hosts promotes differences in adult longevity for this circumpolar species.

Sat-AM2-C-3

Biodiversity Vermont: An Emerging Coalition of Organizations Devoted to Biodiversity Restoration

Brian Shupe (Vermont Natural Resources Council, Montpelier, VT)

Abstract - The abundance and diversity of life on Earth is in a state of alarming decline. The most up-to-date and authoritative source of information on the biodiversity crisis comes from a 2019 Global Assessment Report by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Two of the most powerful findings are that an estimated one million species currently face global extinction, and nothing short of "transformative changes across economic, social, political, and technological factors" can avert catastrophic global ecosystem collapse. An issue of this magnitude can't be solved through government action alone. It can't be solved through action on public land alone. Meaningful progress will depend on mobilizing the public to take action on the 80 percent of Vermont land that is privately owned. We in Vermont are fortunate that we have many talented conservation professionals with the expertise landowners need. We are also fortunate that state government and conservation organizations currently offer a wide array of programs that can help landowners contribute to addressing the global biodiversity crisis. To build on these strengths and dramatically accelerate biodiversity conservation through collaboration, a network of over 20 conservation-oriented organizations and state departments and agencies has come together to form a coalition called Biodiversity Vermont. Early plans for the coalition call for coordinated statewide education campaign and creation of clearinghouse of information, resources, and programs for private landowners.

Sun-PM2-B-3

Review of Conservation Measures to Increase Breeding Success of Cliff Swallows (*Petrochelidon pyrrhonota*) in Massachusetts

Mara Silver (Swallow Conservation, Shelburne Falls, MA)

Abstract - *Petrochelidon pyrrhonota* (Cliff Swallow) is experiencing significant population declines in northeastern North America. At 12 active Cliff Swallow colonies in western Massachusetts, we examined the extent to which installation of artificial nests, providing of mud sources, and control of *Passer domesticus* (House Sparrow) affected colony size and reproductive success of Cliff Swallows. There was a trend for colony size to increase at sites with artificial nests, but the increase was not significant. Cliff Swallow nesting success was significantly lower at colony sites where House Sparrows were present, compared to those at which they were absent. The number of nesting Cliff Swallows at 2 sites where mud sources were enhanced increased between 2 years the study. Our findings suggests that without effective control of House Sparrows, Cliff Swallows are likely to keep declining in Massachusetts, regardless of other management techniques used.

Sat-PM1-F-2

Northeast Wildlife Monitoring Network (NEWMN): A Unifying Framework for Regional Collaboration Using Autonomous Monitoring Units

Alexej P.K. Sirén (Vermont Cooperative Fish and Wildlife Research Unit, University of Vermont, Burlington, VT), Laurence A. Clarfeld, (Vermont Cooperative Fish and Wildlife Research Unit, University of Vermont, Burlington, VT), Cathleen Balantic, (National Park Service, Natural Sounds and Night Skies Division, Fort Collins, CO), Katherine D. Gieder (Vermont Department of Fish and Wildlife, Rutland, VT), Paul G. Jensen (State University of New York College of Environmental Science and Forestry, Department of Environmental Biology, Syracuse, NY), Tammy Wilson (US Geological Survey, Massachusetts Cooperative Fish and Wildlife Research Unit, Department of Environmental Conservation, University of Massachusetts, Amherst, MA), and Therese M. Donovan (US Geological Survey, Vermont Cooperative Fish and Wildlife Research Unit, Rubenstein School of Environment and Natural Resources, University of Vermont, Burlington, VT)

Abstract - Ongoing and projected changes in climate and habitat present significant threats to wildlife populations and communities worldwide. Our challenge, as scientists and natural resource managers, is to provide robust and efficient monitoring approaches to address these stressors. Camera traps have become a standard tool for collecting data on distribution, abundance, and species richness. However, the challenges of storing, tagging, and sharing camera data and the lack of coordination beyond local projects present considerable limitations. Since 2014, state and federal agencies across the northeastern US have collected wildlife and climate data using a standardized camera-trap protocol to better understand species' response to climate and land-use change. This effort, formally known as the Northeastern Wildlife Monitoring Network (NEWMN), has recently expanded to include new technologies and partnerships to increase the efficiency and effectiveness of managing wildlife populations in the northeastern US. In this talk, we provide a brief history of NEWMN and examples of how our standardized and regional approach provides data to evaluate ecological questions not afforded by local camera projects. We also introduce our novel approach to monitoring camera stations and ferrying data from cameras to stable repositories using several computing platforms (e.g., Survey123). Lastly, we introduce AMMonitor, the R package used to standardize data management across many independent collaborators.

Sat-AM2-A-4

Mitogenomic Analysis of Schistosomatidae Evolution and Diversification

Mackenzie Sky (Purchase College, SUNY, Purchase, NY), Amelia Whitehurst (Purchase College, SUNY, Purchase, NY), Stephen Harris (Purchase College, SUNY, Purchase, NY), and Erika Ebbs (Purchase College, SUNY, Purchase, NY)

Abstract - *Schistosoma* spp. (Schistosomes) are parasitic flatworms that are responsible for causing the devastating disease schistosomiasis which affects about 200 million people annually worldwide. *Schistosoma* is one clade within the diverse Schistosomatidae family. Schistosomatidae consists of digenetic trematodes that have unique traits such as dioecism and having one intermediate host, rather than the normal 2 (or more) seen in most trematodes. The complex life cycle of Schistosomes involves an intermediate host (a snail), and a definitive, vertebrate host (mammal or bird). The larvae shed from the vertebrate host in the feces or urine and find a snail host in a body of freshwater. Then, the free-swimming larvae will penetrate the skin of a vertebrate host and the cycle repeats. Evolutionary relationships of Schistosomes are not yet fully understood due to the lack of taxon sampling, small amount of DNA yield, and difficulty sampling adult and larval stages. Additionally, mitochondrial gene order changes further complicate mitogenomic analyses making it difficult to analyze host–parasite relationships and divergence times. There is a need to improve these resources and develop molecular analysis tools for successful species identification. We used next-generation sequencing (Oxford Nanopore and Illumina) to collect 3 nearly complete novel mitochondrial genomes for under sampled taxa, which increased the resolution of Schistosomatidae evolution. Additionally, this study increased the number of mitochondrial loci for well-sampled taxa to improve resolution of uncertain clades. Overall, this work will improve our understanding of the evolution of an important group of zoonotic parasites.

Sun-AM1-C-2

Use of Tree Ring Data to Evaluate Drought Associated Tree Mortality in the Northeast United States

Laura G. Smith (Harvard Forest, Petersham, MA), Neil Pederson (Harvard Forest, Petersham, MA), and David Orwig (Harvard Forest, Petersham, MA)

Abstract - Information about the effects of extreme climate in the past can provide insight into the potential range of forest impacts under various climate scenarios in the future. We use tree-ring data to evaluate tree-growth declines, forest-disturbance patterns, and climate-growth relationships during known drought events in the 20th century, including severe droughts in the 1930s and the 1960s. We collected data from a network of sites that range from southeastern New York state to western Maine and represent a spatial gradient of drought-impacted areas. A diversity of species and functional groups are represented, including members of the genera *Quercus* (oak)*, Acer* (maple)*, Betula* (birch)*, Tsuga* (hemlock)*, Fagus* (beech)*, Picea* (spruce)*,* and *Pinus* (pine)*.* We find a relationship between the location of the plot within the gradient of drought severity and the impact on secondary tree growth, as well as variability in the disturbance signals in the years following drought events.

Sat-PM2-B-3

Association of Massachusetts Wetland Scientists: History, Mission, Objectives, Struggles, and Why You Should Consider Joining

Scott Smyers (AMWS Past-President, and Oxbow Associates, Inc., Boxborough, MA)

Abstract - The Association of Massachusetts Wetland Scientists (AMWS) was formed in 1991 with the 70 members and a mission to promote the profession and understanding of wetland science in Massachusetts and to support the public interest. Today AMWS has over 200 members and provides training opportunities by offering workshops on broad topics including plant identification, wildlife ecology, soil evaluation, complicated regulatory changes, and, of course, wetland delineation. AMWS leadership has been intimately involved in offering guidance through Technical Advisory Committees to state agencies and by submitting comment letters whenever regulatory changes are proposed related to state or federal laws and regulations. I will review the history of AMWS, explain the evolution of professions associated with Wetland Science, how students can prepare themselves for a career in Wetland Science, and how established professionals can contribute to the quality of this science by taking on leadership roles in the organization and instructing workshops.

Sun-PM2-F-1

Tick Densities and Infection Prevalence on Nantucket and Tuckernuck Islands, MA

Allison A. Snow (UMass, Amherst, MA), Patrick Pearson (UMass, Amherst, MA), Guang Xu (UMass, Amherst, MA), David Allen (Middlebury College, Middlebury, VT), Roberto Santamaria (Nantucket Board of Health, Nantucket, MA), and Stephen Rich (UMass, Amherst, MA)

Abstract - To provide a baseline for the town of Nantucket, MA, we recorded tick densities and infection prevalence at study sites on Nantucket and Tuckernuck islands. We recorded densities by drag-sampling along ~0.5–1.5 km of trail per site in 2020–2022. Nymphal *Ixodes scapularis* (Blacklegged Tick) were most abundant at 5 shadier sites and least common in grasslands and scrub oak thickets. *Amblyomma americanum* (Lone Star Tick) were common on Tuckernuck and rare on Nantucket, and both tick species were more numerous in 2021 compared to 2020 and 2022. We did not encounter *Dermacentor variabilis* (American Dog Tick) at our study sites. We tested for several pathogens in Blacklegged Tick nymphs using ~300–400 nymphs/site/year to allow comparisons among 5 sites over 2 years. Infection levels were generally similar among the 4 Nantucket sites within years, averaging 10% vs. 19% (2020–2021) for *Borrelia burgdorferi*, 11% vs. 15% (2020–2021) for *Babesia microti,* and 17% (both years) for *Anaplasma phagocytophilum*. Infection prevalence for these pathogens was greater on Tuckernuck in 2021, as were coinfections with 2 or more pathogens. Despite year-to-year variation in tick densities and nymphal infection levels, our site-specific, quantitative approach provides an assessment of current conditions and a baseline for future monitoring.

Sat-PM2-F-3

Experimental Assessment of Allopolyploid Gametophyte Ecology in the *Adiantum pedatum* Complex

Morgan W. Southgate (UVM PBIO, Burlington, VT) and David S.Barrington (UVM PBIO, Burlington, VT)

Abstract - We asked how the ecology of the gametophyte phase of the fern life cycle shapes distribution of the allopolyploid *Adiantum pedatum* complex. In northeastern North America, this clade comprises the fertile allotetraploid *Adiantum viridimontanum* (Green Mountain Maidenhair Fern) and its 2 diploid progenitors, *Adiantum pedatum* (Northern Maidenhair Fern) and *Adiantum aleuticum* (Aleutian Maidenhair Fern). We conducted a reciprocal growth experiment (n = 540) to assess the viability of hybrid gametophytes relative to those of the diploid species across a variety of soil types, spanning the nutrient-rich soil of deciduous woods (occupied by *A. pedatum*) and the nutrient-poor soils of serpentine habitats (occupied by *A. aleuticum* and *A. viridimontanum)*. Beginning 8 weeks after spores were sown, we photographed individual gametophytes every 2 weeks for a period of 6 months, or until sporeling formation occurred. Once formed, young leaves were photographed every 2 weeks for at least 1 month. We calculated gametophyte and sporeling size at each time point using color thresholding in ImageJ, implemented for large quantities of images with a batch-processing program. We compiled and analyzed these data to yield a set of fitness proxies spanning the spore germination and sporeling phases of the life cycle: time to spore germination, gametophyte size and growth rate, time to sporeling formation, sporeling size and growth rate, and frequency of sporeling formation. We used morphometric analysis of sporeling phenotype to verify species identity for the plants that produced offspring. Preliminary results show variation in fitness proxies by both species and soil type. Spores of the hybrid species germinated more rapidly than those of both progenitor species. Gametophytes of *A. viridimontanum* were larger than those of *A. aleuticum* on all soil types, and comparable in size to those of *A. pedatum* on rich woods soil. Sporelings of *A. viridimontanum* formed more rapidly than those of *A. aleuticum* on rich woods soil, and at a comparable rate on serpentine soil. These results indicate that forces shaping distribution of the *Adiantum pedatum* complex likely include the ecophysiological tolerance of the gametophyte phase of the life cycle.

Sat-PM1-D-2

Dead Cats Walking: The Limitations of Midwest Puma Recolonization and the Imperative for Eastern Reintroductions

Christopher Spatz (Cougar Rewilding Foundation, Rosendale, NY)

Abstract - Since the mid-1990s, dozens of sub-adult *Pums concolor* (Puma) from breeding colonies in the western prairie states have dispersed east, sparking speculation that they will first recolonize the Midwest, then recover some of the cat's historic eastern range, without the need for reintroductions. Most dispersers have been males. All but 1, perhaps, have died, disappeared, or were captured without establishing a home range. The oldest, who traveled famously from the South Dakota Black Hills to Connecticut, was 3 years old. In late January 2023, a female Puma was shot and killed by *Canis Latrans* (Coyote) hunters in Johnson County, IA. Pumas are not protected in Iowa. She was the third female shot in Iowa in the past 6 years, and just the fifth female Puma documented since 2002 in states east of the Dakota/Nebraska source colonies. Of the 5 females, 3 were shot, and 1 was confirmed in 2016 only by DNA extracted from a Missouri *Cervus canadensis* (Elk)-kill. The earliest documented female, confirmed in Tennessee in 2015 by trail cameras and DNA matched to the Black Hills, disappeared. Puma kittens have yet to be documented in states east of the Dakotas and Nebraska. Prairie-state recolonization has taken 25 years to recover 402 km (250 mi) from the Black Hills east to Nebraska's Niobrara River Valley across some of the Lower 48's least-developed terrain. It is another 370 km (230 mi) from the Niobrara through landscapes increasing in industrial and agricultural development and human populations to the Iowa border, where dispersal hazards clearly multiply. I will discuss the effects of hunting quotas in source colony states deliberately suppressing sub-adult dispersal measured by mortalities and captures, how female dispersal mirrors the dozens of male dispersers killed or disappeared despite state protections, how the record of disperser mortalities is limiting the potential for further Midwest recolonization and the subsequent need for eastern-state Puma reintroductions.

Sun-PM2-E-3

The Critical Importance of Staging Areas at Cape Cod National Seashore to Endangered Roseate Terns

Jeffrey A. Spendelow (Emeritus USGS, Silver Spring, MD)

Abstract - The endangered NW Atlantic breeding population of *Sterna dougallii* (Roseate Tern [ROST]) now nests from as far north as Country Island in northern Nova Scotia, to as far southwest as Falkner Island, CT, in Long Island Sound. Started in 1987, the Cooperative Roseate Tern Metapopulation Project (CRTMP) is integrating results of several research studies to evaluate the relative importance of current factors and future threats that may limit population recovery. While it has long been known that after nesting is over ROSTs come to staging sites in the "Cape and Islands" area of southeastern Massachusetts to prepare for their migration to wintering areas off the north and east coasts of South America, relatively little research was done at these locations until the CRTMP began expanding its staging-site studies (SSS) work in 2005 due to possible threats to this species from the construction and operation of offshore wind-energy turbines in the MA-RI-NY-CT area. Early SSS research (1) showed that most hatch year (HY) ROSTs and their single care-giving parents from throughout the entire breeding range become highly concentrated at a few staging sites around the greater Cape Cod, MA, area from August to September, and (2) demonstrated the previously unrecognized importance to this species of staging sites within Cape Cod National Seashore. Recent research shows that these sites also are being used heavily by young, mainly nonbreeding adults in late June and early July before the HYs begin to arrive. This presentation will highlight some recent CRTMP-SSS results and discuss future research needs. The mobile nature of terns, the time they spend away from land, and the distances they travel when foraging offshore are major challenges to conducting the research needed to understand the factors affecting HY first-winter survival and to help promote population recovery.

Sat-AM2-C-1

Species' Forest Model for the Return of the Natural Landscape

Richard H. Stafursky (Species Forest, Inc., Westhampton, MA)

Abstract - The Species' Forest natural landscape research model, developed by Species Forest, Inc., was begun in 2001 and is located on a 32-ha (80-ac) former dairy farm in Conway, MA. This model demonstrates how culturally managed acres can revert to the sole control of dynamic natural forces and processes, first by our identifying aspects of the cultural landscape, followed by the removal of these cultural elements and then using proforestation for the return and protection in perpetuity of this natural landscape. I propose the following: the cultural landscape always harms the natural landscape, yet the natural landscape never harms the cultural landscape; any acreage within the Great North Eastern Broadleaf Forest of New England can be returned to a natural state; and all the other native plants, animals, fungi, and soil microbes must take priority for the return of a species' forest. A species' forest is of, by, and for all the other native species. Species Forest, Inc., is a 501(c)(3) land trust operating foundation with an ethical, vegan board of directors.

Sat-AM1-B-3

Of Mites and Mosquitoes: A Survey and Discussion of Aquatic Mites and Their Mosquito Hosts in Maine

Joseph K. Staples (The University of Southern Maine, Department of Environmental Science, Gorham, ME) and Margret Welch (Lakes Environmental Association, 230 Main Street, Bridgton, ME)

Abstract - In this presentation, we present survey data collected in 2013 on the occurrence of mites on adult mosquitoes from across Maine. Data from 28 of the roughly 40 species known to exist in the state revealed that 13% of all adult female mosquitoes captured were hosts to phoretic and parasitic mites (Acari: spp.). The most abundant species collected from resting boxes, *Culiseta melanura*, *Coquillettidia perturbans,* and *Anopheles punctipennis* contained roughly 12%, 11.5%, and 9.6%, respectively. For mosquitoes captured using light traps, the most abundant species, *Cq. perturbans* and *Aedes canadensis* were hosts to the greatest numbers of mites, 26% and 14.3%, respectively. Finally, we consider what is known regarding the significance of phoretic and parasitic mites on the life history of mosquitoes today and in the future under different climate change scenarios expected to occur across the Northeast in the coming years.

Sat-AM1-C-3

New Names for North American Hay-Scented Ferns: Phylogeny and Evolution of the Dennstaedtiaceae

Michael Sundue (Pringle Herbarium, University of Vermont, Burlington, VT)

Abstract - Whereas most ferns are characterized as shade-tolerant understory herbs or epiphytes, hay-scented ferns (Dennstaedtioideae: Dennstaedtiaceae) stand apart as often being sun-loving and disturbance colonizers. They have a complex array of morphological features not seen in other fern groups including epipetiolar branches, both adaxial and abaxial indusia, prickles, and scandent leaves that are sometimes indeterminate. The clade is predominantly tropical, but includes 3 North American species: *Dennstaedtia punctilobula* (Eastern Hay-scented Fern), widespread in Eastern North America, and *D. bipinnata* (Cuplet Fern) and *D. globulifera* which are widespread in tropical America with restricted and or relictual disjunct populations in the southern and southeastern United States. Previous studies have called into question the monophyly of genera and application of names within the family, and with this in mind, we undertook a molecular phylogenetic revision of hay-scented ferns using 4 plastid markers. Our sampling represents ~40% of the extant diversity and includes the type species for each of the relevant segregate genera. We coded 20 discrete morphological character states that we used to find diagnosable clades. We demonstrate that the circumscription of *Dennstaedtia* relied upon for the past ~200 years is polyphyletic and morphologically untenable. Our results demonstrate that sorus position—the most heavily relied upon character in the classification of Dennstaedtioideae—is homoplastic, changing from abaxial to marginal, sometimes within traditional genera. As for characters that help diagnose genera, we found that the presence/absence of epipetiolar buds, the shape of the petiole base, the presence/absence of wings along the rachis-costa junction and the perispore ornamentation were most useful. Other characters, such as the presence/absence of proliferous buds upon the lamina, rhizome branching, aculeate axes, and lamina division, had sufficient homoplasy or missing data such that they have less diagnostic power at this rank. We propose that many of these labile characters are adaptations to disturbance-colonization, a syndrome of traits that evolve in tandem across the family multiple times. Our results lead us to recognize *Mucura* a new genus of 2 species (*M. bipinnata* and *M. globulifera),* and to recognize the Eastern Hay-scented Fern in the previously synonymized genus *Sitobolium* (*S. punctilobulum*). Following these nomenclatural changes, the name *Dennstaedtia* is restricted to the tropics and no longer applies to any species in the United States.

Sat-PM2-D-1

Outbreak and Epidemic Burnout of Highly Pathogenic Avian Influenza (HPAI) at a Herring Gull Breeding Colony

Liam U. Taylor (Yale University, New Haven, CT), Robert A. Ronconi (Environment and Climate Change Canada, Dartmouth, NS), Hayley A. Spina (Guelph University, Guelph, ON), C. Brandon Ogbunugafor (Yale University, New Haven, CT), and Andrea J. Ayala (Yale University, New Haven, CT)

Abstract - Highly pathogenic avian influenza (HPAI) is an RNA virus known for deadly seasonal outbreaks in waterfowl, wading birds, and seabirds over the last 3 decades. The epidemiological and economic impacts of HPAI are well-studied at commercial poultry farms. However, observations in the wild are historically limited to cross-sectional surveillance (i.e., snapshots from individual carcasses, blood samples, or oral swabs) or post hoc records of mass mortality. Here, we present real-time tracking of a confirmed HPAI H5Nx outbreak at a breeding colony of *Larus argentatus smithsonianus* (American Herring Gull) on Kent Island, NB, Canada. Our records include continuous surveys from before, during, and after the outbreak (31May–15 August 2022) coupled with data on individual clinical signs and mortality. Instead of the mass die-offs seen at other colonies, the outbreak on Kent Island lasted only a few weeks with relatively restricted mortality (22 deaths across 501 birds on the main transect, with a minimum of 74 deaths across ~3077 birds from island-wide estimates). We used photos, videos, and behavioral observations to develop hypotheses for how this gull colony withstood the circulation of HPAI H5Nx. Examining these hypotheses across the region will help us understand how avian influenza spreads among and between wild and domesticated species.

Sat-AM2-C-2

Processing BirdNET Sound ID to Maximize Identification Accuracy of Audio Files

Michael Thompson (University of New Hampshire, Durham, NH), Mark Ducey (University of New Hampshire, Durham, NH), Rebecca Rowe (University of New Hampshire, Durham, NH), and John Gunn (The Nature Conservancy, Cumberland, ME)

Abstract - Surveying birds can be time consuming and expensive. Because of this, acoustic sensors coupled with automatic song identification tools have become increasingly popular. BirdNET Sound ID, a free Artificial Intelligence convolutional neural network built and supplied by the Cornell Lab of Ornithology, has the potential to significantly reduce the cost of data collection and facilitate a variety of new studies because it comes pre-trained on over 900 bird species. While some studies have shown BirdNET to be quite accurate, this is predominantly due to filtering for only the most confident identifications made. We illustrate how this approach can miss species that are present or incorrectly add species ("false positives") that should not be present. We validated over 25 hours of BirdNET outputs and built a post-processing model to better understand the link between species, BirdNET confidence, and species identification accuracy. In our model, we conditionally select confidence cutoffs by species at a desired accuracy which allows a greater number of otherwise missed species to be included and false positives to be rejected. In addition, this model illustrates how species with more recordings are more likely to be accurately identified. Because of this finding, we suggest a user could check observations of species with fewer recordings while accepting species with a high number of recordings. This framework will allow researchers to use BirdNET with greater inventory accuracy while still drastically reducing time spent manually identifying species in the field or via audio files.

Sat-PM1-A-4

Nutrient Enrichment and Rainfall Affect Plant Phenology and Floral Resource Availability for Pollinators

Jessie A. Thuma (Tufts University, Medford, MA), Christopher Duff (Tufts University, Medford, MA), Madeline Pitera (Tufts University, Medford, MA), Nicholas Januario (Tufts University, Medford, MA), Colin M. Orians (Tufts University, Medford, MA), and Philip T. Starks (Tufts University, Medford, MA)

Abstract - Wild pollinators are critical to maintaining ecosystem services and facilitating crop production, but habitat degradation and resource loss are leading to worldwide pollinator declines. Nutrient enrichment and changes in rainfall due to global warming are drivers of global environmental change, and likely to impact pollinator foraging behavior and reproductive success through changes to the growth and phenology of flowering plants. I will provide a brief overview of pollinator conservation in the context of nutritional ecology and plant–pollinator interactions. Then, I will present novel research into the effects of nutrient and rainfall variation on plant phenology. We experimentally manipulated the amount of water and supplemental nutrients available to wild *Helianthus annuus* (Common Sunflower) and *Solidago* sp. (goldenrod) throughout their growing season to evaluate how changes in growth and bloom time could impact resource availability for *Bombus impatiens* (Common Eastern Bumble Bee) queens preparing to overwinter. We found that fertilizer and rainfall alter plant bloom time by 2–18 days, though flowering response was species-specific. Fertilizer did not significantly affect plant growth or number of flowers produced when plants were grown under drought conditions. When water was not limiting, fertilized Common Sunflowers bloomed in floral pulses. These findings carry important implications for growers and land managers, providing insight into potential drivers of wild pollinator decline and possible conservation strategies.

Sat-AM1-D-1

Determining Mobility of *Ixodes scapularis* on Different Fabric Substrates

Sage Tocci (University of Southern Maine, Gorham, ME) and Joseph Staples (University of Southern Maine, Gorham, ME)

Abstract - Across much of the eastern United States, *Ixodes scapularis* (Deer Tick or Black Legged Tick) has become a common vector for several diseases, including anaplasmosis, babesiosis, Borrelia miyamotoi disease, Powassan virus disease, ehrlichiosis, and Lyme disease resulting in millions of dollars in medical costs, loss of productivity, and a lower quality of life for thousands of individuals. Although treatments, such as antibiotics and, more recently, vaccines, are continually being developed to treat tick-born-pathogens, preventing bites remains the most effective method to avoiding illness. Maine forested habitats are home to abundant rodent and *Odocoileus virginianus* (White-tailed Deer) populations, providing ideal ecological conditions for all life stages of Deer Ticks, especially in coastal and southern interior regions of the state. Unfortunately, abundant forest-edge habitat, a focus on outdoor recreation, and a vibrant nature-based economy increase the risk of residents and visitors alike encountering ticks without realizing it. Understanding tick mobility on different fabrics commonly worn when recreating or working outside may therefore help individuals reduce the risk of tick bites by selecting clothing and fabrics that inhibit a tick's ability to attach and climb. In this study, we used cameras to record movement in non-engorged female and male Deer Ticks on 6 different fabrics. Video data was then analyzed to determine the velocity, distance traveled, and resting times of individual ticks on each fabric. Results show clear differences in ticks' ability to move on different fabrics.

Sat-AM1-C-2

The Deadliest Animal in the World

Gary J. Torrisi (SUNY HVCC, Troy, NY)

Abstract - Insects have been a part of the earth's fauna since the late Silurian (443–416 million years ago). It wasn't until the Jurassic Period, popularized by the movie "Jurassic Park" and its sequels of the same period, that ancestral mosquitoes emerged. Originating in South Africa, mosquitoes (Culcidae) became both carriers and transmitters of pathogens across almost the entire globe, including throughout Northeastern North America. Mosquitoes have been feasting on vertebrates prior to human existence for several millions of years. Once human appeared on earth, only a few million years ago, mosquitoes had already co-evolved and adapted the capability of delivering pathogens when taking a blood-meal. At present, mosquitoes have killed more humans than all the combined wars that ever occurred on earth. The history of mosquito behavior has played a major role in shaping human history. It is this legacy that has empowered science to promote awareness and to educate that mosquitoes are indeed the deadliest animal in the world. Today, climate change has increased the range of mosquitoes, not only as an invasive species but also through an expansion of their range both in latitude and altitude. With this advance comes an increase in human–mosquito contact and the consequential increase in the transmission of disease to humans.

Sat-PM2-F-4

Mycorrhizal Fungi as Critical Players for Tree Seedling Establishment During Range Expansions

Jordon Tourville (Appalachian Mountain Club, Boston, MA), Tom Horton (SUNY-ESF, Syracuse, NY), and Martin Dovciak (SUNY-ESF, Syracuse, NY)

Abstract - Global warming will shift the climatic envelopes of many tree species to higher latitudes and elevations across the globe, however, unsuitable soil biota may inhibit tree migrations into these areas of suitable climate. Specifically, the role of mycorrhizal fungi in facilitating tree seedling establishment beyond natural species range limits has not been fully explored within forested ecosystems. We used a multi-step experimental approach to isolate and quantify the effects of mycorrhizal colonization and potential common mycorrhizal network (CMN) connectivity on tree seedling survival and growth across a gradient of elevation which covaries with climate and soil chemistry (Green Mountains of Vermont). We examined plant height growth, biomass, foliar nutrients (N, P, base cations, metals), and the presence of potential root pathogens as metrics influencing plant growth. We examined both an arbuscular (AMF)- and an ectomycorrhizal (EMF)-associated tree species. Mycorrhizal inoculum from within species ranges increased seedling survival and growth in a greenhouse setting; however, only seedling survival was significantly improved in 2-year field studies (inoculum from outside species ranges did not have beneficial effects). Sustained connection to a potential mycelial network increased seedling survival in the field at all elevations. Although seedlings disconnected from a CMN did not suffer decreased foliar nutrient levels compared to connected seedlings, disconnected AMF-associated seedlings had significantly higher aluminum concentrations and more potential pathogens present (and damping off symptoms). Our results demonstrate that mycorrhizal fungi can help facilitate tree seedling establishment beyond range boundaries in forested ecosystems, and that the magnitude of this effect is modulated by the dominant mycorrhizal type present (i.e., AMF vs. EMF). Therefore, our data support the notion that despite improving climate conditions beyond species ranges, a lack of suitable mutualists can still prevent successful seedling establishment; thus, fungal biogeography is a relevant area of inquiry for informing tree range dynamics.

Sun-AM1-A-1

Field Studies for Climate Change Education

Joshua Turner (Bryant University, Smithfield, RI)

Abstract - It is vitally important that the younger generations are educated about the threat of climate change and how it will impact their lives in the decades to come. Field studies are currently an overlooked avenue for meaningful climate-change education. Herein I present a case study to provide an example of how field work can be a powerful way to engage students with climate-change information. Clarkia, ID, is a small rural town internationally known in paleontological circles for its exceptional preservation of leaf fossils from the mid-Miocene, ~15 million years ago. At that time, concentrations of atmospheric carbon dioxide were upwards of 500 ppm, a threshold that Earth will likely reach in the next 50–100 years (Liang et al 2022). Bringing students to fossil sites at Clarkia can be a very engaging experience to help them visualize the power of climate change, as the abundant fossil flora of *Taxodium distichum* (Bald Cypress) and large broad-leaf plants are in stark contrast to the evergreen forest of modern Idaho. In the middle Miocene, the fossil site would have been more similar to a swamp in the southeastern US, demonstrating the effect of climate change on plants' habitats. By studying the fossils and biomolecules preserved in Clarkia, scientists and students can learn more about ancient climate change in hopes to better understand near-future climate change.

Sat-AM2-F-

Arboreal Behavior in a New England Rattlesnake

Tom Tyning (Berkshire Community College, Pittsfield, MA)

Abstract - Despite nearly 40 years of survey work recording data on populations of *Crotalus horridus* (Timber Rattlesnake) in western Massachusetts, it was fascinating to find 1 specimen off the ground and utilizing trees for a period of time. While many northeastern snakes are avid climbers, Timber Rattlesnakes are not known to do so, other than at times as a quick escape usually into shrubs or saplings. There are a few published notes regarding tree use by rattlesnakes, but they are in the southern US, and length of time spent off the ground in such cases is either short or unrecorded. Here I discuss a Timber Rattlesnake that was tracked with radio-telemetry and spent nearly a month in a tree, emerging in the daytime to bask and retreating into a hollow 15 feet off the ground. To my surprise, the animal returned to that same tree a year later and utilized the same space, though for a shorter time. The annual behavior and movements of this endangered species in New England is highlighted and the role of arboreal behavior discussed.

Sun-AM2-A-1

The Hawk-eyed Songbird

Luke P. Tyrrell (SUNY Plattsburgh, Plattsburgh, NY)

Abstract - The vast majority of songbirds (Order Passeriformes) are insectivorous for at least part of the year. However, swallows are one of the only songbird groups that execute all aspects of hunting prey (search, detection, pursuit, and capture) in flight. We examined eye morphology and the retinal ganglion cell layer of wholemounted *Tachycineta bicolor* (Tree Swallow) retinas, cross-sectioned Tree Swallow foveae, and measured the dimensions of Tree Swallow visual fields using the opthalmoscopic reflex technique. We found that Tree Swallows, unlike other songbirds, have evolved a visual system similar to that of raptors (Orders Accipitriformes and Falconiformes). Like raptors, Tree Swallows have a bifoveate retina, unique among studied songbirds, that affords them a "trident" of high-quality vision with deep, central foveae directed laterally to either side of the head and shallow, temporal foveae directed forward. Tree Swallows also have unusually long eyes that increase the focal length of the eye and thus the eye's spatial resolving power. Like raptors, the Tree Swallow has an eye that is just as long as it is wide, whereas typical songbirds have an eye that is only two-thirds as long as it is wide. Raptors have unexpectedly narrow binocular fields (20–39º) but large blind areas behind the head (60–101º). Songbirds, on the other hand, have symmetrical binocular (average 40º) and blind areas (average 40º). Again, Tree Swallows fall out with the distantly related raptors with a blind area (53º) that is over twice the size of the binocular field (23º). As the Tree Swallow visual system demonstrates, the organization of sensory systems is not entirely constrained phylogenetically, but can be reshaped by the ecological challenges that particular species face.

Sat-PM1-F-4

Visualizing Climate Change Across Academic Disciplines

Taylor Vahey (Bryant University 1150 Douglas Pike, Smithfield, RI 02917)

Abstract - Humans are responsible for the warming of our climate and now have the duty of approaching this global problem with actionable solutions. Despite being aware of our increased atmospheric carbon dioxide emissions for the past 2 centuries, little progress has been made. Comprehensive and interdisciplinary climate-change education is needed globally to instill behavior change in students and society, preparing for the future job marketplace where almost all careers will be affected by climate change, and drawing attention to actionable solutions to mitigate this international crisis.

Sat-AM2-F-

Investigating Effects of LED Light Pollution on the Activity and Presence of Insectivorous Bats and their Arthropod Prey

Hope L. VanDerwater (Fordham University, New York, NY), J. Alan Clark (Fordham University, New York, NY), and Jonathan Aldana-Proulx (Fordham University, New York, NY)

Abstract - Levels of artificial light at night (ALAN) are increasing rapidly across the world alongside increasing urbanization, with almost half of the US experiencing light-polluted night skies. Bats are particularly susceptible to the effects of ALAN, experiencing disruptions to their reproductive patterns, migration, and foraging behaviors. In addition, insectivorous bat species must adapt to the effects of ALAN on the activity and composition of their prey community. Older lighting technologies are increasingly being exchanged for energy-efficient and economical light-emitting diode (LED) lights, with largely unknown ecological consequences. Though there is evidence that LEDs are less attractive to nocturnal flying arthropods—the primary prey of northeastern US bats—research examining the combined effects of LEDs on bats and their arthropod prey is lacking. In summer 2021, we tested the effects of LED lighting on the assemblage of flying arthropods and the activity and species composition of bats in Westchester County, NY. We rotated LED floodlights (chosen to mimic the luminance of suburban street lights), arthropod traps, and passive bat recorders among several sites such that each was alternately illuminated with LEDs or left dark. Overall bat activity was lower in light conditions (57% of total bat passes, n = 18,023 passes) than in dark conditions (43%). *Eptesicus fuscus* (Big Brown Bat), *Lasiurus cinereus* (Hoary Bat), and *Lasionycteris noctivagans* (Silver-Haired Bats) were significantly more active in dark conditions, while other species demonstrated a weaker response to light. Lights had an attractive effect on arthropods (mean ± SE arthropods collected per night, in light 88 ± 9 vs. dark conditions 22 ± 3), strongest in orders Lepidoptera, Coleoptera, and Diptera. Analysis by the Bray–Curtis similarity index indicated that light conditions and arthropod abundance significantly contributed to variation in the bat assemblage composition. We found a positive correlation between arthropod abundance and bat activity in light conditions but the effect was not significant in dark conditions. This finding suggests that increased arthropod abundance around LED lights may attract otherwise light-avoidant, foraging bats. We believe that our research underscores the importance of studying the interacting effects of ALAN on the prey base of bats and other nocturnal predators.

Sun-AM2-E-1

A Preliminary Exploration of Stress Physiology in the Wood Fern Genus *Dryopteris*

James (Eddie) Watkins (Colgate University, Hamilton, NY), Jennifer Blake-Mahmud (Hope College, Holland MI), Emily Sessa (NYBG, New York, NY), and Clayton Visger (California State University, Sacramento, CA)

Abstract - Polyploidy is often viewed as a critical process of speciation in plants and is especially important in ferns. However, less attention has been paid to the ecophysiological consequences of polyploidy. Ecologically, allopolyploids may occupy broader ecological ranges and exhibit broader geographic distributions relative to their diploid progenitors. While such patterns have been examined in seed plants and to a lesser extent, in fern sporophytes, very few studies have examined the role, if any, that polyploidy plays in fern gametophyte ecology. For this study, we examined the temperate and drought-stress physiology of gametophytes from 6 *Dryopteris* species, specifically of 2 tetraploids and their 4 diploid progenitors. We exposed gametophytes to differing levels of drought and heat stress over 3 days and tracked their recovery for 72 hours. In both related diploid/tetraploid triads, gametophytes of the tetraploids recovered from heat and drought stress better than their diploid parents. All 6 taxa were able to withstand short periods (24 hours) of high temperature and low humidity stress, and the most significant physiological responses were evident after 2 and 3 days in high-temperature, low-humidity environments. We also discovered different strategies of response, with some species acting as stress avoiders and others as stress tolerators. Fern gametophytes are critical to the sexual reproduction of ferns and the founding of new populations. As the global climate changes, so do the pressures on this generation. Thus, understanding how fern gametophytes respond to changes in abiotic stress will be critical in creating models of species survival and migration.

Sat-PM1-D-4

Demographic Shifts and Ecological Interactions: Small-Mammal and Invertebrate Co-Occurrence and Avoidance in a Changing Vermont

Joseph D. Webb (UVM, Burlington, VT), Emily M. Beasley (UVM Department of Biology, Burlington, VT), George Ni (UVM Department of Biology, Burlington, VT), and Nicholas Gotelli (UVM Department of Biology, Burlington, VT)

Abstract - Current agricultural patterns in Vermont indicate an aging farmer population and increased land pressure for non-agricultural uses, leading to legislative action to support, protect, and revitalize local agriculture, including the repurposing of abandoned agricultural land. This study aims to explore patterns of co-occurrence and avoidance between known small-mammal competitors and invertebrates across Chittenden, VT, particularly in deserted agricultural areas subject to potential redevelopment. Data was collected between April and September 2020 by E.M. Beasley and B. Luter, who sampled 10 transects for 3 consecutive trap days. Small-animal traps were set in the evening and examined the following morning. Sampling was repeated at each site for 3 periods of 3 days each, from 26 May to 14 June, 19 June to 9 July, and 16 July to 3 August 2020. The traps were baited with either peanut butter and sunflower seeds or sunflower seeds only. The study retained data on small mammals and coarse vegetation, and invertebrate samples collected were stored in distilled water or 70% EtOH. In December 2022–April 2023, J.D. Webb identified the biodiversity of invertebrates to family and order. The results suggest patterns of behavior between small mammals and invertebrates and identify environmental patterns between sites. The study's purpose is to contribute to a better understanding of the ecological relationships between small mammals and invertebrates in natural wilderness sites in Vermont to better inform conservation efforts that also seek to bolster the local community in the region.

Sun-AM2-E-2

Morphologic Change between Captive and Wild Small Mammals

Zachary S. Weitzman (University of Vermont, Burlington, VT)

Abstract - A major combatant of biodiversity and wildlife loss today is reintroduction from captively bred populations. These reintroductions have proved effective for a wide variety of species, and are actively being used here in the Northeast with small mammals like *Sylvilagus transitionalis* (New England Cottontail). The study of the constraints of reintroductions often focuses on the genetic diversity and fitness of captive populations as effects on long-term efficacy of the process, yet little research has gone into morphological differences as possible factors in the potential success of reintroductions. Research on captive canine populations found that many, especially hyper- and hypo-carnivores have at least 1 significantly different skull feature than their wild counterparts. I conducted a survey of *Peromyscus leucopus* (White-footed Mouse), *Peromyscus maniculatus* (Deer Mouse), *Microtus pennsylvanicus* (Eastern Meadow Vole), and *Mus musculus* (House Mouse) museum specimens collected from both the wild and a lab colony over a 35-year period to determine if morphological differences are present in other species. Using standard museum measurements for external features including total, tail, left ear, and left-foot length and morphometric photos of skulls features; multiple features can be compared for morphological differences. Based on previous research, I hypothesize that captive individuals will show wider skulls, and increased lengths of skulls and external features possibly due to the dietary challenges and social behavior of captivity. Acknowledgment of these differences and research into mitigation can ultimately improve reintroduction efforts of these species and other small mammal species.

Sun-AM2-E-4

Monitoring and Conserving a Spotted Turtle Population Inside Boston's Urban Landscape

James Welch (Zoo New England Field Conservation Department, Boston, MA), John Berkholtz (Zoo New England Field Conservation Department, Boston, MA), and Bryan Windmillller (Zoo New England Field Conservation Department, Boston, MA)

Abstract - A unique urban population of *Clemmys guttata* (Spotted Turtle) inhabit a nearly 243-ha (600-ac) park in Boston. This is the only known population within the city limits and is surrounded by urban residential neighborhoods. Other populations can be found in bordering busy suburbs across Massachusetts. Since 2018, Zoo New England's Field Conservation Department has been studying this population through trapping surveys and radiotelemetry. In 2021, we estimated the population size based on our trap captures. Habitat use and movements have been recorded among the 15 turtles that have been radiotracked. In addition, we endeavored to locate and protect nests. We pulled eggs by the third trimester to incubate them and subsequently headstart hatchlings. A total of 15 hatchlings are being headstarted, and 4 were released in the spring of 2022 and radiotracked through the active season to determine survival, habitat use, and movement patterns. Another 8 headstarts are slated for release in the spring of 2023, and these turtles will also be radiotracked. The remaining 3 hatchlings are currently being headstarted at 2 Boston elementary schools for release in 2024. The Spotted Turtles live in the many vernal pools and swamps that are also home to several obligate vernal pool species and are certifiable under the Massachusetts Natural Heritage and Endangered Species Program. Our work with these Spotted Turtles aims to better understand the demographics, habitat use, and survival of urban turtle populations and to assess what management strategies may be effective for conservation.

Sun-AM1-D-3

A Multi-taxonomic Survey to Determine the Conservation Status of Native Pollinators

Erin L. White (NY Natural Heritage Program, Albany, NY), Matthew D. Schlesinger (NY Natural Heritage Program, Albany, NY), and Timothy G. Howard (NY Natural Heritage Program, Albany, NY)

Abstract - Understanding which species are in greatest need is key for directing conservation actions. In recent decades, declines in certain pollinating insects have become clear, but the status of many species has remained unknown. The New York Natural Heritage Program coordinated the Empire State Native Pollinator Survey (2017–2021) to meet these information needs in New York and to determine the conservation status of select groups of pollinating bees, flies, moths, and beetles. Our effort was funded through the NYS Department of Environmental Conservation, and we worked closely with an Advisory Committee of taxonomic and sampling design experts to guide our goals, focal taxa, survey design, field protocol, and analyses. We assessed the current and historical distribution of native pollinators with 3 field sampling strategies (extensive surveys, target habitat surveys, and target species surveys) and compilation of museum and partner collection data. In addition, we trained over 200 community scientists through workshops and solicited photos of focal species via iNaturalist. Specimen vouchers were verified by taxonomic experts and curated at the Cornell University Insect Collection and the NYS Museum, while iNaturalist observations were identified by a large community of experts. We obtained over 34,000 specimen records identified to species, and our compiled database of partner, museum, and community science data contained 171,200 records. Our sampling effort yielded many significant finds including 8 focal bees and 8 focal flies added to the list of known species for New York. However, 25 bees, 35 flies, 22 beetles, and 9 moths have not been detected in the state since prior to 2000. We found that, using conservative criteria, 38% of New York's native pollinators (of our focal taxa only) are at risk of extirpation from NY. In the worst-case scenario, as much as 60% of the native insect pollinator fauna may be at risk. ESNPS results provide an important baseline of the distribution and status of native pollinators in New York to help inform conservation efforts. Monitoring our native pollinators using standard protocols may be the only way to know whether we are maintaining New York's important pollinators in the face of continuing global change.

Sun-AM2-D-2

Effects of Mast, Weather, and Forest Structure on Small-Mammal Abundance in the White Mountain National Forest, NH

Joshua Willems (University of New Hampshire, Durham, NH), Remington Moll (University of New Hampshire, Durham, NH), Mariko Yamasaki (USFS, Durham, NH), Christine Costello (USFS, Durham, NH), and Rebecca Rowe (University of New Hampshire, Durham, NH)

Abstract - Many small-mammal populations exhibit dramatic annual fluctuations, with abundance in high years reaching up to an order of magnitude greater than in low years. However, there remains much debate about the factors that drive these changes in abundance. Most studies have focused on either a limited number of species or only analyzed data over a relatively short amount of time. Here, we used a Bayesian N-mixture model and data from a 30-year study to compare the relative effects of pulsed food resources (mast), forest structure, and weather on regulating the population dynamics of 6 rodent and 4 shrew species. This study was conducted at Bartlett Experimental Forest in central New Hampshire, and the small-mammal surveys were initiated coincident with a series of silvicultural prescriptions. Preliminary results indicate that all included variables influenced abundance. However, species' responses to these variables were not consistent, and no single variable proved to be broadly influential across all species. For example, the abundance of several rodent species increased following a high-mast fall, though *Napaeozapus insignis* (Woodland Jumping Mouse) abundance was negatively influenced by increased mast. Abundance of Southern Bog Lemmings (*Synaptomys cooperi*) was positively influenced by increased snow depth and warmer winter temperatures whereas *Sorex hoyi* (Pygmy Shrew) abundance decreased after high-snow winters. Previous work in this system found that population fluctuations were highly synced across species. Despite this synchrony, our results suggest that species are not responding to changes in the environment in the same way.

Sun-AM2-E-3

Vermont Conservation Design and a Vision for an Ecologically Functional Landscape

Robert Zaino (Vermont Fish and Wildlife Department, Barre, VT)

Abstract - Vermont Conservation Design is an assessment and a scientific vision for what is needed to conserve the ~20,000 -40,000 species estimated to occur in Vermont. It identifies a set of simple and efficient "coarse filters" at multiple scales, which collectively offer high confidence in conserving the needs of many species. I'll describe these coarse-filter elements selected for the design—such as interior forest blocks, connectivity blocks, waters and riparian areas, natural communities, and old and young forests—and how they relate back to their individual species. Vermont Conservation Design is a scientific vision, but it has been proven to be a practical tool to further biodiversity protection. Those successes show why we should not hesitate to think big if want to maintain biodiversity and ecological function in the Northeast and beyond.

Sat-PM1-B-1

Studying Drought Responses in New England Forests Using an Experimental and Ecophysiological Approach

Sam Zuckerman (University of New Hampshire [UNH], Durham, NH), Heidi Asbjornsen (UNH, Durham, NH), Matthew Vadeboncoeur (UNH, Durham, NH), Mauro Brum (UNH, Durham, NH), Cameron McIntire (USFS, Durham, NH), Jay Wason (UMaine, Orono, ME), Anthony D'Amato (UVM, Burlington, VT), Tanner Frost (UNH, Durham, NH)

Abstract - Climate change in New England will bring hotter temperatures, more variable precipitation and as a result, more frequent and severe droughts. It is not well understood how mature trees and seedlings of different species will respond to this change. We used an ecophysiological approach to address 2 key research questions: (1) What is the adaptive capacity of different mature tree species to drought? (2) Within a species, are seedlings from hotter or drier ecotypes better at tolerating drought? To assess the response of mature trees, we established 2 30 m x 30 m rainfall-exclusion shelters in 2016 to compare how 2 species representing distinct functional groups—*Quercus* spp. (oaks) and *Pinus strobus* (Eastern White Pine)—respond to moisture stress. After 7 years of treatment, we used anatomical and physiological data in combination with soil moisture and meteorological data to estimate thresholds eliciting drought responses, quantify acclimation potential, and identify drought response strategies of oaks and Eastern White Pine. While trees in the droughted plots responded with slower growth, reduced sap flow, and lower rates of photosynthesis, the timing and magnitude of these responses varied across species and years. We did not observe strong evidence of anatomical plasticity, which suggests limitations in drought acclimation for these species of trees or that the thresholds for inducing anatomical adjustments surpass our experimental treatment. To assess the drought response of seedlings from local ecotypes versus ecotypes from hotter and drier climate, we established a greenhouse common garden experiment using potted seedlings. Seven species from local (NH), hotter (VA), and drier (MI) ecotypes were placed into treatment groups and either irrigated to field capacity or withheld water for 3 weeks. We monitored soil water content, seedling growth and physiology. So far, *Prunus serotina* (Black Cherry) has shown the strongest reductions in growth and gas exchange when withheld water. We will continue this study into 2023 to further understand the relationship between species, ecotype, and drought with the goal of improving our ability to select species and ecotypes for assisted migration.

Sat-PM2-B-4